सत्यमेव जयते

# Guidelines for Model Quality Assurance Plan (MQAP) for Major Equipment of Power Sector



भारत सरकार

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## 1. Background

Quality Assurance aims to keep the quality of a product/ equipment above a specified level and ensures that the product not only meets all customer requirements but also meets the suppliers' objectives and targets. Further, following a good Quality Assurance Plan (QAP) reduces the chance of costly mistakes and mitigates risk. This is specially required for Power Sector for ensuring quality, reliable and economic power supply as it serves billions of people on a daily basis besides serving commercial and industrial sectors in their contribution to economic growth of country. To achieve this, manufacturers and utilities rely on QAP. However, it has often been observed that there is variance in QAPs being followed by different manufacturers, utilities, etc. suiting their requirements. It appears that there is a need for uniform guidelines for QAPs which shall be followed by all stakeholders throughout the country. Further, these Model QAPs (MQAPs) shall be efficient in terms of number and type of tests being performed during the entire cycle from raw material/ sub-component sourcing to production to their commissioning so as to reduce unnecessary testing, avoid redundancy at various stages and consequently save time and cost of the project.

## 2. Quality Assurance Plan (QAP): Introduction

Quality of an equipment can be improved by taking effective steps at the initial stage itself, which include 'use of high quality raw materials' and 'improved manufacturing processes'. The performance of an equipment largely depends on the excellence of design. However, all good designs may not yield good end product unless they are well supported by good materials, good and healthy machines and skilled workmen (operators)/ workmanship. The formulation and implementation of an efficient QAP comprises of a properly designed quality assurance program along with proper documentation at every stage, an efficient quality assurance test and finally implementation of quality assurance plans.

## 3. Broad Categories of Tests conducted on E&M Equipment in Power Sector

### 3.1 Type Tests:

These tests are conducted for validation of design i.e. for confirming the main and basic design expectation of the equipment. These tests are done mainly on a prototype unit and not on all manufactured units in a lot.

This is a test conducted on an equipment, which is representative of other equipment, to demonstrate that these comply with specified requirements not covered by routine tests. It needs to be noted here that an equipment is considered to be representative of others, if it is fully identical in rating and construction, but the Type Test may also be considered valid, if it is made on an equipment which has minor deviations of rating or other characteristics. These deviations should be subject to agreement between the manufacturer and the purchaser.

The Type Tests are conducted as per relevant applicable Standard.

3.2 Routine Tests:

These tests are conducted mainly for confirming the operational performance of the individual unit in a production lot.

These are at present conducted as per relevant applicable Standard.

3.3 Special Tests:

These are the tests other than a Type Test and/ or Routine Test as agreed by the manufacturer and the purchaser in the contract.

These tests are done as per customer requirement to obtain information useful to the user during operation or maintenance of the equipment.

These are conducted as per relevant applicable Standard (as specified under Contract or to meet certain requirement of Contract).

3.4 These above mentioned tests are further classified on the basis of the stage at which they are conducted, either at the works of the contractor or at site as given below:

(i). The Type Tests/ Routine Tests/ Special Tests as the case may be, if conducted at the works of the manufacturer before Manufacture Dispatch Clearance Certificate (MDCC) of the equipment from the works to the site are called as Factory Acceptance Tests (FAT). The objectives of FAT are generally as follows:

a) Factory Acceptance Test (FAT)

A FAT helps to verify that newly manufactured and packaged equipment meets its intended purpose. The FAT validates the operation of the equipment and makes sure the customers' purchase order specifications

and all other requirements have been met.

This is a test that runs on the equipment or components before it is delivered to its intended destination.

FATs are usually done at the factory works to make sure that certain requirements are met. Further, these tests are normally done with the customer, and also, in certain more demanding cases, with a third party inspection agency.

These are conducted as per relevant applicable Standard.

(ii). The Routine tests/ Special tests as the case may be, if conducted at the site during erection and commissioning are called as Site Acceptance Tests (SAT). The objectives of SAT are generally as follows:

a) Site Acceptance Test (SAT)

These tests are done to make certain that specified quality is met by the equipment at site and to offer customers quality testing and documents, and also further ensuring that nothing has changed or was damaged during shipment from supplier premises, storage and its installation.

SATs are done at the specific places where usually commissioning is done.

While FATs can use simulations to demonstrate as to how the equipment will function in its future operating environment, it may be difficult to mimic the actual operating conditions.

SATs are only conducted after the FAT has taken place and the item/ equipment has been delivered. This is the only way to truly determine whether a piece of new equipment will function as required.

These are conducted as per relevant applicable Standard.

## 4. Purpose of Uniform Guidelines for Model Quality Assurance Plan (MQAP):

There is an imperative need to have convergence in the preparation of Model Quality Assurance Plan (MQAP) as this will avoid variance among different stakeholders (manufacturers/ purchaser/ utilities, etc.), significantly save time & money and reduce burden on suppliers & testing facilities and cost to the end consumers by removing redundancies in testing procedures. Therefore, there is an urgent requirement to frame guidelines to make a uniform MQAP.

The major objective behind publication of these guidelines for MQAP of major E&M

equipment of Power Sector are broadly as given below:

(i) **To prepare Model QAPs, which are efficient and simultaneously have overall coverage of tests**. Unnecessary and repetitive tests at different stages would be optimized and the tests for only important/ major equipment would be included in these MQAPs. The sample size for testing shall also be standardized in the MQAPs. This would help in saving cost, time and conflicts for not only the vendors/ manufacturers but also the purchaser/ consumer.

(ii) **To moderate/ optimize Customer Hold Points (CHPs) for non-critical tests**. For this purpose, model QAPs are being framed and accordingly those tests are identified for which only the Test Certificates (TCs) shall be sufficient and acceptable upon its review, thereby reducing the overall number of CHPs in inspections.

(iii) To bring the convergence in QAPs being prepared by various manufacturers or approved by utilities and **set uniform guidelines of MQAP for all major Electro-Mechanical equipment manufacturers/ suppliers and purchasers in the country**.

(iv) **To avoid overloading of testing facilities**. This shall be achieved in conjunction with the guidelines for the validity period of Type Test(s) for major E&M equipment of Power Sector. Specifying the validity of Type Test(s) and removal of repetition of non-critical tests as per applicable Standards and optimizing CHPs in MQAPs would reduce the burden on the existing testing facilities leading to reduction in waiting time and henceforth optimal utilization of testing facilities which are available with limited number of laboratories.

## 5. Broad Guidelines for Model QAP of Power Sector

(i) All the utilities/ purchaser/ developers/ suppliers in Power sector shall prepare and follow the Model QAPs (enclosed as **Annexure A-** for equipment of Substations, Switchyards and Transmission Lines**, Annexure B –** for major equipment in Hydro Power Plant**, Annexure C-** for major equipment in Thermal Power Plant **& Annexure D-** for major equipment used in Distribution System**).**

(ii) MQAPs of those E&M equipment which have not been covered in the **Annexures** shall be subject to the terms of mutual agreement between manufacturer and purchaser.

(iii) Test Certificates (TCs) of Bought-out items establishing the purchaser's

requirement upon review shall be acceptable to the purchaser.

(iv) Any change in practice or acceptance norms (with reference to various tests / parameters in respective National / International standard) would be suitably incorporated by manufacturer from time to time and submit the same for approval of purchaser / utility.

(v) These guidelines of MQAPs specify the maximum numbers of CHPs and highest limit of sampling size that could be included in the specification by the developer/ purchaser while conforming to the applicable Standard.

(vi) In order to save time, both the supplier and the purchaser shall be free to identify lesser number of tests as CHPs as per specific needs of purchaser subject to the agreement between them.

(vii) The utilities/ purchaser may request for additional tests which have not been covered in MQAPs of listed E&M equipment, at their own cost. However, the utilities should refrain from making it a regular practice. The utility must clearly specify as to which additional test(s) would be required during the awarding of the contract and quotation for such tests should be invited separately in the price bid. In such case, the utility shall provide extra time for repetition of such test(s). In case there is change in the governing regulations/ applicable standards, the supplier would conduct the required test at his own cost.

(viii) The purchaser reserves the right to get the test conducted again at the supplier's works/ accredited laboratory at supplier's cost in case the Test Certificates are not establishing/ meeting the purchaser's requirement.

(ix) The TCs at initial/ raw material/ in-process stage by customer shall be prepared and maintained by the supplier. Further, the same shall be considered as accepted only after its acceptance by the purchaser upon review at appropriate stage of CHP.

(x) The quantum of checks shall be strictly kept as specifically quantified in the column of 'Quantum of Check' and shall be governed by the document referred under column of 'Acceptance Norms' in QAP. However, wherever the quantum of check has been mentioned as 'sample per lot' (except Distribution sector), the same shall be minimum 2 numbers or 5% of the lot whichever is higher except in the case of Type Tests.

(xi) No material shall be dispatched from the manufacturer's works before the same is accepted, subsequent to pre-dispatch final inspection including verification of

records of all previous tests/ inspections by Purchaser's authorised Representative and duly authorised for dispatch. However, the purchaser may waive-off inspection depending upon the requirement. In case material is dispatched from manufacturer's works before the same is accepted by Purchaser's authorized representative, a separate procedure to resolve such cases may be made in the contract document.

(xii) Manufacturer shall carry out all tests/ inspection required to establish that the items/ equipment conform to requirements of the specification and the relevant codes/ Standards specified in the specification, in addition to carrying out tests as per the approved quality plan.

(xiii) Quality approval of the results of the tests and inspection will not, however, prejudice the right of the Purchaser to reject the equipment if it does not comply with the specification, when erected or does not give complete satisfaction in service and the above shall in no way limit the liabilities and responsibilities of the manufacturer in ensuring complete conformance of the materials/ equipment supplied to relevant specification, standard, data sheets, drawings (approved by the Purchaser), and minutes of various meetings with customer / Purchaser etc.

(xiv) Any repair/ rectification procedures to be adopted to make the job acceptable shall be subject to the approval of the Purchaser/ authorised representative.

(xv) All inspection, measuring and test equipment used by manufacturer shall be calibrated periodically as per NABL guidelines, depending on its use and criticality of the test/ measurement to be done. The manufacturer shall maintain all the relevant records of periodic calibration and instrument identification, and shall produce the same for inspection by purchaser. In case repair is carried out in the measuring and test equipment it should be compulsorily recalibrated. All calibrated measuring and test equipment must be properly sealed after calibration to stop any kind of manipulation with the equipment. Wherever mutually agreed between manufacturer & purchaser, the manufacturer shall re-calibrate the measuring and test equipment in the presence of the Inspector.

(xvi) The latest CEA (Technical Standards for Construction of Electrical Plants and Electric Lines) Regulations shall also be complied with for ensuring the minimum technical requirements for construction of Generating Stations, Transmission & Distribution Lines and Substations.

# ANNEXURE A

# MODEL QUALITY ASSURANCE PLAN (MQAP) FOR EQUIPMENT OF SUBSTATION, SWITCHYARDS AND TRANSMISSION LINES

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* Category of Responsibility: P - Actual Test Performance V - Verify and Accept W - Witness Actual testing, verify and accept

# Bus Post Insulator

| S. No. | Components / Operations & Description of Test | Type of Check | Quantum of Check / Sampling with basis | Reference Document for Testing | Acceptance Norms | Format of Record | Category of Responsibility | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Sub-Vendor | Manufacturer | Customer |
| | **1. RAW MATERIAL INSPECTION** | | | | | | | | |
| **1.1** | **Alumina** | | | | | | | | |
| ( a ) | Visual Appearance | Physical | 100 gm/bag from 5 % bags/ Consignment/ As per Customer requirement/ Manufacturer's Standard | Technical Specifications/ Manufacturer's Standard | Technical Specifications/ Manufacturer's Standard | | P | V | - |
| (b) | Residue on 63 µm | Physical | | | | | P | V | - |
| (c) | Chemical Analysis | Chemical | | | | | P | V | - |
| | | | | | | | | | |
| **1.2** | **Feldspar** | | | | | | | | |
| (a) | Visual Appearance | Physical | 100 gm/bag from 5 % bags/ Consignment/ As per Customer requirement/ Manufacturer's Standard | Technical Specifications/ Manufacturer's Standard | Technical Specifications/ Manufacturer's Standard | | P | V | - |
| (b) | Sieve Residue on 63 µm | Physical | | | | | P | V | - |
| (c) | Chemical Analysis | Chemical | | | | | P | V | - |
| | | | | | | | | | |
| **1.3** | **Clays** | | | | | | | | |
| (a) | Visual Appearance | Physical | | | | | P | V | - |

* Category of Responsibility: P - Actual Test Performance V - Verify and Accept W - Witness Actual testing, verify and accept

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| (b) | Appearance of Fired sample | Physical | Approx 30 kgs sample from 5% of bags / Consignment/ each type clay/ As per Customer requirement/ Manufacturer's Standard | Technical Specifications/ Manufacturer's Standard | Technical Specifications/ Manufacturer's Standard | | P | V | - |
| (c) | Sieve Residue on 38 microns | Physical | | Technical Specifications/ Manufacturer's Standard | Technical Specifications/ Manufacturer's Standard | | P | V | - |
| (d) | Moisture of Extrusion | Physical | | | | | P | V | - |
| (e) | Dry Shrinkage | Physical | | | | | P | V | - |
| (f) | Fired shrinkage | Physical | | | | | P | V | - |
| (g) | Dry bending strength | Physical | | | | | P | V | - |
| (h) | Warpage | Physical | | | | | P | V | - |
| (i) | Water absorption | Physical | | | | | P | V | - |
| (j) | Chemical Analysis | Chemical | | | | | P | V | - |
| | | | | | | | | | |
| **2.** | **Glaze Materials** | | | | | | | | |
| **2.1** | **Quartz Powder** | | | | | | | | |
| (a) | Visual Appearance | Physical | 100 gm/bag 5% of bags/ consignment/ As per Customer requirement/ Manufacturer's Standard | Technical Specifications/ Manufacturer's Standard | Technical Specifications/ Manufacturer's Standard | | P | V | - |
| (b) | Residue on 63 µm | Physical | | | | | P | V | - |
| (c) | Chemical Analysis | Chemical | | | | | P | V | - |
| | | | | | | | | | |

* Category of Responsibility: P - Actual Test Performance V - Verify and Accept W - Witness Actual testing, verify and accept

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|---|---|---|---|---|---|---|---|---|---|
| **2.2** | **Manganese Carbonate/ Iron Oxide/Chromium Oxide** | | | | | | | | |
| (a) | Visual Appearance of fired sample | Physical | 100 gms / Individual Bags/ As per Customer requirement/ Manufacturer's Standard | Technical Specifications/ Manufacturer's Standard | Technical Specifications/ Manufacturer's Standard | | P | V | - |
| (b) | Sieve Residue (63 microns) | Physical | | | | | P | V | - |
| (c) | Glaze Color and Appearance of fired sample. | Physical | | | | | P | V | - |
| (d) | Chemical Analysis | | | | | | | | |
| | 1) Loss on ignition | Chemical | | | | | P | V | - |
| | 2) Purity | Chemical | | | | | P | V | - |
| | | | | | | | | | |
| **2.3** | **Wollastonite** | | | | | | | | |
| (a) | Visual Appearance | Physical | 100 gm/bag, 5% of bags/ consignment/ As per Customer requirement/ Manufacturer's Standard | Technical Specifications/ Manufacturer's Standard | Technical Specifications/ Manufacturer's Standard | | P | V | - |
| (b) | Appearance of fired sample. | Physical | | | | | P | V | - |
| (c) | Sieve Residue (63 microns) | Physical | | | | | P | V | - |
| (d) | Chemical Analysis | | | | | | | | |
| | 1) Loss on ignition | Chemical | | | | | P | V | - |

* Category of Responsibility: P - Actual Test Performance V - Verify and Accept W - Witness Actual testing, verify and accept

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | |
| | 2) Silica & Calcia | Chemical | | | | | P | V | - |
| | 3) Iron Oxide | Chemical | | | | | P | V | - |
| | | | | | | | | | |
| **2.4** | **Dolomite** | | | | | | | | |
| (a) | Visual Appearance | Physical | 100 gm/bag, 5% of bags from each consignment/ As per Customer requirement/ Manufacturer's Standard | Technical Specifications/ Manufacturer's Standard | Technical Specifications/ Manufacturer's Standard | | P | V | - |
| (b) | Appearance of fired sample. | Physical | | | | | P | V | - |
| (c) | Sieve Residue (63 microns) | Physical | | | | | P | V | - |
| (d) | Chemical Analysis | | | | | | | | |
| | 1) Loss on ignition | Chemical | | | | | P | V | - |
| | 2) Calcia | Chemical | | | | | P | V | - |
| | 3) Magnicia | Chemical | | | | | P | V | - |
| | | | | | | | | | |
| **3.0** | **Auxiliary materials** | | | | | | | | |
| **3.1** | **Cement** | | | | | | | | |
| (a) | Visual Appearance | Physical | | IS 12269/ Plant Standard | IS 12269/ Plant Standard | | P | V | - |

* Category of Responsibility: P - Actual Test Performance V - Verify and Accept W - Witness Actual testing, verify and accept

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| (b) | Initial Setting time | Physical | 500 gm/bag 5% of bags from each consignment/ As per Customer requirement/ Manufacturer's Standard | | | | P | V | - |
| (c) | Final setting time | Physical | | | | | P | V | - |
| (d) | Soundness | Physical | | | | | P | V | - |
| (e) | Compressive Strength | Physical | | | | | P | V | - |
| (f) | Chemical Analysis | | | | | | P | V | - |
| | 1) Loss on Ignition | Chemical | | | | | P | V | - |
| (g) | Fitness Analysis | Physical | | | | | | | |
| | | | | | | | | | |
| **3.2** | **Quartz (Assembly)** | | | | | | | | |
| a) | Appearance | Physical | 100 gm/bag 5 bags/ lot/ As per Customer requirement/ Manufacturer's Standard | Technical Specifications/ Manufacturer's Standard | Technical Specifications/ Manufacturer's Standard | | P | V | - |
| b) | Sieve Residue (Dry Method) | Physical | | | | | P | V | - |
| | | | | | | | | | |
| **SECTION: 2. INCOMING INSPECTION** | | | | | | | | | |
| **1.0** | **Metal Parts** | | | | | | | | |
| 1.1 | **MCI/ SGI Caps / B. Pins <u>(As Cast)</u>** | | | | | | | | |

* Category of Responsibility: P - Actual Test Performance V - Verify and Accept W - Witness Actual testing, verify and accept

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| (a) | Visual Inspection | Physical | 100% | Technical Spec./ Approved Drawings | Technical Spec./ Approved Drawings | | P | V | - |
| (b) | Dimensional Check | Physical | 2/lot or As per Customer requirement/ manufacturer's Standard | IS: 1865 & Relevant Drg | Technical Spec./ Approved Drawings | | P | V | - |
| (c) | M.P.I. Test | Physical | 100% | IS 3703 | No cracks | | P | V | - |
| (d) | Tensile Load Test (Test Bar) | Physical | 1 Test bar/ heat or As per Customer requirement/ manufacturer's Standard | IS: 1865 | IS: 1865 Min.400N /$mm^2$ (As per grade mentioned in drawings) | | P | V | - |
| (e) | % Elongation (Test Bar) | Physical | 1 Test bar/ heat or As per Customer requirement/ manufacturer's Standard | IS: 1865 | Min.15% IS: 1865 (As per grade mentioned in drawings) | | P | V | - |
| (f) | Hardness | Physical | 1/heat or As per Customer requirement/ manufacturer's Standard | IS: 1865 | Max.130-180 BHN (As per grade mentioned in drawings) | | P | V | - |
| (g) | Chemical Analysis | Chemical | 1/heat or As per Customer requirement/ | IS: 1865 | **Phosphorous Max.0.12%** | | P | V | - |

* Category of Responsibility: P - Actual Test Performance V - Verify and Accept W - Witness Actual testing, verify and accept

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | manufacturer's Standard | | (As per grade mentioned in drawings) | | | | |
| (h) | Microstructure (Only Caps) | Physical | 1/heat or As per Customer requirement/ manufacturer's Standard | IS: 1865 | IS: 1865 (As per grade mentioned in drawings) | | P | V | - |
| (i) | Soundness Test | Physical | 100 % | | Ringing Sound | | P | V | - |
| (j) | Proof Load Test | Mechanical | As per Customer requirement/ manufacturer's Standard | IS 1865 | (As per grade mentioned in drawings) | | P | V | - |
| (k) | Malleablising Test | Physical | As per Customer requirement/ Manufacturer's Standard | IS 14329 | As per 14329/ (As per grade mentioned in drawings) | | P | V | - |
| | | | | | | | | | |
| **1.2** | **SGI Caps / B. Pins (Galvanised)** | | | | | | | | |
| (a) | Purity of Zinc | Checmical | As per Customer requirement/ Manufacturer's Standard | IS 209/ Technical Specification | IS 209/ Technical Specification | | P | V | - |
| (b) | Visual Inspection | Physical | 100% | IS: 2629/ 2633 | Technical Spec./ Approved Drawings | | P | V | - |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| (c) | Gauge Check | Physical | 100% | Relevant Drg | Technical Spec./ Approved Drawings | | P | V | - |
| (d) | Other Dimension | Physical | 2% | Relevant Drg | Technical Spec./ Approved Drawings | | P | V | - |
| (e) | Adhesion Test | Physical | 1 sample/ Consignment or As per Customer's requirement/ Manufacturer Standard | IS: 2629 | No Peeling | | P | V | - |
| (f) | Uniformity of Zinc Coating. | Chemical | 1% random or As per Customer's requirement/ Manufacturer Standard | IS: 2633 | Min.4 dips or Technical Specifications/ Approved Drawings | | P | V | - |
| (g) | Thickness of Zinc coating (Elcometer ) | Physical | 2% / lot | IEC 60168 | Min.85 µm or Technical Specifications/ Approved Drawings | | P | V | - |
| | | | | | | | | | |
| **2.1** | **Corona Rings (Where Applicable)** | | | | | | | | |
| (a) | Visual Inspection | Physical | 2 / lot or As per Customer's requirement/ | As per Specifications/ | No dent, scratch, breaking of welded joints. | | P | V | - |

* Category of Responsibility: P - Actual Test Performance V - Verify and Accept W - Witness Actual testing, verify and accept

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | Manufacturer Standard | Relevant Drawings | | | | | |
| (b) | Dimensions | Physical | IS 2500/ IL-3 AQL 0.4% | Relevant Drawing | Relevant Drawing | | P | V | - |
| (c) | Dye Penetration Test on welded joints. | Chemical | IS 2500/ IL-3 AQL 0.4% | Technical Specifications/ IS 3658 | No cracks | | P | V | - |
| (d) | Chemical composition | Chemical | 1/ lot or As per Customer's requirement/ Manufacturer Standard | Relevant Drawing/ IS 5082 | Relevant Drawing | | P | V | - |
| (e) | Mechanical load test | Physical | 1/ lot or As per Customer's requirement/ Manufacturer Standard | Relevant Drawing | Relevant Drawing | | P | V | - |
| | | | | | | | | | |
| **2.2** | **Hardware Bolts-Nuts & Washers** | | | | | | | | |
| a) | Visual Inspection | Physical | As per Customer's requirement/ Manufacturer Standard | IS-6639/12427 and IS 1367 Part 3, IS 3063 | Relevant Drawing/ Smooth, free from defect & no extra zinc. | | P | V | - |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| b) | Dimensions | Physical | As per IS: 1367 Part 17 and IS 6821 | IS 6639/ 12427 and IS 1367 Part 3 | Relevant Drawing | | P | V | - |
| c) | Uniformity of Zinc Coating | Chemical | As per IS: 1367 Part 17 | IS 2633 | Relevant Drawing/ Withstood 4 dips of min each | | P | V | - |
| d) | Thickness of Zinc coating by elcometer | Physical | IEC 60168 | IEC 60168 | | | P | V | - |
| (e) | Permanent Set on spring washer | Mechanical | | ` | | | P | V | - |
| (f) | Twist Test on spring washer | Mechanical | | IS 6639/ 12427 and IS 1367- Part 3 | Technical Specification/ Approved Drawings | | P | V | - |
| (g) | Hardness of Bolt, Nut and Washer | Mechanical | IS 1367- Part 17 | | | | P | V | - |
| (h) | Tensile Load Test (Bolt) | Mechanical | | IS 6639/ 12427 and IS 1367- Part 3, IS 3063 | | | P | V | - |
| (i) | Shear Test ( Bolt) (If applicable) | Mechanical | | | | | P | V | - |
| (j) | Proof Load Test on Bolt and Nut | Mechanical | | | | | P | V | - |
| | | | | | | | | | |
| **SECTION: 3. INPROCESS INSPECTION** | | | | | | | | | |
| **1.0** | **Body Preparation** | | | | | | | | |
| 1.1 | **WEIGHMENT** | | | | | | | | |

* Category of Responsibility: P - Actual Test Performance V - Verify and Accept W - Witness Actual testing, verify and accept

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| (a) | Weight | Physical | | Manufacturer's Standard | Manufacturer's Standard | | | P | V |
| (b) | Moisture content | Physical | Weekly | | | | | P | V |
| | | | | | | | | | |
| **1.2** | **BALL MILLS** | | | | | | | | |
| (a) | Litre Weight | Physical | Each Ball mill | Manufacturer's Standard | Manufacturer's Standard | | | P | V |
| (b) | Sieve Residue on 63 microns | Physical | Each Ball mill | Manufacturer's Standard | Manufacturer's Standard | | | P | V |
| | | | | | | | | | |
| **1.3** | **Agitator Slurry** | | | | | | | | |
| (a) | Liter Weight | Physical | | Manufacturer's Standard | Manufacturer's Standard | | | P | V |
| (b) | Sieve Residue on 63 microns | Physical | Each Shift | | | | | P | V |
| (c) | Free Iron particle | Physical | Each Shift | | | | | P | V |
| | | | | | | | | | |
| 2.0 | **Glaze Preparation** | | | | | | | | |
| (a) | Liter Weight | Physical | | | Manufacturer's Standard | | | P | V |
| (b) | Sieve Residue on 38 micron | Physical | Each Batch | | | | | P | V |

* Category of Responsibility: P - Actual Test Performance V - Verify and Accept W - Witness Actual testing, verify and accept

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|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | |
| (c) | Colour & appearance of fired sample | Physical | Each cycle | Manufacturer's Standard | As per insulators fired in the same kiln | | | P | V |
| (d) | Weighment | Physical | Each Batch | | | | | P | V |
| (e) | Glaze flow | Physical | As per Customer's requirement/ Manufacturers Standard | | Manufacturer's Standard | | | P | V |
| (f) | Density | Physical | | | | | | P | V |
| | | | | | | | | | |
| 3.0 | **Filter Press** | | | | | | | | |
| (a) | Moisture Content | Physical | | Manufacturer's Standard | Manufacturer's Standard | | P | V | - |
| | | | | | | | | | |
| 4.0 | **EXTRUSION** | | | | | | | | |
| (a) | Pug Moisture content | Physical or As per Customer requirement/ manufacturer 's standard | Each shift | | Manufacturer's Standard | | | P | V |
| (b) | Free Iron particles | Physical | Weekly | | | | | P | V |
| (c) | De-airing check | Physical | Each shift | | | | | P | V |

* Category of Responsibility: P - Actual Test Performance V - Verify and Accept W - Witness Actual testing, verify and accept

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|---|---|---|---|---|---|---|---|---|---|
| (d) | Vacuum | Physical | Each shift | Manufacturer's Standard | | | | P | V |
| (e) | Physical properties | Physical | Weekly | | | | | P | V |
| (f) | Chemical Analysis | Chemical | Monthly | | | | | P | V |
| (g) | Penetrometer Reading/Stiffness | Physical | As per Customer requirement/ Manufacturer's Standard | | | | | P | V |
| | | | | | | | | | |
| **5.0** | **Pug Drying** | | | | | | | | |
| (a) | Penetrometer Reading | Physical | Each Shift | Manufacturer's Standard | Manufacturer's Standard | | | P | V |
| (b) | Moisture Content | Physical | As per Customer requirement/ Manufacturer's Standard | | | | | P | V |
| | | | | | | | | | |
| **6.0** | **Shaping** | | | | | | | | |
| (a) | PMR reading | Physical | As per Customer requirement/ Manufacturer's Standard | Manufacturer's Standard | Manufacturer's Standard | | | P | V |
| (b) | Dimensions | Physical | Each shift or As per Customer requirement/ | Relevant Drawings | Manufacturer's Standard | | | P | V |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | Manufacturer's Standard | | | | | | |
| (c) | Visual check | Physical | 100% | Manufacturer's Standard | Free from defects | | | P | V |
| (d) | Covering after shaping | Physical | Random | | Manufacturer's Standard | | | P | V |
| | | | | | | | | | |
| **7.0** | **Drying** | | | | | | | | |
| (a) | Moisture content | Physical | | Manufacturer's Standard | Manufacturer's Standard | | | P | V |
| (b) | Temp. & Humidity | Physical | Every hour | | | | | P | V |
| (c) | Visual checks | Physical | Every item | | | | | P | V |
| | | | | | | | | | |
| 8.0 | **Glazing** | | | | | | | | |
| (a) | Litre Weight | Physical | | Manufacturer's Standard | Manufacturer's Standard | | | P | V |
| (b) | Density | Physical | As per Customer's requirement/ | | | | | P | V |
| (c) | Fluidity | Physical | | | | | | P | V |
| (d) | Visual check before glazing | Visual | | | | | | P | V |
| (e) | Glaze thickness | Physical | | | | | | P | V |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| (f) | Visual check after glazing | Visual | Manufacturer's Standard | | | | | P | V |
| | | | | | | | | | |
| 8.1 | **Gravel** | | | | | | | | |
| (a) | Sieve Analysis | Physical | | Manufacturer's Standard | Manufacturer's Standard | | | P | V |
| | | | | | | | | | |
| **8.2** | **Gravel Application** | | | | | | | | |
| (a) | Sanding Gap (Height) | Physical | | Manufacturer's Standard/ relevant drawings | Manufacturer's Standard/ relevant drawings | | | P | V |
| | | | | | | | | | |
| 9.0 | **Firing** | | | | | | | | |
| (a) | Temperature control | Physical | As per Customer's requirement/ Manufacturer's Standard | Manufacturer's Standard/ relevant drawings | Manufacturer's Standard/ relevant drawings | | | P | V |
| (b) | Firing schedule | Physical | | | | | | P | V |
| (c) | Pressure Control | Physical | As per Customer's requirement/ | Manufacturer's Standard | Manufacturer's Standard | | | P | V |
| (d) | Fuel oil control | Physical | | | | | | P | V |

* Category of Responsibility: P - Actual Test Performance V - Verify and Accept W - Witness Actual testing, verify and accept

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | Manufacturer's Standard | | | | | | |
| | | | | | | | | | |
| 10.0 | **Sorting (Fired Insulators)** | | | | | | | | |
| (a) | Visual checks | Physical | | | | | | | |
| | i) Free from cracks | Physical | 100% | Manufacturer's Standard/ relevant drawings | No cracks as Applicable IS /IEC standard | | | P | V |
| | ii) Free from surface Defects. | Physical | 100% | | Manufacturer's Standard/ relevant drawings | | | P | V |
| | iii) Uniformity of Glaze Appearance | Physical | 100% | | | | | P | V |
| (b) | Dimensional Check | Physical | 2 Nos/ drg / Batch | | | | | P | V |
| (c) | Porosity | Physical | 2 Nos / Kiln | | Non -porous | | | P | V |
| (d) | Fired MOR ( Glazed Specimen) | Physical | As per Customer's requirement/ Manufacturer's Standard | Manufacturer's Standard | Manufacturer's Standard | | | P | V |
| (e) | Bulk Density | Physical | | | | | | P | V |
| | | | | | | | | | |
| 11.0 | **Cutting & Grinding** | | | | | | | | |
| (a) | Dimensional check (Cutting length) | Physical | First piece set up approval of m/c | Manufacturer's Standard/ | Manufacturer's Standard/ | | | P | V |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| (b) | Ultrasonic Test | Physical | 100% | relevant drawings | relevant drawings | | | P | V |
| | | | | | | | | | |
| 12.0 | **ASSEMBLY** | | | | | | | | |
| (a) | Cement Cubes Test | Physical | Weekly | Manufacturer's Standard/ relevant drawings | Manufacturer's Standard/ relevant drawings | | | P | V |
| (b) | Jig verification | Physical | 3 Month | | | | | P | V |
| (c) | Cement mortar preparation | Physical | Each shift | | | | | P | V |
| (d) | Curing temp. control | Physical | Each shift | Technical Specifications/ Manufacturer's Standard/ relevant drawings | Technical Specifications/ Manufacturer's Standard/ relevant drawings | | | P | V |
| | | | | | | | | | |
| **SECTION: 4. TESTING AND FINAL INSPECTION** | | | | | | | | | |
| 1.0 | **Product Tests** | | | | | | | | |
| 1.1 | **ROUTINE TEST** | | | | | | | | |
| (a) | Bending Test in four directions (50% min failing load) | Mechanical | 100% | IEC-60168/ Technical Specifications/ | | | | P | V |

* Category of Responsibility: P - Actual Test Performance V - Verify and Accept W - Witness Actual testing, verify and accept

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|---|---|---|---|---|---|---|---|---|---|
| | | | | IS-2544 | | | | | |
| (b) | Visual Examination Checks for surface defects & glazing defects | Physical | 100% | Technical Specifications/ relevant drawings | Technical Specifications/ relevant drawings | | | P | V |
| (c) | Dimensional Check | Physical | As per customer requirement/ Manufacturer's Standard | Technical Specifications/ Relevant Drawing | | | | P | V |
| | | | | | | | | | |
| 1.2 | **Acceptance Test** | | | | | | | | |
| (a) | Visual Check | Physical | IS/IEC- 60168, IEC-60273 & IS-2544/ 5350 | Technical Specifications/ / relevant drawings | IS/IEC- 60168, IEC-60273 & IS-2544/ 5350 Technical Specifications/ / relevant drawings | | - | P | W |
| (b) | Dimensional Check | Physical | | | | | - | P | W |
| (c) | Temp. Cycle Test | Physical | | | | | - | P | W |
| (d) | Mechanical Failing Load Test (50% in 3 direction & 100% in 4th ) Deflection under load | Physical | | | | | - | P | W |
| (e) | Porosity Test | Physical | | | | | - | P | W |
| (f) | Eccentricity & Parallelism | Physical | | | | | - | P | W |
| (g) | Deflection test at 20%, 50%, 70% min. bending failing | Mechanical | | | | | | | |

* Category of Responsibility: P - Actual Test Performance V - Verify and Accept W - Witness Actual testing, verify and accept

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|---|---|---|---|---|---|---|---|---|---|
| | load on complete stack. | | | | | | | | |
| (h) | Torsion Test | Mechanical | | | | | - | P | W |
| (i) | Galvanizing Test Mass of Zinc coating | Physical | | | | | - | P | W |
| (j) | (OR) Thickness of zinc Coating (Elcometer) | Chemical | | | | | - | P | W |
| (k) | Uniformity of Zn coating | Chemical | IEC- 60168, IEC-60273 & IS-2544/ 5350 or As per Customer requirement/ Manufacturer's Standard | Technical Specification/ IS 2633 | Technical Specifications/ Approved Drawing | | - | P | W |
| (l) | Adhesion test | Chemical | | IS 2629 | As per specification | | - | P | W |
| | | | | | | | | | |
| **2.0** | **Packing & Dispatch** | | | | | | | | |
| (a) | Visual Inspection | Visual | 100% | Tech. spec. | Manufacturer's Drawing | Manufacturer's Drawing | - | P | - |
| (b) | Dimensions | Measurement | 100% | Tech. spec. | Manufacturer's Drawing | Manufacturer's Drawing | - | P | - |

* Category of Responsibility: P - Actual Test Performance V - Verify and Accept W - Witness Actual testing, verify and accept

# Porcelain Long Rod Insulator

| S. No. | Components / Operations & Description of Test | Type of Check | Quantum of Check / Sampling with basis | Reference Document for Testing | Acceptance Norms | Format of Record | Category of Responsibility | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Sub- Vendor | Manufacturer | Customer |
| **1. RAW MATERIAL INSPECTION** | | | | | | | | | |
| **1.1** | **Alumina** | | | | | | | | |
| ( a ) | Visual Appearance | Physical | 100 gm/bag from 5 % bags/ Consignment./ As per customer requirement/ Manufacturer's standard | Technical Specifications/ Manufacturer's Standard | Technical Specifications/ Manufacturer's Standard | | P | V | - |
| (b) | Residue on 63 µm | Physical | | | | | P | V | - |
| (c) | Chemical Analysis | Chemical | | | | | P | V | - |
| | | | | | | | | | |
| **1.2** | **Feldspar** | | | | | | | | |
| (a) | Visual Appearance | Physical | 100 gm/bag from 5 % bags/ Consignment. / As per customer requirement/ Manufacturer's standard | Technical Specifications/ Manufacturer's Standard | Technical Specifications/ Manufacturer's Standard | | P | V | - |
| (b) | Sieve Residue on 63 µm | Physical | | | | | P | V | - |
| (c) | Chemical Analysis | Chemical | | | | | P | V | - |
| | | | | | | | | | |
| **1.3** | **Clays** | | | | | | | | |
| (a) | Visual Appearance | Physical | Approx 30 kgs sample from 5% of bags / | | | | P | V | - |
| (b) | Appearance of Fired sample | Physical | | | | | P | V | - |

* Category of Responsibility: P - Actual Test Performance V - Verify and Accept W - Witness Actual testing, verify and accept

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|---|---|---|---|---|---|---|---|---|---|
| (c) | Sieve Residue on 38 microns | Physical | Consignment/ each type clay/ As per customer requirement/ Manufacturer's standard | Technical Specifications/ Manufacturer's Standard | Technical Specifications/ Manufacturer's Standard | | P | V | - |
| (d) | Moisture of Extrusion | Physical | | | | | P | V | - |
| (e) | Dry Shrinkage | Physical | | | | | P | V | - |
| (f) | Fired shrinkage | Physical | | | | | P | V | - |
| (g) | Dry bending strength | Physical | | | | | P | V | - |
| (h) | Warpage | Physical | | | | | P | V | - |
| (i) | Water absorption | Physical | | | | | P | V | - |
| (j) | Chemical Analysis | Chemical | | | | | P | V | - |
| | | | | | | | | | |
| **2.** | **Glaze Materials** | | | | | | | | |
| **2.1** | **Quartz Powder** | | | | | | | | |
| (a) | Visual Appearance | Physical | 100 gm/bag 5% of bags/ consignment/ As per customer requirement/ Manufacturer's standard | Technical Specifications/ Manufacturer's Standard | Technical Specifications/ Manufacturer's Standard | | P | V | - |
| (b) | Residue on 63 µm | Physical | | | | | P | V | - |
| (c) | Chemical Analysis | Chemical | | | | | P | V | - |
| | | | | | | | | | |
| **2.2** | **Manganese Carbonate/ Iron Oxide/Chromium Oxide** | | | | | | | | |
| (a) | Visual Appearance of fired sample | Physical | 100 gms / Individual Bags/ As per customer requirement/ | | | | P | V | - |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| (b) | Sieve Residue (63 microns) | Physical | Manufacturer's standard | Technical Specifications/ Manufacturer's Standard | Technical Specifications/ Manufacturer's Standard | | P | V | - |
| (c) | Glaze Color and Appearance of fired sample. | Physical | | | | | P | V | - |
| (d) | Chemical Analysis | | | | | | | | |
| | 1) Loss on ignition | Chemical | | | | | P | V | - |
| | 2) Purity | Chemical | | | | | P | V | - |
| | | | | | | | | | |
| **2.3** | **Wollastonite** | | | | | | | | |
| (a) | Visual Appearance | Physical | 100 gm/bag, 5% of bags/ consignment/ As per customer requirement/ Manufacturer's standard | Technical Specifications/ Manufacturer's Standard | Technical Specifications/ Manufacturer's Standard | | P | V | - |
| (b) | Appearance of fired sample. | Physical | | | | | P | V | - |
| (c) | Sieve Residue (63 microns) | Physical | | | | | P | V | - |
| (d) | Chemical Analysis | | | | | | | | |
| | 1) Loss on ignition | Chemical | | | | | P | V | - |
| | 2) Silica & Calcia | Chemical | | | | | P | V | - |
| | 3) Iron Oxide | Chemical | | | | | P | V | - |
| | | | | | | | | | |

* Category of Responsibility: P - Actual Test Performance V - Verify and Accept W - Witness Actual testing, verify and accept

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|---|---|---|---|---|---|---|---|---|---|
| **2.4** | **Dolomite** | | | | | | | | |
| (a) | Visual Appearance | Physical | 100 gm/bag, 5% of bags from each consignment/ As per customer requirement/ Manufacturer's standard | Technical Specifications/ Manufacturer's Standard | Technical Specifications/ Manufacturer's Standard | | P | V | - |
| (b) | Appearance of fired sample. | Physical | | | | | P | V | - |
| (c) | Sieve Residue (63 microns) | Physical | | | | | P | V | - |
| (d) | Chemical Analysis | | | | | | | | |
| | 4) Loss on ignition | Chemical | | | | | P | V | - |
| | 5) Calcia | Chemical | | | | | P | V | - |
| | 6) Magnicia | Chemical | | | | | P | V | - |
| | | | | | | | | | |
| **3.0** | **Auxiliary materials** | | | | | | | | |
| **3.1** | **Cement** | | | | | | | | |
| (a) | Visual Appearance | Physical | 500 gm/bag 5% of bags from each consignment/ As per customer requirement/ Manufacturer's standard | IS 12269/Plant Standard | IS 12269/ Plant Standard | | P | V | - |
| (b) | Initial Setting time | Physical | | | | | P | V | - |
| (c) | Final setting time | Physical | | | | | P | V | - |
| (d) | Soundness | Physical | | | | | P | V | - |
| (e) | Compressive Strength | Physical | | | | | P | V | - |

* Category of Responsibility: P - Actual Test Performance V - Verify and Accept W - Witness Actual testing, verify and accept

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|---|---|---|---|---|---|---|---|---|---|
| (f) | Chemical Analysis | | | | | | P | V | - |
| | 1) Loss on Ignition | Chemical | | | | | P | V | - |
| (g) | Fineness Analysis | Physical | As per customer requirement/ Manufacturer's standard | | | | P | V | - |
| | | | | | | | | | |
| **3.2** | **Quartz (Assembly)** | | | | | | | | |
| a) | Appearance | Physical | 100 gm/bag 5 bags/ lot | Technical Specifications/ Manufacturer's Standard | Technical Specifications/ Manufacturer's Standard | | P | V | - |
| b) | Sieve Residue (Dry Method) | Physical | 100 gm/bag 5 bags/ lot | | | | P | V | - |
| | | | | | | | | | |
| **SECTION: 2. INCOMING INSPECTION** | | | | | | | | | |
| **1.0** | **Metal Parts** | | | | | | | | |
| 1.1 | **MCI/ SGI Caps / B. Pins <u>(As Cast)</u>** | | | | | | | | |
| (a) | Visual Inspection | Physical | 100% | Technical Spec./ Approved Drawings | Technical Spec./ Approved Drawings | | P | V | - |
| (b) | Dimensional Check | Physical | 2/lot / As per customer | Approved Drg | Technical Spec./ Approved Drawings | | P | V | - |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | requirement/ Manufacturer's standard | | | | | | |
| (c) | M.P.I. Test | Physical | 100% | IS: 3703 | No cracks | | P | V | - |
| (d) | Tensile Load Test (Test Bar) | Physical | 1 Test bar/ heat/ As per customer requirement/ Manufacturer's standard | IS 1865 | As per grade mentioned in approved drawings | | P | V | - |
| (e) | % Elongation (Test Bar) | Physical | 1 Test bar/ heat/ As per customer requirement/ Manufacturer's standard | | | | P | V | - |
| (f) | Hardness | Physical | 1/heat | | | | P | V | - |
| (g) | Chemical Analysis | Chemical | 1/heat | | **Phosphorous Max.0.12%** | | P | V | - |
| (h) | Microstructure (Only Caps) | Physical | 1/heat | | IS: 1865 | | P | V | - |
| (i) | Soundness Test | Physical | As per customer requirement/ Manufacturer's standard | | Ringing Sound | | P | V | - |
| (j) | Proof load test (Yield strength on test bar) | Mechanical | | IS 1865 | As per grade mentioned in approved drawings | | P | V | - |
| (k) | Malleablising (For MCI) | Physical | | IS 14329 | IS 14329/ As per grade mentioned in approved drawings | | P | V | - |

* Category of Responsibility: P - Actual Test Performance V - Verify and Accept W - Witness Actual testing, verify and accept

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|---|---|---|---|---|---|---|---|---|---|
| **1.2** | **SGI Caps / B. Pins (Galvanised)** | | | | | | | | |
| | Purity of Zinc | Chemical | As per customer requirement/ Manufacturer's standard | IS 209/ Technical Specification | Technical Specification | | | | |
| (a) | Visual Inspection | Physical | 100% | IS: 2629/ 2633 | Technical Spec./ Approved Drawings | | P | V | - |
| (b) | Gauge Check | Physical | As per customer requirement/ Manufacturer's standard | Relevant Drg | | | P | V | - |
| (c) | Other Dimension | Physical | 2% | Relevant Drg | | | P | V | - |
| (d) | Adhesion Test | Physical | 1 sample/ Consignment/ As per customer requirement/ Manufacturer's standard | IS: 2629 | No Peeling | | P | V | - |
| (e) | Uniformity of Zinc Coating. | Chemical | 1% random/ As per customer requirement/ Manufacturer's standard | IS: 2633 | Min.4 dips/ Technical Spec./ Approved Drawings | | P | V | - |
| (f) | Thickness of Zinc coating (Elcometer ) | Physical | 2% / lot | IEC 60168 | Min.85 µm/ Technical Spec./ Approved Drawings | | P | V | - |

* Category of Responsibility: P - Actual Test Performance V - Verify and Accept W - Witness Actual testing, verify and accept

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| | | | | | | | | | |
| **2.1** | **Corona Rings (Where Applicable)** | | | | | | | | |
| (a) | Visual Inspection | Physical | 2 / lot/ As per customer requirement/ Manufacturer's standard | As per Technical Specifications/ Approved drawings | No dent, scratch, breaking of welded joints. | | P | V | - |
| (b) | Dimensions | Physical | IS 2500 | Relevant Drawing | Relevant Drawing | | P | V | - |
| (c) | Dye Penetration Test on welded joints. | Chemical | IS 2500 | No cracks/ Technical Specifications/ IS 3658 | No cracks | | P | V | - |
| (d) | Chemical composition | Chemical | 1/ lot/ As per customer requirement/ Manufacturer's standard | Relevant Drawing/ IS 5082 | Relevant Drawing/ As per IS-5082/ As per Grade in approved Drawing | | P | V | - |
| (e) | Mechanical load test | Physical | 1/ lot/ As per customer requirement/ Manufacturer's standard | Relevant Drawing | Relevant Drawing | | P | V | - |
| | | | | | | | | | |
| **2.2** | **Hardware Bolts-Nuts & Washers** | | | | | | | | |

* Category of Responsibility: P - Actual Test Performance V - Verify and Accept W - Witness Actual testing, verify and accept

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|---|---|---|---|---|---|---|---|---|---|
| (a) | Visual Inspection | Physical | 100 % | IS-6639/12427 and IS-1367 Part-3, IS-3063 | Relevant Drawing/ Smooth, Free from defect & no extra zinc. | | P | V | - |
| (b) | Dimensions | Physical | As per IS 1367-Part 17 and IS 6821 | IS 6639 /12427 and IS-1367 Part-3 | Relevant Drawing | | P | V | - |
| (c) | Uniformity of Zinc Coating | Chemical | As per IS 1367 Part 17 | IS 2633 | Relevant Drawing/ Technical Spec./ Approved Drawings | | P | V | - |
| (d) | Thickness of Zn Coating by Elcometer | Physical | As per IEC-60168 | As per IEC-60168 | Technical Spec./ Approved Drawings | | P | V | - |
| (e) | Permanent Set on spring washer | Mechanical | As per IS: 1367-part-17 | IS-6639/12427 and IS-1367 Part-3 | | | P | V | - |
| (f) | Twist Test on spring washer | | | | | | P | V | - |
| (g) | Hardness of Bolt, nut and washer | | | IS-6639/12427 and IS-1367 Part-3, IS-3063 | | | P | V | - |
| (h) | Tensile Load Test ( Bolt) | | | | | | P | V | - |
| (i) | Shear Test ( Bolt) (If applicable) | | | | | | P | V | - |
| (j) | Proof Load Test on Bolt and Nut | | | | | | P | V | - |
| | | | | | | | | | |
| **SECTION: 3. INPROCESS INSPECTION** | | | | | | | | | |
| **1.0** | **Body Preparation** | | | | | | | | |
| 1.1 | **WEIGHMENT** | | | | | | | | |

* Category of Responsibility: P - Actual Test Performance V - Verify and Accept W - Witness Actual testing, verify and accept

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| (a) | Weight | Physical | | Technical Specifications/ Manufacturer's Standard | Technical Specifications/ Manufacturer's Standard | | - | P | V |
| (b) | Moisture content | Physical | Weekly | | | | - | P | V |
| | | | | | | | | | |
| **1.2** | **BALL MILLS** | | | | | | | | |
| (a) | Litre Weight | Physical | Each Ball mill | Technical Specifications/ Manufacturer's Standard | Technical Specifications/ Manufacturer's Standard | | - | P | V |
| (b) | Sieve Residue on 63 microns | Physical | Each Ball mill | | | | - | P | V |
| | | | | | | | | | |
| **1.3** | **Agitator Slurry** | | | | | | | | |
| (a) | Liter Weight | Physical | | Technical Specifications/ Manufacturer's Standard | Technical Specifications/ Manufacturer's Standard | | - | P | V |
| (b) | Sieve Residue on 63 microns | Physical | Each Shift | | | | - | P | V |
| (c) | Free Iron particle | Physical | Each Shift | | | | - | P | V |
| | | | | | | | | | |
| 2.0 | **Glaze Preparation** | | | | | | | | |
| (a) | Liter Weight | Physical | | | Technical Specifications/ Manufacturer's Standard | | - | P | V |
| (b) | Sieve Residue on 38 micron | Physical | Each Batch | | | | - | P | V |

* Category of Responsibility: P - Actual Test Performance V - Verify and Accept W - Witness Actual testing, verify and accept

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| (c) | Colour & appearance of fired sample | Physical | Each cycle | Technical Specifications/ Manufacturer's Standard | As per insulators fired in the same kiln | | - | P | V |
| (d) | Weighment | Physical | Each Batch | | Technical Specifications/ Manufacturer's Standard | | - | P | V |
| (e) | Glaze flow | Physical | As per Customer requirement/ Manufacturer's Standard | | | | - | P | V |
| (f) | Density | Physical | As per Customer requirement/ Manufacturer's Standard | | | | - | P | V |
| | | | | | | | | | |
| 3.0 | **Filter Press** | | | | | | | | |
| (a) | Moisture Content | Physical | As per Customer requirement/ Manufacturer's Standard | Technical Specifications/ Manufacturer's Standard | Technical Specifications/ Manufacturer's Standard | | - | P | V |
| | | | | | | | | | |
| 4.0 | **EXTRUSION** | | | | | | | | |
| (a) | Pug Moisture content | Physical | Each shift/ As per Customer requirement/ Manufacturer's Standard | Technical Specifications/ | Technical Specifications/ Manufacturer's Standard | | - | P | V |
| (b) | Free Iron particles | Physical | Weekly | | | | - | P | V |

* Category of Responsibility: P - Actual Test Performance V - Verify and Accept W - Witness Actual testing, verify and accept

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| (c) | De-airing check | Physical | Each shift | Manufacturer's Standard | | | - | P | V |
| (d) | Vacuum | Physical | Each shift | | | | - | P | V |
| (e) | Physical properties | Physical | Weekly | | | | - | P | V |
| (f) | Chemical Analysis | Chemical | Monthly | | | | - | P | V |
| (g) | Reading/Stiffness | Physical | As per Customer requirement/ Manufacturer's Standard | | | | - | P | V |
| | | | | | | | | | |
| **5.0** | **Pug Drying** | | | | | | | | |
| (a) | Penetrometer Reading | Physical | Each Shift | Technical Specifications/ Manufacturer's Standard | Technical Specifications/ Manufacturer's Standard | | - | P | V |
| (b) | Moisture Content | Physical | As per Customer requirement/ Manufacturer's Standard | | | | - | P | V |
| | | | | | | | | | |
| **6.0** | **Shaping** | | | | | | | | |
| (a) | PMR reading | Physical | As per Customer requirement/ Manufacturer's Standard | Technical Specifications/ Manufacturer's Standard | Technical Specifications/ Manufacturer's Standard | | - | P | V |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| (b) | Dimensions | Physical | Each shift/ As per Customer requirement/ Manufacturer's Standard | Relevant Drawings | Technical Specifications/ Manufacturer's Standard | | - | P | V |
| (c) | Visual check | Physical | 100% | Technical Specifications/ Manufacturer's Standard | Free from defects | | - | P | V |
| (d) | Covering after shaping | Physical | Random | Technical Specifications/ Manufacturer's Standard | Technical Specifications/ Manufacturer's Standard | | - | P | V |
| | | | | | | | | | |
| **7.0** | **Drying** | | | | | | | | |
| (a) | Moisture content | Physical | | Technical Specifications/ Manufacturer's Standard | Technical Specifications/ Manufacturer's Standard | | - | P | V |
| (b) | Temp. & Humidity | Physical | Every hour | | | | - | P | V |
| (c) | Visual checks | Physical | Every item | | Free from visual defects | | - | P | V |
| | | | | | | | | | |
| 8.0 | **Glazing** | | | | | | | | |
| (a) | Litre Weight | Physical | | | Technical Specifications/ | | - | P | V |
| (b) | Density | Physical | | | | | - | P | V |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| (c) | Fluidity | Physical | As per Customer requirement/ Manufacturer's Standard | Technical Specifications/ Manufacturer's Standard | Manufacturer's Standard | | - | P | V |
| (d) | Visual check before glazing | Visual | | | | | - | P | V |
| (e) | Glaze Thickness | Physical | | | | | - | P | V |
| (f) | Visual check after Glazing | Visual | | | | | - | P | V |
| | | | | | | | | | |
| 9.0 | **Firing** | | | | | | | | |
| (a) | Temperature control | Physical | As per Customer requirement/ Manufacturer's Standard | Technical Specifications/ Manufacturer's Standard/ relevant drawings | Technical Specifications/ Manufacturer's Standard/ relevant drawings | | - | P | V |
| (b) | Firing schedule | Physical | | | | | - | P | V |
| (c) | Pressure control | Physical | | | | | - | P | V |
| (d) | Fuel Oil Control | Physical | | | | | - | P | V |
| | | | | | | | | | |
| 10.0 | **Sorting (Fired Insulators)** | | | | | | | | |
| (a) | Visual checks | Physical | | | | | | | |
| | i) Free from cracks | Physical | 100% | Technical Specifications/ | No cracks as Applicable IS /IEC standard | | - | P | V |
| | ii) Free from surface Defects. | Physical | 100% | | Technical Specifications/ | | - | P | V |

* Category of Responsibility: P - Actual Test Performance V - Verify and Accept W - Witness Actual testing, verify and accept

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|---|---|---|---|---|---|---|---|---|---|
| | iii) Uniformity of Glaze Appearance | Physical | 100% | Manufacturer's Standard/ relevant drawings | Manufacturer's Standard/ relevant drawings | | - | P | V |
| (b) | Dimensional Check | Physical | 2 Nos/ drg / Batch | | | | - | P | V |
| (c) | Porosity | Physical | 2 Nos / Kiln | | Non -porous | | - | P | V |
| (d) | Glazed Specimen | Physical | As per Customer requirement/ Manufacturer's Standard | Technical Specifications/ Manufacturer's Standard/ | Technical Specifications/ Manufacturer's Standard/ | | - | P | V |
| (e) | Bulk Density | Physical | | | | | - | P | V |
| | | | | | | | | | |
| 11.0 | **Cutting & Grinding** | | | | | | | | |
| (a) | Dimensional check (Cutting length) | Physical | First piece set up approval of m/c | Technical Specifications/ Manufacturer's Standard/ relevant drawings | Technical Specifications/ Manufacturer's Standard/ relevant drawings | | - | P | V |
| (b) | Ultrasonic Test | Physical | 100% | | | | - | P | V |
| | | | | | | | | | |
| 12.0 | **ASSEMBLY** | | | | | | | | |
| (a) | Cement Cubes Test | Physical | Weekly | Technical Specifications/ Manufacturer's Standard/ relevant drawings | Technical Specifications/ Manufacturer's Standard/ relevant drawings | | - | P | V |
| (c) | Cement mortar preparation | Physical | Each shift | | | | - | P | V |
| (d) | Curing temp. control | Physical | Each shift | | | | - | P | V |

* Category of Responsibility: P - Actual Test Performance V - Verify and Accept W - Witness Actual testing, verify and accept

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| **SECTION: 4. TESTING AND FINAL INSPECTION** | | | | | | | | | |
| 1.0 | **Product Tests** | | | | | | | | |
| 1.1 | **ROUTINE TEST** | | | | | | | | |
| (a) | Mechanical Routine Test | Mechnical | 100% | IEC 60383/ Technical Specification/ IS 731 | IEC 60383/ Technical Specification/ IS 731 | | - | P | V |
| (b) | Visual Examination Checks for surface defects & glazing defects | Physical | 100% | Technical Specifications/ relevant drawings | Technical Specifications/ relevant drawings | | - | P | V |
| (c) | Dimensional Checks | Physical | As per Customer requirement/ Manufacturer's Standard | | | | - | P | V |
| | | | | | | | | | |
| 1.2 | **Acceptance Test** | | | | | | | | |
| (a) | Visual Check | Physical | IEC 60383 | IEC 60383/ Technical Specifications/ Relevant drawings | IEC 60383/ Technical Specifications/ Relevant drawings | | - | P | W |

* Category of Responsibility: P - Actual Test Performance V - Verify and Accept W - Witness Actual testing, verify and accept

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|---|---|---|---|---|---|---|---|---|---|
| | Dimensional Check | Physical | IEC 60383/IEC 60433/IS731/ 3 pcs for lot <300 nos or As per Customer requirement/ | IEC 60383/ 60433/IS 731/ Technical Specifications/ relevant drawings | IEC 60383/ IEC 60433/ IS 731/ Technical Specifications/ relevant drawings | | | | |
| (b) | Temp. Cycle Test | Physical | | | | | - | P | W |
| (c) | Mechanical Failing Load Test (50% in 3 direction & 100% in 4th ) Deflection under load | Physical | | | | | - | P | W |
| (d) | Porosity Test | Physical | | | | | - | P | W |
| (e) | Eccentricity & Parallelism | Physical | | | | | - | P | W |
| (f) | Mechanical performance test | Mechanical | | | | | - | P | W |
| (g) | Warpage, Creepage, appearance check | Physical | | | | | - | P | W |
| (h) | Ultrasonic Test with angular probe | Physical | IEC 60383/IEC 60433/IS 731/1% of lot or As per Customer requirement/ | No flaws | No flaws | | - | P | W |
| (i) | Thermal Mechanical Performance test | Mechanical | 5 samples/every 3260 nos. or As per Customer requirement/ Manufacturer's Standard | Technical Specifications | Technical Specifications | | - | P | W |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| (j) | Test on locking device for ball and socket coupling | Mechanical | IEC 60372/ 3 pcs for lot <300 nos or As per Customer requirement/ Manufacturer's Standard | | | | - | P | W |
| (k) | Galvanizing Test Mass of zinc coating. | Physical | | Technical Specifications/ relevant drawings | Technical Specifications/ relevant drawings | | - | P | W |
| (l) | **(OR)** Thickness of zinc Coating (Elcometer) | Chemical | | | Min. 86 Microns | | - | P | W |
| (m) | Uniformity of Zn coating | Chemical | IEC- 60168, IEC-60273 & IS-2544/ 5350 | Customer specifications/ IS 2633 | Withstood Min 6 dips., 1 min each | | - | P | W |
| (n) | Adhesion test | Chemical | 3 pcs/lot <300 nos. or As per Customer requirement/ Manufacturer's Standard | IS 2629 | As per Customer specifications | | - | P | W |
| 1.2.1 | Additional test on samples brought from site (if applicable as per Customer specification) | | | | | | | | |
| (a) | Electro Mecha test | Electrical | 3 samples/every 1500 nos. or As per Customer requirement/ | Customer specifications | Customer specifications | | - | P | W |

* Category of Responsibility: P - Actual Test Performance V - Verify and Accept W - Witness Actual testing, verify and accept

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|---|---|---|---|---|---|---|---|---|---|
| | | | Manufacturer's Standard | | | | | | |
| | | | | | | | | | |
| **2.0** | **Packing & Dispatch** | | | | | | | | |
| (a) | Visual Inspection | Visual | 10% | Tech.spec. | Manufacturer's Drawing | Manufacturer's Drawing | - | P | - |
| (b) | Dimensions | Measurement | 10% | Tech.spec. | Manufacturer's Drawing | Manufacturer's Drawing | - | P | - |

# Disc Insulators

| S. No. | Components / Operations & Description of Test | Type of Check | Quantum of Check / Sampling with basis | Reference Document for Testing | Acceptance Norms | Format of Record | Category of Responsibility | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Sub- Vendor | Manufacturer | Customer |
| **1. RAW MATERIAL INSPECTION** | | | | | | | | | |
| **1.01** | **CALCINED ALUMINA POWDER** | | | | | | | | |
| ( a ) | Visual Inspection & Physical Properties | Visual/ Physical | 5kgs/consignment/ 200 tones or part thereof/ As per Customer requirement/ Manufacturer's Standard | IS9700 & Plant Standard | White or Off White powder, Retention on 300 B.S mesh-1% (Max.), Magnetic Iron- 0.01% (Max.). | Online/ TC | - | P | V |
| ( b) | **Chemical Analysis** $Al_2O_3$ Na2O | Chemical | | IS9700 & Plant Standard | 95.0% Min. 0.10 % Max. | | P/- | V/P | -/V |
| **1.02** | **QUARTZ POWDER** | | | | | | | | |
| (a) | Visual Inspection | Visual | 5kgs/consignment/ 200tonnes or part thereof/ As per Customer requirement/ Manufacturer's Standard | Plant Std & IS 11465 | White or Off White color, free from any foreign impurities./ As per plant standard | Online/ TC | - | P | V |
| (b) | Inspection of Fired samples ( Button Test ) | Visual | | | White or Off White color, free from any inclusion. / As per plant standard | | - | P | V |
| ( c ) | Free magnetic Iron Content | Physical | | | 0.01% Max. / As per plant standard | | - | P | V |
| ( d ) | Grain Size | Physical | | | Retention on 300 BS Mesh - 4% Max. / As per plant standard | | - | P | V |
| ( e ) | Chemical Analysis $SiO_2$ | Chemical | | | 98.0% Min. / As per plant standard | | P | V | - |

* Category of Responsibility: P - Actual Test Performance V - Verify and Accept W - Witness Actual testing, verify and accept

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|---|---|---|---|---|---|---|---|---|---|
| (f) | Sintering/ fired behaviour | Physical | | Plant Standard | Should not stick to the container and no specks | | P | V | - |
| **1.03** | **FELDSPAR POWDER** | | | | | | | | |
| ( a ) | Visual Inspection & Physical Properties | Visual / Physical | 5kgs/consignment/ 200 tonnes or part thereof/ As per Customer requirement/ Manufacturer's Standard | Plant Standard | Off White powder with pinkish tinge. Retention on 300BS Mesh 5% Max. | Online/ TC | - | P | V |
| ( b ) | Inspection of Fired samples ( Button Test ) | Visual | | | Translucent Felspathic glass free from any foreign inclusions. | | - | P | V |
| ( c) | **Chemical Analysis** $K_2O$ $Na_2O$ $K_2O+Na_2O$ | Chemical | | | A B 10%Min. 8%Min 4.0%Max. 4.0%Max 13%Min. 11%Min | | - | P | V |
| (d) | Sintering/ fired behaviour | Physical | | | Translucent (glossy white) with low impurities | | P | V | - |
| **1.04** | **CHINA CLAY** | | | | | | | | |
| ( a ) | Grain Size | Physical | 5kgs/consignment/ 200 tonnes or part thereof/ As per Customer requirement/ Manufacturer's Standard | Plant Standard | Retention on 300 BS Mesh3%Max./ As per plant standard | Online/ TC | - | P | V |
| ( b ) | Fired colour | Visual | | | Whiter/Light Creamy Biscuit Color, free from black or brown specks | | - | P | V |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| ( c ) | **Chemical Analysis**<br>L.O.I at 1000$^{O}$C<br>$Al_2O_3$<br>$Fe_2O_3$<br>$TiO_2$ | Chemical | | | 15.0%Max.<br>30.0%Min.<br>2.0%Max.<br>2.0%Max.<br>Or As per plant standard | | - | P | V |
| **1.05** | **BALL CLAY** | | | | | | | | |
| ( a ) | Grain Size | Physical | 5kgs/consignment/ 200 tonnes or part thereof/ As per Customer requirement/ Manufacturer's Standard | Plant Standard | Retention on 300 BS Mesh3%Max./ as per plant standard | Online/ TC | - | P | V |
| ( b ) | Free Moisture Content | Physical | | | Hymond Blue - 25% Max.<br>Other Clays - 10% Max/ as per plant standard | | - | P | V |
| ( c ) | Dry Shrinkage | Dimensional | | | 8% Max. / as per plant standard | | - | P | V |
| ( d ) | Total Shrinkage | Dimensional | | | 18% Max. / as per plant standard | | - | P | V |
| (e ) | Green MOR | Physical | | | Min 35 Kg/cm2 / as per plant standard | | - | P | V |
| (f ) | **Chemical Analysis**<br>L.O.I at 1000$^{O}$C<br>$Al_2O_3$<br>$Fe_2O_3$<br>$TiO_2$ | Chemical | One sample in every six month / As per Customer requirement/ Manufacturer's Standard | | 13% Max.<br>23% Min.<br>2.5% Max.<br>3% Max.<br>/ as per plant standard | | - | P | V |
| **2. RAW MATERIAL (Glaze - Brown Color)** | | | | | | | | | |
| **2.01** | **Dolomite Powder** | | | | | | | | |
| ( a ) | Visual Inspection | Visual | 500gms/consignment/20tonnes or | | White in color, free from impurities | Online/ TC | - | P | V |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| ( b ) | Inspection of Fired Samples | Visual | part thereof/ As per Customer requirement/ Manufacturer's Standard | Plant Standard | Free from ferrogineous tint and foreign inclusions. | | - | P | V |
| ( c ) | Grain Size | Physical | | | Retention on 200 BS Mesh 5% Max./ As per plant standard | | - | P | V |
| ( d ) | **Chemical Analysis**<br>$Fe_2O_3$<br>CaO<br>MgO | Chemical | | | 0.2% Max.<br>28% Min.<br>18% Min./ As per plant standard | | - | P | V |
| **2.02** | **Talc Powder** | | | | | | | | |
| ( a ) | Visual Inspection | Visual | 500gms/consignment/20tonnes or part thereof/ As per Customer requirement/ Manufacturer's Standard | Plant Standard | White or Off white colour | Online/ TC | - | P | V |
| ( b ) | Fired Appearance | Visual | | | Free from ferrogeneous tint or foreign inclusion | | - | P | V |
| ( c ) | **Chemical Analysis**<br>L.O.I at $1000^{O}C$<br>$SiO_2$<br>$Fe_2O_3$<br>CaO<br>MgO | Chemical | | | 6.0% Max.<br>58% Min.<br>1% Max.<br>5% Max.<br>30% Min./ As per plant standard | | - | P | V |
| ( d ) | Grain Size | Physical | | | Retention on 200 BS Mesh 2%Max./ As per plant standard | | - | P | V |
| **2.03** | **Iron Oxide** | | | | | | | | |
| ( a ) | Visual Inspection | Visual | 500gms/consignment/20tonnes or part thereof/ As per Customer requirement/ | Plant standard | Red coloured powder | Online/ TC | - | P | V |
| ( b ) | Grain Size | Physical | | | Retention on 200 BS Mesh 2% Max.or 5% | | - | P | V |

* Category of Responsibility: P - Actual Test Performance V - Verify and Accept W - Witness Actual testing, verify and accept

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|---|---|---|---|---|---|---|---|---|---|
| | | | Manufacturer's Standard | | on 300 BS mesh/ As per plant standard | | | | |
| ( c ) | Colored Intensity Fired | Visual | | | Should match std. Reference | | - | P | V |
| ( d ) | Chemical Analysis $Fe_2O_3$ | Chemical | | | 90% Min./ As per plant standard | | - | P | V |
| **2.04** | **Manganese Dioxide** | | | | | | | | |
| ( a ) | Visual Inspection | Visual | 500gms/consignment/20tonnes or part thereof/ As per Customer requirement/ Manufacturer's Standard | Plant Standard | Black coloured powder. | Online/ TC | - | P | V |
| ( b ) | Grain Size | Physical | | | Retention on 200 BS Mesh 2% Max.or 5% on 300 BS mesh/ As per plant standard | | - | P | V |
| ( c ) | Color of Fired samples | Visual | | | Should match std. Reference | | - | P | V |
| ( d ) | **Chemical Analysis**<br>L.O.I at $1000^{O}C$<br>$MnO_2$<br>Acid Insolubles | Chemical | | | 7% Max,<br>80% Min.<br>10% Max./ As per plant standard | | - | P | V |
| **2.05** | **Chromium Oxide** | | | | | | | | |
| ( a ) | Visual inspection | | 500gms/consignment/20tonnes or part thereof/ As per Customer requirement/ Manufacturer's Standard | Plant Standard | Green Coloured powder | Online/ TC | - | P | V |
| ( b ) | Grain Size | Physical | | | Retention on 200 BS Mesh 2% Max.or 5% on 300 BS mesh/ As per plant standard | | - | P | V |
| ( c ) | Fired Color | Visual | | | Should match std. Reference | | - | P | V |

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|---|---|---|---|---|---|---|---|---|---|
| ( d ) | **Chemical Analysis**<br>L.O.I at 1000$^{O}$C<br>$Cr_2O_3$ | Chemical | | | 3% Max.<br>90% Min./ As per plant standard | | - | P | V |
| **2.06** | **Zircon Opacifier** | | | | | | | | |
| ( a ) | Visual Inspection | Visual | 500gms/consignment/20tonnes or part thereof/ As per Customer requirement/ | Plant standard | White or Off white coloured powder. | Online/ TC | - | P | V |
| ( b ) | **Chemical Analysis**<br>$ZrO_2$<br>$SiO_2$ | Chemical | | | 25 to 40 %<br>50 to 70%/ As per plant standard | | - | P | V |
| **2.07** | **Sodium Carboxyl Methyl Cellulose (SCMC )** | | | | | | | | |
| ( a ) | Visual Inspection | Visual | 500gms/consignment/20tonnes or part thereof/ As per Customer requirement/ Manufacturer's Standard | Plant Standard | Buff /White /Off white coloured powder. | Online/ TC | - | P | V |
| ( b ) | Solubility Test | Visual | | | 100% soluble in water and shall give clear solution. | | P | V | - |
| ( c ) | Viscosity of 1% Solution. | Physical | | | 330° to 360° overswing | | P | V | - |
| ( d ) | Free Moisture Content | Physical | | | 10% Max. | | P | V | - |
| **3. RAW MATERIAL (Assembly Material)** | | | | | | | | | |
| **3.01** | **Bituminous Paint** | | | | | | | | |
| ( a ) | Visual Inspection | Visual | Each consignment 1 litre at random from a lot of 20 drums or less/ As per Customer requirement/ Manufacturer's Standard | Plant Standard | Black coloured liquid. | Online/ TC | - | P | V |
| ( b ) | Drying Time | Physical | | | 8 Hours Max./ As per plant standard | | - | P | V |

* Category of Responsibility: P - Actual Test Performance V - Verify and Accept W - Witness Actual testing, verify and accept

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| **3.02** | **Rubberised cork sheet** | | | | | | | | |
| ( a ) | Specific Gravity | Physical | Avg. of 5 pcs / 5000 sheets or less/ As per Customer requirement/ Manufacturer's Standard | Plant Standard | 0.85gm/cm³ (min) ./ As per plant standard | Online/ TC | - | P | V |
| ( b ) | Thickness | Dimensional | 5 pcs / 5000 sheets or less/ As per Customer requirement/ Manufacturer's Standard | | 1.0mm (+/- 10%)./ As per plant standard | | - | P | V |
| **3.03** | **Portland Cement (53 S)** | | | | | | | | |
| ( a ) | Visual Inspection | Visual | 5kgs/consignment/ 50tonnes or part thereof/ As per Customer requirement/ Manufacturer's Standard | Plant Standard | No lumpiness & Solidification | Online/ TC | - | P | V |
| ( b ) | Compressive Strength - (25mm cubes avg of 5 -10 cubes) | Mechanical | | | 550kg/cm$^2$ Min.( 2days water + 3days Air Curing) /As per plant standard | | - | P | V |
| ( c ) | Optimum Water Content | Physical | | | 26.0 to 31.0% /As per plant standard | | - | P | V |
| ( d ) | Initial Setting Time | Physical | | | 150 minutes Max /As per plant standard | | - | P | V |
| ( e ) | Final Setting Time | Physical | | | 400 minutes Max /As per plant standard | | - | P | V |
| ( f ) | Auto Clave Expansion | Physical | | | 0.2% Max. /As per plant standard | | - | P | V |
| **4. IN-PROCESS INSPECTION** | | | | | | | | | |
| **4.01** | **Glaze Making (Brown Glaze)** | | | | | | | | |

* Category of Responsibility: P - Actual Test Performance V - Verify and Accept W - Witness Actual testing, verify and accept

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|---|---|---|---|---|---|---|---|---|---|
| ( a ) | Glaze Flow | Physical | Each Batch as per Plant Standard | Plant Standard | 40mm (Min.) /As per plant standard | Online | - | P | V |
| ( b ) | Physical Appearance | Visual | | | Should Match Std. Ref. Samples | | - | P | V |
| ( c) | Particle Size (< 10 micron ) | Physical | | | 65 to 85%/As per plant standard | | - | P | V |
| **4.02** | **Ceramic Slurry properties:** | | | | | | | | |
| ( a ) | **Specific Gravity** | Physical | Once in each Shift/ As per Customer requirement/ Manufacturer's Standard | Plant Standard | | Online | - | P | V |
| | Silica Body | | | | 1.30 Min. /As per plant standard | | - | P | V |
| | Alumina Body | | | | 1.35 Min. /As per plant standard | | - | P | V |
| ( b) | Free Iron Content | Physical | Twice a week/ As per Customer requirement/ Manufacturer's Standard | | 0.001% Max. /As per plant standard | | - | P | V |
| ( c ) | **Particle Size** | Physical | Once in a Day/ As per Customer requirement/ Manufacturer's Standard | | **( < 10 micron )** /As per plant standard | | - | P | V |
| | Silica Body | | | | 65 to 75%/As per plant standard | | - | P | V |
| | Alumina Body | | | | 75 to 85%/As per plant standard | | - | P | V |
| **4.03** | **Filter Pressing** | | | | | | | | |
| ( a ) | **Moisture Content** | Physical | Once in each Shift/ As per Customer requirement/ Manufacturer's Standard | Plant Standard | | | - | P | V |
| | Silica Body | | | | 15 to 25%/As per plant standard | | - | P | V |
| | Alumina Body | | | | 15 to 25 %/As per plant standard | | - | P | V |
| **4.04** | **Pug Mill Blanks** | | | | | | | | |
| ( a) | De-airing Check | Physical | Each Shift 2 to 3 nos. Slices/ As per | Plant Standard | No Lamination Crack | | - | P | V |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| ( b ) | Moisture Content | Physical | Customer requirement/ Manufacturer's Standard | | 16 to 24 %/As per plant standard | | - | P | V |
| **4.05** | **Prop. Of Unfired Porcelain** | | | | | | | | |
| ( a) | Dry MOR | Physical | 5 Nos. a day/ As per Customer requirement/ Manufacturer's Standard | Plant Standard | 35kg/cm² Min. /As per plant standard | | - | P | V |
| ( b ) | Dry Shrinkage | Dimensional | Twice a Week/ As per Customer requirement/ Manufacturer's Standard | | | | - | P | V |
| | Silica Body | | | | 7% Max/As per plant standard | | - | P | V |
| | Alumina Body | | | | | | - | P | V |
| ( c ) | Total Shrinkage | Dimensional | Twice a Week/ As per Customer requirement/ Manufacturer's Standard | | | | - | P | V |
| | Silica Body | | | | 12 to 16%/As per plant standard | | - | P | V |
| | Alumina Body | | | | | | - | P | V |
| **4.06** | **Shaping** | | | | | | | | |
| ( a ) | Making - Moisture Content ( Wet Basis ) | Physical | Each Shift | Plant Standard | Si & Al 16 to 24 % /As per plant standard | Online | - | P | V |
| | | | | | | | - | P | V |
| | | | | | | | - | P | V |
| ( b) | Finishing Dimensional Check | Dimensional | Twice a day | As per Prod. Drg. | As per relevant Prod. Drg. | | - | P | V |
| **4.07** | **Drying of Green Ware** | | | | | | | | |
| ( a) | Temp. Control | Physical | Once each Shift | Plant Standard | 40°C to 120°C/As per plant standard | | - | P | V |
| ( b ) | Moisture Content | Physical | Once each Shift | | < 1.0%/As per plant standard | | - | P | V |

* Category of Responsibility: P - Actual Test Performance V - Verify and Accept W - Witness Actual testing, verify and accept

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| **4.08** | **Glazing ( Brown Glaze)** | | | | | | | | |
| ( a) | Density | Physical | At least Once in a Shift | Plant Standard | 1.45 to 1.58 gm/c.c/As per plant standard | | - | P | V |
| ( b ) | Fluidity ( Degree Overswing ) | Physical | At least Once in a Shift | | 330 to 350/As per plant standard | | - | P | V |
| ( c) | Visual Examination | Visual | 100% | | /As per plant standard | | - | P | V |
| **4.09** | **Grit / Sand** | | | | | | | | |
| ( a) | Grain Size | Physical | Each Batch | Plant Standard | - 8 to 16 BS Mesh/As per plant standard | | - | P | V |
| | Green Grit | | | | -10 to 14 BS mesh/As per plant standard | | - | P | V |
| | Fired Grit (Alumina body only) | | | | | | - | P | V |
| **4.10** | **Firing of Green Wares** | | | | | | | | |
| ( a) | Temp. Control | Physical | Constant Recording | Plant Standard | As per Plant Std. | | - | P | V |
| ( b) | Pressure Control | Physical | Per Shift | | | | - | P | V |
| ( c) | Fuel Control | Physical | Per Shift | | | | - | P | V |
| **4.11** | **Sorting of Fired Insulators** | | | | | | | | |
| ( a) | Visual Examination | Visual | 100% | Plant Standard, IS:13305 & IEC: 60383.1 | IS:13305 , IS: 731 & IEC: 60383.1 | | - | P | V |
| ( b ) | Porosity | Physical | 1 No. / Car | Plant Standard, IS:731 | No Dye Penetration | | - | P | V |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| ( c) | Dimensional Check | Dimensional | 2 item's/Day | Plant Standard, IS:731& IEC:60383.1 | Should conform with the drawing | | - | P | V |
| **4.12** | **Tests on shells** | | | | | | | | |
| (a) | Hyd. Proof load Test | Mechanical | 100 % | Tech.Spec. & Plant Standard | For 120kN-130 ± 10, 160kN - 150 ± 10 and 210kN - 200 ± 10/ As per Plant standard/ As per Technical Specification | | - | P | V |
| **4.13** | **Assembly** | | | | | | | | |
| (a) | Cement Mix Check | Physical | Daily | Plant Std. | | | - | P | V |
| (b) | Curing Time | Physical | Daily | | At least 2 days water & 3 days air curing/ As per plant standard | | - | P | V |
| (C) | Cube Test ( Compressive Strength Test after - 6 days on 25.4 mm Cube ) | Mechanical | Once in a day | IS : 4031, BS : 12, Plant Standard | 500kg/cm2 Min./ As per Technical Specification | | - | P | V |
| | | | | | | | | | |
| **5.00 RAW MATERIAL ( Metal Parts )** | | | | | | | | | |
| **5.01** | **Steel round for Ball pins** | | | | | | | | |
| (a) | Visual Inspection | Visual | 100% | Plant Standard/ BS:970 ( Gr. EN-8D ) | Shall be straight, without rust & free from cracks, folds & similar surface defects. | CMTC | P | V | - |

* Category of Responsibility: P - Actual Test Performance V - Verify and Accept W - Witness Actual testing, verify and accept

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|---|---|---|---|---|---|---|---|---|---|
| (b) | ForgeabiIity | Mechanical | 2 Nos/ Lot | Plant Standard | No cracks on the surface | | P | V | - |
| ( c) | Non Metallic Inclusion rating | Metallurgical | 2 Nos/ Lot | IS:4163 | Max. 2 thick series/ As per Technical Specification | | P | V | - |
| (d) | Chemical Analysis | Chemical | 1 No/ Lot | BS:970 | As per Gr. EN-8D/ As per Technical Specification | | P | V | - |
| **5.02** | **Forged Steel Ball Pins ( Black condition)** | | | | | | | | |
| (a) | Visual inspection | Visual | 100% by Manufacturer & 5% by insulator manufacturer | IS: 2486 & Plant standard | Shall be free from visual defects like surface defects, flakes & other visual defects that make the surface undulated. | CMTC | P | V | - |
| (b) | Heat Treatment | Physical | 100% (100% Review of Documents by customer) | Time & Temperature graph | Should be output of recorder. Gradation as per plant standard/ As per Technical Specification | CMTC | P | V | - |
| (c) | M.P.I | Electro magnetic | 100% by Manufacturer & 5% by insulator manufacturer | IS: 3703 & Plant Standard | No cracks | | P | V | - |
| (d) | Dimension checking | Dimensional | IS:2486 & Plant Stabdard/ MP, Cl.19.8L | Approved Drawing | Should conform with the drawing | CMTC/ | P | V | - |
| (e) | Gauge checking | Dimensional | 100% by Manufacturer & 5% by insulator manufacturer | IS:2486 | Should answer "GO and "NO GO" Gauges | | P | V | - |
| (f) | Failing Load test | Mechanical | 4 Nos./ 2000/ heat | Plant Standard | Should withstand at least 10% above Min. | CMTC | P | V | - |

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| | | | | | rated EMS/ As per Technical Specification | | | | |
| (g) | Yield strength, Tensile strength & % Elongation on test bar | Physical | 4 Nos./ 2000/ heat | IS:1608, BS:970, Tech.spec. & Plant Standard | Y.S - 28 kg/mm² (min.)-Upto 120KN, 47 kg/mm² (min.),-160 & 210KN<br>T.S - 55 kg/mm². (min) upto 120KN, 71 kg/mm². (min)- 160-210KN<br>%E - 16% min. upto 210KN/ As per Technical Specification | | P | V | - |
| (h) | Hardness | Physical | 4 Nos./ 2000/ heat | IS: 1500, BS 970, PG Spec. & Plant Standard | 152 - 207 BHN - upto 120KN. 201 - 255 BHN - 160-210KN/ As per Technical Specification | | P | V | - |
| (I) | Grain Size | Metallurgical | 4 Nos./ 5000/ heat | IS:4748 & Plant Standard | Min. 6, (100X Magnification) / As per Technical Specification | | P | V | - |
| (j) | Non Metallic Inclusion rating | Metallurgical | 4 Nos/ 5000/ heat | IS:4163 | Max. 2 thick series/ As per Technical Specification | | P | V | - |
| (K) | Chemical Analysis | Chemical | 1 No/ Lot | BS:970 | Gr. EN-8D/ As per Technical Specification | CMTC/Third Party Lab.Test cert. | P | V | - |
| **5.03** | **SGCI caps ( Black & Galvanizing condition )** | | | | | | | | |

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|---|---|---|---|---|---|---|---|---|---|
| (a) | Visual inspection | Visual | 100% by Manufacturer & 5% by Insulator manufacturer | Plant Standard | Shall be free from defects & shall be sound, fettled & free from blow holes, porosity, distortion & harmful defects. | | P | V | - |
| (b) | Gauge checking | Physical | 100% by Manufacturer & 5% by Insulator manufacturer | Plant Standard, IS:2486 Part-II, IEC-120 | Should answer "GO" and "NO GO" gauges | CMTC | P | V | - |
| (c) | Dimension checking | Physical | IS:2486, Plant Standard | Approved Drawing | Should conform with the drawing | | P | V | - |
| (d) | Failing Load test | Mechanical | 4 Nos./ 2000/ annealing cycle | Plant Standard | Should withstand at least 10% above Min. rated EMS/ As per Tech. Specs. | | P | V | - |
| (e) | Hardness Test | Physical | 4 Nos./ 2000/ annealing cycle | IS: 1500 , IS:1865(Gr. 450/10)/ Plant Standard | SGCI- 130 BHN (Min.) / As per Tech. Specs. | CMTC | P | V | - |
| (f) | Microstructure | Metallurgical | 2 Nos./ 5000 Nos | IS:1865/Tech. Spec. | SGCI- Spheroidal graphite nodules in ferrite matrix. / As per Tech. Specs. | CMTC | P | V | - |
| (g) | Tensile strength, %Elongation & 0.2% Proof strength test on test bar | Physical | 2 Nos./ Lot of 5000 Nos./ Heat | IS: 1865 (Gr. 450/10)/ Plant standard. | For SGCI: T.S. -450 Mpa(min.), 0.2% PST-310 Mpa(Min.) %E-10%,(Min) / As per Tech. Specs. | CMTC | P | V | - |
| (h) | Chemical Analysis | Chemical | 1 No/ 5000 Nos. | IS:228/ Tech. Spec./ Plant Standard | Phosphorous- 0.12% Max. / As per Tech. Specs. | CMTC | P | V | - |

* Category of Responsibility: P - Actual Test Performance V - Verify and Accept W - Witness Actual testing, verify and accept

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|---|---|---|---|---|---|---|---|---|---|
| (I) | Heat Treatment | Physical | 100% | Time & temperature Graph | Should be output of recorder | CMTC | P | V | - |
| (j) | M.P.I | Electro magnetic | 2nos/5000nos | IS 3703 & Tech. Spec. | IS 3703 & Tech. Spec. | CMTC/EM records | P | V | - |
| **5.04** | **Hot Dip Galvanizing (Caps & Pins)** | | | | | | | | |
| (a) | Visual Inspection | Visual | 100% by Manufacturer & 5% by insulator manufacturer | IS: 2629 & Plant Standard | Surface should be reasonably bright, smooth, free from rust, black spots, extra zinc. | CMTC/EM records | P | V | - |
| (b) | Gauge checking | Dimensional | 100% by Manufacturer & 5% by insulator manufacturer | IS:2486, Plant Standard | Should answer "GO" and "NO GO" gauges | CMTC/EM records | P | V | - |
| ( c ) | Uniformity of Zn coating | Chemical | 3Nos./5000 | IS:2633& Plant Standard | 6 dips Min./ As per Technical Specs. | CMTC/EM records | P | V | - |
| (d) | Mass of Zn coating | Chemical | 3Nos./5000 | IS:6745 & Plant Standard | 610gm/m² Min. / As per Technical Specs. | | P | V | - |
| (e) | Adhesion test | Chemical | 3Nos./5000 | IS:2629 & Plant Standard | No Peel-Off of Zinc Coating/ As per Technical Specs. | | P | V | - |
| (f) | Purity of Zinc (Ingot) | Chemical | 1 No./ Lot | IS: 209 & Plant Standard 0 | 99.95% Min. / As per Technical Specs. | Third Party Lab.Report/ EM | P | V | - |
| (g) | For Ball Pin | | | | | | | | |
| | i) Grain size | Metallurgical | 4nos/5000nos/heat | IS 4748 & Plant Standard | Min 6,(100X magnification) / As per Technical Specs. | CMTC/EM records | P | V | - |
| | ii) Non Metallic Inclusion rating | Metallurgical | 4nos/5000nos/heat | IS 4163 | Max 2 thick series / As per Technical Specs. | CMTC/EM records | P | V | - |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | iii) Chemical analysis | Chemical | 1no/lot/heat | BS:970 Carbon Manganese silicon Phosphorous Sulphur | Gr. EN-8D 0.40 - 0.45% 0.70 - 0.90% 0.05 - 0.35% 0.06% Max 0.05%Max / As per Technical Specs. | CMTC/EM records | P | V | - |
| (h) | For cap | | | | | | | | |
| | I) Microstructure | Metallurgical | 2 nos/5000nos | IS:1865/Tech. Spec./ Plant Standard | SGCI- Spheroidal graphite nodules in ferrite matrix - Min 85%/ As per Technical Specs. | CMTC/EM records | - | P | V |
| | ii) Chemical Analysis | Chemical | 1 no/5000 nos | IS:1865/ Tech. Spec./ Plant Standard | IS:14329/ Tech. Spec./Plant Standard/ Phosporous-0.12% max | CMTC/EM records | P | V | - |
| | iii) M.P.I | Electro magnetic | 2 nos/5000nos | IS 3703 & Tech. Spec. | IS 3703 & tech. Spec. | CMTC/EM records | P | V | - |
| **5.05** | **Zinc sleeve on Ball Pin** | | | | | | | | |
| (a) | Unfused area of surface | Visual | 5 Nos./ 5000 Nos. | Plant Standard & Tech.spec. | Not more than 20% or as per Technical Specifications | CMTC/EM records | P | V | - |
| (b) | Load test | Mechanical | 2 Nos./ 5000 Nos | Plant Standard | Sleeve should not be loose after applying 85% EMS or as per Technical Specifications | EM records | - | P | V |
| ( c ) | Blow holes on surface | Visual | 5 Nos./ 5000 Nos. | Plant Standard | No blow holes on visual inspection | EM records | - | P | V |
| (d) | Deformation of sleeve (including thickness) | Visual | 5 Nos./ 5000 Nos. | Plant Standard | No deformation on visual inspection | CMTC/EM records | P | V | - |

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|---|---|---|---|---|---|---|---|---|---|
| (e) | Foreign material | Visual | 5 Nos./ 5000 Nos. | Plant Standard | No foreign materials visible on visual inspection | CMTC/EM records | P | V | - |
| (f) | Dimension checking | Dimensional | 5 Nos./ 5000 Nos. | Approved Drawing | Should conform with the drawing | CMTC/EM records | P | V | - |
| (g) | Flash on head & Ball side | Visual | 5 Nos./ 5000 Nos. | Plant Standard | No flash or as per Technical Specifications | CMTC/EM records | P | V | - |
| (h) | Zinc purity | Chemical | 1 Nos./ 5000 Nos. | Plant Standard | 99.8% Min. or as per Technical Specifications | Third Party Lab Report/EM records | P | V | - |
| **5.06** | **Security clips (stainless steel /Phosphor Bronze)** | | | | | | | | |
| (a) | Visual | Visual | As per IEC:60372, Cl.12, Table 1 | IEC:60372/ Plant Standard | surface cracking or incipient cracks, AQL=1.5%. For rough surface & blisters, AQL=6.5% or as per Technical Specifications | CMTC/EM records | P | V | - |
| (b) | Dimension checking | Dimensional | As per IEC:60383/ IS:2486 | IEC:60372/ IS:2486/ Approved drawing/As per Tech. Spec. | Should conform with the drawing | | P | V | - |
| (c) | Operation Test | Mechanical | As per IEC:60384/ IS:2486 | IEC:60383/ IS:2486 | 50-500 N or as per Technical Specifications | | - | P | V |
| (d) | Resistance to bending | Mechanical | As per IEC:60372, Cl.13/ IS:2486 | IEC:60372/ IS:2486/ Plant Standard | No cracks at 75 degree bend. or as per | | P | V | - |

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|---|---|---|---|---|---|---|---|---|---|
| | | | | | Technical Specifications | | | | |
| (e) | Hardness | Physical | As per IEC:60372, Cl.13/ IS:2486 | IEC:60372/ IS:2486/ Plant Standard | 152 BHN Min. or as per Technical Specifications | | P | V | - |
| (f) | Intergranular corrosion test (for stainless steel) | Metallurgical | 1 No./ Lot | IS:10461 & ASTM: A 262A | No corrosion | Third Party Lab.Report/ EM Records | P | V | - |
| (g) | Chemical Analysis | Chemical | 1 No./ Lot | AISI:304/IS78 14-Gr-I | Should conform standard | | P | V | - |
| **6.00** | **Final Inspection & Testing** | | | | | | | | |
| **6.01** | **Routine Tests on Disc Insulators** | | | | | | | | |
| (a) | Visual Inspection | Visual | 100 % | IS : 731 | As per Spec. | | - | P | V |
| (b) | Mechanical Routine test (At 65% of rated EMS) | Mechanical | 100 % | IS : 731 | As per Spec. | EM-records | - | P | V |
| (c) | Electrical Routine Test | Electrical | 100 % | IS : 731 | As per Spec. | | - | P | V |
| (d) | High Frequency Test | Electrical | 100 % | IEC : 60383-1, ANSI : 29.1 & Plant Standard | 4 to 5 sec. or as per Technical Specifications | | - | P | V |
| (e) | Power Frequency Test | Electrical | 100 % | IEC : 60383-1, IS : 731 & Plant Standard | 5 mins ( Min. ) or as per Technical Specifications | | - | P | V |
| **6.02** | **Acceptance Test** | | | | | | | | |
| (a) | Visual examination | Visual | IEC 60383 on lot Size of 10000 Nos. or less (E1 + E2) | Plant Standard, IS 731, IS :13305 & IEC: 60383-1 | No Non pemissible defect 0n glazed surface | EM-Format | | P | W |

* Category of Responsibility: P - Actual Test Performance V - Verify and Accept W - Witness Actual testing, verify and accept

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|---|---|---|---|---|---|---|---|---|---|
| (b) | Verification of dimension | Dimensional | IEC 60383 on lot Size of 10000 Nos. or less( E2) | Approved drg. & IS 731, IEC 60383-I | As per Approved Drg. | | | P | W |
| (c) | Temperature cycle test | Thermal | IEC 60383 on lot Size of 10000 Nos. or less (E1 + E2 + Sample for Mech Test) | IEC : 60383-1, IS : 731 | As per spec. | | | P | W |
| (d) | Mech. Performance test | Mechanical | 20 Nos. Min on Lot size of 10000 Nos. | IEC 60575, Tech.Spec. | As per spec. | | | P | W |
| (e) | Test on locking devices for Ball & Socket coupling. | Mechanical | IEC 60383 on lot Size of 10000 Nos. - E2 | IS : 2486 & IEC 60372/ 60383 & Tech.Spec. | As per spec. | EM-Format | | P | W |
| (f) | Eccentricity Test (Axial & Radial runout) | Dimensional | IEC 60383 on lot Size of 10000 Nos. or less (E1 + E2) | IEC 60383-1 & Tech.approved Drg. & Spec. | As per Approved Drg. | EM-Format | P | V | W |
| (g) | Residual strength test (Preceded by Temperature cycle test) | Mechanical | 25 Nos. Min on Lot size of 25000 Nos. | IEC 60797 & Tech.Specification. | As per spec. | EM-Format | P | V | W |
| (h) | Electromechanical strength Test. | Electrical - Mechanical | 20 Nos. Min on Lot size of 10000 Nos. | Tech.spec., IS : 731 & IEC 60383 | As per spec. | EM-Format | P | V | W |
| (i) | Puncture Test | Electrical | IEC : 60383/ Tech.Spec on Lot Size of 10000 Nos. or less - E2 | Tech.spec., IS : 731 & IEC 60383 | As per spec. | | P | V | W |
| (j) | Porosity Test | Physical | IEC 60383 on lot Size of 10000 Nos. - E1 | Tech.spec., IS : 731 & IEC 60383 | As per spec. | | P | V | W |

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| (k) | IR Test ( using 5 kV Megger) | Electrical | 25 Nos. on lot size of 10000 Nos. | Tech.spec. > 2000 Mega ohms | As per spec. | | P | V | W |
| (l) | Galvanizing Test (Cap & Pin) | | IEC 60383 on lot Size of 10000 Nos. - E2 | IS : 2633/ 4759 / 6745 | | EM-Format | P | V | W |
| | i) Mass of zinc coating | Chemical | | 610 g/$m^2$ min | As per spec. | | P | V | W |
| | ii) Uniformity of zinc Coating | Chemical | | 6 dips min. | As per spec. | | P | V | W |
| | iii) Adhesion test | Physical | | IS : 731 & IS 2629 | As per spec. | | P | V | W |
| (m) | Chemical analysis of zinc Sleeve ball pin | Mechanical | 1no/10000nos/LOT | 99.8%min purity Tech.spec. | As per spec. | Third party Lab/ EM LAB | P | V | - |
| (n) | Impact Test | Mechanical | 3 Nos. / Lot size of 10000 Nos. | Tech.spec. ANSI : C-29.2 | As per spec. | | P | V | W |
| (o) | Alumina Content (only if Power Arc Test is included in contract requirement) | Chemical | 1 Sample / Lot | 30% min, Tech.spec. | As per spec. | | P | V | W |
| (p) | Bulk Density | Chemical | 1 Sample / Lot | ≥2.35g/cc for Si body and ≥2.5g/cc for Al body | As per spec. | EM-Format | P | V | W |
| (q) | Closed Porosity | Chemical | 1 Sample / Lot | 5.5 % max, by gravimetric method , Tech.spec. | As per spec. | | P | V | W |
| (r) | Additional EMS Test (If applicable) | Mechanical | 20 Nos. / 10000 Nos. | Tech. Spec./ IS:731/ IEC:60383 | As per spec. | | P | V | W |

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| **6.03** | **Repeat Acceptance Test:-** | | | | | | | | |
| (a) | Steep wave front | Electrical | 20 Nos. / 50000 Nos. | Tech.spec. | As per spec. | EM-Format | | P | W |
| (b) | Thermal mechanical performance test | Thermal / Mechanical | 20 Nos. / 50000 Nos. | Tech.spec. | As per spec. | | | P | W |
| **7.00** | **Packing & Dispatch** | | | | | | | | |
| (a) | Visual Inspection | Visual | 10% | Tech.spec. | EM - Drawing | EM - Drawing | | P | - |
| (b) | Dimensions | Measurement | 10% | Tech.spec. | EM - Drawing | EM - Drawing | | P | - |

EM : Equipment Manufacturer CM : Component Manufacturer CMTC :- Component manufacturer test certificate EMTR :- Equipment manufacturer test Report

# Wave trap

| S. No. | Components / Operations & Description of Test | Type of Check | Quantum of Check / Sampling with basis | Reference Document for Testing | Acceptance Norms | Format of Record | Category of Responsibility | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Sub-Vendor | Manufacturer | Customer |
| **A** | **Raw Material inspection** | | | | | | | | |
| **1** | **Aluminium Conductor** (Grade 63400) | | | | | | | | |
| 1.1 | Tensile Strength [min] [max] | Mechanical | 1 Sample / lot | Manufacturer Plant Specn./ As per specn / IS 733 | Manufacturer Plant Specn./ As per specn / IS 733 | Component Mfg's TC | P | V | - |
| 1.2 | Proof Stress [0.2%] [min] [max] | Mechanical | 1 Sample / lot | Manufacturer Plant Specn./ As per specn / IS 733 | Manufacturer Plant Specn./ As per specn / IS 733 | Component Mfg's TC | P | V | - |
| 1.3 | Electrical Conductivity/ Electrical Resistivity [min] [max] | Electrical | 1 Sample / lot | Manufacturer Plant Specn./ As per specn / IS 733/ IS 398 | Conductivity: 48 % IACS to 56 % IACS Electrical Resistivity for annealed conductor (O) = at 20°C= 0.0280 ohm $mm^2$/ m Max. | Component Mfg's TC | P | V | - |

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| 1.4 | Chemical Composition | Chemical | 1 Sample / lot | Manufacturer Plant Specn./ As per specn / IS 733 | Si : 0.3 - 0.7 %<br>Fe : 0.6 % max<br>Cu : 0.1 % max<br>Mn : 0.3 % max<br>Mg : 0.4 - 0.9 %<br>Zn : 0.2 % max<br>Ti : 0.2 % max<br>Cr : 0.1 % max<br>Balance - aluminium | Component Mfg's TC | P | V | - |
| 1.5 | Dimensional check | Physical | 1 sample / lot | Plant Drg | Plant Drg | Eqpt. Mfg's TC | - | P | V |
| | | | | | | | | | |
| **2** | **CROSS ARM** [BOX SECTION] | | | | | | | | |
| 2.1 | Chemical Composition (Grade 64430) | Chemical | 1 Sample / lot | Manufacturer Plant Specn. As per specn / IS 617/ IS 1285 | Si : 0.6 - 1.3 %<br>Fe : 0.6 % max<br>Cu : 0.1 % max<br>Mn : 0.3 % max<br>Mg : 0.4 - 1.0 %<br>Zn : 01 % max<br>Ti : 0.2 % max<br>Cr : 0.25 % max<br>Balance - Aluminium | Component Mfg's TC | P | V | - |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 2.2 | Tensile Strength | Mechanical | 1 Sample / lot | Manufacturer Plant Specn./As per specn / IS 617/ IS 1285 | Min. 31.5 Kg / $mm^2$ | Component Mfg's TC | P | V | - |
| 2.3 | Proof Stress (0.2%) | Mechanical | 1 Sample / lot | Manufacturer Plant Specn. /As per specn / IS 617/ IS 1285 | Min. 27.5 Kg / mm2 | Component Mfg's TC | P | V | - |
| 2.4 | Elongation | Mechanical | 1 Sample / lot | Manufacturer Plant Specn./As per specn / IS 617/ IS 1285 | 7% Min. | Component Mfg's TC | P | V | - |
| **3** | **END RINGS** | | | | | | | | |
| 3.1 | Dimension | Physical | 1 Sample / lot | Manufacturer Plant Drawing | Manufacturer Plant Drawing/ Compliance to Plant Drg | Component Mfg's TC / Eqpt. Mfg's TC | P | V | - |
| 3.2 | Visual Inspection | Visual | 100% | Manufacturer Plant Specn. | Manufacturer Plant Specn. | | P | V | - |
| 3.3 | Temperature Compatibility | Thermal | One Sample from each lot of 500 Nos or thereof | Manufacturer Plant Specn./ As per specn | Manufacturer Plant Specn./ As per specn No Deformation when left at 155 | | P | V | - |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | Deg C for 24 hrs | | | | |
| 3.4 | Bending Strength | Mechanical | One Sample from each lot of 500 Nos or thereof | As per specn | Manufacturer Plant Specn./ As per specn | | P | V | - |
| | [min] | | | | 40 Kg / $mm^2$ | | | | |
| **4** | **PRE PREG FOIL** | | | | | | | | |
| 4.1 | Visual Check | Visual | 100% | Manufacturer Plant Specn. | Manufacturer Plant Specn. | Component Mfg's TC / Eqpt. Mfg's TC | P | V | - |
| **5** | **PERMA GLASS ROD (FRP ROD)** | | | | | | | | |
| 5.1 | Dimension | Physical | 1 Sample / Lot | Manufacturer Plant Drawing | Manufacturer Plant Drawing Compliance to Plant Drg | Component Mfg's TC / Eqpt. Mfg's TC | P | V | - |
| 5.2 | Visual Inspection | Visual | 100% | Manufacturer Plant Specn. | Manufacturer Plant Specn. | Component Mfg's TC / Eqpt. Mfg's TC | P | V | - |
| 5.3 | Tensile Strength | Mechanical | 1 Sample / Lot | Manufacturer Plant Specn./ As per specn | Manufacturer Plant Specn./ As per specn | Component Mfg's TC | P | V | - |
| **6** | **DISTANCE PIECE [FRP SPACER]** | | | | | | | | |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 6.1 | Dimension | Physical | 5 samples / lot | Manufacturer Plant Drawing | Manufacturer Plant Drawing/ Compliance to Plant Drg | Component Mfg's TC / Eqpt. Mfg's TC | P | V | - |
| 6.2 | Visual Inspection | Visual | 100% | Manufacturer Plant Specn. | Manufacturer Plant Specn. | | P | V | - |
| **7.0** | **STAINLESS STEEL TIE ROD** | | | | | | | | |
| 7.1 | Property of Non - Magnetism | Electrical | 100% | Manufacturer Plant Specn. Should be Non Magnetic | Manufacturer Plant Specn. | Component Mfg's TC / Eqpt. Mfg's TC | P | V | - |
| 7.2 | Dimension | Physical | 1 sample / lot | Manufacturer Plant Drawing | Manufacturer Plant Drawing/ Compliance to Plant Drg | Component Mfg's TC / Eqpt. Mfg's TC | P | V | - |
| 7.3 | Visual Inspection | Visual | 100% | Manufacturer Plant Specn. | Manufacturer Plant Specn. | Component Mfg's TC / Eqpt. Mfg's TC | P | V | - |
| **8** | **LIFTING EYE** | | | | | | | | |
| 8.1 | Capacity | Mechanical | One sample from each lot of 2000 Nos or part thereof | Manufacturer Plant Specn. | Manufacturer Plant Specn. | Eqpt. Mfg's TC / Component Mfg's TC / | P | V | - |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Third Party Report | | | |
| 8.2 | Dimension | Physical | 1 sample / lot | Manufacturer Plant Drawing | Manufacturer Plant Drawing/ Compliance to Plant Drg | Component Mfg's TC / Eqpt. Mfg's TC | P | V | - |
| 8.3 | Visual Inspection | Visual | 100% | Manufacturer Plant Specn. | Manufacturer Plant Specn. | Component Mfg's TC / Eqpt. Mfg's TC | P | V | - |
| **9** | **CORONA RING** | | | | | | | | |
| 9.1 | Dimension | Physical | 1 sample / lot | Manufacturer Plant Drawing | Manufacturer Plant Drawing/ Compliance to Plant Drg | Component Mfg's TC / Eqpt. Mfg's TC | P | V | - |
| 9.2 | Visual Inspection | Visual | 100% | | | Component Mfg's TC / Eqpt. Mfg's TC | P | V | - |
| | | | | | | | | | |
| **10** | **Surge Arrestor** | | | | | | | | |
| | **Routine Test :** | | | | | | | | |
| 10.1 | Reference Voltage Test | Electrical | 100% | IEC - 60099 - 4 / As per specn | IEC - 60099 - 4 /IS:15086-4/ As per specn | Component Mfg's TC | P | V | - |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 10.2 | Residual Voltage Test | Electrical | 100% | As per specn | IEC - 60099 - 4 / IS:15086-4/ As per specn | Component Mfg's TC | P | V | - |
| 10.3 | Partial Discharge Test | Electrical | 100% | IEC - 60099 - 4 / As per specn | IEC - 60099 - 4 / IS:15086-4/ As per specn | Component Mfg's TC | P | V | - |
| 10.4 | Measurement of Power | Electrical | 100% | IEC - 60099 - 4 / | IEC - 60099 - 4 / IS:15086-4 | Component Mfg's TC | P | V | - |
| 10.5 | Frequency Reference Voltage Test | Electrical | 100% | As per specn | As per specn | Component Mfg's TC | P | V | - |
| 10.6 | Lightning Impulse Residual | Electrical | 100% | IEC - 60099 - 4 | IEC - 60099 - 4 / IS:15086-4 | Component Mfg's TC | P | V | - |
| 10.7 | Voltage Test | Electrical | 100% | As per specn | As per specn | Component Mfg's TC | P | V | - |
| 10.8 | Dimensional verification | Visual | 1 sample | Manufacturer Drg | Manufacturer Drg | Component Mfg's TC | P | V | - |
| | | | | | | | | | |
| **11** | **CAPACITORS** | | | | | | | | |
| 11.1 | Capacitance | Electrical | 5 samples / lot | Manufacturer Plant Specn./ As per specn | Manufacturer Plant Specn. As per specn + / - 10 % | Component Mfg's TC / Eqpt. Mfg's TC | P | V | - |
| 11.2 | P. F. Voltage Test | Electrical | 1 sample / lot | | Manufacturer Plant Specn. /As per specn 1.5 kV for 5 Secs | Component Mfg's TC / Eqpt. Mfg's TC | P | V | - |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 11.3 | Loss Angle (Tan Delta) | Electrical | 1 sample / lot | | Manufacturer Plant Specn./ As per specn | Component Mfg's TC / Eqpt. Mfg's TC | P | V | - |
| | [max] | | | | 0.002 | | | | |
| | | | | | | | | | |
| **12** | **BIRD BARRIER** | | | | | | | | |
| 12.1 | Dimension | Physical | 1 sample / lot | Manufacturer Plant Drawing | Manufacturer Plant Drawing/ Compliance to Plant Drg | Component Mfg's TC / Eqpt. Mfg's TC | P | V | - |
| 12.2 | Temperature Compatibility | Thermal | 1 sample / lot | Manufacturer Plant Specn. /As per specn | Manufacturer Plant Specn./ As per specn No deformation at 155º C. for 24 hours | Component Mfg's TC / Eqpt. Mfg's TC | P | V | - |
| 12.3 | Visual Inspection | Visual | 100% | Manufacturer Plant Specn. | Manufacturer Plant Specn. | Component Mfg's TC / Eqpt. Mfg's TC | P | V | - |
| | | | | | | | | | |
| **13** | **TERMINAL CLAMP** | | | | | | | | |
| 13.1 | Major Dimensions | Physical | 1 sample / lot | Plant Drawing / As per specn. | Plant Drawing / As per specn. | Component Mfg's TC / Eqpt. Mfg's | P | V | - |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | TC | | | |
| 13.2 | All routine test as per IS 5561 | Mechanical | 1 sample / lot | IS : 5561 / As per specn. | IS : 5561 / As per specn. | Component Mfg's TC | P | V | - |
| | | | | | | | | | |
| **14** | **SUSPENSION HARDWARES** | | | | | | | | |
| 14.1 | Verification of Major Dimensions | Physical | 1 set / lot | Approved Drg. | Approved Drg. | Component Mfg's TC / Eqpt. Mfg's TC | P | V | - |
| 14.2 | Visual Examination | Visual | 100% | IS : 2486 Part 1 / As per specn | IS : 2486 Part 1 / As per specn | Component Mfg's TC / Eqpt. Mfg's TC | P | V | - |
| 14.3 | Routine Mechanical Test | Mechanical | 1 No / Lot | IS : 2486 Part 1 / As per specn | IS : 2486 Part 1 / As per specn 40 % of min. failing load for 30 sec. 40 % of 120 KN =48 KN No damage should be noticed. | Component Mfg's TC | P | V | - |
| | | | | | | | | | |
| **15** | **STRUCTURES** | | | | | | | | |
| a) | Hardwares - Bolts, Nuts, Flat & Spring | Physical | One sample / lot | Approved Drawing / As per | Approved Drawing / As | Component Mfr's TC / | P | V | - |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Washers | | | specn. | per specn. | Eqpt. Mfg's TC | | | |
| b) | Dimensions | Electrical | One sample section / lot | Approved Drawing / As per specn | Approved Drawing / As per specn. | Component Mfr's TC / Eqpt. Mfg's TC | P | V | - |
| b) | Mechanical Properties | Mechanical | One sample section / lot / | Manufacturer Plant Specn. | Manufacturer Plant Specn./ IS 2062 Grade E250A | Component Mfr's TC / Third Party Report | P | V | - |
| | i) Tensile Strength[min] | | | | 410 N / sq. mm | | | | |
| | ii) Yield Strength [min] for thickness less than 20mm | | | | 250 N / sq. mm | | | | |
| | iii) Elongation | | One sample / section / lot | Manufacturer Plant Specn. | Manufacturer Plant Specn. | Component Mfr's TC / Third Party Report | | | |
| | [min] | | | | 23% | | | | |
| c) | Chemical Composition | Chemical | One sample | IS 2062 / Manufacturer Plant Specn. | maximum values: Carbon -0.23 % Sulphur-0.045 % Phosphorus- .045 % manganese-1.5% Silicon-0.4% | Component Mfr's TC / | P | V | - |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| d) | Hot Dip Galvanising | | | | | | | | |
| | i) Thickness | Physical | On Component | IS – 2633, 2629/ As per specn. | IS - 2633, 2629 /As per specn. | Component Mfr's TC / Eqpt. Mfg's TC | P | V | - |
| | | | | | 5mm thick & above - 85 micron | | | | |
| | | | | | 2mm thick to below 5mm - 64 mic | | | | |
| | ii) Adhestion Test [Pivot Hammer Test] | Mechanical | One sample / lot | IS - 2633, 2629 /As per specn. | IS - 2633 , 2629/ As per specn. | Component Mfr's TC | P | V | - |
| | | | | | Coating should not peel off | | | | |
| | ii) Strip Test [min] [Wt. Of Zinc coating] | Chemical | One sample /section / lot | IS - 2633, 2629, 4759 As per specn./ | IS - 2633, 2629, 4759 As per specn. | Component Mfr's TC | P | V | - |
| | a) 5mm thick & above | | | | 610 gm / $m^2$ | | | | |
| | b) 2mm thick to below 5mm | | | | 460 gm / $m^2$ | | | | |
| | c) 1.2mm thick to below 2mm | | | | 340 gm / $m^2$ | | | | |
| | iii) Precee Test [Uniformity of Zn coating] | Chemical | One sample / lot | IS - 2633 , 2629 As per specn | IS - 2633 , 2629 /As per specn. | Component Mfr's TC | P | V | - |

* Category of Responsibility: P - Actual Test Performance V - Verify and Accept W - Witness Actual testing, verify and accept

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | . | No reddish deposit of copper after 6 dips in CuSo4 Solution | | | | |
| | | | | | | | | | |
| **16.0** | **HARDWARES [Stainless Steel - APL, KUN, LPS, SAI]** | | | | | | | | |
| 16.1 | Verification of Make | Visual | 10% | Approved List | Approved List | Eqpt. Mfg's TC | P | V | - |
| | | | | | | | | | |
| **B** | **INPROCESS INSPECTION** | | | | | | | | |
| **1.0** | **WINDINGS** | | | | | | | | |
| 1.1 | Diameter | Physical | 100% | APPROVED DRAWING | APPROVED DRAWING | `Equp. Mfg's Log Book | - | P | V |
| 1.2 | Number Of Turns | Physical | 100% | PLANT DRAWING | PLANT DRAWING | Equp. Mfg's Log Book | - | P | V |
| | | | | | | | | | |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **2.0** | **Assembly Of Coil** | | | | | | | | |
| 2.1 | Dimensions | Physical | 1 Sample / lot | PLANT STANDARD | PLANT STANDARD | MPR Card | - | P | V |
| | | | | | | | | | |
| **3.0** | **CURING** | | | | | | | | |
| 3.1 | Gluing | Thermal | 100% | PLANT STANDARD | PLANT STANDARD | MPR Card | - | P | V |
| | | | | | | | | | |
| **4** | **WELDING** | | | | | | | | |
| 4.1 | Welding Procedure Specification | | | As per Manufacturer Internal Specification | As per Manufacturer Internal Specification | | - | P | V |
| 4.1 | Welders Procedure Qualification | | | | | | - | P | V |
| | | | | | | | | | |
| **5.0** | **TUNING UNIT (Before Foaming)** | | | | | | | | |
| 5.1 | Adjustment for R. min (Blocking Impedance) | Electrical | 100% | As per Specn. | As per Specn. | Equp. Mfg's Log Book | - | P | V |
| | | | | | | | | | |
| **6.0** | **TUNING UNIT (After Foaming)** | | | | | | | | |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 6.1 | Measurement of R. min<br>(Blocking Impedence) | Electrical | 100% | As per Specn. | As per Specn. | Equp. Mfg's Log Book | - | P | V |
| **6.2** | **DP Test On load bearing members** | Chemical | 1 Sample / lot | | No Dye Penetration / No chemical come out after foaming | Equp. Mfg's Log Book | - | P | V |
| | | | | | | | | | |
| **C** | **FINAL ACCEPTANCE & TESTING** | | | | | | | | |
| 1.0 | Dimensional & Visual Check | Physical | 1 Sample / lot | As per specn / Approved Drawings | As per specn / Approved Drawings | Eqpt. Mfg's TC | - | P | V |
| 2.0 | Measurement of Blocking Resistance & blocking Impedance | Electrical | 100% | IEC - 60353 / IS 8792/ IS 8793/ As per specn | IEC - 60353 / IS 8792/ IS 8793/ As per specn | Eqpt. Mfg's TC | - | P | W |
| 3.0 | Measurement of rated inductance of the main coil | Electrical | 100% | | | Eqpt. Mfg's TC | - | P | W |
| 4.0 | Measurement of Power Frequency Inductance of the main coil | Electrical | 100% | | | Eqpt. Mfg's TC | - | P | W |
| 5.0 | Power Frequency voltage test on tuning device | Electrical | 100% | | | Eqpt. Mfg's TC | - | P | W |

* Category of Responsibility: P - Actual Test Performance V - Verify and Accept W - Witness Actual testing, verify and accept

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 6.0 | Measurement of tapping loss and tapping loss based on blocking resistance (calculation method) | Electrical | 100% | IEC - 60353 / IS 8792/ IS 8793 | IEC - 60353 / IS 8792/ IS 8793 | Eqpt. Mfg's TC | - | P | W |
| **D** | **PACKING & DESPATCH** | | | | | | | | |
| i) | Verification of Completeness of Stage as appearing In MQP | Physical | 100% | Manufacturer Packing Instruction | Manufacturer Packing Instruction | - | - | P | V |
| ii) | Check for Finish | Visual | 100% | | | - | - | P | V |
| iii) | Check for Packing | Visual | 100% | | | - | - | P | V |

EM : Equipment Manufacturer CM : Component Manufacturer CMTC :- Component manufacturer test certificate EMTR :- Equipment manufacturer test Report

# Oil filled Current Transformer

| S. No. | Components / Operations & Description of Test | Type of check | Quantum of Check /Sampling with basis | Reference document for Testing | Acceptance Norms | Format of Record | Category of responsibility | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Sub- Vendor | Manufacturer | Customer |
| **A. Section RAW MATERIAL INSPECTION** | | | | | | | | | |
| **1.A** | **Porcelain Insulators (If applicable)** | | | | | | | | |
| a | Routine Tests | Electrical & Mechanical | 100% | IS : 5621/IEC 62155 | IS : 5621/IEC 62155 | CMTC | P | V | - |
| b | Dimensions and visual | Measurement | 01 sample/lot | Relevant Drawing | Relevant Drawing | CMTC/ EMTR | P | V | - |
| c | Porosity Test | Physical | 01 sample/lot | IS : 5621/IEC 62155 | IS : 5621/IEC 62155 | CMTC | P | V | - |
| d | Temp. Cycle Test | Physical | 01 sample/lot | IS : 5621/IEC 62155 | IS : 5621/IEC 62155 | CMTC | P | V | - |
| **1.B** | **Composite Insulator (If applicable)** | | | | | | P | V | - |
| | Dimension | physical | 1 No/Lot | IEC 61462/ Tech. Specn./ Mfr Drg | IEC 61462/ Tech. Specn./ Mfr Drg | CMTC | P | V | - |

* Category of Responsibility: P - Actual Test Performance V - Verify and Accept W - Witness Actual testing, verify and accept

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Routine Mechanical test | Mechanical | 100% | IEC 61462/ Tech. Specn. | IEC 61462/ Tech. Specn. | CMTC | P | V | - |
| | Silicon Content | Chemical | 1 No/mfg batch | | | CMTC | P | V | - |
| | Ultrasonic test | Mechanical | 100% | | | CMTC | P | V | - |
| | | | | | | | P | V | - |
| **2** | **Transformer Oil** | | | | | | P | V | - |
| a | Kinematic Viscosity @ 40ºC | Test | 01 sample/Lot | | | CMTC | P | V | - |
| b | Pour Point | Test | 01 sample/lot | | | CMTC | P | V | - |
| c | Water content | Test | 01 sample/lot | | | CMTC | P | V | - |
| d | Electric Strength BDV (New unfiltered) | Test | 01 sample/lot | | | CMTC/EMTR | P | V | - |
| e | Density @ 20degC | Test | 01 sample/lot | | | CMTC | P | V | - |
| f | Dielectric Dissipation Factor (Tan Delta)@90ºC | Test | 01 sample/lot | | | CMTC/EMTR | P | V | - |
| g | Neutralization Value/Acidity | Test | 01 sample/lot | Mfg.std./IEC 60296/IS 335 | Mfg.std./IEC 60296/IS 335 | CMTC | P | V | - |
| h | Interfacial Tension | Test | 01 sample/lot | | | CMTC | P | V | - |
| i | Total Sulpher Content | Test | 01 sample/lot | | | CMTC | P | V | - |

* Category of Responsibility: P - Actual Test Performance V - Verify and Accept W - Witness Actual testing, verify and accept

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| j | Corrosive Sulpher | Test | 01 sample/lot | | | CMTC | P | V | - |
| k | Dibenzyl Disulphide | Test | 01 sample/lot | | | CMTC | P | V | - |
| l | Antioxidant Additives, | Test | 01 sample/lot | | | CMTC | P | V | - |
| m | Metal Passivator | Test | 01 sample/lot | | | CMTC | P | V | - |
| n | Furfural Content | Test | 01 sample/lot | | | CMTC | P | V | - |
| o | Oxidation Stability | Test | 01 sample/lot | | | CMTC | P | V | - |
| p | Total acidity | Test | 01 sample/lot | | | CMTC | P | V | - |
| | | | | | | | | | |
| **3** | **Copper Wire** | | | | | | | | |
| a | Dimension | Measure | 01 sample/lot | Mfg.std./IS 13730 | Mfg.std./ IS 3730 | CMTC | P | V | - |
| b | Mechanical Properties | Mechanical | 01 sample/lot | | | CMTC | P | V | - |
| c | Thermal Properties | Thermal | 01 sample/lot | | | CMTC | P | V | - |
| d | Chemical Properties | Chemical | 01 sample/lot | | | CMTC | P | V | - |
| e | Electrical Properties | Electrical | 01 sample/lot | | | CMTC | P | V | - |
| | | | | | | | | | |
| q | Total sludge | Test | 01 sample/lot | Mfg.std./IEC 60296/IS 335 | Mfg.std./IEC 60296/IS 335 | CMTC | P | V | - |
| **4** | **Primary Terminal** | | | | | | | | |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| a | Visual | Visual | 10 %/ lot | App. Drg./MFR PO. | Free from Damage | CMTC/EMTR | P | V | - |
| b | Dimension | Measure | 5 % / lot | App. Drg./MFR PO. | As per Drg. | CMTC/EMTR | P | V | - |
| | | | | | | | | | |
| r | Flash Point | Test | 01 sample/lot | Mfg.std./IEC 60296/IS 335 | Mfg.std./IEC 60296/IS 335 | CMTC | P | V | - |
| **5** | **ALUMINIUM FOIL (if applicable)** | | | | | | | | |
| a | Thickness Tolerance | Physical | 1 Sample / lot | Mfg. plant std. | Mfg. plant std. | CMTC | P | V | - |
| b | Purity (min) | Chemical | 1 Sample / lot | | | CMTC | P | V | - |
| c | Visual | Visual | 1 Sample / lot | | | CMTC | P | V | - |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **6** | **Insulation Crepe Paper** | | | | | | | | |
| a | Thickness | Measure | 01sample/size/lot | Material Spec./MFR PO | Material Spec./MFR PO | CMTC/ EMTR | P | V | - |
| b | Hillcount | Measure | | Material Spec./IS 9335/IEC 60554 | Material Spec./IS 9335/IEC 60554 | | P | V | - |
| c | Substance | Measure | | | | | P | V | - |
| d | Elongation at break MD | Mechanical | | IS 9335/IEC 60554 | IS 9335/ IEC 60554 | | P | V | - |
| e | Ash Content | Mechanical | | | | | P | V | - |
| f | Moisture Content | Mechanical | | | | | P | V | - |
| g | PH Value | Chemical | | | | | P | V | - |
| h | Conductivity | Electrical | | | | | P | V | - |
| i | Tensile Strength | Mechanical | | | | | P | V | - |
| | | | | | | | | | |
| **7** | **Semi conducting Crepe Paper** | | | | | | | | |
| a | Visual | Visual | | Mfg.std./Data Sheet | Free from Damage | | P | V | - |
| b | Dimension Thickness | Measure | | | | | P | V | - |

* Category of Responsibility: P - Actual Test Performance V - Verify and Accept W - Witness Actual testing, verify and accept

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| c | Tensile Strength | Mechanical | 01 sample/ lot | | Mfg.std./Data Sheet | CMTC/ EMTR | P | V | - |
| d | Elongation | Mechanical | | | | | P | V | - |
| | | | | | | | | | |
| **8** | **Core** | | | | | | | | |
| a | Visual / dimensions check | Measure | 100% | As per Tech. Spec./ Drawing/ P.O | As per Tech. Spec./ Drawing/ P.O | CMTC/ EMTR | P | V | - |
| b | Test at specified flux density for losses. | Electrical | 100% | Within limit as per specified grade of Core/ P.O. | Within limit as per specified grade of Core/ P.O. | CMTC/ EMTR | P | V | - |
| c | Magnetizing Force (Max) | Electrical | 1 Sample / lot | As per Tech. Spec./Drawing/ P.O | As per Tech. Spec./Drawing/ P.O | CMTC /EMTR | P | V | - |
| d | Type and Grade of material | Electrical | 1 Sample / lot | | | CMTC/ EMTR | P | V | - |
| e | Stacking Factor | Electrical | 100% | | | CMTC/ EMTR | P | V | - |
| | | | | | | | | | |
| **9** | **MS Tanks** | | | | | | | | |
| a | Leakage Test | Mechanical | 100% | Leakage check at 30 psi | No Leakage at 30 P.S.I | CMTC | P | V | - |
| b | Dimensions | Measure | 01 sample/size/lot | App. Drg./MFR drg. | App. Drg./MFR drg. | EMTR | - | P | - |

* Category of Responsibility: P - Actual Test Performance V - Verify and Accept W - Witness Actual testing, verify and accept

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **10** | **Galvanising Checks** | | | | | | | | |
| a | Thickness of Zinc coating | Measure | 1 Sample /Lot | IS 4759-1984/ App.Drg./ Tech Spec | Min Avg. thickness ≥ 5mm - 86 µm, < 5mm - 65 µm, | CMTC | P | V | - |
| b | Mass of Zn coating on sample | Measure | 1 Sample /Lot | IS 4759-1984/ App.Drg. /Tech Spec | Plant Std ,Min Avg.<br>≥ 5mm 610g/m²<br>< 5mm 460g/m² | CMTC | P | V | - |
| c | Uniformity of Zinc coating | Measure | 1 Sample /Lot | IS 2633/ App. Drg./ Tech Spec | IS 2633/PG App.Drg./Tech Spec | CMTC | P | V | - |
| d | Adhesion test | Mechanical | 1 Sample /Lot | IS 2629/App. Drg./ Tech Spec | No peeling of Zinc | CMTC | P | V | - |
| | | | | | | | | | |
| **11** | **Painting Of Tanks** | | | | | | | | |
| a | Visual /Shade | Visual | 1 Samples / lot | App.Drg./Tech Spec/ MFR P.O | App.Drg. /Tech Spec /GTP /Mfg.std | CMTC | P | V | - |
| b | Thickness (DFT) | Measure | DO | App.Drg./ Tech Spec/ GTP/ Mfg.std. | App.Drg. /Tech Spec /GTP /Mfg.std. | CMTC | P | V | - |

* Category of Responsibility: P - Actual Test Performance V - Verify and Accept W - Witness Actual testing, verify and accept

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **12** | **Sealing Element Rubber 'O' Ring** | | | | | | | | |
| a | Dimensions | Measure | 1 Sample /Lot | Mfg. Std./Drawing | Mfg. Std./ Drawing | CMTC/ EMTR | P | V | - |
| b | Hardness | Mechanical | | | | CMTC/ EMTR | P | V | - |
| c | Elongation at break | Mechanical | | | | CMTC | P | V | - |
| d | Aging in transformer oil for 70 hrs. | Mechanical | | | | CMTC | P | V | - |
| e | Compression Set | Mechanical | | | | CMTC | P | V | - |
| | | | | | | | | | |
| **13** | **Bellow** | | | | | | | | |
| a | Major Dimensions | Physical | 1 Sample / lot | Mfg. Std./Drawing | Mfg. Std./ Drawing | CMTC/ EMTR | P | V | - |
| b | Visual | Visual | 100% | Mfg. Std./Drawing | Mfg. Std./ Drawing | CMTC/ EMTR | P | V | - |
| | | | | | | | | | |
| **14** | **TEFZEL CABLE/PTFE CABLE (if applicable)** | | | | | | | | |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| a | Di electric withstand voltage test | Physical | 1 Sample / lot | Mfg. Std./Drawing | Mfg. Std./ Drawing | CMTC/ EMTR | P | V | - |
| | | | | | | | | | |
| **15** | **Terminal Blocks** | | | | | | | | |
| a | Voltage Grade | Electrical | 1 Sample / lot | Supplier Catalogue/ Tech. Specn. | Supplier Catalogue/ Tech. Specn. | CMTC | P | V | - |
| b | HV test | Electrical | | | | | P | V | - |
| c | IR b/w - adjacent terminal & b/w terminal & Channel | Electrical | | | | | P | V | - |
| | | | | | | | | | |
| **B. Section INPROCESS INSPECTION - CT** | | | | | | | | | |
| **1** | **Primary Winding** | | | | | | | | |
| a | Visual check, Dimension & Cleanliness of Primary conductor | Physical | 100% | Free from damage/PG App.Drg./Tech Spec | Free from damage/PG App.Drg./Tech Spec | EMTR | - | P | V |
| b | Overlap of Insulation | | 100% | As per Plant Standard | As per Plant Standard | EMTR | - | P | V |
| 2 | **Core Winding ( Secondary ) & Coil Insulation** | | | | | | | | |
| a | Interturn Over Voltage test | Electrical | | | | | - | P | V |

* Category of Responsibility: P - Actual Test Performance V - Verify and Accept W - Witness Actual testing, verify and accept

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| b | Accuracy | Electrical | 100% | IS 16227 | IS 16227 | EMTR | - | P | V |
| c | Polarity Marking & Verification of Core Sequence | Electrical | | | | | - | P | V |
| d | Secondary H.v Test | Electrical | | | | | - | P | V |
| e | Interturn Over Voltage test | Electrical | | | | | - | P | V |
| **4** | **CT Assembly** | | | | | | | | |
| a | Fitment of Primary Terminal | Mechanical | 100% | As per Approved Drawing | As per Approved Drawing | EMTR | - | P | V |
| b | Fitment of Bushing | Mechanical | 100% | As per Approved Drawing | As per Approved Drawing | EMTR | - | P | V |
| c | Secondary H.V.test | Electrical | 100% | IS 16227 | IS 16227 | EMTR | - | P | V |
| d | Verification of Accuracy Class | Electrical | 100% | | | EMTR | - | P | V |
| e | Polarity Marking & Verification of Core Sequence | Electrical | 100% | | | EMTR | - | P | V |

* Category of Responsibility: P - Actual Test Performance V - Verify and Accept W - Witness Actual testing, verify and accept

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| f | Leakage Test | Mechanical | 100% | leakage testing is done on complete assembled unit at 30 psi. | No Leakage | EMTR | - | P | V |
| **5** | **Vacuum Drying & Oil impregnation** | | | | | | | | |
| a | Temperature of Oven | Physical | 100% | Mfr's Plant Standard | Mfr's Plant Standard | EMTR | - | P | V |
| b | Vacuum & vacuum Leakage | Electrical | | | Mfr's Plant Standard | EMTR | - | P | V |
| c | Measurement of Water in Vapor Condenser | Electrical | | | No water for 6 hours in vapour condensor. | EMTR | - | P | V |
| d | BDV of Insulating Oil | Electrical | One sample/lot | As per IEC 60296/IS 335 | As per IEC 60296/IS 335 | EMTR | - | P | V |
| e | Tan delta | Electrical | | | | EMTR | - | P | V |
| f | Moisture/Water Content | Electrical | | | | EMTR | - | P | V |
| | | | | | | | | | |
| **C. Section FINAL INSPECTION & TESTING - CT** | | | | | | | | | |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **1** | **Routine Test :- All Routine/Acceptance test as per Contract Technical Specification need to carried out without fail** | | | | | | | | |
| a | Verification of Terminal marking & Polarity | Electrical | 100% | Tech. Specs / IS16227/ IEC61869 | Tech. Specs / IS16227/ IEC61869 | Log Sheet | - | P | V |
| b | High voltage power frequency withstand test on primary winding. | Electrical | | | | | - | P | V |
| c | High voltage power frequency withstand test on secondary winding.(All cores to be tested seperatly)3kV for 1 min | Electrical | | | | | - | P | V |
| d | Partial Discharge test | Electrical | | | | | - | P | V |
| e | Accuracy Test -Ratio and phase angle error test on metering & protection class cores. | Electrical | | | | | - | P | V |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| f | Resistance ,Knee point voltage ,Exciting Current measurement on special protection (Class PS) cores. | Electrical | 100% | Tech. Specs / IS16227/ IEC61869 | Tech. Specs / IS16227/ IEC61869 | Log Sheet | - | P | V |
| g | Turns ratio measurement (Ratio error at no load )for special purpose protection (Class PS)cores. | Electrical | | | | | - | P | V |
| h | Interturn over voltage test (all cores will be tested separately) | Electrical | | | | | - | P | V |
| i | Determination of composite error | Electrical | | | | | - | P | V |
| j | Measurement of capacitance & tan delta at 10kV & Um/root3 kV. | Electrical | 100% | | | Log Sheet | - | P | V |
| k | I.R. Measurement Between primary & secondary (Earth) | Electrical | | | Min 7000 M Ohms./mfg std | Log Sheet | - | P | V |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 1 | Oil level check | visual | | Tech. Specs / Mfr's Drawing/ Standard | Tech. Specs / Mfr's Drawing/ Standard | Log Sheet | - | P | V |
| | | | | | | | | | |
| **2** | **Acceptance Test** | | | | | | | | |
| a | Verification of Terminal marking & Polarity | Electrical | 10 % | Tech Specs / IS16227/ IEC61869 | Tech. Specs / IS16227/ IEC61869 | Test Report | - | P | W |
| b | High voltage power frequency withstand test on primary winding. | Electrical | | | | | - | P | W |
| c | Transformer Oil from CT After HV Test for each rating | | | | | | | | |
| i | BDV Test ( Min.) | Electrical | 01sample /lot | IEC 60422 | Min.60 kV | Test Report | - | P/V | V |
| ii | Tan Delta at $90^0$C Max. | Electrical | | IEC 60422 | IEC 60422 | Test Report | - | P/V | V |
| iii | Moisture Content | Electrical | | IS 1866 /IEC 60422/ Tech. spec. | less than 10 ppm | Test Report | - | P/V | V |
| iv | Interfacial Tension( Min.) | Electrical | | IEC 60422 | Min. 35 mN/mtr | Test Report | - | P/V | V |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| d | High voltage power frequency withstand test on secondary winding.(All cores to be tested seperatly)3kV for 1 min | Electrical | 10 % | Tech. Specs / IS16227/ IEC61869 | Tech. Specs / IS16227/ IEC61869 | Test Report | - | P | W |
| e | Partial Discharge test | Electrical | | | | | - | P | W |
| f | Accuracy Test -Ratio and phase angle error test on metering & protection class cores. | Electrical | | | | | - | P | W |
| g | Resistance ,Knee point voltage ,Exciting Current measurement on special protection (Class PS) cores. | Electrical | | | | | - | P | W |
| h | Turns ratio measurement (Ratio error at no load )for special purpose protection (Class PS)cores. | Electrical | | | | | - | P | W |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| i | Interturn over voltage test (all cores will be tested separately) | Electrical | 10 % | Tech. Specs / IS16227/ IEC61869 | Tech. Specs / IS16227/ IEC61869 | Test Report | - | P | W |
| j | Determination of composite error | Electrical | | | | | - | P | W |
| k | Measurement of capacitance & tan delta at 10 kV, 0.3,0.7,1.0 &1.1 Um/root3 kV.before & after HV Test | Electrical | | | | | - | P | W |
| l | Instrument Security Factor Test | Electrical | | | | | - | P | W |
| m | IR measurement between Primary & Secondary (Earth ) | Electrical | | | Min 7000 M Ohms. | | - | P | W |
| n | Painting Shade & Thickness Check | Measure | 10 % | Tech. Specs./ 85 Micron Min. | Tech. Specs./85 Micron Min. | Test Report | - | P | W |
| o | Oil level check | visual | 10 % | Tech. Specs / Mfr's Drawing/standard | Tech. Specs / Mfr's Drawing/standard | Log Sheet | - | P | W |
| | | | | | | | | | |

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|---|---|---|---|---|---|---|---|---|---|
| **D. Section PACKING & DESPATCH - CT** | | | | | | | | | |
| 1 | N2 Gas Filling | Mechanical | 100% | N2 is filled at 10 psi. | Pressure is observed after 1 hour. To check leakage | EM RECORD | - | P | - |
| **2** | Checking for completeness of the equipment and accessories<br>including spares as per order. | Visual | | As per MFR Process Specification | As per MFR Process Specification | EM RECORD | - | P | - |
| **3** | Check for proper packing | Visual | | | | EM RECORD | - | P | - |
| 4 | Ensure supply of operation manual,packing list and test reports along with copy of inspection reports, CIP and MICC | Visual | | | | EM RECORD | - | P | - |

* Category of Responsibility: P - Actual Test Performance V - Verify and Accept W - Witness Actual testing, verify and accept

# 1.1 kV Grade PVC Power Cable

| S. No. | Components / Operations & Description of Test | Type of check | Quantum of Check / Sampling with basis | Reference document for Testing | Acceptance Norms | Format of Record | Category of responsibility | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Sub- Vendor | Manufacturer | Customer |
| **A. RAW MATERIAL INSPECTION** | | | | | | | | | |
| **1.0** | **ALUMINIUM WIRE ROD** | | | | | | | | |
| 1.1 | Chemical Analysis | Chem | One Sample per heat per lot | IS: 4026 (Gr. II) and Tech. Specification Al-99.6% Min. Si-0.13% Max. Fe-0.30% Max. Cu-0.04% Max. (Ti+Va)-0.02% Max. | IS: 4026 (Gr. II) and Tech. Specification Al-99.6% Min. Si-0.13% Max. Fe-0.30% Max. Cu-0.04% Max. (Ti+Va)-0.02% Max | Manuf. T.C./ Raw Material (RM) Test Report | - | P | V |
| 1.2 | Diameter of Aluminium Wire Rod | Meas. | | IS: 5484 & Tech. Specification Min. 9.00 mm Nom. 9.50 mm Max. 10.00 mm | IS: 5484 & Tech. Specification Min. 9.00 mm Nom. 9.50 mm Max. 10.00 mm | Manuf. T.C./ RM Test Report | - | P | V |
| 1.3 | Breaking Load | Mech. | | IS : 5484 & Tech. Specification | IS : 5484 & Tech. | Manuf. | | | |

* Category of Responsibility: P - Actual Test Performance V - Verify and Accept W - Witness Actual testing, verify and accept

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Range I to IV Tensile strength-65 to 150 N/mm² | Specification Range I to IV Tensile strength-65 to 150 N/mm² | T.C./ RM Test Report | - | P | V |
| 1.4 | Resistivity / Conductivity | Elect. | | IS : 5484 & Tech. Specn Max. resistivity 0.028264 Ohm x mm²/meter at 20 deg C. Min. Conductivity 61% of IACS | IS : 5484 & Tech. Specn Max. resistivity 0.028264 Ohm x mm²/meter at 20 deg C. Min. Conductivity 61% of IACS | Manuf. T.C./ RM Test Report | - | P | V |
| 1.5 | Cleanliness & Surface Smoothness (Visual Check) | Visual | 100% on each Coil | IS : 5484 & Tech.Specification The rods shall be bright and clean. It shall be free from blisters, scale, fins, spills cracks and other defects. | IS : 5484 & Tech. Specification The rods shall be bright and clean. It shall be free from blisters, scale, fins, spills cracks and other defects. | Manuf. T.C./ RM Test Report | - | P | V |
| | | | | | | | | | |
| 2.0 | PVC COMPOUND FOR INSULATION (TYPE-A) | | | | | | | | |
| 2.1 | Type / Specific Gravity | Meas. | One Sample per Lot of 5 MT or part | IS: 5831 & Approved data Sheets | IS: 5831 & Approved data Sheets | Manuf. T.C./ RM Test Report | - | P | V |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | thereof | | | | | | |
| 2.2 | Visual Check for PVC granules i.e. burns etc | Visual | One sample per lot of 5 MT or part thereof | IS: 5831& Approved Data sheets. Should be generally free from burn particles | IS: 5831& Approved Data sheets. Should be generally free from burn particles | Manuf. T.C./ RM Test Report | - | P | V |
| 2.3 | Tensile Strength and elongation before ageing | Mech | One sample per lot of 5 MT or part thereof | IS: 5831 & Approved Data Sheets. Min. TS-12.5 N/mm² Elongation 150% (Min.) | IS: 5831 & Approved Data Sheets. Min. TS-12.5 N/mm² Elongation 150% (Min.) | Manuf. T.C./ RM Test Report | - | P | V |
| 2.4 | Tensile Strength and elongation after ageing | Mech | One sample per lot of 5 MT or part thereof | IS: 5831 & Approved Data Sheets. Min. TS-12.5 N/mm² Max. Variation±20% from the actual values before ageing Elongation 150% (Min.) Max.variation ± 20% from the actual values before ageing | IS: 5831 & Approved Data Sheets. Min. TS-12.5 N/mm² Max. Variation±20% from the actual values before ageing Elongation 150% (Min.) Max.variation ± 20% from the actual values before ageing | Manuf. T.C./ RM Test Report | - | P | V |
| 2.5 | Loss of Mass in air oven | Therm | | | | | | | |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | One sample per lot of 5 MT or part thereof | IS: 5831 & Technical Specification Max. 2 mg/cm² | IS: 5831 & TechnicalSpecification Max. 2 mg/cm² | Manuf. T.C./ RM Test Report | - | P | V |
| 2.6 | Thermal Stability | Therm | One sample per lot of 5 MT or part thereof | IS: 5831 & Technical Specification. The indicating paper shall not change colour when the insulation is kept at a temperature of 200 deg. C for a period of Min. 80 Minutes | IS: 5831 & Technical Specification. The indicating paper shall not change colour when the insulation is kept at a temperature of 200 deg. C for a period of Min. 80 Minutes | Manuf. T.C./ RM Test Report | - | P | V |
| 2.7 | Volume Resistivity | Elect | One sample per lot of 5 MT or part thereof | IS: 5831 & Approved Data Sheets. Min. at 27 deg. C - 1x1013 Ohm cm. Min at 70 deg. C - 1×1010 Ohm.cm. | IS: 5831 & Approved Data Sheets. Min. at 27 deg. C - 1x1013 Ohm cm. Min at 70 deg. C - 1×1010 Ohm.cm. | Manuf. T.C./ RM Test Report | - | P | V |
| | | | | | | | | | |
| 3.0 | PVC COMPOUND FOR SHEATH (TYPE ST-1) | | | | | | | | |

* Category of Responsibility: P - Actual Test Performance V - Verify and Accept W - Witness Actual testing, verify and accept

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 3.1 | Type / Specific Gravity | Meas. | One sample per lot of 5 MT or part thereof | IS: 5831 & Approved data sheet | IS: 5831 & Approved data sheet | Manuf. T.C./ RM Test Report | - | P | V |
| 3.2 | Visual Check for PVC granules i.e. burns etc. | Visual | One sample per lot of 5 MT or part thereof | IS: 5831 & Tech. Specification. Should be generally free from burn particles. | IS: 5831 & Tech. Specification. Should be generally free from burn particles. | Manuf. T.C./ RM Test Report | - | P | V |
| 3.3 | Tensile strength and elongation before ageing | Mech | One sample per lot of 5 MT or part thereof | IS: 5831 & Tech. Specification. Min. TS 12.5 N/mm² Elongation 150% (Min.) | IS: 5831 & Tech. Specification. Min. TS 12.5 N/mm² Elongation 150% (Min.) | Manuf. T.C./ RM Test Report | - | P | V |
| 3.4 | Tensile strength and elongation after ageing | Mech | One sample per lot of 5 MT or part thereof | IS: 5831 & Tech. Specification. Min. TS 12.5 N/mm² (Max.) Variation ± 20% from the actual value before ageing Elongation 150% (Min.) Max. variation ± 20% from the | IS: 5831 Tech. Specification. Min. TS 12.5 N/mm² (Max.) Variation ± 20% from the actual value before ageing Elongation 150% (Min.) Max. variation ± 20% from the | Manuf. T.C./ RM Test Report | - | P | V |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | actual values before ageing | actual values before ageing | | | | |
| 3.5 | Loss of Mass in air oven | Therm | One sample per lot of 5 MT or part thereof | IS: 5831 & Tech. Specification Max. 2 mg/cm² | IS: 5831 & Tech. Specification Max. 2 mg/cm² | Manuf. T.C./ RM Test Report | - | P | V |
| 3.6 | Thermal Stability | Therm | One sample per lot of 5 MT or part thereof | IS: 5831 & Tech. Specification. The indicating paper Shall not change colour when the sample of sheath is kept at 200 deg. C for a period of min. 40 Minutes | IS: 5831 & Tech. Specification. The indicating paper Shall not change colour when the sample of sheath is kept at 200 deg. C for a period of min. 40 Minutes | Manuf. T.C./ RM Test Report | - | P | V |
| 3.7 | Oxygen Index Test on PVC for Outer Sheath Only. | Envir. | One sample per lot of 5 MT or part thereof | ASTM-D-2863 & Approved Data Sheets Min. 29% | ASTM-D-2863 & Approved Data Sheets Min. 29% | Manuf. T.C./ RM Test Report | - | P | V |
| 3.8 | Temperature Index Test on PVC for Outer Sheath Only | Envir. | One sample per lot of 5 MT or part thereof | ASTM-D-2863 & Approved Data Sheets Min. 250 Deg.C | ASTM-D-2863 & Approved Data Sheets Min. 250 | Manuf. T.C./ RM Test Report | - | P | V |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | Deg.C | | | | |
| | | | | | | | | | |
| **4.0** | **ARMOUR WIRE / STRIP** | | | | | | | | |
| 4.1 | DIMENSION | Meas. | One Sample for every 10 coils | IS : 3975 & Approved Data Sheets | IS : 3975 & Approved Data Sheets | Manuf. T.C./ RM Test Report | - | P | V |
| 4.2 | Tensile Stength | Mech | | | | | - | P | V |
| 4.3 | Elongation | Mech | | | | | - | P | V |
| 4.4 | Torsion / Winding | Mech | | | | | - | P | V |
| 4.5 | Wrapping Test | Mech | | IS : 3975 & Approved Data Sheet Wrap-8 Unwrap-6 & Wrap-6 on a mandrel as per above IS. The wire shall not crack or break | IS : 3975 & Approved Data Sheet Wrap-8 Unwrap-6 & Wrap-6 on a mandrel as per above IS. The wire shall not crack or break | Manuf. T.C./ RM Test Report | - | P | V |
| 4.6 | Uniformity of Zinc coating (Preece Test) | Chem. | | IS : 4826, IS : 3975 & approved data sheets. At the end of specified number of dips as per IS, the specimen shall not | IS : 4826, IS : 3975 & approved data sheets. At the end of specified number of dips as per IS, the specimen shall | Manuf. T.C./ RM Test Report | - | P | V |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | show any red deposit of copper upon base metal | not show any red deposit of copper upon base metal | | | | |
| 4.7 | Weight of Zinc Coating | Chem. | One Sample for every 10 coils | IS : 4826, IS : 3975 & Approved Data Sheets | IS : 4826, IS : 3975 & Approved Data Sheets | Manuf. T.C./ RM Test Report | - | P | V |
| 4.8 | Adhesion Test | Mech | | IS: 4826, IS : 3975 & Approved Data Sheets. The Zinc Coating shall remain adherent to the steel wire. | IS: 4826, IS : 3975 & Approved Data Sheets. The Zinc Coating shall remain adherent to the steel wire. | Manuf. T.C./ RM Test Report | - | P | V |
| 4.9 | Resistivity | Elect. | | IS : 3975 & Approved Data Sheets. | IS : 3975 & Approved Data Sheets. | Manuf. T.C./ RM Test Report | - | P | V |
| 4.10 | Check for Purity of Zinc | Chem | One Sample for every lot of 50 MT or part thereof | IS : 209 & Tech. Specification Min. purity of Zinc 99.95% | IS : 209 & Tech. Specification Min. purity of Zinc 99.95% | Manuf. T.C./ RM Test Report | - | P | V |
| | | | | | | | | | |
| B INPROCESS INSPECTION | | | | | | | | | |
| **5.0** | **ALUMINIUM DRAWN WIRE (H2** | | | | | | | | |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | **grade)** | | | | | | | | |
| 5.1 | Surface finish and winding (Visual check) | Visual | 100% on each spool | IS: 8130 & Approved data sheet. The wire shall be smooth and free from scratches | IS: 8130 & Approved data sheet. The wire shall be smooth and free from scratches | In Process Log Sheet | - | P | V |
| 5.2 | Diameter of drawn Aluminium Wire | Meas. | One Sample from each spool | IS : 8130 & Approved data Sheet. | IS : 8130 & Approved data Sheet. | In Process Log Sheet | - | P | V |
| 5.3 | Tensile Strength | Mech | | | | | - | P | V |
| 5.4 | Wrapping Test | Mech | | IS : 8130 & Approved data Sheets. Wrap-8 Unwrap-6 & Wrap-6 on its own dia. The wire shall not crack or break | IS : 8130 & Approved data Sheets. Wrap-8 Unwrap-6 & Wrap-6 on its own dia. The wire shall not crack or break | In Process Log Sheet | - | P | V |
| | | | | | | | | | |
| **6.0** | **STRANDING** | | | | | | | | |
| 6.1 | Lay Direction & Compactness | Visual | Each length at the beginning | IS : 1554 / Approved data sheet. | IS : 1554 / Approved data sheet. | In Process Log Sheet | - | P | V |
| 6.2 | Smoothness / Surface scratches | Visual | 100% | The surface shall be smooth and free from | The surface shall be smooth and free from | In Process Log Sheet | - | P | V |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | (Visual check) | | | Scratches | Scratches | | | | |
| 6.3 | Resistance / Km at 20°C | Elect | One Sample from each spool | IS : 8130 & Approved data Sheet. | IS : 8130 & Approved data Sheet. | In Process Log Sheet | - | P | V |
| 6.4 | Dimensions | Meas. | One Sample from each spool | Approved data Sheet | Approved data Sheet | In Process Log Sheet | - | P | V |
| | | | | | | | | | |
| **7.0** | **INSULATED CORE** | | | | | | - | P | V |
| 7.1 | Thickness of Insulation Average Minimum | Meas . Meas . | Each setting during running of machine | IS: 1554 (Part-1) Table 2 & Approved data sheet. | IS: 1554 (Part-1) Table 2 & Approved data sheet. | In Process Log Sheet | - | P | V |
| 7.2 | Type of Insulating Material | Visual | Each setting during running of machine | IS: 1554 (Part-1) Table 2 & Approved data sheet. Type-A | IS: 1554 (Part-1) Table 2 & Approved data sheet. Type-A | In Process Log Sheet | - | P | V |
| 7.3 | Surface Finish | Visual | Each setting during running of machine | IS: 1554 (Part-1) The Surface shall be smooth and free from any defects | IS: 1554 (Part-1) The Surface shall be smooth and free from any defects | In Process Log Sheet | - | P | V |
| 7.4 | Spark Test | Elect. | 100% | Min. 6 KV (r.m.s.) | Min. 6 KV | | - | P | V |

* Category of Responsibility: P - Actual Test Performance V - Verify and Accept W - Witness Actual testing, verify and accept

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|---|---|---|---|---|---|---|---|---|---|
| | | | | | (r.m.s.) | In Process Log Sheet | | | |
| 7.5 | Core Identification / Colour of Cores | Visual | 100% | IS : 1554 (Part-1) & Approved data sheet. | IS : 1554 (Part-1) & Approved data sheet. | In Process Log Sheet | - | P | V |
| 7.6 | Eccentricity | Meas. | 100% | Max. 10% / Approved Data Sheet | Max. 10% / Approved Data Sheet | In Process Log Sheet | - | P | V |
| | | | | | | | | | |
| **8.0** | **LAID UP CORES** | | | | | | | | |
| 8.1 | Direction of Lay | Visual | Each setting during process | The outer most layer shall be right hand and other layers opposite to previous one. | The outer most layer shall be right hand and other layers opposite to previous one. | In Process Log Sheet | - | P | V |
| 8.2 | Lay Length | Meas. | Each setting during process | Approved data sheet | Approved data sheet | In Process Log Sheet | - | P | V |
| 8.3 | Sequence of Laying | Visual | Each setting during process | Approved data sheet | Approved data sheet | In Process Log Sheet | - | P | V |
| 8.4 | Tightness of Cores | Visual | Each setting | The cores shall be | The cores shall | In Process | - | P | V |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | during process | reasonable tight. | be reasonable tight. | Log Sheet | | | |
| 8.5 | Diameter | Meas. | Each setting during process | Approved Data Sheet | Approved Data Sheet | In Process Log Sheet | - | P | V |
| | | | | | | | | | |
| **9.0** | **INNER SHEATHING BY EXTRUSION** | | | | | | | | |
| 9.1 | Thickness of Inner Sheath | Meas. | Each setting during process | IS : 1554 (Part-1) Table -4 & Approved Data Sheets. | IS : 1554 (Part-1) Table -4 & Approved Data Sheets. | In Process Log Sheet | - | P | V |
| 9.2 | Dia Over Inner Sheath | Meas. | | Approved data sheet | Approved data sheet | | - | P | V |
| 9.3 | Type of Sheathing Material | Visual | | IS : 1554 (Part-1) & Approved data sheet | IS : 1554 (Part-1) & Approved data sheet | | - | P | V |
| 9.4 | Surface Finish | Visual | 100% | IS : 1554 (Part-1) The Surface shall be smooth & free from any defects. | IS : 1554 (Part-1) The Surface shall be smooth & free from any defects. | | - | P | V |
| | | | | | | | | | |

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| **10.0** | **ARMOURING** | | | | | | | | |
| 10.1 | No. of Armour Wires & Construction | Meas. | Starting of M/C and during running | Approved Data Sheet | Approved Data Sheet | In Process Log Sheet | - | P | V |
| 10.2 | Dimensions or Armour Wire / Strip | Meas. | Starting of M/C and during running | Approved Data Sheet | Approved Data Sheet | In Process Log Sheet | - | P | V |
| 10.3 | Surface Finish | Visual | | Should be reasonably smooth | Should be reasonably smooth | | - | P | V |
| 10.4 | Lay Direction | Visual | | Left Hand Lay | Left Hand Lay | | - | P | V |
| 10.5 | Gap between two Wire / Strip | Meas. | | Not more than one Wire dia/ width of Strip | Not more than one Wire dia/ width of Strip | | - | P | V |
| 10.6 | Cross over / Over Riding | Visual | | No cross - over | No cross - over | | - | P | V |
| 10.7 | Armour Coverage / Face Bend | Meas. | | Min. 90% coverage. No face bend | Min. 90% coverage. No face bend | | - | P | V |
| 10.8 | Dia Over Armour | Meas. | | Approved Data Sheet | Approved Data Sheet | | - | P | V |
| | | | | | | | | | |
| **11.0** | **FINISHED CABLES** | | | | | | | | |

* Category of Responsibility: P - Actual Test Performance V - Verify and Accept W - Witness Actual testing, verify and accept

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | **(Outer Sheathing)** | | | | | | | | |
| 11.1 | Thickness of Outer Sheath | Meas | Starting of M/C and during running | IS : 1554 (Part-1) Table -7 and Approved Data Sheet | IS : 1554 (Part-1) Table -7 and Approved Data Sheet | In Process Log Sheet | - | P | V |
| 11.2 | Type of Sheathing Material | Visual | | IS : 1554 (Part-1) & Approved Data Sheet | IS : 1554 (Part-1) & Approved Data Sheet | In Process Log Sheet | - | P | V |
| 11.3 | Surface Finish | Visual | | The surface shall be smooth and free from any defects | The surface shall be smooth and free from any defects | | - | P | V |
| 11.4 | Overall Dia | Meas. | Starting of M/C and during running | Approved Data Sheets. | Approved Data Sheets. | | - | P | V |
| 11.5 | Porosity | Visual | | No porosity | No porosity | | - | P | V |
| 11.6 | Embossing | Visual | | IS : 1554 (Part-1) and Tech. Specification | IS : 1554 (Part-1) and Tech. Specification | | - | P | V |
| 11.7 | Progressive Sequential Marking | Visual | | Tech. Specification | Tech. Specification | | - | P | V |
| | | | | | | | | | |
| **12.0** | **DRUM WINDING** | | | | | | | | |

* Category of Responsibility: P - Actual Test Performance V - Verify and Accept W - Witness Actual testing, verify and accept

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|---|---|---|---|---|---|---|---|---|---|
| 12.1 | Drum Condition | Visual | 100% | Tech. Specification | Tech. Specification | In Process Log Sheet | - | P | V |
| 12.2 | Bituminized Water Proof Paper Covering | Visual | | Tech. Specification | Tech. Specification | | - | P | V |
| 12.3 | Cable Length in Meters | Meas. | | Approved Data Sheets 500 / 1000 ± 5% | Approved Data Sheets 500 / 1000 ± 5% | | - | P | V |
| 12.4 | Drum Marking | Visual | | IS : 1554 (Part-1) and Tech. Specification | IS : 1554 (Part-1) and Tech. Specification | | - | P | V |
| | | | | | | | | | |
| C FINAL INSPECTION & TESTING | | | | | | | | | |
| **13.0** | **ROUTINE TESTING** | | | | | | | | |
| 13.1 | Conductor Resistance at 20°C | Elect. | 100% Drums | IS : 8130 Table-2/ Approved Data Sheet | IS : 8130 Table-2/ Approved Data Sheet | Routine Test Certificate | - | P | W |
| 13.2 | High Voltage Test at Room Temperature | Elect. | 100% Drums | IS : 1554 (Part-1) Shall withstand 3 KV (rms) for 5 Minute | IS : 1554 (Part-1) Shall withstand 3 KV (rms) for 5 Minute | Routine Test Certificate | - | P | W |

* Category of Responsibility: P - Actual Test Performance V - Verify and Accept W - Witness Actual testing, verify and accept

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| **14.0** | **ACCEPTANCE TESTS** | | | | | | | | |
| **14.1** | **FINISHED CABLE** | | | | | | | | |
| 14.1.1 | Visual Check for | Visual | All Drums | IS : 1554 (Part-1) / Approved Data Sheet | IS : 1554 (Part-1) / Approved Data Sheet | | - | P | W |
| i) | Core Identification | | | | | | - | P | W |
| ii) | Embossing | | | | | | - | P | W |
| iii) | Printing Quality of sequential Marking Check | | | | | | - | P | W |
| iv) | Surface Finish | | | | | | - | P | W |
| v) | Top & Bottom Sequential Marking Check | | | | | | - | P | W |
| vi) | Length Measurement | Measurement through rewinding 5% of drum from total lot offered. | | | | | - | P | W |
| | | | | | | | | | |
| 14.1.3 | Conductor Resistance at 20°C | Elect. | 10% Drums Test value to tally with original routine test | IS : 8130 Table-2/ Approved Data Sheet | IS : 8130 Table-2/ Approved Data Sheet | Acceptance Test Certificate | - | P | W |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | value of drums. | | | | | | |
| 14.1.4 | Insulation Resistance Test and Volume Resistivity | Elect. | Every 10 Drums or Part thereof per size | IS: 5831 / Approved Data sheets. Min. at 27°C 36.7 Mohm/Km | IS: 5831 / Approved Data sheets. Min. at 27°C 36.7 Mohm/Km | Acceptance Test Certificate | - | P | W |
| 14.1.5 | Flammability Test | Thermal | 1 Sample per lot for each size | IS : 1554 (Part-1) / Tech. Specn. | IS : 1554 (Part-1) / Tech. Specn. | Acceptance Test Certificate | - | P | W |
| 14.1.6 | High Voltage test at room temperature | | 1 Sample per lot for each size | IS : 1554 (Part-1) | IS : 1554 (Part-1) | Acceptance Test Certificate | | | |
| | | | | | | | | | |
| **14.2** | **ALUMINIUM CONDUCTOR** | | | | | | | | |
| 14.2.1 | Tensile Strength | Mech | 1 sample for every 10 drums or part thereof per size | IS : 8130 / Tech. Specification Min. 100 N/mm² | IS : 8130 / Tech. Specification Min. 100 N/mm² | Acceptance Test Certificate | - | P | W |
| 14.2.2 | Wrapping Test | Mech | 1 sample for every 10 drums or part thereof per size | IS : 8130 / Tech. Specification. Wrap-8, Unwrap-6 & Wrap-6 on its own dia. The wire shall not crack or break | IS : 8130 / Tech. Specification. Wrap-8, Unwrap-6 & Wrap-6 on its own dia. The wire shall not crack or break | Acceptance Test Certificate | - | P | W |

* Category of Responsibility: P - Actual Test Performance V - Verify and Accept W - Witness Actual testing, verify and accept

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| **14.3** | **PVC INSULATION & SHEATH** | | | | | | | | |
| 14.3.1 | Thickness of Insulation of Core | Meas. | 1 sample for every 10 drums or part thereof per size | IS : 1554 (Part-1) Table -2/ Approved Data Sheets. | IS : 1554 (Part-1) Table -2/ Approved Data Sheets. | Acceptance Test Certificate | - | P | W |
| i) | Average | | | | | | | | |
| ii) | Minimum | | | | | | | | |
| 14.3.2 | Thickness of Inner Sheath | Meas. | 1 sample for every 10 drums or part thereof per size | IS : 1554 (Part-1) Table -4/ Approved Data Sheets. | IS : 1554 (Part-1) Table -4/ Approved Data Sheets. | Acceptance Test Certificate | - | P | W |
| 14.3.3 | Thickness of Outer Sheath | Meas. | 1 sample for every 10 drums or part thereof per size | IS : 1554 (Part-1) Table -7/ Approved Data Sheets. | IS : 1554 (Part-1) Table -7/ Approved Data Sheets. | Acceptance Test Certificate | - | P | W |
| 14.3.4 | Tensile Strength & Elongation for Insulation | Mech | 1 sample for every 10 drums or part thereof per size | IS : 5831 Table-1/ Approved Data Sheets. Min. TS 12.5 N/mm² Elongation 150% (Min.) | IS : 5831 Table-1/ Approved Data Sheets. Min. TS 12.5 N/mm² Elongation 150% (Min.) | Acceptance Test Certificate | - | P | W |

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|---|---|---|---|---|---|---|---|---|---|
| 14.3.5 | Tensile Strength & Elongation for Inner & Outer Sheath | Mech | 1 sample for every 10 drums or part thereof per size | IS : 5831 Table-2/ Approved Data Sheets. Min. TS 12.5 N/mm² Elongation 150% (Min.) | IS : 5831 Table-2/ Approved Data Sheets. Min. TS 12.5 N/mm² Elongation 150% (Min.) | Acceptance Test Certificate | - | P | W |
| 14.3.6 | Cold Bend Test for Diameter upto 12.5 mm | Mech | 1 sample of any size per order | IS : 1554 (Part-1) No signs of cracks or scales | IS : 1554 (Part-1) No signs of cracks or scales | Acceptance Test Certificate | - | P | W |
| 14.3.7 | Cold Impact Test for diameter more than 12.5 mm | Mech | 1 sample of any size per order | IS : 1554 (Part-1) No signs of cracks or scales | IS : 1554 (Part-1) No signs of cracks or scales | Acceptance Test Certificate | - | P | W |
| 14.3.8 | Oxygen Index Test on Outer Sheath | Envir. | 02 sample per lot per type | ASTM-D-2863 / Approved Data Sheet Min. 29% | ASTM-D-2863 / Approved Data Sheet Min. 29% | Acceptance Test Certificate | - | P | W |
| 14.3.10 | Flame Retardant Test On Single Cables | Thermal | 1 sample per lot for each size | IS : 1554 Cl. 16.6 No visible damages on the test specimen within 300 mm from its upper end | IS : 1554 Cl. 16.6 No visible damages on the test specimen within 300 mm from its upper end | Acceptance Test Certificate | - | P | W |

* Category of Responsibility: P - Actual Test Performance V - Verify and Accept W - Witness Actual testing, verify and accept

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| **14.4** | **ADDITIONAL TEST FOR FRLS CABLES** | | | | | | | | |
| 14.4.1 | Smoke Density Rating | Envir. | 1 sample per lot for each size | ASTM-D-2843 / Approved Data Sheet Max. 60% | ASTM-D-2843 / Approved Data Sheet Max. 60% | Acceptance Test Certificate | - | P | W |
| 14.4.2 | Acid Gas Generation | Envir. | 1 sample per lot for each size | IEC - 754-1/ Tech. Specn. Max. 20% by weight | IEC - 754-1/ Tech. Specn. Max. 20% by weight | Acceptance Test Certificate | - | P | W |
| 14.4.3 | Flammability | Thermal | 1 sample per lot for each size | IEEE-383 Swedish Chimney SS-424-14-75 Class F3 & Approved Data Sheet | IEEE-383 Swedish Chimney SS-424-14-75 Class F3 & Approved Data Sheet | Acceptance Test Certificate | - | P | W |
| | | | | | | | | | |
| **14.5** | **ARMOURING** | | | | | | | | |
| 14.5.1 | Resistivity for Armour Wire | Elect. | 4 Sample per type per size of armour | IS : 3975 / Approved Data Sheets Max. 14.5× 10-6 Ohm.cm at 20 Deg. C | IS : 3975 / Approved Data Sheets Max. 14.5× 10-6 Ohm.cm at 20 Deg. C | Acceptance Test Certificate | - | P | W |
| 14.5.2 | Tensile Strength | Mech | 4 Sample per | IS : 3975 / | IS : 3975 / | Acceptance | - | P | W |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | type per size of armour | Approved Data Sheet | Approved Data Sheet | Test Certificate | | | |
| 14.5.3 | Closeness | Visual | 4 Sample per type per size of armour | IS : 3975 / Approved Data Sheet. Gap between two wires shall not be more than one wire dia/ width of strip | IS : 3975 / Approved Data Sheet.Gap between two wires shall not be more than one wire dia/ width of strip | Acceptance Test Certificate | - | P | W |
| 14.5.4 | Uniformity of Zinc Coating | Meas. | 4 Sample per type per size of armour | IS: 3975 & IS : 4826/ Approved Data Sheet. At the end of specified number of dips as per IS, the specimen shall not show any red deposit of Copper upon base metal. | IS: 3975 & IS : 4826/ Approved Data Sheet. At the end of specified number of dips as per IS, the specimen shall not show any red deposit of Copper upon base metal. | Acceptance Test Certificate | - | P | W |
| | | | | | | | | | |
| 14.5.5 | Weight of Zinc Coating | Chem | 4 Sample per type of offered lot | IS : 3975, IS: 4826 / Approved Data Sheets | IS : 3975, IS: 4826 / Approved Data Sheets | Acceptance Test Certificate | - | P | W |
| 14.5.6 | Torsion/Winding | Mech | 4 sample per | IS:3975/approved | IS:3975/approve | Acceptance | - | P | V |

* Category of Responsibility: P - Actual Test Performance V - Verify and Accept W - Witness Actual testing, verify and accept

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|---|---|---|---|---|---|---|---|---|---|
| | | | type of offered lot | data sheet | d data sheet | Test Certificate | | | |
| | | | | | | | | | |
| **14.6** | **DRUMS** | | | | | | | | |
| 14.6.1 | Visual Check for defects | Visual | 100% | Tech. Specification | Tech. Specification | Acceptance Test Certificate | - | P | W |
| 14.6.2 | Dimensions | Meas. | 1 sample per every 10 Drums or part thereof per size | Approved Drawings | Approved Drawings | Acceptance Test Certificate | - | P | W |
| 14.6.3 | Sealing of Drums | Visual | 100% | | | Test Report | - | P | W |
| | | | | | | | | | |
| **14.7** | **Additional Test** Physical test for Insulation and outer Sheath | | | | | | | | |
| 14.7.1 | Shrinkage Test | Meas. | 1 sample per lot per size | Tech. Specn./As Per IS : 1554 (Part-1) | Tech. Specn./As Per IS : 1554 (Part-1) | Test Report | - | P | W |
| 14.7.2 | Hot Deformation Test | Meas | 1 sample/Lot/Size | Tech. spec/As per IS:1554(Part-1) | Tech. spec/As per IS:1554(Part-1) | Test Report | - | P | V |

* Category of Responsibility: P - Actual Test Performance V - Verify and Accept W - Witness Actual testing, verify and accept

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|---|---|---|---|---|---|---|---|---|---|
| 14.7.3 | Heat Shock Test | Meas | 1 sample/Lot/Size | Tech. spec/As per IS:1554(Part-1) | Tech. spec/As per IS:1554(Part-1) | Test Report | - | P | V |
| 14.7.4 | Thermal Stability | Meas. | 1 sample per lot per size | Tech. Specn./As Per IS : 1554 (Part-1) | Tech. Specn./As Per IS : 1554 (Part-1) | Test Report | - | P | W |
| 14.7.5 | High Voltage Test (Water Immersion Test) | Meas. | 1 sample per lot per size | Tech. Specn./As Per IS : 1554 (Part-1) | Tech. Specn./As Per IS : 1554 (Part-1) | Test Report | - | P | W |
| 14.7.6 | Insulation resistance measurement with 500 V DC Calibrated IR tester | | | | | | | | |
| a | Between Core to Core | Measurement | 100% of the cable drum offered | During the measurement following parameters will be recorded<br>Ambient Temperature at the time of measurement<br>Length of the cable drum under measurement<br>Actual Value of the IR measured in Mohm | | | - | P | W |
| b | Individual Core to armour | | | | | | | | |
| | | | | | | | | | |

* Category of Responsibility: P - Actual Test Performance V - Verify and Accept W - Witness Actual testing, verify and accept

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|---|---|---|---|---|---|---|---|---|---|
| **15.0** | **PACKING & DISPATCH** | Visual | 100% | | | Check List | - | P | V |
| 15.1 | Application of bituminized water proof paper | | | | | | | | |
| 15.2 | Space between outer most layer & drum edge | | | | | | | | |
| 15.3 | Proper Packing | | | | | | | | |
| 15.4 | Sealing of ends | | | | | | | | |
| 15.5 | Manufacturer's Name | | | | | | | | |
| 15.6 | Name & Address of the Consignee | | | | | | | | |
| 15.7 | Contract Number | | | | | | | | |
| 15.8 | Drum Number | | | | | | | | |
| 15.9 | Type, Size and length of the cable | | | | | | | | |
| 15.10 | Gross Weight | | | | | | | | |
| 15.11 | Tare Weight | | | | | | | | |
| 15.12 | Nett Weight | | | | | | | | |
| 15.13 | Arrow Marking for unwinding | | | | | | | | |
| 15.14 | CIP/MICC Nos Marking | | | | | | | | |

EM : Equipment Manufacturer CM : Component Manufacturer CMTC :- Component manufacturer test certificate EMTR :- Equipment manufacturer test Report

# SF6 Gas Circuit Breaker

| S. No. | Components / Operations & Description of Test | Type of check | Quantum of Check / Sampling with basis | Reference document for Testing | Acceptance Norms | Format of Record | Category of responsibility | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Sub- Vendor | Manufacturer | Customer |
| **A. RAW MATERIAL INSPECTION** | | | | | | | | | |
| **1** | **Chamber & Support Insulators** | | | | | | | | |
| 1.1 | Visual Inspection | Visual | 100% | IEC 62155 | IEC 62155 | CM's TC | P | V | - |
| 1.2 | • Dimensional Check after conducting routine tests Paralism, height<br>• Concentricity<br>• Creepage, warpage | Mechanical | 2 sample per lot of each type | As per manufacturer drawing/IEC 62155 | As per manufacturer drawing/IEC 62155 | CM's TC | P | V | - |
| 1.3 | Ultrasonic test | Electrical | 100% | IEC 62155 | IEC 62155 | CM's TC | P | V | - |
| 1.4 | Hydraulic Pressure test (Chamber Insulator.) | Mechanical | 100% | | | | P | V | - |
| 1.5 | Bending load test in 4 direction at 70 % specified bending load for 10 sec | Mechanical | 100% | | | | P | V | - |
| 1.6 | Porosity test | Mechanical | One sample per firing cycle | | | | P | V | - |
| 1.7 | Temperature cycle test | Mechanical | one sample per year | | | | P | V | - |
| 1.8 | Burst pressure test | Mechanical | one sample per six months | | | | P | V | - |

* Category of Responsibility: P - Actual Test Performance V - Verify and Accept W - Witness Actual testing, verify and accept

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|---|---|---|---|---|---|---|---|---|---|
| 1.90 | 70 % load in all 3 direction for 10 sec & 100% load in 4th direction for 1 min | Mechanical | one sample per year | IEC 62155 | IEC 62155 | CM's TC | P | V | - |
| | | | | | | | | | |
| **2** | **Insulating rod.** | | | | | | | | |
| 2.1 | Visual inspection for damage on surface and internal defects. | Visual | 100% | Plant drawings | Certificate of conformance / TC | Certificate of conformance / TC | P | V | - |
| 2.2 | Pull Test | Mechanical | 100% | Plant drawings | Certificate of conformance / TC | Certificate of conformance / TC | P | V | - |
| 2.a | **PIR Tube** | | | | | | | | |
| 2.1a | Visual inspection for damage on surface and internal defects. | Visual | 100% | | | | | | |
| | Internal thread | Visual | 100% | | | | | | |
| **3** | **Puffer Cylinder (Heat Cylinder)** | | | | | | | | |
| 3.1 | Visual check for damages, surface defects, surface finish | Visual | 100% | Manufacturer's Plant Standard | Manufacturer's Plant Standard | - | P | V | - |
| 3.2 | Dimensional check | Mechanical | 10% | | | CM's TC | P | V | - |
| 3.3 | Chemical composition | Chemical | 1 sample/batch | | | CM's TC | P | V | - |
| 3.4 | Silver plating thickness | Chemical | 5% | | | CM's TC | P | V | - |
| 3.5 | Adhesion of silver plating | Mechanical | 100% | | | CM's TC | P | V | - |
| 3.6 | Tensile test & elongation | Mechanical | 1 sample per batch | | | CM's TC | P | V | - |

* Category of Responsibility: P - Actual Test Performance V - Verify and Accept W - Witness Actual testing, verify and accept

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| | | | | | | | | | |
| **4** | **Finger contacts** | | | | | | | | |
| 4.1 | Visual check for damage & surface finish | Visual | 100% | Manufacturer's Plant Standard | Manufacturer's Plant Standard | | P | V | - |
| 4.2 | Hardness | Mechanical | 1 no per batch | | | CM's TC | P | V | - |
| 4.3 | Conductivity | Electrical | 1 no per batch | | | CM's TC | P | V | - |
| 4.4 | Chemical composition | Chemical | 1 no per batch | | | CM's TC | P | V | - |
| 4.5 | Dimensional check | Mechanical | 10% of each lot | Drawing | Drawing | CM's TC | P | V | - |
| 4.6 | Silver plating thickness | Chemical | 5% of each batch | Drawing | Drawing | CM's TC | P | V | - |
| 4.7 | Adhesion of silver plating | Mechanical | 100% | Manufacturer's Plant Standard | Manufacturer's Plant Standard | CM's TC | P | V | - |
| | | | | | | | | | |
| **5** | **Fixed Contact support (Al. Alloy casting)** | | | | | | | | |
| 5.1 | Visual aspects- blow holes, surface finish | Visual | 100% | Manufacturer's Plant Standard | Manufacturer's Plant Standard | CM's TC | P | V | - |
| 5.2 | Chemical analysis | Chemical | 1 sample per batch | | | CM's TC | P | V | - |
| 5.3 | Tensile test & elongation | Mechanical | 1 sample per batch | | | CM's TC | P | V | - |
| 5.4 | Dimensional check | Mechanical | 100% | | | CM's TC | P | V | - |
| | | | | | | | | | |
| **6** | **Moving contact support (Al. Alloy casting)** | | | | | | | | |
| 6.1 | Visual aspects- blow holes, surface finish | Visual | 100% | Manufacturer's Plant Standard | Manufacturer's Plant Standard | CM's TC | P | V | - |
| 6.2 | Chemical analysis | Chemical | 1 sample per batch | | | CM's TC | P | V | - |

* Category of Responsibility: P - Actual Test Performance V - Verify and Accept W - Witness Actual testing, verify and accept

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|---|---|---|---|---|---|---|---|---|---|
| 6.3 | Tensile test & elongation | Mechanical | 1 sample per batch | | | CM's TC | P | V | - |
| 6.4 | Dimensional check | Mechanical | 100% | | | CM's TC | P | V | - |
| | | | | | | | | | |
| **7** | **Arcing contacts** | | | | | | | | |
| 7.1 | Visual inspection | Visual | 100% | Plant drawings | Certificate of conformance / TC | Certificate of conformance / TC | P | V | - |
| | Dimensional check | | 100% | | | | | | |
| | Hardness (Cu, Tungsten) | | 1 sample per lot | | | | | | |
| | Conductivity | | 1 sample per lot | | | | | | |
| | Chemical test | | 1 sample per lot | | | | | | |
| **8** | **Multi lam contact** | | | | | | | | |
| 8.1 | Visual inspection & other tests | Visual | 100% | Plant drawings | Certificate of conformance / TC | Certificate of conformance / TC | P | V | - |
| | | | | | | | | | |
| **9** | **NOZZLE** | | | | | | | | |
| 9.1 | Visual check for damage and presence of foreign particles | Visual | 100% | Plant drawings | Certificate of conformance / TC | Certificate of conformance / TC | P | V | - |
| | Dimensional check | | 2 sample per lot | | | | | | |
| | Tensile Strength | | 1 sample per lot | | | | | | |
| | Elongation | | 1 sample per lot | | | | | | |
| | Hardness | | 1 sample per lot | | | | | | |
| **10** | **Mechanism Housing** | | | | | | | | |
| 10.1 | Visual aspects- blow | Visual | 100% | Manufacturer's | Manufacturer's | | | | |

* Category of Responsibility: P - Actual Test Performance V - Verify and Accept W - Witness Actual testing, verify and accept

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|---|---|---|---|---|---|---|---|---|---|
| | holes, surface finish | | | Plant Standard | Plant Standard | | | | |
| 10.2 | Chemical analysis | Chemical | 1 sample per batch | | | CM's TC | P | V | - |
| 10.3 | Tensile test & elongation | Mechanical | 1 sample per batch | | | CM's TC | P | V | - |
| 10.4 | Dimensional check | Mechanical | 2 sample per lot | | | CM's TC | P | V | - |
| | | | | | | | | | |
| **11** | **Springs** | | | | | | | | |
| 11.1 | Visual checks for damages | Visual | 100% | Manufacturer's Plant Standard | Manufacturer's Plant Standard | | | | |
| 11.2 | Dimensional check | Mechanical | 100% | | | CM's TC | P | V | - |
| 11.3 | Load characteristics ( For tensile / compression springs) | Mechanical | 1sample per lot | | | CM's TC | P | V | - |
| 11.4 | Chemical check | Chemical | 1sample per lot | | | CM's TC | P | V | - |
| 11.5 | Magnetic particles test | Mechanical | 100% | | | CM's TC | P | V | - |
| 11.6 | Hardness test (for spiral spring) | | 1sample per lot | | | | | | |
| **12** | **Holding Latches** | | | | | | | | |
| 12.1 | Visual aspects- blow holes, surface finish | Visual | 100% | Manufacturer's Plant Standard | Manufacturer's Plant Standard | | | | |
| 12.2 | Chemical analysis | Chemical | 1sample per lot | | | CM's TC | P | V | - |
| 12.3 | M.P.I. Test | Mechanical | 100% | | | CM's TC | P | V | - |
| 12.4 | Dimensional check | Mechanical | 100% | | | CM's TC | P | V | - |
| 12.6 | Surface hardness & Case depth after heat treatment | Mechanical | 1sample per lot | | | CM's TC | P | V | - |
| 12.7 | Microstructure test | | 1sample per lot | | | | | | |

* Category of Responsibility: P - Actual Test Performance V - Verify and Accept W - Witness Actual testing, verify and accept

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| **13** | **Trip & Close coils** | | | | | | | | |
| 13.1 | Coil resistance | Electrical | 100% | Manufacturer's Plant Standard | Manufacturer's Plant Standard | Routine test certificate | P | V | - |
| 13.2 | HV test 2kv for 1 minute | Electrical | 100% | | | Routine test certificate | P | V | - |
| 13.3 | Functional test | Electrical | 100% | | | - | P | V | - |
| | | | | | | | | | |
| **14** | **Auxiliary Switch** | | | | | | | | |
| 14.1 | Insulation resistance test | Electrical | 100% | Manufacturer's Plant Standard | Manufacturer's Plant Standard | CM's TC | P | V | - |
| 14.2 | HV test 2kv for 1 minute | Electrical | 100% | | | CM's TC | P | V | - |
| 14.3 | Contact resistance | Electrical | 100% | | | CM's TC | P | V | - |
| 14.4 | Functional test | Electrical | 100% | | | | - | P | V |
| | | | | | | | | | |
| **15** | **Motor** | | | | | | | | |
| 15.1 | Insulation resistance test | Electrical | 100% | Manufacturer's Plant Standard | Manufacturer's Plant Standard | CM's TC | P | V | - |
| 15.2 | HV test 2kv for 1 minute | Electrical | 100% | | | CM's TC | P | V | - |
| 15.3 | No load test | Electrical | 100% | | | CM's TC | P | V | - |
| 15.4 | Functional test | Electrical | 100% | - | - | | - | P | V |
| | | | | | | | | | |
| **16** | **Control Panel** | | | | | | | | |
| 16.1 | Visual check | Visual | 100% | Drawing | Drawing | CM's TC | P | V | - |
| 16.2 | Dimensional check | Mechanical | 15% | Drawing | Drawing | CM's TC | P | V | - |
| 16.3 | Coating thickness | Mechanical | 1 sample per batch | Drawing | Coating thickness 80-120 microns | CM's TC | - | P | V |
| 16.4 | Adhesion test | Mechanical | 1 sample per batch | P.S. | P.S. | CM's TC | P | V | - |
| | | | | | | | | | |
| **17** | **Density Monitor Switch** | | | | | | | | |
| 17.1 | Visual aspects | Visual | 100% | - | - | | - | P | V |
| 17.2 | Verification of different settings of alarm & | Electrical | 100% | - | - | Routine Test Record | - | P | V |

* Category of Responsibility: P - Actual Test Performance V - Verify and Accept W - Witness Actual testing, verify and accept

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | lockout | | | | | | | | |
| 17.3 | HV Test at 2 KV for one minute | Electrical | 100% | - | - | Routine Test Record | - | P | V |
| | | | | | | | | | |
| **18** | **Gas pressure gauge** | | | | | | | | |
| 18.1 | Checks for visual defects. | Visual | 100% | - | No damage | CM's TC | P | V | - |
| 18.2 | Accuracy (±1.5% on full scale deflection) | Mechanical | 100% | Manufacturer's Plant Standard | ±1.5% | CM's TC | P | V | - |
| | | | | | | | | | |
| **19** | **Gas stop valve** | | | | | | | | |
| 19.1 | Visual & Dimensional check | Visual | 100% | Manufacturer's Plant Standard | Manufacturer's Plant Standard | CM's TC | P | V | - |
| 19.2 | Metal- Metail leak test | Mechanical | 100% | | | CM's TC | P | V | - |
| 19.3 | Rubber- Metal leak test | Mechanical | 100% | | | CM's TC | P | V | - |
| | | | | | | | | | |
| **20** | **Sealing 'O' ring** | | | | | | | | |
| 20.1 | Visual inspection for damage on surface and internal defects. | Visual | 100% | Plant Drawings | Certificate of conformance | Certificate of conformance | P | V | - |
| | | | | | | | | | |
| **21** | **SF6 gas with cylinder** | | | | | | | | |
| 21.1 | Properties as per IEC 60376 | Chemical | One no. per batch | IEC 60376 | IEC 60376 | CM's TC | P | V | - |
| 21.2 | Leakage test on cylinders | Mechanical | 10% | - | No leakage with probe | - | P | V | - |
| | | | | | | | | | |
| **22** | **Absorbent** | | | | | | | | |
| 22.1 | Visual inspection for damage on surface and internal defects. | Visual | 100% | Plant Drawing | No damage | Certificate of conformance | P | V | - |

* Category of Responsibility: P - Actual Test Performance V - Verify and Accept W - Witness Actual testing, verify and accept

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **23** | **Base frame & structure** | | | | | | | | |
| 23.1 | Visual check | Visual | 100% | Drawing | No damages | | P | V | - |
| 23.2 | Dimensional check | Mechanical | 100% | Drawing | Tolerances within limits | | P | V | - |
| 23.3 | Coating thickness | Mechanical | 1 sample per batch | Technical spec. min 85 | Technical spec. min 85 | CM's TC | P | V | - |
| | | | | micron coating thickness. | micron coating thickness. | | P | V | - |
| 23.4 | Uniformity of coating | Mechanical | 1 sample per batch | IS2633 | IS2633 | CM's TC | P | V | - |
| 23.5 | Mass of coating | Mechanical | 1 sample per batch | Tech spec. | Tech spec. | CM's TC | P | V | - |
| | | | | 610 gm/sq.m | 610 gm/sq.m | | P | V | - |
| 23.6 | Adhesion test | Mechanical | 1 sample per batch | IS 2629 | IS 2629 | CM's TC | P | V | - |
| | | | | | | | | | |
| **24** | **Grading Capacitor** | | | | | | | | |
| 24.1 | Visual check | Visual | 100% | Drawing | No damages | | P | V/P | -/V |
| 24.2 | Capacitance & Tan delta before & after 1 minute HV test | Electrical | 100% | Measurement at 10kV, 250kV | C=±5% of rated value Tan delta less than 0.5% | CM's TC | P | V | - |
| 24.3 | Partial discharge before & after 1 minute HV test | Electrical | 100% | Measurement at 349kV | less than or equal to 3 pC | CM's TC | P | V | - |
| 24.4 | One minute power frequency withstand test on the Capacitor unit | Electrical | 100% | 544kV | No breakdown of Insulation | CM's TC | P | V | - |
| 24.5 | Leakage test | Electrical | 100% | Visual check | No leakage from any part | CM's TC | P | V | - |
| | | | | | | | | | |
| **25** | **Resistor Disks** | | | | | | | | |

* Category of Responsibility: P - Actual Test Performance V - Verify and Accept W - Witness Actual testing, verify and accept

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|---|---|---|---|---|---|---|---|---|---|
| 25.1 | Visual inspection & other tests | Visual | 100% | Plant drawings | Certificate of conformance | Certificate of conformance | P | V/P | -/V |
| | | | | | | | | | |
| **26** | **PIR Operating rod** | | | | | | | | |
| 26.1 | Visual inspection & other tests | Visual | 100% | Plant drawings | Certificate of conformance / TC | Certificate of conformance / TC | P | V/P | -/V |
| **27** | **PSD ( Phase synchronizing Device)** | | | | | | | | |
| 27.1 | Visual check | Visual | 100% | - | No damages | | P | V/P | -/V |
| 27.2 | Adjustment & test of I/O ports | Electrical | 100% | Manufacturer internal document | Manufacturer internal document | CM's TC | P | V | - |
| 27.3 | Functional test | Electrical | 100% | -do- | -do- | CM's TC | P | V | - |
| 27.4 | Compensation functions | Electrical | 100% | -do- | -do- | CM's TC | P | V | - |
| 27.5 | Output signals | Electrical | 100% | -do- | -do- | CM's TC | P | V | - |
| 27.6 | Voltage withstand test 1 kV AC | Electrical | 100% | -do- | -do- | CM's TC | P | V | - |
| | | | | | | | | | |
| **28** | **Contactors & Overload Relay** | | | | | | | | |
| 28.1 | HV Test at 1 KV for one minute | Electrical | 100% | Manufacturer Internal Document | Manufacturer Internal Document | | - | P | V |
| 28.2 | Functional test | Electrical | 100% | | | | - | P | V |
| 28.3 | Functional test of Overload relay | Electrical | 100% | | | CM's TC | P | V | - |
| | | | | | | | | | |
| **29** | **Plug in Connectors(For Interpole wiring) (for 800kV)** | | | | | | | | |
| 29.1 | Visual check | Visual | 100% | Manufacturer | No damages | CM's TC | P | V | - |

* Category of Responsibility: P - Actual Test Performance V - Verify and Accept W - Witness Actual testing, verify and accept

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|---|---|---|---|---|---|---|---|---|---|
| | | | | Internal Document | | | | | |
| 29.2 | HV Test (1kV for 1 minute) (pin to ground) | Electrical | 100% | Manufacturer Internal Document | Manufacturer Internal Document | CM's TC | P | V | - |
| | | | | | | | | | |
| **B. Section : IN PROCESS INSPECTION** | | | | | | | | | |
| **30** | **Interrupter Assembly** | | | | | | | | |
| 30.1 | Clutch plate movement by manual operation | Mechanical | 100% | | Free movement | NA | - | P | V |
| | | | | | | | | | |
| **31** | **Drive Mechanism Assembly** | | | | | | | | |
| 31.1 | Verification of Tightening Torques | Mechanical | 100% | Manufacturer internal document | Manufacturer internal document | Assembly Records | - | P | V |
| 31.2 | Stroke Length Measurement of Shock Absorber | Mechanical | 100% | | | Assembly Records | - | P | V |
| 31.3 | 1.2mm gap setting of Drive | Mechanical | 100% | | | Assembly Records | - | P | V |
| 31.4 | Free rolling of bearings after sub assembly | Mechanical | 100% | | | Assembly Records | - | P | V |
| 31.5 | In process quality check | Mechanical | 100% | | | Assembly Records | - | P | V |
| | | | | | | | | | |
| **32** | **Control Panel with wiring** | | | | | | | | |
| 32.1 | Functional Test | Mechanical | 100% | As per IEC 62271-100 | Routine test certificate | - | - | P | V |
| 32.2 | Continuity Test on Wiring | Electrical | 100% | As per IEC 62271-100 | Routine test certificate | - | - | P | V |
| 32.3 | HV Test on Wiring | Electrical | 100% | As per IEC | Routine test | Routine test | - | P | V |

* Category of Responsibility: P - Actual Test Performance V - Verify and Accept W - Witness Actual testing, verify and accept

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|---|---|---|---|---|---|---|---|---|---|
| | | | | 62271-100 | certificate | certificate | | | |
| | | | | | | | | | |
| **33** | **Plug in Connectors(For Interpole wiring)(for 800kV)** | | | | | | | | |
| 33.1 | Visual check | Visual | 100% | - | No damages | | - | P | V |
| 33.2 | HV Test (2kV for 1 minute) (pin to ground) | Electrical | 100% | As per IEC 62271-100 | Routine test certificate | Routine test certificate | - | P | V |
| | | | | | | | | | |
| **34** | **FINAL ASSEMBLY OF COMPLETE BREAKER** | | | | | | | | |
| 34.1 | Completeness of assembly as per check list | Mechanical | 100% | Manufacturer internal document | Manufacturer internal document | Control card | - | P | V |
| 34.2 | Visual Check of switch lever safety plate bending | Mechanical | 100% | | | PDI check | - | P | V |
| | | | | | | | | | |
| **C. Section : FINAL TESTING** | | | | | | | | | |
| **35** | **Routine Tests** | | | | | | | | |
| 35.1 | Mechanical Operations at rated SF6 gas pressure at 20 deg.C * | | | | | | - | P | W |
| a)<br>b)<br>c)<br>d)<br>e) | At 100% V &<br>110%V : 5-Closing,5-Opening<br>At 70% V 5-Opening<br>At 85% V 5-Closing<br>At 100%V 5-CO & 1O-C-O<br>At 50% voltage for | Electrical | 100% | IEC-62271-100 & Specification | IEC-62271-100 & Specification | Routine Test Record | - | P | W |

* Category of Responsibility: P - Actual Test Performance V - Verify and Accept W - Witness Actual testing, verify and accept

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|---|---|---|---|---|---|---|---|---|---|
| | opening. | | | | | | | | |
| 35.2 a) | Measurement of speed & time (Curves to be maintained by operational analyser) At 100%V Opening Operation | -do- | 100% | | | -do- | - | P | W |
| b) | At 100% V Closing Operation | -do- | 100% | | | -do- | - | P | W |
| c) | At 110% V Opening Operation | -do- | 100% | | | - do- | - | P | W |
| d) | At 110% V Closing Operation | -do- | 100% | | | - do- | - | P | W |
| e) | At 70% V Opening Operation | -do- | 100% | | | - do- | - | P | W |
| f) | At 85% V Closing Operation | -do- | 100% | | | - do- | - | P | W |
| g) | At 100% V O-C-O Operation | -do- | 100% | | | - do- | - | P | W |
| h) | At 100% V CO Operation | -do- | 100% | | | - do- | - | P | W |
| 35.3 | MV Drop (Contact Resistance) | -do- | 100% | | | - do- | - | P | W |
| 35.4 | Dynamic Contact Resistance Measurement 1 Close-Open operation | -do- | 100% | As per Specification | As per Specification | -do- | - | P | W |
| 35.5 | Gas Leakage | -do- | 100% | IEC 62271-100 | IEC 62271-100 | - do- | - | P | W |
| 35.6 | Dielectric test on the main circuit | | 100% | | | - do- | - | P | W |
| 35.7 | Tests on auxiliary and control circuits | | 100% | | | - do- | - | P | W |
| 35.8 | Measurement of the | | 100% | | | - do- | - | P | W |

* Category of Responsibility: P - Actual Test Performance V - Verify and Accept W - Witness Actual testing, verify and accept

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|---|---|---|---|---|---|---|---|---|---|
| | resistance of the main circuit | | | | | | | | |
| 35.9 | Design and visual checks | | 100% | | | - do- | - | P | W |
| 35.6 | **ELECTRICAL SEQUENCE CHECK** | | | | | | | | |
| a) | Antipumping / Pole discrepancy | Electrical | 100% | IEC 62271-100 | IEC 62271-100 | Routine Test Record | - | P | W |
| b) | Other A.C.Circuit Check | -do- | 100% | | | - do- | - | P | W |
| 35.7 | 1 kV test on<br>i) Control Circuit<br>ii) Aux. Circuit | -do- | 100% | | | - do- | - | P | W |
| 35.8 | Verification of settings of density monitor switch at Siemens | -do- | 100% | | | - do- | - | P | W |
| | at Alarms & Lockout condition | -do- | | | | - do- | - | P | W |
| | | | | | | | | | |
| 35.9 | HV Test ( at Lock out pressure) | -do- | | | | - do- | - | P | W |
| a) | Between contacts (Breaker in open condition) | -do- | 100% | | | - do- | - | P | W |
| b) | Between live parts to ground (Breaker in closed condition) | -do- | 100% | | | - do- | - | P | W |
| | | | | | | | | | |
| 36 | **Grading Capacitor** | | | | | | | | |
| 36.1 | One minute power frequency withstand test on the GC along with CB ( on each break) | Electrical | 100% | IEC-62271-100 | IEC-62271-100 | Routine Test Record | - | P | W |
| | | | | | | | | | |
| **37** | **Controlled Switching equipment (If** | | | | | | | | |

* Category of Responsibility: P - Actual Test Performance V - Verify and Accept W - Witness Actual testing, verify and accept

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|---|---|---|---|---|---|---|---|---|---|
| | **applicable)** | | | | | | | | |
| 37.1 | Controlled switching equipment validation tests | | | | | | | | |
| a) | Tests with PSD & CB, 1. Phase sequence check with PSD.2. Indication/display on PSD 3. Mech operations check for external tripping/closing thru PSD as per PSD requirements with inputs for validation testing with adaptive features as per annexure 1 attached. 4. Check for close / open operations- bypass operation of PSD. 5. Self-monitoring function check. 6. Potential free contact check. | Electrical | 100% | As per specification | As per specification | Routine test record | - | P | W |
| | | | | | | | | | |
| **38** | **Pre Insertion Resistor (If applicable)** | | | | | | | | |
| 38.1 | Measurement of Resistance | Electrical | 100% | IEC-62271-100 | IEC-62271-100 | Routine Test Record | - | P | W |
| 38.2 | PIR Contact timings | Electrical | 100% | - do- | - do- | - do- | - | P | W |
| | | | | | | | | | |

# Alternatively the mechanical tests can be conducted on Phantom arrangement.

* Category of Responsibility: P - Actual Test Performance V - Verify and Accept W - Witness Actual testing, verify and accept

# Control and Relay & SAS Panels

| S. No. | Components / Operations & Description of Test | Type of Check | Quantum of Check / Sampling with basis | Reference Document for Testing | Acceptance Norms | Format of Record | Category of Responsibility | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Sub- Vendor | Manufacturer | Customer |
| **A. RAW MATERIAL INSPECTION for Enclosures (Panel, Trolley, Kiosk)** | | | | | | | | | |
| 1 | **Sheet steel CRCA / HR** | | | | | | | | |
| 1.1 | Dimension conformity including thickness | Measurement | Minimum of 1 sheet of each size per lot. | IS/ISO 16162 (For CRCA) IS 1852(For HR), IS 513 | IS/ISO 16162 (For CRCA) IS 1852(For HR), IS 513 | CMTC | P | V | - |
| 1.2 | Surface finish (Dent, line marks, Waviness) | Visual | 100% | IS 513 / IS 1079<br><br>IS 513 for CRCA & IS 1079 for HR | IS513 / IS 1079<br><br>IS 513 for CRCA & IS 1079 for HR | CMTC | P | V | - |
| 1.3 | Chemical composition (Grade CR2 & HR2 as per relevant IS) | Chemical | 1 sample / lot | IS 513 for CRCA & IS 1079 for HR | IS 513 for CRCA & IS 1079 for HR | CMTC | P | V | - |
| 1.4 | Mechanical Test (Tensile Test, Hardness Test & Bend Test) | Mechanical | 1 sample / lot | IS 513 for CRCA & IS 1079 for HR | IS 513 for CRCA & IS 1079 for HR | CMTC | P | V | - |
| | | | | | | | | | |
| 2 | **Fabrication** | | | | | | | | |

* Category of Responsibility: P - Actual Test Performance V - Verify and Accept W - Witness Actual testing, verify and accept

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 2.1 | Dimensional conformity & appearance | Visual / Measurement | 10% / Lot | As per Approved Drg. | As per Approved Drg. | CMTC | P | V | - |
| | | | | | | | | | |
| 3 | **Surface preparation / Pretreatment.(7 Tank Process)** | | | | | | | | |
| 3.1 | Hot Degreasing, derusting/ / pickling, Hot phosphating, , rinsing with water after each process or equivalent | Visual / Measurement | 100% | IS6005/IS 3618 | IS6005/IS 3618 | CMTC | P | V | - |
| 3.2 | Weight of Phosphate Coating | Measurement | once in month | IS6005/IS 3618 | MIN. 4.3g/m2 | CMTC | P | V | - |
| 3.3 | Visual check including nail scratch test | Visual | once in month | | | CMTC | P | V | - |
| 4 | **Powder coating and baking.** | | | | | | | | |
| 4.1 | Shade | Visual | 100% | As per Approved Drg. | As per Approved Drg. | | P | V | - |
| 4.2 | Adhesion/ scratch hatch test. | Visual / Measurement | Test Coupon | ASTM-D-3359 | ASTM-D-3359 | | P | V | - |
| 4.3 | Coating thickness/ Surface finish | Measurement | Random | As per Approved Drg. | As per Approved Drg. | | P | V | - |
| | | | | | | | | | |
| 5 | **Cubicle Components** | | | | | | | | |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 5.1 | **EARTH BUS BAR**<br>Dimension<br>al<br>conformity<br>Hardness<br>& surface defects | Visual / Measureme nt | One sample per lot | IS 1897 / IS 613 | IS 1897 / IS 613 | CMTC | P | V | - |
| 5.2 | **FASTENERS-**<br>**(**Bolts/Nuts/Washers)<br>Dimensional<br>conformity<br>Surface finish | As per Sampling Plan | 10% sample per lo | IS 1363, 1364, 1367, 2016 | IS 1363, 1364, 1367, 2016 | | P | V | - |
| 5.3 | **ASSEMBLED PANEL WITH ASSOCIATED COMPONENTS**<br>(Door Switch, Space Heater, Thermostats, 3 Pin Socket with Switch, Fluorescent/ Incandescent Lamp LED Lamp)<br>Position of component assembly Type & Quantity of components assembled<br>Quality of assembly | confor mity tests | Sampling | Approved project specifc Panel Construction drg, GA Drg | Approved project specifc Panel Construction drg, GA Drg | CMTC | P | V | - |
| 5.4 | **GASKET (Neoprene/EPDM)**<br>Physical properties, compressibility , Shore hardness, tensile and | Visual / Measurem ent | One sample per lot | TECH. Spec/ /IS 11149 | TECH. Spec/ /IS 11149 | CMTC | P | V | - |

* Category of Responsibility: P - Actual Test Performance V - Verify and Accept W - Witness Actual testing, verify and accept

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| | elongation test | | | | | | | | |
| 5.5 | OTHER COMPONENTS (Bought out items) MCBs, ,Aux relays, Semaphore indicators, Indicating Lamp, Fuses, Selector Switches / Control Switches, terminal Blocks and Push buttons, Hooter, Bell & Buzzer | Functional / Conformity test | 100% | Approved BOM, Panel Construction , GA drg , | Project specific. approved BOM, Panel Construction , GA drg , | CMTC | P | V | - |
| 5.6 | Electrical sundry items likes, PVC Channel,Test switches, short ckt tools, Extractor tools, Branch connectors (as applicable) | Functional / Visual ,Dimensional Check. | 100% | Approved BOM, Panel Construction , GA drg , | Project specific. approved BOM, Panel Construction , GA drg , | CMTC | P | V | - |
| | | | | | | | | | |
| 6 | **PVC/FRLS INSULATED WIRES (ISI Marked)** | | | | | | | | |
| 6.1 | Conductor Resistance, Strands/ Color, Elongation, Type of | Measurement - Dimensional | Sampling | Project Specific Panel Construction / IS 694 / IS | Project Specific Panel Construction / IS 694 / IS | CMTC | P | V | - |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | cable, Material, Shielding (if applicable), Overall Diameter | conformity Check/ Visual | | 5831 | 5831 | | | | |
| 6.2 | High voltage Spark test | Electrical | 100% | | | CMTC | P | V | - |
| 6.3 | Check for thickness of insulation & Overall Dimension, Insulation, Tensile strength, Elongation at Break test, Shrinkage Test, Heat Shock Test, Hot Deformation Test, Loss of Mass Test, Thermal Aging Test in Air | Measurement / Electrical / Visual | 1 coil/Type/ As per IS 694 / IS 5831 | Project Specific Panel Construction / IS 694 / IS 5831 | Project Specific Panel Construction / IS 694 / IS 5831 | CMTC | P | V | - |
| 6.4 | Flammability (As applicable) & High Voltage test (water immersion test) | Electrical | Sampling | | | CMTC | P | V | - |
| | | | | | | | | | |
| 7 | **MEASURING INSTRUMENTS (Analog/Digital),** (Voltmeter, Ammeter, Wattmeter, VAR meter, Frequency Meter, Synchroscope, Strip Chart Recorders) | | | | | | | | |
| 7.1 | Visual Inspection for, | Visual | 100% | | | CMTC | P | V | - |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Type, Range, Movement type, Angle of indication, Graduation Marking | | | Project specific approved BOM / IS 1248 | Project specific approved BOM / IS 1248 | | | | |
| 7.2 | Operational & Calibration check- For accuracy test | Electrical/ Functional | 100% | | | CMTC | P | V | - |
| 7.3 | H.V. Test: 2 kV for 1 min. in Panel assembly | Electrical/ Functional | 100% | | | CMTC | P | V | - |
| 7.4 | Energy Meter | Visual Check,Measurement, Calibration & Electrical functional checks. | 100% | As per 14697 & IEC 62053/52 As per MQP of component Manufacturer/ Tech. specification & GTP. | As per 14697 & IEC 62053/52 As per MQP of component Manufacturer/ Tech. specification & GTP. | | P | V | W |
| | | | | | | | | | |
| 8 | **TRANSDUCER** Operational test, Visual, Dimensions check, HV Test 2 kV for 1min in panel assembly | Measurement / Electrical / Visual | 100% | Project specific approved BOM / IS 1248 | Project specific approved BOM / IS 1248 | CMTC | P | V | - |

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| 9 | **CURRENT/ VOLTAGE TRANSFORMER** | | | | | | | | |
| 9.1 | Name plate, CT/PT Ratio, Rated burden, accuracy Class, Termination, Mounting accessories | Visual check & Dimensional conformity | 100% | Project specific approved BOM | Project specific approved BOM | CMTC | P | V | - |
| 9.2 | Functional check for Polarity check, Ratio check, Accuracy class, No load current, HV Test 2 kV for 1min | Functional / Electrical | | | | CMTC | P | V | - |
| | | | | | | | | | |
| 10 | **ANNUNCIATORS** | | | | | | | | |
| 10.1 | Type, No. of windows, Rows/ columns, Aux. Supply voltage, Initiation by NO/NC, Accessories, Text (Inscription) | Visual check & Dimensional conformity | 100% | Project specific approved BOM / schematic drawing | Project specific approved BOM / schematic drawing | CMTC | P | V | - |
| 10.2 | Functional check for, Lamp/ Alarm test, Trip/ Non trip Segregation, Fault indication order, Any other sp. Features, HV Test 2 kV for 1min. | Functional / Electrical | 100% | | | CMTC | P | V | - |

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|---|---|---|---|---|---|---|---|---|---|
| 11 | **UPS / INVERTER/ BULK POWER SUPPLY UNITS** - Type, Make, Rating, Operation Check, Load test, High Voltage Test 2 KV for 1Min | Visual check & Measurement - Dimensional conformity / Electrical - Functional checks | 100% | Project specific approved BOM/ GTP | Project specific approved BOM/GTP | CMTC | P | V | - |
| | | | | | | | | | |
| 12 | **TIME SYNCHRONISATION EQUIPMENT** Functional | Visual, Measurement & Dimensional conformity / Functional | 100% | Project specific approved BOM/ GTP | Project specific approved BOM/ GTP | CMTC | P | V | - |
| 12.1 | HV Test 2kV for 1 min in panel assembly | Electrical | 100% | | | CMTC | P | V | - |
| | | | | | | | | | |
| 13 | **RECORDERS** | | | | | | | | |
| 13.1 | **DISTURBANCE RECORDERS** (Stand alone | Visual, Measurement, | 100% | Project specific approved | Project specific approved | CMTC | P | V | - |

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|---|---|---|---|---|---|---|---|---|---|
| | functional<br>)<br>Functional Test HV Test 2 kV for 1min. | Dimensional conformity / Functional Electrical | | BOM/ GTP | BOM/ GTP | | | | |
| | | | | | | | | | |
| 14 | **EVENT LOGGER**<br>Functional Test<br>HV test 2KV for 1 min in panel assembly | Visual, Measurement, Dimensional conformity / Functional | 100% | Project specific approved BOM/ GTP | Project specific approved BOM/ GTP | CMTC | P | V | - |
| | | | | | | | | | |
| 15 | **COMPUTER HARDWARES & APPLICABLE SOFTWARES** | | | | | | | | |
| 15.1 | Printers, workstations computers, modems: Type, Make, Communication & configuration check, operating systems (as part of integrated test) | Visual, Measurement, Dimensional conformity / Functional | 100% (As part of Integrated Test) | Project specific approved BOM/ GTP | Project specific approved BOM/ GTP | EM/CM-TC | P/- | V/P | -/W |
| 15.2 | Ethernet switch, Armoured communication cables | | | | | | P | V | - |

* Category of Responsibility: P - Actual Test Performance V - Verify and Accept W - Witness Actual testing, verify and accept

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|---|---|---|---|---|---|---|---|---|---|
| 15.3 | Communication cables (FO cable / Patch chord), Extender and accessories. | visual / Functional | 100% | Project specific approved BOM/ GTP | Project specific approved BOM/ GTP | EM/CM- TC | P/- | V/P | -/W |
| | | | | | | | | | |
| 16 | **PROTECTION RELAYS(Conventional/Numerical)** | | | | | | | | |
| 16.1 | Verification of Hardware , Software version, **Functional** Calibration check /Accuracy Drop- out / Reset Test (As applicable) Verification of pickup voltage of BI and Ensuring Suitable BI cards as per scheme DC level. Indication Check High Voltage Test Communication Check (If applicable) Check for secured arrangement of Moving Parts for during transport | Electrical / Visual Check | 100% | Tech. specification , GTP, BOM, and Approved drawings /, CM's Documents | Tech. specification , GTP, BOM, and Approved drawings /, CM's Documents | EM-TC | P | V | - |
| | | | | | | | | | |

* Category of Responsibility: P - Actual Test Performance V - Verify and Accept W - Witness Actual testing, verify and accept

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|---|---|---|---|---|---|---|---|---|---|
| 17 | **PROTECTION RELAYS(Conventional/Numerical) including Bay controller** | | | | | | | | |
| 17.1 | Verification of Hardware , Software version, Functional/ Calibration check /Accuracy Drop-out / Reset Test (As applicable) Indication Check, High Voltage Test, Communication Check (If applicable), Check for secured arrangement of Moving Parts for during transport | Electrical / Visual Check | 100% | Tech. specification, GTP, BOM, and Approved drawings /, CM's Documents | Tech. specification, GTP, BOM, and Approved drawings /, CM's Documents | EM TC | P | V | - |
| | | | | | | | | | |
| 18 | **Software / OEM Software** | | | | | | | | |
| | Simulation Check Time synch check Alarm & Events General interogation checks | Functional | 100% | Tech. specification, GTP, BOM, and Approved drawings , software | Tech. specification, GTP, BOM, and Approved drawings , software | EM TC | - | P | V |

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| | | | | manual, as a part of integrated test / software manual | manual, as a part of integrated test / software manual | | | | |
| | | | | | | | | | |
| 19 | **RELAY TEST KITS** | | | | | | | | |
| 19.1 | Visual check, functional | Electrical/ Visual | 100% | Project specific approved Equipment list | Project specific approved Equipment list | CM /EM TC | - | P | V |
| 20 | RELAY TOOL KIT | Visual | 100% | Tech. specification / Approved drawings/Test instructions | Tech. specification / Approved drawings/Test instructions | CM /EM TC | - | P | V |
| 20.1 | Time sync. Check | Functional | 100% | Tech. specification, GTP, BOM, and Approved drawings, | Tech. specification, GTP, BOM, and Approved drawings, OEMs. | EM TC | - | P | V |
| | | | | | | | | | |
| **B. IN PROCESS INSPECTION** | | | | | | | | | |

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|---|---|---|---|---|---|---|---|---|---|
| **1** | **Auxiliary relays** | | | | | | | | |
| 1.1 | Functional and calibration check, High voltage test | Electrical/ Visual | 100% | Tech. Specification Approved Drg/BOM, GTP | Tech. Specification Approved Drg/BOM, GTP | EM TC | - | P | V |
| | | | | | | | | | |
| **2** | Static relays: Current relays, voltage relays, trip ckt supervision relay, timer relays, flasher relays, fuse fail relays | | | | | | | | |
| 2.1 | Functional and calibration check, Drop-out test flag indication check High Voltage test 2KV for 1 min check for secured arrangement of moving parts for transport | Electrical/ Visual | 100% | Tech. Specification Approved Drg/BOM, GTP | Tech. Specification Approved Drg/BOM, GTP | EM TC | - | P | V |
| | | | | | | | | | |
| 3 | Protection Relays | | | | | | | | |
| 3.1 | **Functional test:** Hardware test, | Functional | 100% | Tech. specification | Tech. specification | RTR | - | P | V |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Software loading & Measurement | | | , GTP, BOM, and Approved drawings | , GTP, BOM, and Approved drawings | | | | |
| 3.2 | High Voltage Test 2 KV AC/DC for 1 min. | Functional | 100% | | | RTR | - | P | V |
| | | | | | | | | | |
| 4 | **PROCESS CHECKS PANEL WIRING & ASSEMBLY** | | | | | | | | |
| 4.1 | Availability of all Items and their position | visual | 100% | Project specific approved Panel Construction / GA / BOM / scheme drg / Quality Check list | Project specific approved Panel Construction / GA / BOM / scheme drg / Quality Check list | EMTC / VTC | P | V | W |
| 4.2 | Verification of labelling of Equipment, terminal block, ferruling etc. | visual | 100% | | | EMTC / VTC | P | V | W |
| 4.3 | Proper fastening of Items | visual | 100% | | | EMTC / VTC | P | V | W |
| 4.4 | Terminal Block Mountings | visual | 100% | | | EMTC / VTC | P | V | W |
| 4.5 | Mounting Locations | visual | 100% | | | EMTC / VTC | P | V | W |
| 4.6 | Type of Lug /Crimping Quality | visual/Functional | Random | | | EMTC / VTC | P | V | W |
| 4.7 | Physical Damages | visual | 100% | | | EMTC / VTC | P | V | W |
| 4.8 | Completion of wiring | visual | 100% | | | EMTC / VTC | P | V | W |
| 4.9 | Earthing of all Equipment | visual | 100% | | | EMTC / VTC | P | V | W |
| 4.10 | Verification of applicable Routine | verification | 100% | | | EMTC / VTC | P | V | W |

* Category of Responsibility: P - Actual Test Performance V - Verify and Accept W - Witness Actual testing, verify and accept

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| | Test Certificates. | | | | | | | | |
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| **C.** | **Preliminary Acceptance Testing** | | | | | | | | |
| **C-1** | **Final Assembly** | | | | | | | | |
| 1.1 | Visual Check for Basic assembly and Mimic Diagram/ Dimensional Conformity. | Visual Dimensional - conformity tests | 100% | Approved Panel Construction / GA/ BOM / scheme drg/ Quality Check list/ panel assembly check list | Approved Panel Construction/ GA / BOM / scheme drg / Quality Check list/ panel assembly check list | EMTC / VTC | P | V | W |
| 1.2 | Visual Check for Mounting of all equipment (approved makes)/ BOM Check | Visual | 100% | | | EMTC / VTC | P | V | W |
| 1.3 | Visual Inspection for Paint shade, Paint thickness, Surface finish, adhesion. | Visual Measurement of coating Thickness | Coating thickness tested Random | | | EMTC / VTC | P | V | W |
| | | | | | | | | | |
| **C-2** | **WIRING** | | | | | | | | |
| 2.1 | Cross section of wires/ cable ferruling/ Crimping of lugs & wires | Visual & Physical Checks | Random | project specific approved Panel | project specific approved Panel | EMTC / VTC | P | V | W |

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|---|---|---|---|---|---|---|---|---|---|
| 2.2 | Continuity Check | Functional | 100% | Construction / GA / BOM / scheme drg / Quality Check list | Construction/ GA / BOM / scheme drg / Quality Check list | EMTC / VTC | P | V | W |
| 2.3 | Check for earthing continuity between each apparatus and earth bus by continuity tester | Functional | 100% | | | EMTC / VTC | P | V | W |
| | | | | | | | | | |
| **C-3** | **Functional Test** | | | | | | | | |
| 3.1 | All Functional / scheme test -protection, -control, -metering. All spare IO/DO wiring up to TB (to be done) | Electrical/ Functional | 100% | Appd drg, BOM, GTP, Tech. spec/ Internal drawing/ Routine Test Reports | Appd drg, BOM, GTP, spec/ Internal drawing/ Routine Test Reports | EM TC | - | P | V |
| 3.2 | Scheme Check (I/O check, DC/AC logic, DC1- DC2 Mixing, Interlock, Event logging, VT Selection, Special logic if any) - Protection (IED Function, A/R, VT fuse Fail) -Metering (Synchro Check, Measurement Accuracy) -Gatewy communucation using | Electrical/ Functional | 100% | | | EM TC | - | P | V |

* Category of Responsibility: P - Actual Test Performance V - Verify and Accept W - Witness Actual testing, verify and accept

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| | protocolSimulator<br>- All trip commands ( for TC1 & TC2 of CB) of main protection relays to be checked up to panel terminal block as per the PSL & Scheme.<br>- Auto reclosure scheme checks to include : Block logic including 3- phase trip, priority closing in case of Main & Tie CB.<br>verification of Trip and initiation from protection functions as per trip matrix, verification of Relay LED signal list. verification of list of functions available in relays | | | | | | | | |
| | | | | | | | | | |
| **C-4** | **Integrated FAT of Protection Panels with SAS (For** | | | | | | | | |

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| | **Subatation Automation System )** | | | | | | | | |
| 4.1 | Check all IEDs loaded with Settings received from Customer and the Approved PSL Logic.<br>- Verification of DR signal standardisation as per approved DR list.<br>- Verification of SAS Alarm /Events signals as per standard List. | Visual / Functional | 100% | Appd drg, GTP, Internal Check list, Approved PSL Logic . | Appd drg, GTP, Internal Check list, Approved PSL Logic . | EM TC | - | P | V |
| 4.2 | Functionality of all IEDs checked with Settings received from Customer and the Approved PSL. | Visual / Functional | 100% | | | EM TC | - | P | V |
| 4.3 | SAS Database is updated as per Customer approved SLD & SAS drawings | Visual / Functional | 100% | | | EM TC | - | P | V |
| 4.4 | Checks based on Pre I-FAT Check | Visual / Functional | 100% | | | EM TC | - | P | V |
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| **C-5** | **FINAL ACCEPTANCE TESTS** | | | | | | | | |
| 5.1 | Visual Check for -Basic assembly and Mimic Diagram/ Dimensional Conformity/ finish and workmanship / door alignment / dust proofing | Visual Dimensional conformity tests | 100% | Appd drg, BOM, GTP, Tech. spec/ Internal drawing/ RTR Approved PSL Logic . | Appd drg, BOM, GTP, Tech. spec/ Internal drawing/ RTR Approved PSL Logic . | EM - TC | - | P | W |
| 5.2 | Visual Check for -Mounting of all equipment (approved makes)/BOM Check/ Check for hardware and software version of IED , check for MLFB nos in IED | Visual conformity tests | 100% | | | EM TC | - | P | W |
| 5.3 | IR Value Test (before & after HV test) | Electrical / Measurement | 100% | Appd drg, BOM,GTP | Appd drg, BOM,GTP | EM TC | - | P | W |
| 5.4 | High Voltage Test 2KV test for 1min between all terminals and earth -HV Test. | Electrical / Measurement | 100% | Tech. spec/ Internal drawing/ RTR ,Settings provided by Customer & Approved | Tech. spec/ Internal drawing/ RTR ,Settings provided by Customer & Approved | EM TC | - | P | W |
| 5.5 | Visual inspection for paint shade, paint thickness, surface finish, adhesion | Visual / Measurement | 100% | | | EM TC | - | P | W |

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| 5.6 | Check for availability of Spare Digital Inputs & outputs as per specification | Visual | 100% | PSL Logic . | PSL Logic . | EM TC | - | P | W |
| 5.7 | Check for availability of spare terminals in each panel | Visual | 100% | | | EM TC | - | P | W |
| 5.8 | Check all IEDs loaded with Settings received from purchaser and the Approved PSL Logic. | Visual | 100% | | | EM TC | - | P | W |
| 5.9 | Functionality of all IEDs checked with Settings received from purchaser and the Approved PSL Logic. | Visual | 100% | | | EM TC | - | P | W |
| 5.10 | Sas Database is updated as per purchaser approved SLD and SAS drawings | Visual | 100% | | | EM TC | - | P | W |
| 5.11 | Individual BCU mimics are configured as per approved SLD | Visual | 100% | | | EM TC | - | P | W |
| 5.12 | Event/Alarm list is configured in full and reporting of same checked | Visual | 100% | | | EM TC | - | P | W |
| 5.13 | Scheme , Protection, Metering and Gateway | Visual | 100% | | | EM TC | - | P | W |

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| | communication checked as per approved scheme | | | | | | | | |
| 5.14 | Operational check- For protection relays, meters etc. | Visual check & Measurement/ Electrical - Functional checks | 100% | Appd drg, BOM, GTP, Tech. spec/ Internal drawing/ RTR | Appd drg, BOM, GTP, Tech. spec/ Internal drawing/ RTR | EM - TC | - | P | W |
| 5.15 | Current injection test on all instrument / meter | Visual check & Measurement/ Electrical - Functional | 100% | | | EM - TC | - | P | W |
| 5.16 | Annunciation sequence annunciation inscription details checks | Visual check & Measurement/ Electrical - Functional | 100% | | | EM - TC | - | P | W |
| 5.17 | Operational Test : -Scheme Check (I/O check, DC/AC logic, DC1-DC2 Mixing, Interlock, Event logging, VT Selection, Special logic if any) - Protection (IED Function, A/R, VT fuse Fail, trip circuit | Visual & Electrical | 100% | | | EM - TC | - | P | W |

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| | supervision)<br>-Metering (Synchro Check, Measurement Accuracy)<br>-Gateway communication using protocol Simulator | | | | | | | | |
| 5.18 | The complete integration check for Communication, relay configuration, parameterization, with interfacing of necessary software/ hardwares.<br>Printers | Visual check & Measurement/ Electrical - Functional checks | 100% | Appd drg, BOM,,GTP, Tech. spech/ Internal drawing/ RTR, As per Check List (Distance relays, Transformer - protn & all non numerical relays) | Appd drg, GTP, Tech. spec/ Internal drawing/ RTR. | EM - TC | - | P | W |
| | | | | | | | | | |
| C-6 | Time Synchronization Equipment | Visual check & Measurement/ Calibration Electrical - Functional | 100% | Appd drg, BOM,,GTP, Tech. spech/ Internal drawing/ RTR, As per Check List (Distance relays, | Appd drg, GTP, Tech. spec/ Internal drawing/ RTR | EM - TC | - | P | W |
| C-7 | Disturbance Recorder (Stand alone funtional) | Visual check & Measureme | 100% | | | EM - TC | - | P | W |

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| | | nt & Dimensional conformity /funtional | | Transformer - protn & all non numerical relays) | | | | | |
| C-8 | Event Logger | Visual check & Measurement & Dimensional conformity /funtional | 100% | | | EM-TC | - | P | W |
| C-9 | Energy Meter | Visual check & Measurement & communication checks. | 100% | As per IS 14697 & IEC 62053/62052/As per MQP of component Manufacturer/ Tech. Specification and GTP | As per IS 14697 & IEC 62053/62052/As per MQP of component Manufacturer/ Tech. Specification and GTP | EM/CM - | - | P | W |
| | | | | | | | | | |
| **C-10** | **SYSTEM TESTING As per IEC 61850 Substation Automation System*** | | | | | | | | |
| 10.1 | Disturbance Recorder function check including communication through Ethernet | Electrical - Functional checks | 100% | Appd Specification.GTP & drg/ | Appd Specification.GTP & drg/ | EM - TC | - | P | W |

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| | switch(Part of panel testing) | | | | | | | | |
| 10.2 | Verification of Bay unit function using stand alone central unit for Bus Bar protection system (Part of panel testing) | Electrical - Functional checks | 100% | Appd Specification.GTP & drg & as per **checklist : BB Protn (Decentralised)** | | EM - TC | - | P | W |
| 10.3 | BAY CONTROLLER | Electrical - Functional checks | 100% | Appd Specification.GTP & drg & as per **checklist : Bay controller** | Appd Specification.GTP & drg/ | EM - TC | - | P | W |
| C-11 | **PART OF SAS TESTING DURING FAT (all checks to be done as per approved FAT document by Customer)** | | | | | | | | |
| 11.1 | SAS with IEDs Mounted in panel along with Ethernet Switches ,accessories and software key and hardware key of SAS for FAT ( items including software | Visual check,Validity of software, Electrical - Functional checks | 100% | Approved SAS BOM & Tech. Specification/ approved FATProcedure | Approved SAS BOM & Tech. Specification/ approved FATProcedure | EM - TC | - | P | W |

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| | used Project specific) | | | | | | | | |
| 11.2 | Verification of SAS Accessories | Visual Check / Functional | 100% | Approved SAS BOM & Tech. Specification/ approved FAT Procedure | Approved SAS BOM & Tech. Specification/ approved FATProcedure | EM - TC | - | P | W |
| 11.3 | DS AGILE/ AVIEW server/ client/ gateway simulation check Time Synch Check Alarm and event Information availability for telecontrol centre Device control | Functional | 100% | Approved SAS BOM & Tech. Specification/ approved FAT Procedure | Approved SAS BOM & Tech. Specification/ approved FATProcedure | EM - TC | - | P | W |
| | | | | | | | | | |
| **C-12** | **Hardware Integration Test** | | | | | | | | |
| 12.1 | The complete Integration check for Third party IEDs, Meters with interfacing of necessary softwares's/hardwares -IED/Meter healthiness -Communication -I/O Check | Visual & Electrical | 100% | Appd drg / BOM,GTP | Appd drg / BOM,GTP | EM - TC | - | P | W |

* Category of Responsibility: P - Actual Test Performance V - Verify and Accept W - Witness Actual testing, verify and accept

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| | -LED Indication.<br>- Operation of Electromechanical relays (if any)<br>-Accuracy check<br>- Relay configuration & setting | | | | | | | | |
| 12.2 | Enegy meter | Visual & Electrical | 100% | As per IS 14697 & IEC 62053/62052/ As per MQP of component Manufacturer/ Tech. Specification and GTP | As per IS 14697 & IEC 62053/62052/ As per MQP of component Manufacturer/ Tech. Specification and GTP | EM/CM - T | - | P | W |
| 12.3 | Disturbance Recorder (Stand alone funtional) | Visual & Electrical | 100% | | | | - | P | W |
| 12.4 | Disturbance Recorder function check including communication through Ethernet switch(Part of panel testing) | Visual & Electrical | 100% | Appd. Drg., BOM, GTP, EM internal scheme drg. | Appd. Drg., BOM, GTP, EM internal scheme drg. | | - | P | W |
| 12.5 | Verification of Bay unit function using stand alone central unit for Bus Bar protection system (Part of panel | Electrical_ Functional Checks | 100% | | | | - | P | W |

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| | testing) | | | | | | | | |
| 12.6 | Bay control unit (BCU) Test | Electrical_ Functional Checks | 100% | | | | - | P | W |
| 12.7 | Verification of SAS BOQ | | | | | | - | P | W |
| | | | | | | | | | |
| **C- 13** | **DS AGILE/AVIEW SOFTWARE** | | | | | | | | |
| 13.1 | Time sync. Check | Functional | 100% | Tech specification, GTP, BOM, and Approved drawings | Tech specification, GTP, BOM, and Approved drawings | EM TC | - | P | W |
| 13.2 | Alarm & Events | | 100% | Tech specification, GTP, BOM, and Approved drawings | Tech specification, GTP, BOM, and Approved drawings | EM TC | - | P | W |
| | | | | | | | | | |
| **C- 14** | **SAS Functional Test** | | | | | | | | |
| 14.1 | Time synchronization Equipment Test<br>a) Time synchronization Equipment Test | Visual & Electrical | 100% | | | EM TC | - | P | W |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | b) System time Synchronization Check | | | Tech. specn/ GTP, Approved drgs., Approved FAT Procedure | Tech. specn/ GTP, Approved drgs., Approved FAT Procedure | | | | |
| 14.2 | SAS Functional Test<br>a) Digital Input/ Output<br>b) Software Interlock Logic Display<br>c) Synchronization Check<br>d) Auto Reclosure Check | Visual & Electrical | 100% | | | EM TC | - | P | W |
| 14.3 | HMI / Server Functional Test<br>a) Event & Alarm management<br>b) Trends & Reports<br>c) OWS Memory & Disk utilization<br>d) HMI Server Redundency Check | Visual & Electrical | 100% | | | EM TC | - | P | W |
| 14.4 | Substation SAS server / Gateway functional test<br>a) Communication of server / Client with Bay Level devices<br>b) Data retrieval of Master Digital<br>c) Data retrieval of Analog Inputs<br>d) SAS Server/ Gateway redundancy check. | Visual & Electrical | 100% | | | EM TC | - | P | W |

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| 14.5 | EWS Test<br>a) Setting and Configuring of IED's<br>b) Retrieval of Disturbance file from IED's<br>c) Automatic downloading of Disturbance. | Visual & Electrical | 100% | | | EM TC | - | P | W |
| 14.6 | LAN Redundacy Test :As per Ring formation & Ethernet LAN redundancy check list | Visual & Electrical | 100% | | | EM TC Checklist | - | P | W |
| | | | | | | | | | |
| C- 15 | **Integrated System Test** | | | | | | | | |
| 15.1 | 100 hours, System stability Test. | Functional | 100% | Tech Spec. | Tech Spec. | EM TC | - | P | W |

EM : Equipment Manufacturer CM : Component Manufacturer CMTC :- Component manufacturer test certificate EMTR :- Equipment manufacturer test Report

# Capacitive Voltage Transformer

| S. No. | Components / Operations & Description of Test | Type of check | Quantum of Check / Sampling with basis | Reference document for Testing | Acceptance Norms | Format of Record | Category of responsibility | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Sub-Vendor | Manufacturer | Customer |
| **A.** | **RAW MATERIAL INSPECTION** | | | | | | | | |
| **1** | **Aluminium Foil** | | | | | | | | |
| a | Visual check for presence of foreign particles and surface finish | Visual | 100% | Technical Data sheet/ Mfr's specification | Technical Data sheet/ Mfr's specification | CMTC/ EMTC | P | V/P | -/V |
| b | Verification of Dimensions Thickness & width | Measure | 01 sample/lot | | | CMTC/ EMTC/ TPC | P | V/P | -/V |
| c | Tensile Strength | Test | | | | CMTC/ EMTC | P | V/P | -/V |
| d | Elongation | Test | | | | CMTC/ EMTC | P | V/P | -/V |
| e | Purity of Aluminium | Measure | | | | CMTC/ EMTC | P | V/P | -/V |
| | | | | | | | | | |
| **2** | **Porcelain Insulators** | | | | | | | | |
| a | Routine Tests | Test | 100% | As per IS 5621/IEC 62155 | As per IS 5621/IEC 62155 | CMTC | P | V | - |
| b | Verification of Dimensions ( Creepage) | Measure | 01 sample/lot | As per Drg. | As per Drg. | CMTC | - | P | V |

* Category of Responsibility: P - Actual Test Performance V - Verify and Accept W - Witness Actual testing, verify and accept

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| c | Porosity Test | Test | | As per IS 5621/IEC 62155 | As per IS 5621/IEC 62155 | CMTC | P | V | - |
| d | Temp. Cycle Test | Test | | | | CMTC | P | V | - |
| d | Visual Inspection | Test | | | | CMTC | P | V | - |
| | | | | | | | | | |
| **2A** | **Composite Insulators (If Applicable)** | | | | | | | | |
| a | Dimension | physical | 1 No/Lot | Relevant Drawing | Relevant Drawing | CMTC | P | V | - |
| b | Routine Mechanical test | Mechanical | 1 No/Lot | IEC 61462/AS PER Specn. | IEC 61462/AS PER Specn. | CMTC | P | V | - |
| c | Silicon Content | Chemical | 1 No/mfg batch | | | CMTC | P | V | - |
| | | | | | | | | | |
| **3** | **Transformer Oil for EMU Unit :-** All test as per IEC 60296/IS 335 to be carried out | | | | | | | | |
| a | Appearance | Visual | 01 sample/lot | IS 335/ IEC 60296 | Oil shall be clear & transparent | CMTC | P | V | - |
| b | Density | Test | | | IS 335/ IEC 60296 | CMTC | P | V | - |
| c | Kinematic viscosity | Test | | | | CMTC | P | V | - |
| d | Interfacial tension | Test | | | | CMTC | P | V | - |
| e | Flash Point | Test | | | | CMTC | P | V | - |
| f | Pour Point | Test | | | | CMTC | P | V | - |
| g | Total Acidity | Test | | | | CMTC | P | V | - |

* Category of Responsibility: P - Actual Test Performance V - Verify and Accept W - Witness Actual testing, verify and accept

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| h | Water content(ppm) | Test | | IS 335/ IEC 60296 | IS 335/ IEC 60296 | CMTC | P | V | - |
| i | Corrosive Sulpher | Test | | | | CMTC | P | V | - |
| j | Oxidation stability | Test | | | | CMTC | P | V | - |
| k | Electrical Strength (B.D.V.) | Test | | | | CMTC | P | V | - |
| l | Dielectric dissipation factor | Test | | | | CMTC | P | V | - |
| | | | | | | | | | |
| **4** | **Synthetic Oil for Capacitor Unit** | | | | | | | | |
| a | Appearance | Visual | 01 sample/lot | Limpid with light bluish shimmers, no suspended matter/IEC 60867 | Limpid with light bluish shimmers, no suspended matter//IEC 60867 | CMTC | P | V | - |
| b | Density | Test | 01 sample/year | Technical Data sheet/Mfr's specification//IEC 60867 | Technical Data sheet/Mfr's specification//IEC 60867 | CMTC | P | V | - |
| c | Kinematic viscosity | Test | 01 sample/year | | | CMTC | P | V | - |
| d | Water content | Test | 01 sample/lot | | | CMTC | P | V | - |
| e | Epoxide | Test | | | | CMTC | P | V | - |
| g | Electrical Strength (B.D.V.) | Test | | | | CMTC | P | V | - |
| h | Dielectric dissipation factor | Test | | | | CMTC | P | V | - |
| | | | | | | | | | |
| **5** | **Insulation Kraft Paper** | | | | | | | | |
| a | Elongation at break MD | Test | 01 sample/lot | IS 9335 -2 / IEC60554 | IS 9335 -2 / | CMTC | P | V | - |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| b | Ash Content | Test | | | IEC60554 | CMTC | P | V | - |
| c | Moisture Content | Test | | | | CMTC | P | V | - |
| d | PH Value | Test | | | | CMTC | P | V | - |
| e | Conductivity | Test | | | | CMTC | P | V | - |
| f | Tensile Strength | Test | | | | CMTC | P | V | - |
| g | Thickness | Measure | | Tech.spec./Mfg.Std. | Tech.spec./Mfg.Std. | CMTC | P | V | - |
| h | Density | Test | | IS 9335 -2 / IEC60554 | IS 9335 -2 / IEC60554 | CMTC | P | V | - |
| **i** | Electric strength in air | Test | | | | CMTC | P | V | - |
| **6** | **Copper Wire** | | | | | | | | |
| a | Dimension | Measure | 01sample/size/ lot | IS 13730/Mfr's PO | IS 13730/Mfr's PO | CMTC/EMTC | P | V | - |
| b | Mechanical Properties | Test | | IS 13730- 3 | IS 13730- 3 | CMTC/EMTC | P | V | - |
| c | Thermal Properties | Test | | IS 13730- 6 | IS 13730- 6 | CMTC/EMTC | P | V | - |
| d | Chemical Properties | Test | | IS 13730- 4 | IS 13730- 4 | CMTC/EMTC | P | V | - |
| e | Electrical Properties | Test | | IS 13730- 5 | IS 13730- 5 | CMTC/EMTC | P | V | - |
| | | | | | | | | | |
| **7** | **Capacitor Tissue Paper** | | | | | | | | |
| a | Thickness & width | Measure | 01sample/ lot | Technical Data sheet/ Mfr's specification | Technical Data sheet/ Mfr's specification | CMTC/EMTC/TPC | P | V | - |

* Category of Responsibility: P - Actual Test Performance V - Verify and Accept W - Witness Actual testing, verify and accept

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| b | Density | Test | | | | CMTC | P | V | - |
| c | Ash Content | Test | | | | CMTC | P | V | - |
| d | pH Value | Test | | | | CMTC | P | V | - |
| e | Conductivity of aqeous extract | Test | | | | CMTC | P | V | - |
| f | Dielectric Strength | Test | | | | CMTC | P | V | - |
| | | | | | | | | | |
| **8** | **Bi-Axially Oriented Plain Polypropelene Film** | | | | | | | | |
| a | Thickness, Space Factor | Measure | 01sample/size/ lot | Technical Data sheet/ Mfr's specification | Technical Data sheet/ Mfr's specification | CMTC | P | V | - |
| b | Dielectric Strength | Test | | | | CMTC | P | V | - |
| c | Shrinkage | Test | | | | CMTC | P | V | - |
| d | Visual | Visual | 100% | | | CMTC | P | V | - |
| | | | | | | | | | |
| **9** | **Tanks** | | | | | | | | |
| a | Leakage Test | Mechanic al | 100% | As pe Mfr's Spec | As pe Mfr's Spec | CMTC | P | V | - |
| b | Dimensions | Measure | One sample/ lot | As per approved drawings / Mfr's drawings | Obtain manufacturers test certificate | CMTC | P | V | - |
| **c** | Welding Procedure & Welder's Qualification, Type of Electrode, DP Test on lifting lug welds, Visual check of Paint | | One sample/ lot | As per approved drawings / Mfr's drawings | Obtain manufacturers test certificate | CMTC | P | V | - |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | shade & DFT - Inside and Outside | | | | | | | | |
| **10** | **<u>Galvanizing</u>** | | | | | | | | |
| a | Thickness of Zinc coating | Measure | 1 Samples / lot | As per Customer Specification/ IS 4759 | As per Customer Specification/ IS 4759 | CMTC | P | V | - |
| b | Mass of Zinc coating on sample | Measure | | As per Customer Specification/ IS 4759 | As per Customer Specification/ IS 4759 | CMTC | P | V | - |
| c | Uniformity of Zinc coating | Chemical | | IS 2633 | IS 2633 | CMTC | P | V | - |
| d | Adhesion test | Mechanical | | IS 2629 | No peel of Zinc | CMTC | P | V | - |
| | | | | | | | | | |
| **11** | **<u>Rubber 'O' Ring</u>** | | | | | | | | |
| a | Dimensions | Measure | 1 sample/ size/ lot | As per Drawing/Mfr's P.O | As per Drawing/Mfr's P.O | CMTC | P | V | - |
| b | Hardness | Test | | Tech. Spec. / Mfg. Std. | Tech. Spec. / Mfg. Std. | CMTC | P | V | - |
| c | Elongation at break | Test | | | | CMTC | P | V | - |
| d | Aging in transformer oil | Test | | | | CMTC | P | V | - |
| e | Compression Set | Test | | | | CMTC | P | V | - |
| | | | | | | | | | |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **12** | **Cork Gasket ( If Applicable)** | | | | | | | | |
| a | Dimensions | Measure | 1 sample/ size/ lot | As per Drawing/Mfr's P.O | As per Drawing/Mfr's P.O | CMTC | P | V | - |
| b | Hardness | Test | | Tech.spec./ IS 4253 | Tech.spec./ IS 4253 | CMTC | P | V | - |
| c | Tensile Strength | Test | | | | CMTC | P | V | - |
| d | Compression Set | Test | | Tech.spec./ IS 4253/IS 3400 | Tech.spec./ IS 4253/ IS 3400 | CMTC | P | V | - |
| e | Compressibility | Test | | Tech.spec./ IS 4253 | Tech.spec./ IS 4253 | CMTC | P | V | - |
| f | Flexibility | Test | | | | CMTC | P | V | - |
| g | Resistance to transformer oil at 100 °C for 70 hrs. | Test | | | | CMTC | P | V | - |
| h | pH of water extract | Test | | | | CMTC | P | V | - |
| | | | | | | | | | |
| **13** | **Cut Core ( Transformer & Choke Lamination )** | | | | | | | | |
| a | Dimensions | Measur e | 1 sample/ size/ lot | As per Drawing/Mfr's P.O | As per Drawing/Mfr's P.O | CMTC | P | V | - |
| b | Core Loss | Test | | Technical Data sheet/Mfr's specification | Technical Data sheet/Mfr's specification | CMTC | P | V | - |
| c | Stacking Factor | Test | | | | CMTC | P | V | - |
| | | | | | | | | | |
| **14** | **Damping Device(if applicable)** | | | | | | | | |

* Category of Responsibility: P - Actual Test Performance V - Verify and Accept W - Witness Actual testing, verify and accept

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| a | Dimensions | Measure | 1 sample/ size/ lot | As per Drawing/Mfr's P.O | As per Drawing/Mfr's P.O | CMTC | P | V | - |
| b | Resistance | Test | 1 sample/ size/ lot | Technical Data sheet/Mfr's specification | Technical Data sheet/Mfr's specification | CMTC | P | V | - |
| | | | | | | | | | |
| **15** | **HRC Fuse with carrier(If applicable)** | | | | | | | | |
| a | Visual Check | Visual | 100% | Supplier Catalogue/ Mfr's Specification | Supplier Catalogue/ Mfr's Specification | CMTC | P | V | - |
| | | | | | | | | | |
| **16** | **Intermediate Voltage Bushing ( MV Tap Bushing )** | | | | | | | | |
| a | Dimensions | Measure | 1 sample/ size/ lot | As per Drawing/ Mfr's P.O | As per Drawing/ Mfr's P.O | CMTC | P | V | - |
| b | Visual Check | Visual | 100% | Free From Damage | Free From Damage | CMTC | P | V | - |
| | | | | | | | | | |
| **17** | **Stainless Steel Bellow (If applicable)** | | | | | | | | |
| a | Dimensions | Measure | 1 sample/ size/ lot | As per Drawing/Mfr's P.O | As per Drawing/Mfr's P.O | CMTC | P | V | - |
| b | Helium Leak Test | Test | | Technical Data sheet/Mfr's specification | Technical Data sheet/Mfr's specification | CMTC | P | V | - |
| c | Chemical Composition | Measure | | Technical Data sheet/Mfr's | Technical Data sheet/Mfr's | CMTC | P | V | - |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | specification | specification | | | | |
| | | | | | | | | | |
| **18** | **Fasteners ( H.D.G / Stainless Steel )** | | | | | | | | |
| a | Verification of Make & Visual | Visual | 100% | Mfr's Specification | Mfr's Specification | CMTC | P | V | - |
| | | | | | | | | | |
| **B. Section INPROCESS INSPECTION** | | | | | | | | | |
| **1** | **Test on Capacitor** | | | | | | | | |
| a | Alignment of foil pp film( if applicable) & condenser paper | Visual | one sample/ New coil or other operator/ M/C | Mfr's Drg./ Mfg. std. | Mfr's Drg./ Mfg. std. | EMTR/ LOG BOOK | - | P | V |
| b | Stack Height | Measur e | 100% | Mfr's Drg./ Mfg. std. | Mfr's Drg./ Mfg. std. | DO | - | P | V |
| c | High Voltage test on Dry element-(if applicable) | Test | DO | Mfr's Drg./ Mfg. std | Mfr's Drg./ Mfg. std | DO | - | P | V |
| | | | | | | | | | |
| **2** | **Drying of Capacitors** | | | | | | | | |
| a | Temperature of Oven | | Hourly Reading | Equipment Mfr's plant standard | Equipment Mfr's plant standard | EMTR/ LOG BOOK | - | P | V |
| b | Vacuum Leakage | | 6 Hourly | Equipment Mfr's plant standard | Equipment Mfr's plant standard | DO | - | P | V |
| | | | | | | | | | |

* Category of Responsibility: P - Actual Test Performance V - Verify and Accept W - Witness Actual testing, verify and accept

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **3** | **Assembly** | | | | | | | | |
| a | Capacitance measurement | Test | 100% | As per Job Card/Drg. | As per Job Card/Drg. | EMTR/ LOG BOOK | - | P | V |
| b | Stack & Insulator Assembly | Verification | 100% | As per Approved Drawing | As per Approved Drawing | EMTR/ LOG BOOK | - | P | V |
| | | | | | | | | | |
| **4** | **Oil Filling** | | | | | | | | |
| a | Oil filling in Capacitor Unit | | 100% | App. GTP/Drg. | App. GTP/Drg. | LOG BOOK | - | P | V |
| | | | | | | | | | |
| **5** | **Test on EMU at assembly stage** | | | | | | | | |
| a | Turn ratio measurement & Polarity Test | Test | 100% | Mfr's Drg./ Mfg. std. | Mfr's Drg./ Mfg. std. | CMTC/EMTC | P | V/P | -/V |
| b | Resistance of HT winding- If applicable | Test | 100% | As per Job Card/Drg. | As per Job Card/Drg. | CMTC/EMTC | P | V/P | -/V |
| c | Megger Test | Test | 100% | As per Job Card/Drg. | As per Job Card/Drg. | DO | P | V/P | -/V |
| | | | | | | | | | |
| **6** | **Vacuum Drying & Oil impregnation (EMU)** | | | | | | | | |
| a | Temperature of Oven | | Hourly Reading | Equipment Mfr's plant standard | Equipment Mfr's plant standard | LOG BOOK | - | P | V |
| b | Vacuum Leakage | | 6 Hourly | Equipment Mfr's plant standard | Equipment Mfr's plant standard | LOG BOOK | - | P | V |

* Category of Responsibility: P - Actual Test Performance V - Verify and Accept W - Witness Actual testing, verify and accept

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | |
| **7** | **Treated Transformer Oil For EMU** | | | | | | | | |
| a | BDV | Test | 1 Sample/ lot | IS 335 / IEC 60296/TS | IS 335 / IEC 60296/TS | LOG BOOK | - | P | V |
| b | Tan Delta at 90° C | Test | 1 Sample/ lot | | | LOG BOOK | - | P | V |
| c | Moisture Content | Test | 1 Sample/ lot | | | LOG BOOK | - | P | V |
| | | | | | | | | | |
| **8** | **Synthetic Oil for Capacitor Divider after treatment** | | | | | | | | |
| a | BDV & Tan Delta | Test | 1 Sample/ lot | IEC 60867/Mfr's Specification | IEC 60867/Mfr's Specification | LOG BOOK | - | P | V |
| | | | | | | | | | |
| **9** | **Sealing Test on Divider with Bellow** | Test | 100% | IEC 60867/Mfr's Specification | IEC 60867/Mfr's Specification | LOG BOOK | - | P | V |
| **10** | **Check for Connection on Between Bellow & Capacitor Stack** | Test | 100% | IEC 60867/Mfr's Specification | IEC 60867/Mfr's Specification | LOG BOOK | - | P | V |
| | | | | | | | | | |
| **C. Section FINAL INSPECTION & TESTING :- All Routine/Acceptance test as per applicable contract Tech Spec need to be carried out without fail** | | | | | | | | | |
| 1 | **Routine Test ( Test on Complete CVT )** | | | | | | | | |
| a | Visual & Dimension check | Measure | 01sample/lot | Tech.spec./App.Drg. | Tech.spec./App.Drg. | EM Log Sheet | - | P | V |
| b | Verification of Terminal marking & Polarity | Electrical | 100% | IS 16227 / IEC 61869-5 | IS 16227 / IEC 61869-5 | EM Log Sheet | - | P | V |

* Category of Responsibility: P - Actual Test Performance V - Verify and Accept W - Witness Actual testing, verify and accept

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| c | Determination of errors (ratio & phase angle)according to the requirements of appropriate accuracy class | Electrical | | | | EM Log Sheet | - | P | V |
| d | Ferro resonance Test | Electrical | | | | EM Log Sheet | - | P | V |
| | **Test on EMU** | | | | | | | | |
| e | High voltage power frequency withstand test on primary winding.( HT neutral to earth ) at 4KV | Electrical | 100% | IS 16227 / IEC 61869-5 | IS 16227 / IEC 61869-5 | EM Log Sheet | - | P | V |
| f | High voltage power frequency withstand test on secondary winding at 3 KV. | Electrical | | | | EM Log Sheet | - | P | V |
| g | Induced overvoltage test | Electrical | | | | EM Log Sheet | - | P | V |
| | **(Test on capacitor assembly)** | | | | | | | | |
| h | Measurement of Capacitance & Loss Angle before HV test | Electrical | 100% | IS 16227 / IEC 61869-5 | IS 16227 / IEC 61869-5 | EM Log Sheet | - | P | V |
| i | Power frequency Withstand test for one minute | Electrical | | | | EM Log Sheet | - | P | V |
| j | Measurement of Partial Discharge | Electrical | | | | EM Log Sheet | - | P | V |
| k | Measurement of Capacitance & Loss Angle after HV test | Electrical | | | | EM Log Sheet | - | P | V |
| l | Power frequency Withstand test on LV | Electrical | | | | EM Log Sheet | - | P | V |
| m | Enclosure tightness test at | Physical | | | No leakage | EM Log | - | P | V |

* Category of Responsibility: P - Actual Test Performance V - Verify and Accept W - Witness Actual testing, verify and accept

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | ambient temperature | | | | | Sheet | | | |
| | | | | | | | | | |
| 2 | **Acceptance Test ( Test on Complete CVT )** | | | | | | | | |
| a | Visual & Dimension check | Measure | 01sample/lot | Tech.spec./App.Drg. | Tech.spec./App.Drg. | Test report | - | P | W |
| b | Verification of Terminal marking & Polarity | Electrical | 10 % | IS 16227 / IEC 61869-5 | IS 16227 / IEC 61869-5 | Test report | - | P | W |
| c | Determination of errors (ratio &phase angle)according to the requirements of appropriate accuracy class | Electrical | | | | Test report | - | P | W |
| d | Ferro resonance Test | Electrical | | | | Test report | - | P | W |
| | **(Test on EMU)** | | | | | | | | |
| e | High voltage power frequency withstand test on primary winding.( HT neutral to earth ) at 4KV | Electrical | 10 % | IS 16227 / IEC 61869-5 | IS 16227 / IEC 61869-5 | Test report | - | P | W |
| f | High voltage power frequency withstand test on secondary winding at 3 KV. | Electrical | | | | Test report | - | P | W |
| g | Induced over voltage test | Electrical | | | | Test report | - | P | W |
| | **(Test on capacitor assembly)** | | | | | | | | |
| h | Measurement of Capacitance & Loss Angle before HV test | Electrical | 10 % | IS 16227 / IEC 61869-5 | IS 16227 / IEC 61869-5 | Test report | - | P | W |

* Category of Responsibility: P - Actual Test Performance V - Verify and Accept W - Witness Actual testing, verify and accept

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| i | Power frequency Withstand test for one minute<br>(Repeated test to be done at 80 % of test voltage level) | Electrical | | | | Test report | - | P | W |
| j | Measurement of Partial Discharge (Repeated test to be done at 80 % of test voltage as per standard) | Electrical | | | | Test report | - | P | W |
| k | Measurement of Capacitance & Loss Angle after HV test | Electrical | | | | Test report | - | P | W |
| l | Power frequency Withstand test on LV | Electrical | | | | Test report | - | P | W |
| m | Enclosure tightness test at ambient temperature | Physical | 1 Sample/ lot | | No Leakage | Test report | - | P | W |
| n | Transformer Oil from EMU | | | | | | | | |
| i | BDV Test ( Min.) | Electrical | 01sample /lot | IEC 60422 | Min.60 kV | Test Report | P | V | W |
| ii | Tan Delta at $90^0$C Max. | Electrical | | IEC 60422 | IEC 60422 | Test Report | P | V | W |
| iii | Moisture Content | Electrical | | IS 1866 /IEC 60422/As per spec. | less than 10 ppm | Test Report | P | V | W |
| iv | Interfacial Tension( Min.) | Chemical | | IEC 60422 | Min. 35 mN/mtr | Test Report | P | V | W |

* Category of Responsibility: P - Actual Test Performance V - Verify and Accept W - Witness Actual testing, verify and accept

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | |
| **D. Section PACKING & DESPATCH** | | | | | | | | | |
| 1 | Checking for completeness of the equipment and accessories including spares as per order. | Visual | 100% | As per Mfr's Process pecification | As per Mfr's Process Specification | | - | P | - |
| 2 | Check for proper packing | Visual | | | | | - | P | - |
| 3 | Ensure supply of operation manual,packing list and test reports along with copy of inspection reports,CIP and MICC | Visual | | | | | - | P | - |

EM : Equipment Manufacturer CM : Component Manufacturer CMTC :- Component manufacturer test certificate EMTR :- Equipment manufacturer test Report

* Category of Responsibility: P - Actual Test Performance V - Verify and Accept W - Witness Actual testing, verify and accept

# Isolators (Disconnecting Switches)

| S. No. | Components / Operations & Description of Test | Type of check | Quantum of Check / Sampling with basis | Reference document for Testing | Acceptance Norms | Format of Record | Category of responsibility | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Sub-Vendor | Manufacturer | Customer |
| **SECTION 1. RAW MATERIAL INSPECTION** | | | | | | | | | |
| **A** | **ELECTRICAL ITEMS** | | | | | | | | |
| 1.1 | CONTACTORS | Visual | | IS/IEC 60947 (Part 4/Sec 4) /IS 6875/ Tech. Specn./Apprd. Drgs./ Mfg Plant Standard | | CMTC | | | |
| a. | Visual | | 100% | | Ok | | P | V | - |
| b. | Verification –15%, 10% Voltage, verification of the limits of operation | Electrical | 10% | | should pick up without trouble | | P | V | - |
| c. | Pick-up & drop out voltage test | Electrical | 10% | | IS/IEC 60947 (Part 4/Sec 4) /IS 6875/ Tech. Specn./Apprd. Drgs./ Mfg Plant Standard | | P | V | - |
| d. | High Voltage Test | H V Tester | 10% | | | | P | V | - |
| e. | I.R. Value | Megger tester | 10% | | | | P | V | - |
| | | | | | | | | | |
| 1.2 | OVERLOAD RELAYS | Visual | | IS/IEC 60947 /IS 6875/ Tech. Specn./Apprd. Drgs./ Mfg Plant Standard | IS/IEC 60947 (Part 4/Sec 4) /IS 6875/ Tech. Specn./Apprd. Drgs./ Mfg Plant Standard | CMTC | | | |
| a. | Visual | | 100% | | | | - | P | V |
| b | High Voltage Test | Electrical | 10% | | | | P | V | - |
| c | I.R. Value | Electrical | 10% | | | | P | V | - |
| d | Operation test during MOM assembly | Electrical | 100 % on each type / Lot | | | | P | V | - |
| | | | | | | | | | |

* Category of Responsibility: P - Actual Test Performance V - Verify and Accept W - Witness Actual testing, verify and accept

| S. No. | Components / Operations & Description of Test | Type of check | Quantum of Check / Sampling with basis | Reference document for Testing | Acceptance Norms | Format of Record | Category of responsibility | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Sub-Vendor | Manufacturer | Customer |
| 1.3 | PUSH BUTTONS | Visual | IEC 60947 | IS 4794/IEC 60947/ Tech. Specn./Apprd. Drgs. | | CMTC | | | |
| a. | Visual ( Make & Type) | Visual | 100% | | AS PER PO | | - | P | V |
| b. | High Voltage Test | H V Tester | 10% | | 2 KV , 1min | | P | V | - |
| c. | I.R. Value | Megger tester | 10% | | > 500 V DC Megger | | P | V | - |
| | | | | | | | | | |
| 1.4 | TERMINAL BLOCKS | Visual | IEC 60947 | IEC 60947 / IS 3669/ Tech. Specn./Apprd. Drgs. | | CMTC | | | |
| a. | Visual ( Make & Type) | Visual | 100% | " | AS PER PO | | - | P | V |
| b. | High Voltage Test | H V Tester | 10% | " | 2 KV , 1min | | P | V | - |
| c. | I.R. Value | IR tester | 10% | IS4007 | > 500 V DC IR tester | | P | V | - |
| d. | Torque Test | Visual | 10% | 110% of Rated Torque | No damage to the screws | | P | V | - |
| e. | Continuity Check | Electrical | 5% on each type /lot | " | " | | P | V | - |
| | | | | | | | | | |
| 1.5 | AUXILIARY SWITCH (SNAP type) | Visual | IS 6875 | IS 6875/ Tech. Specn./Apprd. Drgs. | | CMTC | | | |
| a. | Identification of Switch | Visual | 100% | | Sticker with | | - | P | V |

* Category of Responsibility: P - Actual Test Performance V - Verify and Accept W - Witness Actual testing, verify and accept

| S. No. | Components / Operations & Description of Test | Type of check | Quantum of Check / Sampling with basis | Reference document for Testing | Acceptance Norms | Format of Record | Category of responsibility | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Sub-Vendor | Manufacturer | Customer |
| | | | | | Serial No. | | | | |
| b. | Rotary Contact Alignment | Visual | 10% | | ok | | - | P | V |
| c. | High Voltage Test | H V Tester | 10% | | 2 KV , 1min | | P | V | - |
| d. | NO & NC Configuration & Change over | Multimeter | 10% | | All the contacts shall be maintained at NO & NC | | P | V | - |
| e. | Insulation resistance test | Megger tester | 10% | min 2 Mohms | > 500 V DC Megger | | P | V | - |
| | | | | | | | | | |
| | | | | | | | | | |
| 1.6 | HEATERS | Visual | | Tech. | Make & | CMTC | | | |
| | | | | Specn./ Apprd. Drgs. | Product Code No | | | | |
| a. | Visual ( Make & Type) | Visual | 100% | | AS PER schematic | | - | P | V |
| b. | High Voltage Test | H V Tester | 10% | | 2 KV , 1min | | P | V | - |
| c. | I.R. Value | Megger tester | 10% | | > 500 V DC Megger | | P | V | - |
| d. | Functional Check | Electrical | 10 % of each type /lot | | | | P | V | - |
| | | | | | | | | | |
| 1.7 | FUSE BASE & CARRIER | Visual | IS 13703 | IS 13703/ Tech. Specn./Apprd. Drgs. | Make & Product Code No | | | | |

* Category of Responsibility: P - Actual Test Performance V - Verify and Accept W - Witness Actual testing, verify and accept

| S. No. | Components / Operations & Description of Test | Type of check | Quantum of Check / Sampling with basis | Reference document for Testing | Acceptance Norms | Format of Record | Category of responsibility | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Sub-Vendor | Manufacturer | Customer |
| a. | Visual | | 100% | | No damage | | - | P | V |
| b. | Dimensional Check | | 10% | | As per manufacturer | | - | P | V |
| c. | Resistance Check | | 10% | | As per manufacturer | | P | V | - |
| d. | Power Dissipation Test | | 10% | | Test to be withstood | | P | V | - |
| e. | Insulation Properties | | 10% | | IS 13703-1993 | | P | V | - |
| | | | | | | | | | |
| 1.8 | INTERLOCK COILS | | | Tech. Specn./Apprd. Drgs. | Make & Product Code No | CMTC | | | |
| a. | Visual ( Make & Type) | Visual | 100% | | AS PER schematic | | - | P | V |
| b. | High Voltage Test | H V Tester | 100%of each type /lot | | 2 KV , 1min | | P | V | - |
| c. | I.R. Value | IR tester | 100%of each type /lot | | > 500 V DC IR tester | | P | V | - |
| d. | Operation Test at rated voltage , + 10 % and -15 % of rated voltage | DC/AC voltage | 10% of each type / lot | | Should pickup for 85% of Rated Voltage | | P | V | - |
| e | Resistance check | Electrical | One Sample of each type / lot | | | | P | V | - |
| f | Pick up and drop out Voltage test | Electrical | 50 % of Each Type / lot | | | | P | V | - |

* Category of Responsibility: P - Actual Test Performance V - Verify and Accept W - Witness Actual testing, verify and accept

| S. No. | Components / Operations & Description of Test | Type of check | Quantum of Check / Sampling with basis | Reference document for Testing | Acceptance Norms | Format of Record | Category of responsibility | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Sub-Vendor | Manufacturer | Customer |
| | | | | | | | | | |
| 1.9 | CIRCUIT BREAKER (MCB) | Visual | | Tech. Specn./Apprd. Drgs./ IEC 60898 -1-2002 / IS 8828-1996 | Make & Product Code No | CMTC | | | |
| a. | Visual ( Make & Type) | Visual | 100% | | AS PER schematic | | - | P | V |
| b. | High Voltage Test | H V Tester | 10% | | 2 KV , 1min | | P | V | - |
| c. | I.R. Value | Megger tester | 10% | | > 500 V DC Megger | | P | V | - |
| d. | Functional check | Electrical | 5 % on each type /lot | | | | P | V | - |
| | | | | | | | | | |
| 1.10 | MOTORS (S1 Duty Class) | Visual | IS 325 | IS 325 / Tech. Specn./Apprd. Drgs./ Apprd. Tech Data Sheets | | CMTC | | | |
| a. | Insulation resistance | Megger tester | 100% of each Type /lot | | >500 V DC Megger | | P | V | - |
| b. | High Voltage Test | H V Tester | 100% of each Type /lot | | 2 kV,1min | | P | V | - |
| c. | No load test | wattmeter, Multimeter& tachometer | 100% of each Type /lot | | Measurement of Input power current and speed | | P | V | - |

* Category of Responsibility: P - Actual Test Performance V - Verify and Accept W - Witness Actual testing, verify and accept

| S. No. | Components / Operations & Description of Test | Type of check | Quantum of Check / Sampling with basis | Reference document for Testing | Acceptance Norms | Format of Record | Category of responsibility | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Sub-Vendor | Manufacturer | Customer |
| d. | Locked rotor readings | wattmeter, Multimeter& tachometer | 1 sample/batch | | Measurement of Input power current and speed | | P | V | - |
| e. | Visual inspection/Rating | Visual | 100% | | no damage | | - | P | V |
| f | Reduced Voltage running test | Electrical | 1 sample/batch | | | | P | V | - |
| | | | | | | | | | |
| 1.11 | GASKET ( EPDM RUBBER) | Visual | Manufacturer Standard / ASTMD 1171 / IS 11149 | Manufacturer Standard / ASTMD 1171 / IS 11149/ Tech. Specn. /Apprd. Drgs. | | CMTC | | | |
| a. | UTS | UTS Machine | 3samples/lot | | 70 KG/cm 2 min (ref std ASTM D412 ) | | P | V | - |
| b. | OZONE RESISTANCE(50PPHM /40degree C /20% STRAIN/ 72 HRS ) | MFR Practice | 3samples/lot | | NO CRACK (ref std ASTM D1149 ) | | P | V | - |
| c. | Compression set % (70 degree C X 22hrs) | MFR Practice | 3samples/lot | | 50 max( ref std ASTM D396 ) | | P | V | - |
| d. | Ageing | Mechnical | 1 sample/lot | Manufacturer std | | | P | V | - |
| e | Dimension | | 1 sample/lot | | | | P | V | - |

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| S. No. | Components / Operations & Description of Test | Type of check | Quantum of Check / Sampling with basis | Reference document for Testing | Acceptance Norms | Format of Record | Category of responsibility | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Sub-Vendor | Manufacturer | Customer |
| | | | | | | | | | |
| 1.12 | THERMOSTAT | Visual | IS 3017 | IS 3017 / Tech. Specn. /Apprd. Drgs. | Make & Product Code No | CMTC | | | |
| a. | Visual | | 100% | | | | - | P | V |
| b. | High Voltage Test | H V Tester | 10% | | IS 3017 | | P | V | - |
| c. | I.R. Value | IR tester | 10% | Min 2 M ohms | > 500 V DC IR tester | | P | V | - |
| d. | Marking | | 10% | | As Per IS:3017:1985 | | - | P | V |
| e | Functional Check | | 10 % per lot | | | | P | V | - |
| | | | | | | | | | |
| 1.13 | CASTLE LOCKS | Visual | Manufacturer's Catalogue | Manufacturer's Approved Catalogue / Specn | Make & Product Code No | CMTC | | | |
| a. | Visual(Make & Type) | Visual | 100% | | AS PER schematic | | - | P | V |
| b. | Dimension check | Vernier | 10% | | Should be Within limits | | - | P | V |
| c. | Operationof Lock & Key / Functional Check | Check | 100% | As per manufacturer | As per manufacturer | | - | P | V |
| | | | | | | | | | |
| 1.14 | TOGGLE / CONTROL SWITCHES | Visual | IS 13947 Part 5 & 3 / IS/IEC 60947 | IS 13947 Part 5 & 3 / IS/IEC 60947/ Tech. Specn. | Make & Product Code No | CMTC | | | |

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| S. No. | Components / Operations & Description of Test | Type of check | Quantum of Check / Sampling with basis | Reference document for Testing | Acceptance Norms | Format of Record | Category of responsibility | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Sub-Vendor | Manufacturer | Customer |
| | | | | /Apprd. Drgs | | | | | |
| a. | Visual(Make & Type) | Visual | 100% | IS 13947 Part 5 & 3 | No damage | | - | P | V |
| b. | High Voltage Test | H V Tester | 10% | | 2 KV , 1min | | P | V | - |
| c. | Switching Sequence | | 10% | Approved Schematic | Approved Schematic | | P | V | - |
| d. | IR Check | IR tester | 10% | Min 2 M ohms | > 500 V DC IR tester | | P | V | - |
| | | | | | | | | | |
| 1.15 | LIMIT SWITCHES | Visual | IS 6875 / IS/IEC 60947 | IS 6875 / IS/IEC 60947/ Tech. Specn. /Apprd. Drgs. | | CMTC | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| a. | Visual inspection | Visual | 100% | Clause 8.3.3.4 of IS 13947-5-1,1993 | no damage | | - | P | V |
| b. | NC to Body (Dielectric Test) | H V Tester | 10% | Clause 8.3.3.4 | 2.5 kV,1min | | P | V | - |
| c. | NO to Body (Dielectric Test) | H V Tester | 10% | Clause 8.3.3.4 | 2.5 kV,1min | | P | V | - |
| d. | NC to NO (Dielectric Test) | H V Tester | 10% | Clause 8.3.3.4 | 1.3 kV,1min | | P | V | - |
| e. | IR Check | IR tester | 10% | Min 2 M ohms | > 500 V DC IR | | P | V | - |

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| S. No. | Components / Operations & Description of Test | Type of check | Quantum of Check / Sampling with basis | Reference document for Testing | Acceptance Norms | Format of Record | Category of responsibility | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Sub-Vendor | Manufacturer | Customer |
| | | | | | tester | | | | |
| | | | | | | | | | |
| B | OTHER ITEMS | | | | | | | | |
| 1.16 | STRUCTURAL STEEL (Channels, Sheets, Plates, Rods & Flats) | Mechanical | IS 2062 / IS 1079 / IS 5986/ IS 1977 | IS 2062 / IS 1079 / IS 5986/ IS 1977/ Tech. Spec. | | CMTC | | | |
| a. | Grade / Quality of Steel | Chemical analysis | 1sample/Lot | | Fe410W A(E 250A) ,410W B(E250 B), Fe 410W C(E250 C) as per IS 2062 | | P | V | - |
| b. | Dimensional check Galvanzing Thickness (As per IS) Mass of Zinc Coating (As per IS) | Visual | 1sample/Lot | | IS1852 | | P | V | - |
| c. | Chemical Composition | Chemical analysis | 1sample/50 tonnes | | IS 2062/ IS4923 | | P | V | - |
| d. | Tensile Strength ( UTS & Yield Stress) | UTS Machine | 1sample/50 tonnes | | 250Mpa Min | | P | V | - |
| e. | % Elongation | UTS Machine | 1sample/50 tonnes | | 23 % Min | | P | V | - |

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| S. No. | Components / Operations & Description of Test | Type of check | Quantum of Check / Sampling with basis | Reference document for Testing | Acceptance Norms | Format of Record | Category of responsibility | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Sub-Vendor | Manufacturer | Customer |
| f. | Bend Test | Visual | 1sample/50 tonnes | | no crack | | P | V | - |
| | | | | | | | | | |
| 1.17 | GI PIPES “B” CLASS | Mechanical | One Sample per Lot | IS 1239 / 1161 - 1998 | As per | CMTC | | | |
| | | | of Each Size | IS 2633 / IS 4759 | Manufacturer’s Internal Document | | | | |
| a. | Dimensional check | Vernier/micrometer | 10% of each size /lot | | Nominal Bore( 25NB,32 NB,40 NB,50 NB etc) as per IS 1239 | | - | P | V |
| b. | Marking | Visual | 100% | | Light tubes- Yellow Medium- Blue Heavy-Red | | - | P | V |
| c. | UTS | UTS Machine | 1sample/lot | | 320Mpa Min | | P | V | - |
| d. | Elongatoin , Bend Test /flattening test | UTS Machine | 1sample/lot | | Up to 25NB mm-12 % Min& 25 NB mm to 150 NBmm-20% | | P | V | - |
| e. | Chemical Composition | Chemical analysis | 1sample/lot | | IS 1239/ CM/L-2247549 | | P | V | - |
| f. | wt of Zn g/m 2 (up to | Chemical | 1sample/lot | | 360 | | P | V | - |

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| S. No. | Components / Operations & Description of Test | Type of check | Quantum of Check / Sampling with basis | Reference document for Testing | Acceptance Norms | Format of Record | Category of responsibility | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Sub-Vendor | Manufacturer | Customer |
| | 6mm thick ) | analysis | | | | | | | |
| g. | Uniformity | Chemical analysis | 1sample/lot | | 4x 1 min dip | | P | V | - |
| | | | | | | | | | |
| 1.18 | ALUMINIUM TUBES (Seamless), FLATS, PROFILES | Mechanical/ Electrical | IS 2678 / IS 3965/ IS 5082 / IS 733 | IS 2678 / IS 3965/ IS 5082 / IS 733 / Tech. S | | CMTC | | | |
| a. | Grade of Aluminium Alloy | Chemical analysis | 1sample/lot | | 63401Grade IS 5082 | | P | V | - |
| b. | Freedom from defects | Visual | 100% | | Free from cross cutting and harmful defects | | P | V | - |
| c. | Dimensional check | vernier/micrometer | ONE SAMPLE | | AS PER schematic | | - | P | V |
| d. | UTS | UTS Machine | 1sample/lot | | 200Mpa Min | | P | V | - |
| e. | Elongatoin | UTS Machine | 1sample/lot | | 10 % Min | | P | V | - |
| f. | Bend Test for Flats | Visual | 1sample/lot | | No cracks upto 90 Deg | | P | V | - |
| g. | Conductivity test | TECHNOFOUR | 1sample/lot | | min 55 % IACS | | P | V/P | - |
| h. | Chemical Composition ( in weight % ) | Chemical analysis | 1sample/lot | | IS 5082-1998 IS 1608-2005 | | P | V | - |
| | | | | | | | | | |

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| S. No. | Components / Operations & Description of Test | Type of check | Quantum of Check / Sampling with basis | Reference document for Testing | Acceptance Norms | Format of Record | Category of responsibility | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Sub-Vendor | Manufacturer | Customer |
| 1.19 | COPPER RODS PROFILES / FLATS / PIPES | Mechanical/ Chemical/ Electrical | IS 613 / IS 191 / IS 2501 / IS 1897 | IS 613 / IS 191 / TECH. Specn. | | CMTC | | | |
| a. | Grade of copper | Chemical analysis | 1sample/300tubes, 2sam ples/lot up to 100 flats/bars | | ETP(ELECTROLYTIC TOUGH PITCH) IS191 ( PART 5 ) | | P | V | - |
| b. | Condition of Supply | Mechanical Properties Check | 1sample/300tubes, 2sam ples/lot up to 100 flats/bars | | As Drawn (HD) for Tubes IS 2501 & Half Hard (HB) for Flats/BarsIS 613 | | P | V | - |
| c. | Freedom from defects | Visual | 100% | | Free from blisters, slivers, scale, fins, spills, cracks | | P | V | - |
| d. | Dimensional check | vernier/micro meter | ONE SAMPLE | | AS PER schematic | | P | V | - |
| e. | UTS ( for tubes ) | UTS Machine | ONE SAMPLE | | 250Mpa Min | | P | V | - |
| f. | UTS (for flats) | UTS Machine | ONE SAMPLE | | 230Mpa Min | | P | V | - |
| g. | Elongatoin(for flats) | UTS | ONE SAMPLE | | 15 % Min | | P | V | - |

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| S. No. | Components / Operations & Description of Test | Type of check | Quantum of Check / Sampling with basis | Reference document for Testing | Acceptance Norms | Format of Record | Category of responsibility | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Sub-Vendor | Manufacturer | Customer |
| | | Machine | | | | | | | |
| h. | Bend test -180 degree (for flats ) | fixure | ONE SAMPLE | | no crack | | P | V | - |
| i. | Conductivity test | TECHNOFOUR | 1sample/300tubes, 2samples/lot up to 100 flats/bars | | min 97 % IACS | | P | V/P | - |
| j. | Chemical Composition ( in weight % ) | Chemical analysis | 1sample/lot | | IS 191:(Pt V)& IS 2501-1995 IS 613-2000 | | P | V | - |
| | | | | | | | | | |
| 1.20 | SILVER PLATED COMPONENTS | Mechanical | 5%per lot | TECH. Specn. (Plating Thickness) | P.S 001 | CMTC | P | V | - |
| a. | Purity of Silver | Chemical Analysis | One Sample/Month | Min. 99% | | CMTC | P | V | - |
| b. | Adhession Test | Oven Test | 100% | Mfr's Specification | Free from Peel, Bubbles | CMTC | P | V/P | -/W |
| c. | Thickness | Thickness Meter | 5% | Specn. /Apprd. Drgs. | | CMTC | P | V/P | -/W |
| 1.20.1 | TIN Plated Components | | | | | | P | V/P | -/W |
| a. | Adhession Test | Oven Test | 100% | Mfr's Specification | Free from Peel, Bubbles | CMTC | P | V/P | -/W |
| b. | Thickness | Thickness Meter | 5% | Specn. /Apprd. Drgs. | | CMTC | P | V/P | -/W |
| | | | | | | | | | |

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| S. No. | Components / Operations & Description of Test | Type of check | Quantum of Check / Sampling with basis | Reference document for Testing | Acceptance Norms | Format of Record | Category of responsibility | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Sub-Vendor | Manufacturer | Customer |
| 1.21 | MOM / BOM BOXES | | IS 9921 | IS 9921 / | IS 9921 / | | | | |
| a. | Operation Test(Close & Open) | Electrical / | 100% | do | do | CMTC | P | V | W |
| | | Mechanical | | | | | | | |
| b. | IR Value Check | Electrical | 100% | More than 2 Mega | More than 2 Mega | CMTC | P | V | W |
| | | | | Ohms | Ohms | | P | V | W |
| c. | High Voltage TEST | Electrical | 100% | 1.75 KV / 1min | 1.75 KV / 1min | CMTC | P | V | W |
| d. | Dimensional Check | Mechanical | 10% | IS 9921 / Specn. /Apprd. Drgs./Apprd. Data Sheet | IS 9921 / Specn. /Apprd. Drgs./Apprd. Data Sheet | CMTC | P | V | W |
| | | | | | | | | | |
| e. | Visual Check for gasketting | Visual | 100% | do | FREE FROM DAMAGE | | P | V | W |
| f. | Check for | Mechanical/ | 100% | do | | | P | V | W |
| | Manual Operation Interlock, | Electrical | 100% | | OK /NOT OK | | | | |
| | O/L Relay Operation, | Electrical | 100% | | OK/NOT OK | | | | |
| | Degree of Rotation | Mechanical/ | 100% | | OK/NOT OK | | | | |
| | Current Drawn by Motor, | Electrical | 100% | | NOT MORE THAN RATED CURRENT | | | | |
| | Painting Thickness | Mechanica | 5% | | As per | | | | |

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| S. No. | Components / Operations & Description of Test | Type of check | Quantum of Check / Sampling with basis | Reference document for Testing | Acceptance Norms | Format of Record | Category of responsibility | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Sub-Vendor | Manufacturer | Customer |
| | | l/ | | | Drg/GTP/TS | | | | |
| | | | | | | | | | |
| g. | Check for Pick-up & Dropout | Electrical | 10% | pick up 85% of rated | | | | | |
| | voltage on contactors. | | | dropout 10to75% of | | | P | V | W |
| | | | | rated D.C Voltage | | | | | |
| | | | | | | | | | |
| h | Water jet test | Mechanical | 1 NO/ LOT | 12.5 lt/min -jet | No leakage | | P | V | W |
| i. | Paper test for Gasket (4 direction) | Visual | 10% | Specn./Apprd. Drgs. | Specn./Apprd. Drgs. | | P | V | W |
| | | | | | | | | | |
| 1.22 | BASE CHANNEL Including Bearing Housing Assembly / Main Frame Structure Assembly | | | Approved Drawing & Data Sheet | Approved Drawing & Data Sheet | | | | |
| a. | Visual Check | Visual | 100% | do | do | | - | P | V |
| b. | Dimensional Check | Mechanical | 5% | do | do | | - | P | V |
| c. | Check for Thickness of Zinc Coating | Mechanical | One Sample Per Lot | 86 µ Min./ TECH. Specn. | 86 µ Min./ TECH. Specn. | | - | P | V |
| d. | Level / Straightness Check on base Channel by Spirit level | Mechanical | 100% | Approved Drawing & data sheet | Approved Drawing & data sheet | | - | P | V |

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| S. No. | Components / Operations & Description of Test | Type of check | Quantum of Check / Sampling with basis | Reference document for Testing | Acceptance Norms | Format of Record | Category of responsibility | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Sub-Vendor | Manufacturer | Customer |
| e. | Check Free movement of rotating Shafts | Mechanical | 100% | do | do | | - | P | V |
| | | | | | | | | | |
| 1.23 | Spring (SS) | | | AISI standard | AISI standard | | | | |
| | | | | AISI 304 / AISI 301 | | | | | |
| a. | Visual | Visual | 10% | | | CMTC | - | P | V |
| b. | Dimensional | Dimensional | 5 % of lot of each size | | | | - | P | V |
| c. | Chemical | Chemical | 1 sample per lot of each size | | | | P | V | - |
| d. | Mechanical ( tensile strength / Elongation | Mechanical | 1 sample per lot of each size | | | | P | V | - |
| | | | | | | | | | |
| 1.23 .1 | Spring (Spring Steel) | | | IS 4454 (Grade 2 & Grade 3) | IS 4454 (Grade 2 & Grade 3) | | | | |
| a. | Visual | Visual | 10% | do | do | CMTC | - | P | V |
| b. | Dimensional | Dimensional | 5 % of lot of each size | do | do | | P/- | V/P | -/W |
| c. | Chemical | Chemical | 1 sample per lot of each | do | do | | P | V | - |

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| S. No. | Components / Operations & Description of Test | Type of check | Quantum of Check / Sampling with basis | Reference document for Testing | Acceptance Norms | Format of Record | Category of responsibility | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Sub-Vendor | Manufacturer | Customer |
| | | | size | | | | | | |
| d. | Mechanical ( tensile strength / Elongation | Mechanical | 1 sample per lot of each size | do | do | | P | V | - |
| e. | Coating Thickness | Mechanical | 1 sample per lot of each | Mfr's Drawing | min 50 µ | | P | V | - |
| | | | | | | | | | |
| 1.24 | Bearing | | | | | | | | |
| a. | Visual | Visual | 10% | Product code | Product code | | - | P | V |
| b. | Dimensional | Dimensional | 5% samples per lot | | | | - | P | V |
| | | | | | | | | | |
| 1.25 | Gear Box | | | | | | | | |
| A | Gear Components | | | | | | | | |
| | Raw Material Test Report | Chemical Analysis | One Sample / Batch | Component Manufacturer specification | Component Manufacturer specification | CMTC | P | V | - |
| | Mechanical ( tensile strength / Elongation | Mechanical | One Sample / Batch | Component Manufacturer specification | Component Manufacturer specification | CMTC | P | V | - |
| | Surface Treatment report | Mechanical | One Sample / Batch | Component Manufacturer specification | Component Manufacturer specification | CMTC | P | V | - |
| B | Casting | | | | | | P | V | - |
| | Raw Material Test Report | Chemical Analysis | One Sample / Batch | Component Manufacturer specification | Component Manufacturer specification | CMTC | P | V | - |

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| S. No. | Components / Operations & Description of Test | Type of check | Quantum of Check / Sampling with basis | Reference document for Testing | Acceptance Norms | Format of Record | Category of responsibility | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Sub-Vendor | Manufacturer | Customer |
| | Mechanical ( tensile strength / Elongation | Mechanical | One Sample / Batch | Component Manufacturer specification | Component Manufacturer specification | CMTC | P | V | - |
| | Surface Treatment report | Mechanical | One Sample / Batch | Component Manufacturer specification | Component Manufacturer specification | CMTC | P | V | - |
| | | | | | | | | | |
| 1.26 | Aluminium Casting | | | | | | | | |
| | Raw Material Test Report | Chemical Analysis | One Sample / Batch | Mfr's Specification | Mfr's Specification | | P | V | - |
| | Mechanical ( tensile strength / Elongation | Mechanical | One Sample / Batch | Mfr's Specification | Mfr's Specification | | P | V | - |
| | **SECTION 2. INPROCESS INSPECTION** | | | | | | | | |
| 2.1 | MALE & FEMALE CONTACT ASSEMBLY | | 100% | IEC 62271-102 Technical Specn./Approved Drawings/ Approved Tech. Data Sheet | IEC 62271-102 Technical Specn./Approved Drawings/ Approved Tech. Data Sheet | | | | |
| a. | Visual Check | Visual | 100% | do | do | | - | P | V |
| b. | Dimensional Check | Mechanical | 5% | do | do | | - | P | V |
| c. | Contact Resistance / MV Drop Test | Electrical | 100% | 1.2 Times Type Test Value Max. | 1.2 Times Type Test Value Max. | | - | P | V |

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| S. No. | Components / Operations & Description of Test | Type of check | Quantum of Check / Sampling with basis | Reference document for Testing | Acceptance Norms | Format of Record | Category of responsibility | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Sub-Vendor | Manufacturer | Customer |
| | | | | | | | | | |
| 2.2 | EARTH SWITCH | | | | | EM Records | | | |
| | Visual & Dimensional Check | Visual/ Mechanical | 5% | IEC 62271-102 | IEC 62271-102/ Technical Specn./Approved Drawings | | - | P | V |
| | | | | | | | | | |
| 2.3 | GEAR BOX ASSEMBLY | | | Approved Drawing & Data Sheet | Approved Drawing & Data Sheet | EM Records | | | |
| a. | Gear and Pinion movement | Visual/Manual | 100% | Free Movement | Free Movement | | P | V | - |
| b. | b.Motor run trial | Electrical | 100% | 5 min | No abnormality during 5 min | | P | V | - |
| | | | | | | | | | |
| 2.4 | MOM SHELL MANUFACTURING | | | | | | | | |
| a. | Fabrication of MOM shell | Visual | 100% | Squareness shall be maintained | Free from Dents, Sharp edges | | P | V | - |
| b. | Dimensional Check | Measurement | 5% | As per approved GA | As per approved GA | | P | V | - |
| | | | | | | | | | |
| 2.5 | PAINTING | | | | PS:003 | | | | |
| a. | Pre Treatment of Shell | Chemical | 100% | As per Powder coating Manufacturer | As per Powder coating Manufacturer | | P | V | - |

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|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Sub-Vendor | Manufacturer | Customer |
| b. | Baking of Shell after powder spray by Electrostatically | Measurement | 100% | 170-180 degrees for 15 minutes | 170-180 degrees for 15 minutes | | P | V | - |
| c. | Thickness measurement | Measurement | 5% | As per GTP/Drg/TS | As per GTP/Drg/TS | | P | V | - |
| | | | | | | | | | |
| 2.6 | GALVANISING | | | | | | | | |
| a. | Pre Treatment of Structural Components | Chemical | 100% | AS per IS 2629/2633/PG specifications | AS per IS 2629/2633/PG specifications | | P | V | - |
| b. | Dipping of structural parts in molten Zinc | Measurement | Daily check | Zinc bath temperature shall be 445 to465 centigrade | Zinc bath temperature shall be 445 to465 centigrade | | P | V | - |
| c. | Thickness measurement | Mechanical | One Sample Per Lot | 86 µ Min./ Tech Specn. | 86 µ Min./ Tech Specn. | | P | V | - |
| | | | | | | | | | |
| 2.7 | SILVER PLATING | | | | | | | | |
| a. | Pre-treatment of component | Chemical | 100% | As per Manufacturer practice | As per Manufacturer practice | CMTC | P | V | - |
| b. | Silver strike | Chemical | Every Week | As per Manufacturer practice | As per Manufacturer practice | | P | V | - |
| c. | Silver Plating | Chemical | Every Week | Verfication of | As per | | P | V | - |

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| S. No. | Components / Operations & Description of Test | Type of check | Quantum of Check / Sampling with basis | Reference document for Testing | Acceptance Norms | Format of Record | Category of responsibility | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Sub-Vendor | Manufacturer | Customer |
| | | | | Silver & Free Cynide | Manufacturer practice | | | | |
| d. | Thickness | Mechanical | 5%per lot | Tech Specn. | Tech. Specn. | | P | V | - |
| | | | | | | | | | |
| 2.8 | Lubrication | | | | | | | | |
| a. | For Contacts | Visual | | Mfr's Specification | Graphite Oil / Centoplex | CMTC | P | V | - |
| b. | For Gears | Visual | | Mfr's Specification | Multipurpose Grease (MP3)/ Molykote long term 2 plus | CMTC | P | V | - |
| | | | | | | | | | |
| SECTION 3. FINAL INSPECTION **- All Routine/Acceptance test as per applicable contract Tech Spec need to be carried out without fail | | | | | | | | | |
| 3. 1 | ACCEPTANCE TEST on Complete Isolator Assembly & All Accessories as per TECH. Spec./Apprd. Drgs. With * Insulators Forming Part of the Same Isolator with MOM (All acceptance Test as Per Contract to be Conducted) | Visual/ Mechanical/ Electrical | 10 % of each type (kV) per lot (to nearest whole no) min. One | IEC 62271-102/ Tech. Specn. /Apprd. Drgs./Apprd. Tech. Data Sheet | IEC 62271-102/ Tech. Specn. /Apprd. Drgs./Apprd. Tech. Data Sheet | | - | P | W |
| | * Mfr's Standard Insulators can be used for the acceptance test if they are equal (in height) to the approved drawings. | | | | | | | | |
| a. | Mechanical Operation Test | Mechanical / | One Set of each | IEC 62271-102/ Tech. Specn. | IEC 62271-102/ Tech. | EM Test Reports | - | P | W |

* Category of Responsibility: P - Actual Test Performance V - Verify and Accept W - Witness Actual testing, verify and accept

| S. No. | Components / Operations & Description of Test | Type of check | Quantum of Check / Sampling with basis | Reference document for Testing | Acceptance Norms | Format of Record | Category of responsibility | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Sub-Vendor | Manufacturer | Customer |
| | - | Electrical | type (kV) per Lot / LOA / Project<br><br>One Set of randomly Selected Sample with higher rating of Current and earthswitches per inspection lot | /Apprd. Drgs./Apprd. Tech. Data Sheet | Specn. /Apprd. Drgs./Apprd. Tech. Data Sheet<br><br>no removal of silver coating in contact area(MS/ES) | | | | |
| | i. Contact Resistance Measurment | Electrical | | Tech. Specn. & Apprd. Data Sheet / Drgs | Tech. Specn. & Apprd. Data Sheet / Drgs | EM Test Reports | - | P | W |
| | ii. Check for Avg Power Drawn by Motor & Operating Time along with travel Characteristics | Electrical | | do | ±10 % variation after mechanical operations | EM Test Reports | - | P | W |
| | iii. Check for Manual (Mech.) Operation& Interlocks (elect & Mech). | Electrical/ Mechanical | | do | do | EM Test Reports | - | P | W |
| | iv. Vertically Alignment Check & Clearance Check | Electrical/ Mechanical | | do | do | EM Test Reports | - | P | W |
| | v. General Assembly | Electrical/ | | do | do | EM Test Reports | - | P | W |

* Category of Responsibility: P - Actual Test Performance V - Verify and Accept W - Witness Actual testing, verify and accept

| S. No. | Components / Operations & Description of Test | Type of check | Quantum of Check / Sampling with basis | Reference document for Testing | Acceptance Norms | Format of Record | Category of responsibility | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Sub-Vendor | Manufacturer | Customer |
| | Dimensional Check & Aux. Switch and Limit Switch Operation. | Mechanical | | | | | | | |
| | vi. Visual Check for Completeness | Visual | | IS 9921 / IEC 62271-102/ Tech. Specn. /Apprd. Drgs./Apprd. Tech. Data Sheet | IS 9921 / IEC 62271-102/ Tech. Specn. /Apprd. Drgs./Apprd. Tech. Data Sheet | EM Test Reports | - | P | W |
| b. | Dimension measurement between Phase to Earth & between Conductive Parts. | Mechanical | | do | do | EM Test Reports | - | P | W |
| c | CRM | Electrical/ Mech | 5% | do | do | | - | P | W |
| d | Di-Electric test on Aux Ckt (2 kV) | Electrical/ Mech | 5% | do | do | | - | P | W |
| e | Witness of Silver Plating | Mechanical | One sample / Inspection lot | Tech. Specn. & Apprd. Data Sheet/Drgs. | do | EM Test Reports | - | P | W |
| | | | | | | | | | |
| **SECTION 4.PACKING & DISPATCH** | | | | | | | | | |
| 4.1 | Verification of Completeness of all Items as per Contract | | 100% | Tech. Specn./Apprd. Drgs. | Tech. Specn./Apprd. Drgs. | | - | P | - |

* Category of Responsibility: P - Actual Test Performance V - Verify and Accept W - Witness Actual testing, verify and accept

| S. No. | Components / Operations & Description of Test | Type of check | Quantum of Check / Sampling with basis | Reference document for Testing | Acceptance Norms | Format of Record | Category of responsibility | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Sub-Vendor | Manufacturer | Customer |
| 4.2 | Check for Soundness of Packing | | 100% | Tech. Specn./Apprd. Drgs. | Tech. Specn./Apprd. Drgs. | | - | P | - |
| 4.3 | Verification of CIP/MDCC Reference on Packing / Crates | | 100% | do | do | | - | P | - |

* Category of Responsibility: P - Actual Test Performance V - Verify and Accept W - Witness Actual testing, verify and accept

# Surge Arrestor

| S. No. | Components / Operations & Description of Test | Type of check | Quantum of Check / Sampling with basis | Reference document for Testing | Acceptance Norms | Format of Record | Category of responsibility | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Sub-Vendor | Manufacturer | Customer |
| **SECTION 1. Raw Materials/ Bought out Components** | | | | | | | | | |
| **1** | **Porcelain Insulator** | | | | | | | | |
| a) | Visual Examination (surface defect) | Visual | 100% | Manufacturer's Plant Standard/IS 5621/IEC 62155/IEC 99-4 As per spec /GTP | Manufacturer's Plant Standard/ IS 5621/ IEC 62155 | CMTC/ EMTC | P | V/P | -/V |
| b) | Verification of Dimensions including Creepage distance & Parallelity | Dimensional | 2 Samples/Lot | | Drawing/Manufacturer's Plant Standard/IS 5621/IEC 62155 | CMTC/ EMTC | P | V/P | -/V |
| c) | Porosity Test | Physical | 1 Sample/Lot | | No Dye penetration should occur | CMTC/ EMTC | P | V/P | -/V |
| d) | Temperature Cycle Test | Physical | 2 Samples/Lot | | Cracks / Glaze defects should not occur | CMTC/ EMTC | P | V/P | -/V |
| e) | Routine Pressure Test | Mechanical | 100% | | Manufacturer's Plant Standard/IS 5621/IEC 62155/IEC 99-4 As per spec /GTP | CMTC/ EMTC | P | V/P | -/V |
| f) | Ultrasonic Test | Mechanical | 100% | | | CMTC/ EMTC | P | V/P | -/V |
| g) | Burst Pressure Test | Mechanical | 1 Sample/Lot | | | CMTC/ EMTC | P | V/P | -/V |
| h) | Bending Load Test in 3 directions at 50% specified | Mechanical | 1 Sample/Lot | | | CMTC/ EMTC | P | V/P | -/V |

* Category of Responsibility: P - Actual Test Performance V - Verify and Accept W - Witness Actual testing, verify and accept

| S. No. | Components / Operations & Description of Test | Type of check | Quantum of Check / Sampling with basis | Reference document for Testing | Acceptance Norms | Format of Record | Category of responsibility | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Sub-Vendor | Manufacturer | Customer |
| | bending load and in 4th direction at 100% load | | | | | | | | |
| | | | | | | | | | |
| **2** | **Polymer Insulator (Silicon)** | | | | | | | | |
| a) | Visual | Visual | 100% | Manufacturer's Plant Standard/ Purchase Drg/IEC 61462/IEC 62217/AS PER Spec | Manufacturer's Plant Standard/ Purchase Drg/IEC 61462/IEC 62217/AS PER Spec | CMTC/ EMTC | P | V/P | -/V |
| b) | Overall Height | Mechanical | 100% | | | CMTC/ EMTC | P | V/P | -/V |
| c) | Inner Diameter | Mechanical | 100% | | | CMTC/ EMTC | P | V/P | -/V |
| d) | Parallesim of flanges | Mechanical | 100% | | | CMTC/ EMTC | P | V/P | -/V |
| e) | Creepage distance | Mechanical | 100% | | | CMTC/ EMTC | P | V/P | -/V |
| g) | Inner pressure | Mechanical | 100% | | | CMTC/ EMTC | P | V/P | -/V |
| h) | bending load | Mechanical | 100% | | | CMTC/ EMTC | P | V/P | -/V |
| i) | Gas Leakage test | Mechanical | 100% | | | CMTC/ EMTC | P | V/P | -/V |
| j) | NDT check to ensure the quality of jointing of the housing interface with core | Mechanical | 1 Sample/Shift | | | CMTC/ EMTC | P | V/P | -/V |
| | All routine test | | | | | CMTC/ | P | V/P | -/V |

* Category of Responsibility: P - Actual Test Performance V - Verify and Accept W - Witness Actual testing, verify and accept

| S. No. | Components / Operations & Description of Test | Type of check | Quantum of Check / Sampling with basis | Reference document for Testing | Acceptance Norms | Format of Record | Category of responsibility | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Sub-Vendor | Manufacturer | Customer |
| k) | (Electrical & Mech) as per IEC 61462 as applicable | Electrical | 100% | | | EMTC | | | |
| | | | | | | | | | |
| **3** | **Aluminium Castings** | | | | | | | | |
| a) | Visual Examination | Visual | 100% | Manufacturer's Plant Standard/ DRG/AS PER Spec/BS 1490 | Manufacturer's Plant Standard/ DRG /AS PER Spec/ BS 1490 | CMTC/ EMTC | P | V/P | -/V |
| b) | Verification of Dimensions | Dimensional | 5 Samples/Lot | | | CMTC/ EMTC | P | V/P | -/V |
| c) | Tensile Test on Test Bar | Mechanical | 1Test piece/1000kgs castings | | | CMTC | P | V/P | -/V |
| d) | Elongation Test on Test Bar | Mechanical | 1Test piece/1000kgs castings | | | CMTC | P | V/P | -/V |
| e) | Chemical Analysis | Chemical | 1Test piece/2000kgs castings | | | Third party TC | P | V/P | -/V |
| f) | Hardness | Physical | 1Test piece/1000kgs castings | | | CMTC | P | V/P | -/V |
| | | | | | | | | | |
| **4** | **Gaskets / 'O' rings** | | | | | | | | |

* Category of Responsibility: P - Actual Test Performance V - Verify and Accept W - Witness Actual testing, verify and accept

| S. No. | Components / Operations & Description of Test | Type of check | Quantum of Check / Sampling with basis | Reference document for Testing | Acceptance Norms | Format of Record | Category of responsibility | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Sub-Vendor | Manufacturer | Customer |
| a) | Verification of Dimensions | Dimensional | 2 Samples/Lot | Manufacturer's Plant Standard/DRG/AS PER Spec/IS 11149/ IS 3400 | Manufacturer's Plant Standard/DRG/AS PER Spec/IS 11149/ IS 3400 | CMTC/ EMTC | P | V/P | -/V |
| b) | Hardness Test (Shore A) | Physical | 2 Samples/Lot | | | CMTC | P | V | - |
| c) | Elongation | Mechanical | 2 Samples/Lot | | | CMTC | P | V | - |
| d) | Tensile Strength | Mechanical | 2 Samples/Lot | | | CMTC | P | V | - |
| e) | Density | Mechanical | 2 Samples/Lot | | | CMTC | P | V | - |
| f) | Comprssion Set Test | Physical | 2 Samples/Lot | | | CMTC | P | V | - |
| g) | Accelerated Ageing Test | Physical | 2 Samples/Lot | | | CMTC | P | V | - |
| h) | Ozone Resistance test | Physical | 2 Samples/Lot | | | CMTC | P | V | - |
| | | | | | | | | | |
| **5** | **Springs** | | | | | | | | |
| a) | Verification of Dimensions | Dimensional | 2 Samples/Lot | Manufacturer's Plant Standard/DRG/IS 4454 (Part-4) | Manufacturer's Plant Standard/DRG | CMTC/ EMTC | P | V/P | -/V |
| b) | Surface Condition | Visual | 100% | | Should be smooth and free from burrs | CMTC | P | V | - |

* Category of Responsibility: P - Actual Test Performance V - Verify and Accept W - Witness Actual testing, verify and accept

| S. No. | Components / Operations & Description of Test | Type of check | Quantum of Check / Sampling with basis | Reference document for Testing | Acceptance Norms | Format of Record | Category of responsibility | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Sub-Vendor | Manufacturer | Customer |
| c) | Load deflection test | Mechanical | 2 Samples/Lot | | Manufacturer's Plant Standard/DRG/IS 4454 (Part-4) | CMTC | P | V | - |
| d) | Chemical Analysis | Chemical | 2 Samples/Lot | | | CMTC | P | V | - |
| | | | | | | | | | |
| **6** | **Pressure Relief Diaphram** | | | | | | | | |
| a) | Visual Examination | Visual | 100% | Manufacturer's Plant Standard/ DRG/AS PER Spec | Manufacturer's Plant Standard/ DRG/AS PER Spec | CMTC/ EMTC | P | V/P | -/V |
| b) | Verification of Dimensions | Dimensional | 1 Sample/Lot | | | CMTC | P | V | - |
| c) | Burst Pressure Test | Pneumatic | 1 Sample/Lot | | | CMTC | P | V | - |
| | | | | | | | | | |
| **7** | **Sulphur Cement ( if applicable )** | | | | | | | | |
| a) | Compressive Strength after aging for 48hrs | Mechanical | 2 Cubes of 50mm / lot of 2500kg | Manufacturer's Plant Standard/IS 4832 | Manufacturer's Plant Standard/IS 4832 | CMTC | P | V | - |
| b) | Tensile strength after aging for 48hrs | Mechanical | 2 Samples/lot | | | CMTC | P | V | - |
| c) | Flextural strength after aging for 48hrs | Mechanical | 2 Samples/lot | | | CMTC | P | V | - |
| d) | Bonding strength after aging for 48hrs | Mechanical | 2 Samples/lot | | | CMTC | P | V | - |

* Category of Responsibility: P - Actual Test Performance V - Verify and Accept W - Witness Actual testing, verify and accept

| S. No. | Components / Operations & Description of Test | Type of check | Quantum of Check / Sampling with basis | Reference document for Testing | Acceptance Norms | Format of Record | Category of responsibility | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Sub-Vendor | Manufacturer | Customer |
| | | | | | | | | | |
| **8** | **Silicon Rubber** | | | | | | | | |
| a) | Specific gravity | Physical | 1 /month | Manufacturer's Plant Standard/AS PER Spec | Manufacturer's Plant Standard/AS PER Spec | CMTC | P | V | - |
| b) | Hardness | Physical | 1 /month | | | CMTC | P | V | - |
| c) | Tensile strength | Mechanical | 1 /month | | | CMTC | P | V | - |
| d) | Elongation at break | Mechanical | 1 /month | | | CMTC | P | V | - |
| e) | Tear resistance | Electrical | 1 /half year | | | CMTC | P | V | - |
| f) | Dielectric strength | Mechanical | 1 /month | | | CMTC | P | V | - |
| g) | Volume resistivity | Electrical | 1 /month | | | CMTC | P | V | - |
| h) | Surface resistivity | Electrical | 1 /month | | | CMTC | P | V | - |
| i) | Dielectric constanct, 50Hz | Electrical | 1 /half year | | | CMTC | P | V | - |
| j) | Dissipation factor (tanδ), 50Hz | Electrical | 1 /half year | | | CMTC | P | V | - |
| k) | Tracking resistance | Electrical | 1 /half year | | | CMTC | P | V | - |
| l) | Flammability (FV-0) | Physical | 1 /half year | | | CMTC | P | V | - |

* Category of Responsibility: P - Actual Test Performance V - Verify and Accept W - Witness Actual testing, verify and accept

| S. No. | Components / Operations & Description of Test | Type of check | Quantum of Check / Sampling with basis | Reference document for Testing | Acceptance Norms | Format of Record | Category of responsibility | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Sub-Vendor | Manufacturer | Customer |
| | | | | | | | | | |
| **9** | **Sheet Metal Pressed Components** | | | | | | | | |
| a) | Visual Examination | Visual | 100% | Manufacturer's Plant Standard/DRG | Manufacturer's Plant Standard/DRG | CMTC/ EMTC | P | V/P | -/V |
| b) | Verification of Dimensions | Dimensional | 2 Samples/Lot | | | CMTC/ EMTC | P | V/P | -/V |
| | | | | | | | | | |
| **10** | **Grading/ Corona Ring** | | | | | | | | |
| a) | Visual Examination | Visual | 100% | IS 733/ Manufacturer's Plant Standard/DRG | IS 733/ Manufacturer's Plant Standard/DRG | CMTC/EMTC | P | V | - |
| b) | Verification of Dimensions | Dimensional | 2 Samples/Lot | | | CMTC/EMTC | P | V | - |
| c) | Chemical Composition | Chemical | 1 Sample/Lot | | | Third party test report | P | V | - |
| d) | Tensile Strength | Mechanical | 1 Sample/Lot | | | CMTC | P | V | - |
| | | | | | | | | | |
| **11** | **FRP Tie Rods / Tubes** | | | | | | | | |

* Category of Responsibility: P - Actual Test Performance V - Verify and Accept W - Witness Actual testing, verify and accept

| S. No. | Components / Operations & Description of Test | Type of check | Quantum of Check / Sampling with basis | Reference document for Testing | Acceptance Norms | Format of Record | Category of responsibility | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Sub-Vendor | Manufacturer | Customer |
| a) | Visual Examination | Visual | 100% | IEC 62217/Manufacturer's Plant Standard/DRG/ AS PER Spec. | IEC 62217/Manufacturer's Plant Standard/DRG/ AS PER Spec. | CMTC/ EMTC | P | V | - |
| b) | Verification of Dimensions | Dimensional | 100% | | | CMTC/ EMTC | P | V | - |
| c) | Voltage With stand Test | Electrical | 1 Sample/Lot | | | CMTC/ EMTC | P | V | - |
| d) | Leakage Current Test | Electrical | 1 Sample/Lot | | | CMTC/ EMTC | P | V | - |
| e) | Specific Gravity | Physical | 1 Sample/Lot | | | CMTC/ EMTC | P | V | - |
| f) | Water Absorption/Diffusion | Physical | 1 Sample/Lot | | | CMTC/ EMTC | P | V | - |
| g) | Dye penetration test | Physical | 1 Sample/Lot | | | CMTC/ EMTC | P | V | - |
| | | | | | | | | | |
| **12** | **Insulating Base** | | | | | | | | |
| a) | Visual Examination | Visual | 100% | Manufacturer's Plant Standard/DRG | Manufacturer's Plant Standard/DRG | CMTC/EMTC | P/- | V/P | -/W |
| b) | Verification of Dimensions | Dimensional | 2 Sample/Lot | | | CMTC/EMTC | P/- | V/P | -/W |
| c) | Insulation With stand Test | Electrical | 2 Sample/Lot | | | CMTC | P | V | - |
| d) | Bending moment | Mechanical | 2 Sample/Lot | | | CMTC | P | V | - |
| e) | Tensile test | Mechanical | 100% | | | CMTC | P | V | - |

* Category of Responsibility: P - Actual Test Performance V - Verify and Accept W - Witness Actual testing, verify and accept

| S. No. | Components / Operations & Description of Test | Type of check | Quantum of Check / Sampling with basis | Reference document for Testing | Acceptance Norms | Format of Record | Category of responsibility | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Sub-Vendor | Manufacturer | Customer |
| | | | | | | | | | |
| **13** | **Milli-ammeter** | | | | | | | | |
| a) | Visual Examination | Visual | 100% | IS:1248/Manufacturer's Plant Standard | IS:1248/Manufacturer's Plant Standard | CMTC/ EMTC | P/- | V/P | -/W |
| b) | Verification of Dimensions | Dimensional | 2 Sample/Lot | | | CMTC/ EMTC | P/- | V/P | -/W |
| c) | Operational Test | Electrical | 100% | | | CMTC | P | V | - |
| d) | HV test | Electrical | 2 Sample/Lot | | | CMTC | P | V | - |
| e) | Insulation resistance | Electrical | 2 Sample/Lot | | | CMTC | P | V | - |
| | | | | | | | | | |
| **14** | **Cyclometric Counter** | | | | | | | | |
| a) | Visual Examination | Visual | 100% | Manufacturer's Plant Standard/ DRG | Manufacturer's Plant Standard/ DRG | CMTC/ EMTC | P/- | V/P | -/W |
| b) | Operational Test | Electrical | 100% | | | CMTC/ EMTC | P/- | V/P | -/W |
| | | | | | | | | | |
| **15** | **Raw materials for Metal Oxide Blocks (ZnO** | | | | | | | | |

* Category of Responsibility: P - Actual Test Performance V - Verify and Accept W - Witness Actual testing, verify and accept

| S. No. | Components / Operations & Description of Test | Type of check | Quantum of Check / Sampling with basis | Reference document for Testing | Acceptance Norms | Format of Record | Category of responsibility | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Sub-Vendor | Manufacturer | Customer |
| | **Blocks)** | | | | | | | | |
| **a** | Zinc Oxide | Chemical | 50 gms / batch | Manufacturer's Plant Standard/DRG | Manufacturer's Plant Standard/DRG | CMTC/ EMTC | P/- | V/P | -/W |
| **b** | Bismuth Oxide | Chemical | 50 gms / batch | | | CMTC/EMTC | P/- | V/P | -/W |
| **c** | Antimony Tri Oxide | Chemical | 50 gms / batch | | | CMTC/EMTC | P/- | V/P | -/W |
| **d** | Cobalt Oxide | Chemical | 50 gms / batch | | | CMTC/EMTC | P/- | V/P | -/W |
| **e** | Chromium Oxide | Chemical | 50 gms / batch | | | CMTC/EMTC | P/- | V/P | -/W |
| **f** | Manganese Dioxide | Chemical | 50 gms / batch | | | CMTC/EMTC | P/- | V/P | -/W |
| **g** | Silicone Dioxide | Chemical | 50 gms / batch | | | CMTC/EMTC | P/- | V/P | -/W |
| **h** | PVA | Chemical | 50 gms / batch | | | CMTC/EMTC | P/- | V/P | -/W |
| | | | | | | | | | |
| **16** | **Pressure Release Plate (S.S – 304 )** | | | | | | | | |
| a) | Visual Inspection | Physical | 1 Sample/Lot | Manufacturer's Plant Standard/DRG | Manufacturer's Plant Standard/DRG | CMTC | P | V | - |
| b) | Dimensions | Physical | 1 Sample/Lot | | | CMTC | P | V | - |
| c) | Chemical Analysis | Chemical | 1 Sample/Lot | | | CMTC | P | V | - |
| | | | | | | | | | |

* Category of Responsibility: P - Actual Test Performance V - Verify and Accept W - Witness Actual testing, verify and accept

| S. No. | Components / Operations & Description of Test | Type of check | Quantum of Check / Sampling with basis | Reference document for Testing | Acceptance Norms | Format of Record | Category of responsibility | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Sub-Vendor | Manufacturer | Customer |
| **17** | **S.S. Hardware** | | | | | | | | |
| a) | Visual Inspection | Physical | 100% | Manufacturer's Plant Standard/DRG | Manufacturer's Plant Standard/DRG | CMTC | P | V | - |
| b) | Magnetic Check | Physical | 100% | | | CMTC | P | V | - |
| c) | Chemical Analysis | Chemical | 1 Sample/Lot | | | CMTC | P | V | - |
| | | | | | | | | | |
| 18 | **Terminal Clamps** | | | | | | | | |
| a) | Visual Examination | Physical | 1 Sample/Lot | Manufacturer's Plant Standard/ DRG/Tech. Spec/IS 733 | Manufacturer's Plant Standard/ DRG/Tech. Spec/IS 733 | CMTC | P | V | - |
| b) | Dimensions | Physical | 1 Sample/Lot | | | CMTC | P | V | - |
| c) | Tesnile test | Mechanical | 1 Sample/Lot | | | CMTC | P | V | - |
| d) | Chemical Analysis | Chemical | 1 Sample/Lot | | | CMTC | P | V | - |
| | | | | | | | | | |
| Section II : In process Checks | | | | | | | | | |
| | **Zinc Oxide Blocks Inspections** | | | | | | | | |
| a) | Visual Examination | Visual | 100% | IEC 60099-4/Manufacturer's Plant | IEC 60099-4/Manufacturer's | EMTC | P/- | V/P | -/W |
| b) | Verification of Dimensions | Dimensional | 5 Sample/Lot | | | EMTC | P/- | V/P | -/W |

* Category of Responsibility: P - Actual Test Performance V - Verify and Accept W - Witness Actual testing, verify and accept

| S. No. | Components / Operations & Description of Test | Type of check | Quantum of Check / Sampling with basis | Reference document for Testing | Acceptance Norms | Format of Record | Category of responsibility | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Sub-Vendor | Manufacturer | Customer |
| c) | Energy Handling Capability test | Electircal | 100% | Standard/DRG/ Tech. Spec. | Plant Standard/DRG/ Tech. Spec. | EMTC | P/- | V/P | -/W |
| d) | RDV Test | Electircal | 100% | | | EMTC | P/- | V/P | -/W |
| e) | Accelerated aging test for 72hrs | Electircal | 5 Sample/Lot | | | EMTC | P/- | V/P | -/W |
| f) | Thermal Stability Test | Electircal | 5 Sample/Lot | | | EMTC | P/- | V/P | -/W |
| g) | Watloss or Resistive Current | Electircal | 5 Sample/Lot | | | EMTC | P/- | V/P | -/W |
| | Sample should be from ongoing production irrespective of contract | | | | | | | | |
| | | | | | | | | | |
| Section III: Surge Arresters Assembly | | | | | | | | | |
| **1** | **Surge Arresters** | | | | | | | | |
| a) | Seal leak Test | Physical | 100% | IEC 60099-4/ IS : 3070/AS PER Tech. Spec./ Apporved | Megger value after dip test should be >10GΩ for L.A. >=66kV,>1GΩ for LA<66kV | EMTC | P | V | - |
| b) | Visual Examination | Visual | 100% | | IEC 99-4 | EMTC | P | V | - |

* Category of Responsibility: P - Actual Test Performance V - Verify and Accept W - Witness Actual testing, verify and accept

| S. No. | Components / Operations & Description of Test | Type of check | Quantum of Check / Sampling with basis | Reference document for Testing | Acceptance Norms | Format of Record | Category of responsibility | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Sub-Vendor | Manufacturer | Customer |
| c) | Verification of Dimensions | Dimensional | 2 Samples/Lot | GTP/Mfr's Plant Std. | Approved Drawing | EMTC | P | V | - |
| d) | Reference Voltage | Electrical | 100% | | > Surge Arrester Rating. | EMTC | P | V | - |
| e) | Lightning Impulse Residual DischargeVoltageTest at 10kA | Electrical | 100% | | IEC 99 - 4 GTP | EMTC | P | V | - |
| f) | Partial Discharge Test at MCOV x 1.05 times KV | Electrical | 100% | | < 10 pC | EMTC | P | V | - |
| g) | Leakage Current at MCOV | Electrical | 100% | | IEC 99 - 4/ Approved GTP | EMTC | P | V | - |
| h) | Verticality Check on | Mechanical | 1 Sample/Lot | | Max.10 mm deviation | EMTC | P | V | - |
| | | | | | | | | | |
| **2** | **Surge Monitor** | | | | | | | | |
| a) | Visual Examination | Visual | 100% | IEC 60099-4// AS PER Spec./Apporved GTP/Mfr's Plant Std. | IEC 60099-4/ AS PER Spec./Apporved GTP/Mfr's Plant Std. | EMTC | P | V | - |
| b) | Verification of Dimensions | Dimensional | 1 Sample/Lot | | | EMTC | P | V | - |
| c) | Meter Operation | Electrical | 100% | | | EMTC | P | V | - |
| d) | Counter Operation | Electrical | 100% | | | EMTC | P | V | - |

* Category of Responsibility: P - Actual Test Performance V - Verify and Accept W - Witness Actual testing, verify and accept

| S. No. | Components / Operations & Description of Test | Type of check | Quantum of Check / Sampling with basis | Reference document for Testing | Acceptance Norms | Format of Record | Category of responsibility | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Sub-Vendor | Manufacturer | Customer |
| e) | Water Dip Test | Physical | 100% | | No condensation of water | EMTC | P | V | - |
| | | | | | | | | | |
| **Section IV : Acceptance Tests ( All Routine and Acceptance test mentioned in applicable Technical Specification of subject Contract in question need to be carried out)** | | | | | | | | | |
| **1** | **Surge Arresters** | | | | | | | | |
| a) | Reference Voltage test | Electrical | Cube root of the Qty ordered | IEC 99 - 4/IS : 3070/appvd<br>GTP/As per Spec | > Surge Arrester Rating | EMTC | P | V | W |
| b) | Lightning Impulse Residual Discharge Voltage Test at 10kA | Electrical | Cube root of the Qty ordered | IEC 99 - 4/IS : 3070/appvd<br>GTP/As per Spec | IEC 99 - 4 GTP As per Spec | EMTC | P | V | W |
| c) | Partial Discharge Test | Electrical | Cube root of the Qty ordered | IEC 99 – 4/IS : 3070/appvd<br>GTP/As per Spec | < 10 pC | EMTC | P | V | W |
| d) | Thermal Stability Test on ZnO blocks | Electrical | 1 Samples per Lot | IEC 99 - 4/ /appvd<br>GTP/As per Spec | IEC 99 - 4 | EMTC | P | V | W |

* Category of Responsibility: P - Actual Test Performance V - Verify and Accept W - Witness Actual testing, verify and accept

| S. No. | Components / Operations & Description of Test | Type of check | Quantum of Check / Sampling with basis | Reference document for Testing | Acceptance Norms | Format of Record | Category of responsibility | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Sub-Vendor | Manufacturer | Customer |
| e) | Accelerated Aging test for 72 Hrs. on ZnO blocks | Electrical | 3 Samples per Lot | IEC 99 - 4/appvd GTP/As per Spec | IEC 99 - 4/appvd GTP/As per Spec | EMTC | P | V | W |
| f) | Energy Handling Test on ZnO blocks | Electrical | 3 Samples per Lot | IEC 99 - 4/appvd GTP/As per Spec | IEC 99 - 4/appvd GTP/As per Spec | EMTC | P | V | W |
| g) | Watt loss / IR measurement test on ZnO blocks | Electrical | 3 Samples per Lot | IEC 99 - 4/appvd GTP/As per Spec | IEC 99 - 4/appvd GTP/As per Spec | EMTC | P | V | W |
| h) | Seal leak Test | Physical | Cube root of the Qty ordered | IEC 99 - 4/appvd GTP/As per Spec | Megger value after dip test should be >10GΩ for L.A. >=66kV,>1GΩ for LA<66kV | EMTC | P | V | W |
| i) | Verticality Check on Assembled Surge Arrester | Mechanical | 1 Sample/ Lot | IEC 99 - 4/appvd GTP/As per Spec | Max.10 mm deviation allowed in verticality | EMTC | P | V | - |
| j) | **Galvanizing Test** | | | | | | | | |
| (i) | Uniformity of Zn Coating | Chemical | 2 Sample/ Lot | IS 2633 | IS 2633 | EMTC | P | V | W |

* Category of Responsibility: P - Actual Test Performance V - Verify and Accept W - Witness Actual testing, verify and accept

| S. No. | Components / Operations & Description of Test | Type of check | Quantum of Check / Sampling with basis | Reference document for Testing | Acceptance Norms | Format of Record | Category of responsibility | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Sub-Vendor | Manufacturer | Customer |
| (ii) | Weight of Zn Coating | Chemical | 2 Sample/ Lot | IS 2633 | IS 2633 | EMTC | P | V | W |
| (iii) | Adhesion Test | Physical | 2 Samples/Lot | IS 2633 | IS 2633 | EMTC | P | V | W |
| | | | | | | | | | |
| **2** | **Surge Monitor** | | | | | | | | |
| a) | Visual Examination | Visual | Cube root of the Qty ordered | IEC 60099-4/ AS PER Spec./Apporved GTP/Mfr's Plant Std. | IEC 60099-4/ AS PER Spec./Apporved GTP/Mfr's Plant Std. | EMTC | P | V | W |
| b) | Verification of Dimensions | Dimensional | | | | EMTC | P | V | W |
| c) | Water Dip Test | Physical | | | | EMTC | P | V | W |
| d) | Counter Operation at 10kA 8/20µs | Electrical | | | | EMTC | P | V | W |
| e) | MiliiAmmeter Operation | Electrical | | | | EMTC | P | V | W |
| | | | | | | | | | |
| **Section V: Packing & Dispatch** | | | | | | | | | |
| **1** | Physical | visual | AS PER Spec./ Apporved GTP/Mfr's Plant Std. | | | EMTC | P | V | - |
| **2** | Dimension | Physical | | | | EMTC | P | V | - |

EM : Equipment Manufacturer CM : Component Manufacturer CMTC :- Component manufacturer test certificate EMTR :- Equipment manufacturer test Report

* Category of Responsibility: P - Actual Test Performance V - Verify and Accept W - Witness Actual testing, verify and accept

# Transformer/ Reactors

For Model QAP of Transformer/ Reactor (66 kV and above), Annexure-E of CEA's Standard Specification and Technical Parameters for Transformers and Reactors (66 kV & above Voltage Class) shall be referred.

**Note:** Purchaser reserves the right to review the records of all tests specified in this document at the time of final acceptance.

* Category of Responsibility: P - Actual Test Performance V - Verify and Accept W - Witness Actual testing, verify and accept

# ANNEXURE B

# MODEL QAPs OF MAJOR EQUIPMENT IN HYDRO POWER PLANT

**List of Major Equipment in Hydro Power Plant for Model QAP Preparation:**

| Sl. No. | Name of Equipment |
|---|---|
| 1) | Hydro Turbine/ Pump Turbine & Governing System<br>a) Runner<br>b) Stay Rings<br>c) Discharge Ring<br>d) Spiral Casing<br>e) Head Cover<br>f) Bottom Ring<br>g) Turbine Shaft<br>h) Turbine Shaft seal<br>i) Servo Motor<br>j) Turbine Guide Bearing<br>k) Labyrinth<br>l) Injector (Nozzle Assembly)<br>m) Guide Apparatus<br>n) Digital Governing System |
| 2) | Generator<br>a) Rotor<br>b) Stator<br>c) Generator Shaft<br>d) Generator Bracket<br>e) Generator Guide and/ or Thrust Bearings |
| 3) | Main Inlet Valve (Spherical / Butterfly Valve) |
| 4) | Penstock Valve (Butterfly Valve) |
| 5) | i. Static Excitation System for Synchronous machines<br>ii. Dynamic Excitation System for Asynchronous machines |
| 6) | Isolated Phase Bus Duct (IPBD) / Segregated Phase Bus Duct (SPBD) |
| 7) | EOT Crane |
| 8) | Lubricating and Insulating Oil Handling System |
| 9) | i. Static Frequency Converter (SFC) system<br>ii. Variable-Frequency Drive (VFD) |
| 10) | Current Limiting Reactors |
| 11) | Generator Circuit Breaker |

| | |
|---|---|
| 12) | Phase Reversal Disconnecting Switch |
| 13) | i. Dynamic Braking cubicle<br>ii. Starting Switch |
| 14) | EHV XLPE cable and termination bushings |
| 15) | Shunt Reactor/ Generator Transformer/ Distribution Transformer ** |
| 16) | Circuit Breaker** |
| 17) | Isolator** |
| 18) | Lightning Arrester** |
| 19) | Wave Trap** |
| 20) | Instrument Transformers (CT, PT)** |
| 21) | LV and MV Switchgear** |
| 22) | GIS & Hybrid Switchgear** |
| 23) | Cables and associated Joints** |
| 24) | Battery and Battery Charger** |
| 25) | Transformer/ Reactor Fittings and Accessories** |

** MQAPs of Transmission Sector shall be referred for these equipment.

Note:- MQAPs of those E&M equipment which have not been covered in this section shall be subject to the terms of mutual agreement between manufacturer and purchaser.

## Index of Model QAPs of major Equipment in Hydro Power Plant:


| Sl. No. | Name of Equipment | Page Nos. |
|---|---|---|
| 1) | Hydro Turbine/ Pump Turbine & Governing System<br>a) Runner<br>b) Stay Rings<br>c) Discharge Ring<br>d) Spiral Casing<br>e) Head Cover<br>f) Bottom Ring<br>g) Turbine Shaft<br>h) Turbine Shaft seal<br>i) Servo Motor<br>j) Turbine Guide Bearing<br>k) Labyrinth<br>l) Injector (Nozzle Assembly)<br>m) Guide Apparatus<br>n) Digital Governing System | B-7-B-57 |
| 2) | Generator<br>a) Rotor<br>b) Stator<br>c) Generator Shaft<br>d) Generator Bracket<br>e) Generator Guide and/ or Thrust Bearings | B-58-93 |
| 3) | Main Inlet Valve (Spherical/ Butterfly Valve) | B-94-B-107 |
| 4) | Penstock Valve (Butterfly Valve) | B-94-B-107 |
| 5) | i. Static Excitation System for Synchronous machines<br>ii. Dynamic Excitation System for Asynchronous machines | B-108-B-118<br>B-119-B-125 |
| 6) | Isolated Phase Bus Duct (IPBD) / Segregated Phase Bus Duct (SPBD) | B-126-B-139 |
| 7) | EOT Crane | B-140-B-147 |
| 8) | Lubricating and Insulating Oil Handling System | B-148-B-157 |
| 9) | i. Static Frequency Converter (SFC) system<br>ii. Variable-Frequency Drive (VFD) | B-158-B-163<br>B-164-B-167 |
| 10) | Current Limiting Reactors | B-168-B-170 |

| | | |
|---|---|---|
| 11) | Generator Circuit Breaker | B-171-B-174 |
| 12) | Phase Reversal Disconnecting Switch | B-175-B-178 |
| 13) | i. Dynamic Braking cubicle<br>ii. Starting Switch | B-179-B-181<br>B-182-B-186 |
| 14) | EHV XLPE cable and termination bushings | B-187-B-200 |
| 15) | Shunt Reactor/ Generator Transformer/ Distribution Transformer ** | |
| 16) | Circuit Breaker** | |
| 17) | Isolator** | |
| 18) | Lightning Arrester** | |
| 19) | Wave Trap** | |
| 20) | Instrument Transformers (CT, PT)** | |
| 21) | LV and MV Switchgear** | |
| 22) | GIS & Hybrid Switchgear** | |
| 23) | Cables and associated Joints** | |
| 24) | Battery and Battery Charger** | |
| 25) | Transformer/ Reactor Fittings and Accessories** | |

** MQAPs of Transmission Sector shall be referred for these equipment.

## Abbreviations used in Model QAPs:

| S. No | Abbreviation | Full Form |
|---|---|---|
| 1. | IS | Indian Standard |
| 2. | IEC | International Electrotechnical Commission |
| 3. | NABL | National Accreditation Board for Testing and Calibration Laboratories |
| 4. | RR | Review of Records |
| 5. | TC | Test Certificate |
| 6. | TR | Test Report |
| 7. | JIR | Joint Inspection Report |
| 8. | CHP | Customer Hold Point |
| 9. | IR | Internal Report |
| 10. | P | Perform |
| 11. | W | Witness |
| 12. | NDT | Non-Destructive Testing |
| 13. | RT | Radiographic Testing |
| 14. | UT | Ultrasonic Testing |
| 15. | MPI | Magnetic Particle Inspection |
| 16. | DPT | Dye Penetrant Test |
| 17. | HVOF | High Velocity Oxygen Fuel |

## 1) HYDRO TURBINE/ PUMP TURBINE & GOVERNING SYSTEM

| उपस्कर का नाम (NAME OF EQUIPMENT) : Stay Ring & Spiral Casing | | | | विक्रेता (VENDOR) : | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | एनआईटी/ क्रय आदेश संदर्भ (NIT/P.O. REFERENCE) : | | | | | |
| क्र. सं. SR. NO. | मद/घटक एवं विशेषता ITEM /COMPONENTS & CHARACTERISTICS | जाँच की प्रकृति NATURE OF CHECKS | जाँच की मात्रा QUANTUM OF CHECKS | संदर्भ दस्तावेज़ / स्वीकृति मानदंड REFERENCE DOCUMENTS/ ACCEPTANCE NORMS | रिकॉर्ड प्रारूप RECORD FORMAT | निरीक्षण एजेंसी (INSP. AGENCY) | | | टिप्पणी REMARKS |
| | | | | | | प्रदर्शन Perform | गवाह Witness | सत्यापन Verify | |
| **1** | **Raw Material** | | | | | | | | |
| 1.1 | Casting/Plate for Parallel Ring, Stay Vane & Spiral Casing | | | Appd. drawings/ Tech. specs./IS/IEC/Equivalent | | | | | |
| a) | Chemical Composition | Chemical Test | Sample per Lot | | TC | 3/2 | - | 1 | TC |
| b) | Mechanical Analysis-As Applicable (Tensile Test, Impact Test, Hardness Test ) | Mechanical Test | Sample per Lot | -do- | TC | 3/2 | - | 1 | TC |
| c) | NDT of Plate Material | UT, MPI, DPT (as applicable) | 100% | -do- | TC | 3/2 | - | 1 | TC |
| **2** | **In Process Stage** | | | | | | | | |
| 2.1 | Post weld Heat treatment | Heat Chart | -do- | -do- | TC | 3/2 | - | 1 | TC |
| 2.2 | Welder Certification | Visual | 100% | -do- | TC | 3/2 | - | 1 | TC |
| 2.3 | NDT of Weld Joints after Heat Treatment | UT, MPI, DPT (as applicable) | -do- | -do- | TC | 3/2 | - | 1 | TC |
| 2.4 | Dimensional Check -PCD, Dia & orientation of Holes w.r.t. parting plane, Concentricity | Visual / Measurement | -do- | -do- | IR | 3/2 | - | 1 | RR |
| 2.5 | Marking of X-Y axis | Visual | -do- | -do- | IR | 3/2 | - | 1 | RR |
| **3** | **Final Inspection** | | | | | | | | |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 3.1 | Layout check of individual segments with dummy stay ring | Visual / Measurement | Critical Dim. | -do- | IR | 3/2 | - | 1 | TC |
| 3.2 | Dimensional check of Stay Ring after machining. | -do- | 100% | -do- | JIR | 3/2 | 1 | - | CHP |
| **4** | **Surface Preparation & Painting** | -do- | -do- | -do- | TC | 3/2 | - | 1 | TC |
| Note : | a. In 'Inspection Agency'column figure 1,2,or 3 to be filled. 1- will indicate 'Employer', 2- will indicate 'supplier' & 3- will indicate 'sub-supplier'. | | | | | | | | |
| | b. In 'Remarks' column following abbreviations shall be used - RR-Review of Records, T.C. - Test Certificate Submission, JIR-Joint Inspection Report & CHP - Customer Hold Point. | | | | | | | | |
| | c. The firm shall obtain acceptance/clearance of finished product for further activities based on Test Certificates & Internal Report (IR) | | | | | | | | |
| | d. At the time of Inspection the supplier shall arrange the requisite calibrated measuring instruments i.e.micrometer, vernier caliper, pie tape, surface roughness tester, dial gauge etc. | | | | | | | | |
| | e.This QAP does not absolve the Contractor/sub-contractor of his responsibility to supply the correct products, strictly in conformity to the specifications given in the purchase order/contract. The above Model QAP stipulates the bare minimum requirements which shall be complied by the contractor. The above QAP has been made presuming subletting of work shall be allowed in the tender. In case subletting of work is not allowed in the tender, then"3/2" shall be considered as "2" under the column " Perform" . | | | | | | | | |
| | f.Material testing shall be conducted from Govt. Lab, NABL Lab or NABL accredited lab having valid Scope of accreditation of all specified tests mentioned in approved QAP. NDT shall be conducted from NABL accredited lab/Govt. approved lab/Level 2 or level 3 certified person. | | | | | | | | |
| | g. Any additional test required as per the requirement of equipment in accordance with Contract Agreement/Relevent standard apart from QAP will be carried out by the firm without any additional financial implication. | | | | | | | | |
| | | | Signature | | | **Signature & Seal** | | | |
| | | | **EMPLOYER ( QA&I DEPT.)** | | **(VENDORS Q.C. DEPT. OR REPRESENTATIVE)** | | | | |

| **परियोजना (PROJECT) :** | | | | **ग्राहक (CLIENT) :** | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **उपस्कर का नाम (NAME OF EQUIPMENT) : - Bottom Ring** | | | | **विक्रेता (VENDOR) :** | | | | | |
| | | | | **एनआईटी/ क्रय आदेश संदर्भ (NIT/P.O. REFERENCE) :** | | | | | |
| **क्र. सं. SR. NO.** | **मद/घटक एवं विशेषता ITEM /COMPONENTS & CHARACTERISTICS** | **जाँच की प्रकृति NATURE OF CHECKS** | **जाँच की मात्रा QUANTUM OF CHECKS** | **संदर्भ दस्तावेज़ / स्वीकृति मानदंड REFERENCE DOCUMENTS/ ACCEPTANCE NORMS** | **रिकॉर्ड प्रारूप RECORD FORMAT** | **निरीक्षण एजेंसी (INSP. AGENCY)** | | | **टिप्पणी REMARKS** |
| | | | | | | **प्रदर्शन Perform** | **गवाह Witness** | **सत्यापन Verify** | |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **1** | **Raw Material** | | | | | | | | |
| 1.1 | Plates / Carbon Steel | | | Appd. drawings/ Tech. specs./IS/IEC/Equivalent | | | | | |
| a) | Test Piece Marking | Visual | Sample per Lot | | IR | 3/2 | - | 1 | TC |
| b) | Chemical Composition | Chemical Test | Sample per Lot | | IR | 3/2 | - | 1 | TC |
| c) | Mechanical Analysis- As applicable (Tensile Test, Impact Test and Hardness Test ) | Mechanical Test | - do- | -do- | IR | 3/2 | - | 1 | TC |
| d) | NDT of Plates / Casting | UT, MPI, DPT (as applicable) | 100% | -do- | TC | 3/2 | - | 1 | TC |
| **2** | **In Process Stage** | | | | | | | | |
| 2.1 | Welder Certification | Visual | 100% | -do- | TC | 3/2 | - | 1 | TC |
| 2.2 | Post Weld Stress Relieving | Heat chart | -do- | -do- | IR | 3/2 | - | 1 | TC |
| 2.3 | NDT on weld joints after Heat Treatment | UT, MPI, DPT (as applicable) | -do- | -do- | TC | 3/2 | - | 1 | TC |
| 2.4 | Dimensions check and Flatness of liner plate face | Measurement | - do- | -do- | IR | 3/2 | - | 1 | TC |
| **3** | **Final Inspection before HP-HVOF Coating** | | | | | | | | |
| 3.1 | Marking of X & Y axis | Visual / Measurement | 100% | -do- | IR | 3/2 | - | 1 | TC |
| 3.2 | Dimensional check & Surface finish check | Measurement | Critical Dim. | -do- | IR | 3/2 | - | 1 | TC |
| 3.3 | Proof Assly. with Guide Apparatus Assembly | Measurement | 100% | -do- | IR | 3/2 | - | 1 | TC |
| 3.4 | Attachment/Tagging of atleast five sample pieces with Job before start of coating ( If HVOF coating is applicable) | Visual | Sample | -do- | IR | 3/2 | - | 1 | TC |
| **4** | **HVOF Coating (If applicable)** | | | | | | | | |
| 4.1 | Chemical Composition of coating Powder | Test | Sample per Lot | -do- | TC | 3/2 | - | 1 | TC |
| 4.2 | Detachment of sample pieces after coating | Visual | Sample | -do- | IR | 3/2 | - | 1 | TC |
| 4.3 | Mechanical Properties- Micro Hardness, Porosity, Bond Strength on sample | Visual & Measurement | Sample per Lot | -do- | IR | 3/2 | - | 1 | TC |
| 4.4 | Coating Thickness | Visual & Measurement | Sample | -do- | IR | 3/2 | - | 1 | TC |

| | |
|---|---|
| Note : | a. In 'Inspection Agency'column figure 1,2,or 3 to be filled. 1- will indicate'Employer', 2- will indicate 'supplier' & 3- will indicate 'sub-supplier'. |
| | b. In 'Remarks' column following abbreviations shall be used - RR-Review of Records, T.C. - Test Certificate Submission, JIR-Joint Inspection Report & CHP - Customer Hold Point. |
| | c. The firm shall obtain acceptance/clearance of finished product for further activities based on Test Certificates & Internal Report (IR) |
| | d. At the time of Inspection the supplier shall arrange the requisite calibrated measuring instruments i.e.micrometer, vernier caliper, pie tape, surface roughness tester, dial gauge etc. |
| | e.This QAP does not absolve the Contractor/sub-contractor of his responsibility to supply the correct products, strictly in conformity to the specifications given in the purchase order/contract. The above Model QAP stipulates the bare minimum requirements which shall be complied by the contractor. The above QAP has been made presuming subletting of work shall be allowed in the tender. In case subletting of work is not allowed in the tender, then"3/2" shall be considered as "2" under the column " Perform" . |
| | f.Material testing shall be conducted from Govt. Lab, NABL Lab or NABL accredited lab having valid Scope of accreditation of all specified tests mentioned in approved QAP. NDT shall be conducted from NABL accredited lab/Govt. approved lab/Level 2 or level 3 certified person. |
| | g. Any additional test required as per the requirement of equipment in accordance with Contract Agreement/Relevent standard apart from QAP will be carried out by the firm without any additional financial implication. |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | |
| | | | Signature | | | **Signature & Seal** | | | |
| | | | **EMPLOYER ( QA&I DEPT.)** | | **(VENDORS Q.C. DEPT. OR REPRESENTATIVE)** | | | | |

| **परियोजना (PROJECT) :** | | | | **ग्राहक (CLIENT) :** | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **उपस्कर का नाम (NAME OF EQUIPMENT) : -Discharge Ring** | | | | **विक्रेता (VENDOR) :** | | | | | |
| | | | | **एनआईटी/ क्रय आदेश संदर्भ (NIT/P.O. REFERENCE) :** | | | | | |
| **क्र. सं. SR. NO.** | **मद/घटक एवं विशेषता ITEM /COMPONENTS & CHARACTERISTICS** | **जाँच की प्रकृति NATURE OF CHECKS** | **जाँच की मात्रा QUANTUM OF CHECKS** | **संदर्भ दस्तावेज़ / स्वीकृति मानदंड REFERENCE DOCUMENTS/ ACCEPTANCE NORMS** | **रिकॉर्ड प्रारूप RECORD FORMAT** | **निरीक्षण एजेंसी (INSP. AGENCY)** | | | **टिप्पणी REMARKS** |
| | | | | | | **प्रदर्शन Perform** | **गवाह Witness** | **सत्यापन Verify** | |
| **1** | **Raw Material** | | | | | | | | |
| 1.1 | Plates / Casting - | | | Appd. drawings/ Tech. specs./IS/IEC/Equivalent | | | | | |
| a) | Chemical Composition | Chemical Test | Sample per Lot | | TC | 3/2 | - | 1 | TC |
| b) | Mechanical Analysis- As applicable (Tensile Test, Impact Test and Hardness Test ) | Mechanical Test | - do- | -do- | TC | 3/2 | - | 1 | TC |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| c) | NDT of Plates | UT, MPI, DPT (as applicable) | 100% | -do- | TC | 3/2 | - | 1 | TC |
| **2** | **In Process Stage** | | | | | | | | |
| 2.1 | Post Weld Stress Relieving | Heat chart | -do- | -do- | IR | 3/2 | - | 1 | TC |
| 2.2 | Welder Certification | Visual | 100% | -do- | TC | 3/2 | - | 1 | TC |
| 2.3 | NDT on weld joints after Heat Treatment | UT, MPI, DPT (as applicable) | 100% | -do- | TC | 3/2 | - | 1 | TC |
| 2.4 | Dimensional Check of Machined Surface | Measurement | 100% | -do- | IR | 3/2 | - | 1 | RR |
| **3** | **Final Inspection** | | | | | | | | |
| 3.1 | Marking of X & Y axis | Visual / Measurement | 100% | -do- | IR | 3/2 | - | 1 | TC |
| 3.2 | Dimensional check | Measurement | Critical Dim. | -do- | IR | 3/2 | - | 1 | TC |
| 3.3 | Attachment/Tagging of atleast five sample pieces with Job before start of coating ( If HVOF coating is applicable) | Visual | Sample | -do- | IR | 3/2 | - | 1 | TC |
| **4** | **HVOF Coating (If applicable)** | | | | | | | | |
| 4.1 | Chemical Composition of coating Powder | Test | Sample per Lot | -do- | TC | 3/2 | - | 1 | TC |
| 4.2 | Detachment of sample pieces after coating | Visual | Sample | -Do- | IR | 3/2 | - | 1 | TC |
| 4.3 | Mechanical Properties- Micro Hardness, Porosity, Bond Strength on sample | Visual & Measurement | Sample per Lot | -do- | IR | 3/2 | - | 1 | TC |
| 4.4 | Coating Thickness | Visual & Measurement | Sample | -do- | IR | 3/2 | - | 1 | TC |
| Note : | a. In 'Inspection Agency'column figure 1,2,or 3 to be filled. 1- will indicate'Employer', 2- will indicate 'supplier' & 3- will indicate 'sub-supplier'. | | | | | | | | |
| | b. In 'Remarks' column following abbreviations shall be used - RR-Review of Records, T.C. - Test Certificate Submission, JIR-Joint Inspection Report & CHP - Customer Hold Point. | | | | | | | | |
| | c. The firm shall obtain acceptance/clearance of finished product for further activities based on Test Certificates & Internal Report (IR) | | | | | | | | |
| | d. At the time of Inspection the supplier shall arrange the requisite calibrated measuring instruments i.e.micrometer, vernier caliper, pie tape, surface roughness tester, dial gauge etc. | | | | | | | | |
| | e.This QAP does not absolve the Contractor/sub-contractor of his responsibility to supply the correct products, strictly in conformity to the specifications given in the purchase order/contract. The above Model QAP stipulates the bare minimum requirements which shall be complied by the contractor. The above QAP has been made presuming subletting of work shall be allowed in the tender. In case subletting of work is not allowed in the tender, then"3/2" shall be considered as "2" under the column " Perform" . | | | | | | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| | f.Material testing shall be conducted from Govt. Lab, NABL Lab or NABL accredited lab having valid Scope of accreditation of all specified tests mentioned in approved QAP. NDT shall be conducted from NABL accredited lab/Govt. approved lab/Level 2 or level 3 certified person. | | | | | |
| | g. Any additional test required as per the requirement of equipment in accordance with Contract Agreement/Relevent standard apart from QAP will be carried out by the firm without any additional financial implication. | | | | | |
| | | | Signature | | | **Signature & Seal** |
| | | | **EMPLOYER ( QA&I DEPT.)** | | **(VENDORS Q.C. DEPT. OR REPRESENTATIVE)** | |

| **परियोजना (PROJECT) :** | | | | **ग्राहक (CLIENT) :** | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **उपस्कर का नाम (NAME OF EQUIPMENT) : -Head Cover** | | | | **विक्रेता (VENDOR) :** | | | | | |
| | | | | **एनआईटी/ क्रय आदेश संदर्भ (NIT/P.O. REFERENCE) :** | | | | | |
| **क्र. सं. SR. NO.** | **मद/घटक एवं विशेषता ITEM /COMPONENTS & CHARACTERISTICS** | **जाँच की प्रकृति NATURE OF CHECKS** | **जाँच की मात्रा QUANTUM OF CHECKS** | **संदर्भ दस्तावेज़ / स्वीकृति मानदंड REFERENCE DOCUMENTS/ ACCEPTANCE NORMS** | **रिकॉर्ड प्रारूप RECORD FORMAT** | **निरीक्षण एजेंसी (INSP. AGENCY)** | | | **टिप्पणी REMARKS** |
| | | | | | | **प्रदर्शन Perform** | **गवाह Witness** | **सत्यापन Verify** | |
| **1** | **Raw Material** | | | | | | | | |
| 1.1 | Plates / Carbon Steel | | | Appd. drawings/ Tech. specs./IS/IEC/Equivalent | | | | | |
| a) | Chemical Composition | Chemical Test | - do- | | IR | 3/2 | - | 1 | TC |
| b) | Mechanical Analysis(Tensile Test, Impact Test,Hardness Test & Bend Test -Plate) As applicable | Mechanical Test | - do- | -do- | IR | 3/2 | - | 1 | TC |
| c) | NDT of Plates / Casting | UT, MPI, DPT (as applicable) | 100% | -do- | TC | 3/2 | - | 1 | TC |
| **2** | **In Process Stage** | | | | | | | | |
| 2.1 | Post Weld Stress Relieving | Heat chart | -do- | -do- | IR | 3/2 | - | 1 | TC |
| 2.2 | Welder Certification | Visual | 100% | -do- | TC | 3/2 | - | 1 | TC |
| 2.3 | NDT on weld joints after Heat Treatment | UT, MPI, DPT | -do- | -do- | TC | 3/2 | - | 1 | TC |

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|---|---|---|---|---|---|---|---|---|---|
| | | (as applicable) | | | | | | | |
| 2.4 | Dimensions check and Flatness of liner plate face | Measurement | - do- | -do- | IR | 3/2 | - | 1 | TC |
| **3** | **Final Inspection before HP-HVOF Coating** | | | | | | | | |
| 3.1 | NDT of Facing Plate after machining | | 100% | -do- | IR | 3/2 | - | 1 | TC |
| 3.2 | Marking of X &Y axis | Visual / Measurement | 100% | -do- | IR | 3/2 | - | 1 | TC |
| 3.3 | Dimensional check and Surface finish check | Measurement | Critical Dim. | -do- | IR | 3/2 | - | 1 | TC |
| 3.4 | Proof Assly. with Guide Apparatus Assembly | Measurement | 100% | -do- | IR | 3/2 | - | 1 | TC |
| 3.5 | Attachment/Tagging of atleast five sample pieces with Job before start of coating (If HVOF coating is applicable) | Visual | Sample | -do- | IR | 3/2 | - | 1 | TC |
| **4** | **HVOF Coating ( If Applicable)** | | | | | | | | |
| 4.1 | Chemical Composition of coating Powder | Test | Sample per Lot | -do- | TC | 3/2 | - | 1 | TC |
| 4.2 | Detachment of sample pieces after coating | Visual | Sample | -do- | IR | 3/2 | - | 1 | TC |
| 4.3 | Mechanical Properties- Micro Hardness, Porosity, Bond Strength on sample | Visual & Measurement | Sample per Lot | -do- | IR | 3/2 | - | 1 | TC |
| 4.4 | Coating Thickness | Visual & Measurement | Sample | -do- | IR | 3/2 | - | 1 | TC |
| Note : | a. In ‘Inspection Agency’column figure 1,2,or 3 to be filled. 1- will indicate'Employer', 2- will indicate ‘supplier’ & 3- will indicate ‘sub-supplier’. | | | | | | | | |
| | b. In ‘Remarks’ column following abbreviations shall be used - RR-Review of Records, T.C. - Test Certificate Submission, JIR-Joint Inspection Report & CHP - Customer Hold Point. | | | | | | | | |
| | c. The firm shall obtain acceptance/clearance of finished product for further activities based on Test Certificates & Internal Report (IR) | | | | | | | | |
| | d. At the time of Inspection the supplier shall arrange the requisite calibrated measuring instruments i.e.micrometer, vernier caliper, pie tape, surface roughness tester, dial gauge etc. | | | | | | | | |
| | e.This QAP does not absolve the Contractor/sub-contractor of his responsibility to supply the correct products, strictly in conformity to the specifications given in the purchase order/contract. The above Model QAP stipulates the bare minimum requirements which shall be complied by the contractor. The above QAP has been made presuming subletting of work shall be allowed in the tender. In case subletting of work is not allowed in the tender, then"3/2" shall be considered as "2" under the column " Perform" . | | | | | | | | |
| | f.Material testing shall be conducted from Govt. Lab, NABL Lab or NABL accredited lab having valid Scope of accreditation of all specified tests mentioned in approved QAP. NDT shall be conducted from NABL accredited lab/Govt. approved lab/Level 2 or level 3 certified person. | | | | | | | | |
| | g. Any additional test required as per the requirement of equipment in accordance with Contract Agreement/Relevent standard apart from QAP will be carried out by the firm without any additional financial implication. | | | | | | | | |
| | | | Signature | | | **Signature & Seal** | | | |
| | | | **EMPLOYER ( QA&I DEPT.)** | | **(VENDORS Q.C. DEPT. OR REPRESENTATIVE)** | | | | |

| परियोजना (PROJECT) : | | | | ग्राहक (CLIENT) : | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| उपस्कर का नाम (NAME OF EQUIPMENT) : -Guide Vanes | | | | विक्रेता (VENDOR) : | | | | | |
| | | | | एनआईटी/ क्रय आदेश संदर्भ (NIT/P.O. REFERENCE) : | | | | | |
| क्र. सं. SR. NO. | मद/घटक एवं विशेषता ITEM /COMPONENTS & CHARACTERISTICS | जाँच की प्रकृति NATURE OF CHECKS | जाँच की मात्रा QUANTUM OF CHECKS | संदर्भ दस्तावेज़ / स्वीकृति मानदंड REFERENCE DOCUMENTS/ ACCEPTANCE NORMS | रिकॉर्ड प्रारूप RECORD FORMAT | निरीक्षण एजेंसी (INSP. AGENCY) | | | टिप्पणी REMARKS |
| | | | | | | प्रदर्शन Perform | गवाह Witness | सत्यापन Verify | |
| **1** | **Raw Material** | | | | | | | | |
| 1.1 | Casting- | | | Appd. drawings/ Tech. specs./IS/IEC/Equivalent | | | | | |
| a) | Keel Block Identification | Visual | Sample per Lot | | IR | 3/2 | - | 1 | TC |
| b) | Chemical Composition | Chemical Test | Sample per Lot | -do- | IR | 3/2 | - | 1 | TC |
| c) | Mechanical Analysis (Tensile Test, Impact Test and Hardness Test) | Mechanical Test | - do- | -do- | IR | 3/2 | - | 1 | TC |
| d) | NDT of Casting | UT, MPI, DPT (as applicable) | 100% | -do- | TC | 3/2 | - | 1 | TC |
| **2** | **In Process Stage** | | | | | | | | |
| 2.1 | Heat Treatment | Heat Chart | -do- | -do- | IR | 3/2 | - | 1 | TC |
| 2.2 | Profile Checking | Measurement | 100% | -do- | IR | 3/2 | - | 1 | RR |
| 2.3 | Machining | | | | | | | | |
| a) | Dimensions & Surface Finish Check | Visual / Measurement | 100% | -do- | IR | 3/2 | - | 1 | TC |
| **3** | **Final Inspection before HP-HVOF Coating** | | | | | | | | |
| 3.1 | Dimensional Check & Surface finish | Measurement | Critical Dim. | -do- | IR | 3/2 | - | 1 | TC |
| 3.2 | Profile Checking with Template (Top, Middle & Bottom) | Measurement | 100% | -do- | IR | 3/2 | - | 1 | TC |

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|---|---|---|---|---|---|---|---|---|---|
| 3.3 | Coaxiality of Journal Diameters /Run out Check | -do- | 20% | -do- | IR | 3/2 | - | 1 | TC |
| 3.4 | Proof Assly. With Guide Appratus Assly. | -do- | 100% | -do- | IR | 3/2 | - | 1 | TC |
| 3.5 | Attachment/Tagging of atleast five sample pieces with one lot before start of coating (If HVOF coating is applicable) | Visual | Sample | -Do- | IR | 3/2 | - | 1 | TC |
| **4** | **HP-HVOF Coating ( If Applicable)** | | | | | | | | |
| 4.1 | Chemical Composition of coating Powder | Test | Sample per Lot | -do- | TC | 3/2 | - | 1 | TC |
| 4.2 | Detachment of sample pieces after coating | Visual | Sample | -Do- | IR | 3/2 | - | 1 | TC |
| 4.3 | Mechanical Properties- Micro Hardness, Porosity, Bond Strength on sample | Visual & Measurement | Sample per Lot | -do- | IR | 3/2 | - | 1 | TC |
| 4.4 | Coating Thickness | Visual & Measurement | Sample | -do- | IR | 3/2 | - | 1 | TC |

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| Note: | a. In 'Inspection Agency'column figure 1,2,or 3 to be filled. 1- will indicate'Employer', 2- will indicate 'supplier' & 3- will indicate 'sub-supplier'. |
| | b. In 'Remarks' column following abbreviations shall be used - RR-Review of Records, T.C. - Test Certificate Submission, JIR-Joint Inspection Report & CHP - Customer Hold Point. |
| | c. The firm shall obtain acceptance/clearance of finished product for further activities based on Test Certificates & Internal Report (IR) |
| | d. At the time of Inspection the supplier shall arrange the requisite calibrated measuring instruments i.e.micrometer, vernier caliper, pie tape, surface roughness tester, dial gauge etc. |
| | e.This QAP does not absolve the Contractor/sub-contractor of his responsibility to supply the correct products, strictly in conformity to the specifications given in the purchase order/contract. The above Model QAP stipulates the bare minimum requirements which shall be complied by the contractor. The above QAP has been made presuming subletting of work shall be allowed in the tender. In case subletting of work is not allowed in the tender, then"3/2" shall be considered as "2" under the column " Perform" . |
| | f.Material testing shall be conducted from Govt. Lab, NABL Lab or NABL accredited lab having valid Scope of accreditation of all specified tests mentioned in approved QAP. NDT shall be conducted from NABL accredited lab/Govt. approved lab/Level 2 or level 3 certified person. |
| | g. Any additional test required as per the requirement of equipment in accordance with Contract Agreement/Relevent standard apart from QAP will be carried out by the firm without any additional financial implication. |

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|---|---|---|---|---|---|---|
| | | | Signature | | | **Signature & Seal** |
| | | | **EMPLOYER ( QA&I DEPT.)** | | **(VENDORS Q.C. DEPT. OR REPRESENTATIVE)** | |

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|---|---|
| **परियोजना (PROJECT) :** | **ग्राहक (CLIENT) :** |
| **उपस्कर का नाम (NAME OF EQUIPMENT) : Servomotor** | **विक्रेता (VENDOR) :** |
| | **एनआईटी/ क्रय आदेश संदर्भ (NIT/P.O. REFERENCE) :** |

| क्र. सं. SR. NO. | मद/घटक एवं विशेषता ITEM /COMPONENTS & CHARACTERISTICS | जाँच की प्रकृति NATURE OF CHECKS | जाँच की मात्रा QUANTUM OF CHECKS | संदर्भ दस्तावेज़ / स्वीकृति मानदंड REFERENCE DOCUMENTS/ ACCEPTANCE NORMS | रिकॉर्ड प्रारूप RECORD FORMAT | निरीक्षण एजेंसी (INSP. AGENCY) | | | टिप्पणी REMARKS |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | प्रदर्शन Perform | गवाह Witness | सत्यापन Verify | |
| **1** | **Raw Material** | | | | | | | | |
| 1.1 | Cast / Forged Steel, Steel Plate and Rod | | | Appd. drawings/ Tech. specs./IS/IEC/Equivalent | | | | | |
| a) | Chemical Composition | Chemical Test | Sample per Lot | | TC | 3/2 | - | 1 | TC |
| b) | Mechanical Analysis-As Applicable (Tensile Test, Impact Test, Hardness Test etc) | Mechanical Test | - do- | -do- | TC | 3/2 | - | 1 | TC |
| c) | NDT of Material | UT, MPI, DPT (as applicable) | 100% | -do- | TC | 3/2 | - | 1 | TC |
| **2** | **In Process Stage** | | | | | | | | |
| 2.1 | Heat Treatment | Heat Chart | - do- | -do- | IR | 3/2 | - | 1 | TC |
| 2.2 | Welder Certification | Visual | 100% | -do- | TC | 3/2 | - | 1 | TC |
| 2.3 | NDT of weld joints after Heat Treatment | UT, MPI, DPT (as applicable) | - do- | | TC | 3/2 | - | 1 | TC |
| 2.4 | Dimensional check after machining | Visual/Measurement | - do- | -do- | IR | 3/2 | - | 1 | RR |
| **3** | **Final Inspection** | | | | | | | | |
| 3.1 | Dimensional check of Final Assembly | Measurement | Critical Dim. | -do- | JIR | 3/2 | 1 | - | CHP |
| 3.2 | Hydraulic pressure test of Servomotor-On test Pressure (Design Pressure) | Test | 100% | -do- | JIR | 3/2 | 1 | - | CHP |
| 3.3 | Leakage across Piston Check in fully open& fully close Position-On Working pressure | -do- | 100% | -do- | JIR | 3/2 | 1 | - | CHP |
| 3.4 | Stroke Length measurement-On Working Pressure | Visual / Measurement | -do- | -do- | JIR | 3/2 | 1 | - | CHP |
| 3.5 | Functional Test of servo-motor (Stroking 10 cycles)-on Working Pressure | -do- | -do- | -do- | JIR | 3/2 | 1 | - | CHP |
| **4** | **Painting** | -do- | -do- | -do- | TC | 3/2 | - | 1 | TC |
| Note | a. In 'Inspection Agency'column figure 1,2,or 3 to be filled. 1- will indicate'Employer', 2- will indicate 'supplier' & 3- will indicate 'sub-supplier'. | | | | | | | | |

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|---|---|
| : | |
| | b. In 'Remarks' column following abbreviations shall be used - RR-Review of Records, T.C. - Test Certificate Submission, JIR-Joint Inspection Report & CHP - Customer Hold Point. |
| | c. The firm shall obtain acceptance/clearance of finished product for further activities based on Test Certificates & Internal Report (IR) |
| | d. At the time of Inspection the supplier shall arrange the requisite calibrated measuring instruments i.e.micrometer, vernier caliper, pie tape, surface roughness tester, dial gauge etc. |
| | e.This QAP does not absolve the Contractor/sub-contractor of his responsibility to supply the correct products, strictly in conformity to the specifications given in the purchase order/contract. The above Model QAP stipulates the bare minimum requirements which shall be complied by the contractor. The above QAP has been made presuming subletting of work shall be allowed in the tender. In case subletting of work is not allowed in the tender, then"3/2" shall be considered as "2" under the column " Perform" . |
| | f.Material testing shall be conducted from Govt. Lab, NABL Lab or NABL accredited lab having valid Scope of accreditation of all specified tests mentioned in approved QAP. NDT shall be conducted from NABL accredited lab/Govt. approved lab/Level 2 or level 3 certified person. |
| | g. Any additional test required as per the requirement of equipment in accordance with Contract Agreement/Relevent standard apart from QAP will be carried out by the firm without any additional financial implication. |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | | Signature | | | **Signature & Seal** |
| | | | **EMPLOYER ( QA&I DEPT.)** | | **(VENDORS Q.C. DEPT. OR REPRESENTATIVE)** | |

| **परियोजना (PROJECT) :** | | | | **ग्राहक (CLIENT) :** | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **उपस्कर का नाम (NAME OF EQUIPMENT) : - Francis Runner** | | | | **विक्रेता (VENDOR) :** | | | | | |
| | | | | **एनआईटी/ क्रय आदेश संदर्भ (NIT/P.O. REFERENCE) :** | | | | | |
| **क्र. सं. SR. NO.** | **मद/घटक एवं विशेषता ITEM /COMPONENTS & CHARACTERISTICS** | **जाँच की प्रकृति NATURE OF CHECKS** | **जाँच की मात्रा QUANTUM OF CHECKS** | **संदर्भ दस्तावेज़ / स्वीकृति मानदंड REFERENCE DOCUMENTS/ ACCEPTANCE NORMS** | **रिकॉर्ड प्रारूप RECORD FORMAT** | **निरीक्षण एजेंसी (INSP. AGENCY)** | | | **टिप्पणी REMARKS** |
| | | | | | | **प्रदर्शन Perform** | **गवाह Witness** | **सत्यापन Verify** | |
| **1** | **Runner (Runner casting, Plate/blade,Crown, Band)** | | | Appd. drawings/ Tech. specs./IS/IEC/Equivalent | | | | | |
| 1.1 | Keel Block Identification | Visual | Sample per Lot | | JIR | 3/2 | 1 | - | CHP |
| 1.2 | Chemical Composition | Chemical Test | - do- | | JIR | 3/2 | 1 | - | CHP |
| 1.3 | Mechanical Analysis (Tensile Test, Impact Test, Hardness Test etc) | Mechanical Test | - do- | -do- | JIR | 3/2 | 1 | - | CHP |
| 1.4 | Microstructure of material | Metallurgical Test | - do- | -do- | JIR | 3/2 | 1 | - | CHP |

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|---|---|---|---|---|---|---|---|---|---|
| **2** | **In Process Stage Inspection** | | | | | | | - | |
| 2.1 | Welder Certification | Visual | 100% | -do- | TC | 3/2 | - | 1 | TC |
| 2.2 | Heat Treatment & S/R of Complete Runner | H-T Chart | -do- | -do- | TC | 3/2 | - | 1 | TC |
| 2.3 | NDT of Casting/blades of Runner after heat treatment & S/R | RT, UT, MPI, DPT (as applicable) | -do- | -do- | JIR | 3/2 | 1 | - | CHP |
| 2.4 | Dimensional and profile check before machining | Measurement | -do- | -do- | JIR | 3/2 | 1 | - | CHP |
| **3** | **Final Inspection before HVOF Coating.** | | | | | | | | |
| 3.1 | Dimension Check and Surface Finish | -do- | Critical Dim. | -do- | JIR | 3/2 | 1 | - | CHP |
| 3.2 | Concentricity & Run Out Check of labyrinth with Runner | -do- | 100% | -do- | IR | 3/2 | - | 1 | TC |
| 3.3 | Profile checking with templates. | -do- | -do- | -do- | JIR | 3/2 | 1 | - | CHP |
| 3.4 | Inlet & Outlet Pitch | Measurement with Template | -do- | -do- | JIR | 3/2 | 1 | - | CHP |
| 3.5 | Water paths (Pr.and Suction Side) Profile Check | | -do- | -do- | JIR | 3/2 | 1 | - | CHP |
| 3.6 | NDT for Surface / Sub-surface Defects after machining | UT, MPI, DPT (as applicable) | -do- | -do- | JIR | 3/2 | 1 | - | CHP |
| 3.7 | Attachment/Tagging of atleast five sample pieces with Job before start of coating (If HVOF is applicable) | Visual | Sample | -Do- | IR | 3/2 | - | 1 | TC |
| **4** | **Static & Dynamic Balancing of Runner** | Measurement | -do- | -do- | JIR | 3/2 | 1 | - | CHP |
| **5** | **Final Inspection after HVOF Coating ( If Applicable)** | | | | | | | | |
| 5.1 | Chemical Composition of coating Powder | Measurement | Lot/ sample | -Do- | TC | 3/2 | - | 1 | TC |
| 5.2 | Detachment of sample pieces after coating | Visual | Sample | -Do- | IR | 3/2 | - | 1 | TC |
| 5.3 | Mechanical Properties- Micro Hardness, Porosity, Bond Strength on sample | Visual & Measurement | Sample per Lot | -do- | IR | 3/2 | - | 1 | TC |
| 5.4 | Coating thickness | Measurement | Sample | -do- | IR | 3/2 | - | 1 | TC |
| 5.5 | Dimension checking after coating | Measurement | Critical Dim. | -do- | IR | 3/2 | - | 1 | TC |
| Note : | a. In 'Inspection Agency'column figure 1,2,or 3 to be filled. 1- will indicate'Employer', 2- will indicate 'supplier' & 3- will indicate 'sub-supplier'. | | | | | | | | |
| | b. In 'Remarks' column following abbreviations shall be used - RR-Review of Records, T.C. - Test Certificate Submission, JIR-Joint Inspection Report & CHP - Customer Hold Point. | | | | | | | | |
| | c. The firm shall obtain acceptance/clearance of finished product for further activities based on Test Certificates & Internal Report (IR) | | | | | | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| | d. At the time of Inspection the supplier shall arrange the requisite calibrated measuring instruments i.e.micrometer, vernier caliper, pie tape, surface roughness tester, dial gauge etc. | | | | | |
| | e.This QAP does not absolve the Contractor/sub-contractor of his responsibility to supply the correct products, strictly in conformity to the specifications given in the purchase order/contract. The above Model QAP stipulates the bare minimum requirements which shall be complied by the contractor. The above QAP has been made presuming subletting of work shall be allowed in the tender. In case subletting of work is not allowed in the tender, then"3/2" shall be considered as "2" under the column " Perform" . | | | | | |
| | f.Material testing shall be conducted from Govt. Lab, NABL Lab or NABL accredited lab having valid Scope of accreditation of all specified tests mentioned in approved QAP. NDT shall be conducted from NABL accredited lab/Govt. approved lab/Level 2 or level 3 certified person. | | | | | |
| | g. Any additional test required as per the requirement of equipment in accordance with Contract Agreement/Relevent standard apart from QAP will be carried out by the firm without any additional financial implication. | | | | | |
| | | | **Signature** | | | **Signature & Seal** |
| | | | **EMPLOYER ( QA&I DEPT.)** | | | **(VENDORS Q.C. DEPT. OR REPRESENTATIVE)** |

| **परियोजना (PROJECT) :** | | | | **ग्राहक (CLIENT) :** | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **उपस्कर का नाम (NAME OF EQUIPMENT) : - Labyrinth** | | | | **विक्रेता (VENDOR) :** | | | | | |
| | | | | **एनआईटी/ क्रय आदेश संदर्भ (NIT/P.O. REFERENCE) :** | | | | | |
| **क्र. सं. SR. NO.** | **मद/घटक एवं विशेषता ITEM /COMPONENTS & CHARACTERISTICS** | **जाँच की प्रकृति NATURE OF CHECKS** | **जाँच की मात्रा QUANTUM OF CHECKS** | **संदर्भ दस्तावेज़ / स्वीकृति मानदंड REFERENCE DOCUMENTS/ ACCEPTANCE NORMS** | **रिकॉर्ड प्रारूप RECORD FORMAT** | **निरीक्षण एजेंसी (INSP. AGENCY)** | | | **टिप्पणी REMARKS** |
| | | | | | | **प्रदर्शन Perform** | **गवाह Witness** | **सत्यापन Verify** | |
| **1** | **Raw Material** | | | | | | | | |
| 1.1 | Test Piece Marking | Visual | Sample per Lot | Appd. Drawings/Tech. specs./IS/IEC/Equivalent | IR | 3/2 | - | 1 | TC |
| 1.2 | Chemical Composition | Chemical Test | Sample per Lot | | IR | 3/2 | - | 1 | TC |
| 1.3 | Mechanical Analysis-As applicable (Tensile test, Impact test, Hardness etc.) | Mech. Test | Sample per Lot | -do- | IR | 3/2 | - | 1 | TC |
| **2** | **In Process Stage** | | | | | | | | |
| 2.1 | Heat Treatment | Heat chart | -do- | -do- | IR | 3/2 | - | 1 | TC |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 2.2 | NDT of forged material after heat treatment | RT, UT, MPI, DPT (as applicable) | -do- | -do- | TC | 3/2 | - | 1 | TC |
| 2.3 | Dimension checking of forged Labyrinth after machining | Measurement | 100% | -do- | IR | 3/2 | - | 1 | RR |
| **3** | **Final Inspection before HVOF coating** | | | | | | | | |
| 3.1 | Dimensional Check | Measurement | Critical Dim. | -do- | IR | 3/2 | - | 1 | TC |
| 3.2 | NDT of forged/ casting/ fabrication material after machining. | UT, MPI, DPT (as applicable) | 100% | -do- | IR | 3/2 | - | 1 | TC |
| 3.3 | Attachment/Tagging of atleast five sample pieces with Job before start of coating (If HVOF coating is applicable) | Visual | Sample | -Do- | IR | 3/2 | - | 1 | TC |
| **4** | **HP-HVOF Coating (If applicable)** | | | | | | | | |
| 4.1 | Chemical Composition of coating Powder | Measurement | Lot/ sample | -Do- | TC | 3/2 | - | 1 | TC |
| 4.2 | Detachment of sample pieces after coating | Visual | Sample | -Do- | IR | 3/2 | - | 1 | TC |
| 4.3 | Mechanical Properties- Micro Hardness, Porosity, Bond Strength on sample | Visual & Measurement | Sample per Lot | -do- | IR | 3/2 | - | 1 | TC |
| 4.4 | Coating thickness | Measurement | Sample | -do- | IR | 3/2 | - | 1 | TC |
| Note : | a. In 'Inspection Agency'column figure 1,2,or 3 to be filled. 1- will indicate'Employer', 2- will indicate 'supplier' & 3- will indicate 'sub-supplier'. | | | | | | | | |
| | b. In 'Remarks' column following abbreviations shall be used - RR-Review of Records, T.C. - Test Certificate Submission, JIR-Joint Inspection Report & CHP - Customer Hold Point. | | | | | | | | |
| | c. The firm shall obtain acceptance/clearance of finished product for further activities based on Test Certificates & Internal Report (IR) | | | | | | | | |
| | d. At the time of Inspection the supplier shall arrange the requisite calibrated measuring instruments i.e.micrometer, vernier caliper, pie tape, surface roughness tester, dial gauge etc. | | | | | | | | |
| | e.This QAP does not absolve the Contractor/sub-contractor of his responsibility to supply the correct products, strictly in conformity to the specifications given in the purchase order/contract. The above Model QAP stipulates the bare minimum requirements which shall be complied by the contractor. The above QAP has been made presuming subletting of work shall be allowed in the tender. In case subletting of work is not allowed in the tender, then"3/2" shall be considered as "2" under the column " Perform" . | | | | | | | | |
| | f.Material testing shall be conducted from Govt. Lab, NABL Lab or NABL accredited lab having valid Scope of accreditation of all specified tests mentioned in approved QAP. NDT shall be conducted from NABL accredited lab/Govt. approved lab/Level 2 or level 3 certified person. | | | | | | | | |
| | g. Any additional test required as per the requirement of equipment in accordance with Contract Agreement/Relevent standard apart from QAP will be carried out by the firm without any additional financial implication. | | | | | | | | |
| | | | **Signature** | | | **Signature & Seal** | | | |
| | | | **EMPLOYER ( QA&I DEPT.)** | | **(VENDORS Q.C. DEPT. OR REPRESENTATIVE)** | | | | |

| परियोजना (PROJECT) : | | | | ग्राहक (CLIENT) : | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| उपस्कर का नाम (NAME OF EQUIPMENT) :-Turbine Shaft | | | | विक्रेता (VENDOR) : | | | | | |
| | | | | एनआईटी/ क्रय आदेश संदर्भ (NIT/P.O. REFERENCE) : | | | | | |
| क्र. सं. SR. NO. | मद/घटक एवं विशेषता ITEM /COMPONENTS & CHARACTERISTICS | जाँच की प्रकृति NATURE OF CHECKS | जाँच की मात्रा QUANTUM OF CHECKS | संदर्भ दस्तावेज़ / स्वीकृति मानदंड REFERENCE DOCUMENTS/ ACCEPTANCE NORMS | रिकॉर्ड प्रारूप RECORD FORMAT | निरीक्षण एजेंसी (INSP. AGENCY) | | | टिप्पणी REMARKS |
| | | | | | | प्रदर्शन Perform | गवाह Witness | सत्यापन Verify | |
| **1** | **Raw Material** | | | | | | | | |
| 1.1 | Forged Shaft-Forged Carbon Steel | | | Appd. Drawings/Tech. specs./IS/IEC/Equivalent | | | | | |
| a) | Test Piece Marking | Visual | Sample per Lot | | JIR | 3/2 | 1 | - | CHP |
| b) | Chemical Composition | Chemical Test | Sample per Lot | -do- | JIR | 3/2 | 1 | - | CHP |
| c) | Mechanical Analysis-As applicable (Tensile Test, Impact Test, Hardness Test & Bend Test) | Mechanical Test | - do- | -do- | JIR | 3/2 | 1 | - | CHP |
| d) | NDT of Shaft | UT, MPI, DPT (as applicable) | 100% | - do- | IR | 3/2 | - | 1 | RR |
| **2** | **In Process Stage** | | | | | | | | |
| 2.1 | Heat treatment | Heat Chart | - do- | - do- | IR | 3/2 | - | 1 | TC |
| 2.2 | Post Heat Treatment- NDT of Shaft (Radial & Axial Direction) | RT, UT, MPI, DPT (as applicable) | - do- | - do- | IR | 3/2 | - | 1 | RR |
| 2.3 | Dimensional examination after rough machining | Measurement | - do- | - do- | IR | 3/2 | - | 1 | RR |
| **3** | **Final Inspection** | | | | | | | | |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 3.1 | Boroscopic Examination of Shaft - Centre Bore Dia | Visual / Measurement | - do- | - do- | JIR | 3/2 | 1 | - | CHP |
| 3.2 | NDT for Surface / Sub-surface Defects | UT, MPI, DPT (as applicable) | - do- | - do- | JIR | 3/2 | 1 | - | CHP |
| 3.3 | Run out check of Turbine shaft, Flanges | Measurement | - do- | - do- | JIR | 3/2 | 1 | - | CHP |
| 3.4 | Dimension check for Shaft | Visual / Measurement | Critical Dim. | - do- | JIR | 3/2 | 1 | - | CHP |
| 3.5 | Concavity & Convexity of Flanges | Measurement | 100% | - do- | JIR | 3/2 | 1 | - | CHP |
| 3.6 | Surface Finish Check of Guide Bearing Journals & Flanges | Visual / Measurement | Sample | - do- | JIR | 3/2 | 1 | - | CHP |
| 3.7 | Dimensional check for coupling holes ( Both side) | Visual / Measurement | 100% | - do- | JIR | 3/2 | 1 | - | CHP |
| **4** | **Painting** | Visual / Measurement | - do- | - do- | TC | 3/2 | - | 1 | TC |
| Note : | a. In 'Inspection Agency'column figure 1,2,or 3 to be filled. 1- will indicate'Employer', 2- will indicate 'supplier' & 3- will indicate 'sub-supplier'. | | | | | | | | |
| | b. In 'Remarks' column following abbreviations shall be used - RR-Review of Records, T.C. - Test Certificate Submission, JIR-Joint Inspection Report & CHP - Customer Hold Point. | | | | | | | | |
| | c. The firm shall obtain acceptance/clearance of finished product for further activities based on Test Certificates & Internal Report (IR) | | | | | | | | |
| | d. At the time of Inspection the supplier shall arrange the requisite calibrated measuring instruments i.e.micrometer, vernier caliper, pie tape, surface roughness tester, dial gauge etc. | | | | | | | | |
| | e.This QAP does not absolve the Contractor/sub-contractor of his responsibility to supply the correct products, strictly in conformity to the specifications given in the purchase order/contract. The above Model QAP stipulates the bare minimum requirements which shall be complied by the contractor. The above QAP has been made presuming subletting of work shall be allowed in the tender. In case subletting of work is not allowed in the tender, then"3/2" shall be considered as "2" under the column " Perform" . | | | | | | | | |
| | f.Material testing shall be conducted from Govt. Lab, NABL Lab or NABL accredited lab having valid Scope of accreditation of all specified tests mentioned in approved QAP. NDT shall be conducted from NABL accredited lab/Govt. approved lab/Level 2 or level 3 certified person. | | | | | | | | |
| | g. Any additional test required as per the requirement of equipment in accordance with Contract Agreement/Relevent standard apart from QAP will be carried out by the firm without any additional financial implication. | | | | | | | | |
| | | | **Signature** | | | **Signature & Seal** | | | |
| | | | **EMPLOYER ( QA&I DEPT.)** | | **(VENDORS Q.C. DEPT. OR REPRESENTATIVE)** | | | | |

| | |
|---|---|
| **परियोजना (PROJECT) :** | **ग्राहक (CLIENT) :** |

| उपस्कर का नाम (NAME OF EQUIPMENT) : -Turbine Guide Bearing Assembly | | | | विक्रेता (VENDOR) : | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | एनआईटी/ क्रय आदेश संदर्भ (NIT/P.O. REFERENCE) : | | | | | |
| क्र. सं. SR. NO. | मद/घटक एवं विशेषता ITEM /COMPONENTS & CHARACTERISTICS | जाँच की प्रकृति NATURE OF CHECKS | जाँच की मात्रा QUANTUM OF CHECKS | संदर्भ दस्तावेज़ / स्वीकृति मानदंड REFERENCE DOCUMENTS/ ACCEPTANCE NORMS | रिकॉर्ड प्रारूप RECORD FORMAT | निरीक्षण एजेंसी (INSP. AGENCY) | | | टिप्पणी REMARKS |
| | | | | | | प्रदर्शन Perform | गवाह Witness | सत्यापन Verify | |
| **1** | **Raw Material** | | | Appd. Drawings/Tech. specs./IS/IEC/Equivalent | | | | | |
| **1.1** | **Plate for Housing, Pivot Bolt & Locking Nut** | | | | | | | | |
| a) | Chemical Composition | Chemical Test | Sample per Lot | -do- | TC | 3/2 | - | 1 | TC |
| b) | Mechanical Analysis-As applicable-(Tensile Test and Hardness Test) | Mechanical Test | - do- | -do- | TC | 3/2 | - | 1 | TC |
| c) | NDT of Plates | UT, MPI, DPT (as applicable) | 100% | -do- | TC | 3/2 | - | 1 | TC |
| **1.2** | **Bearing Pad Segment / Shell/SS Sleeve (As applicable)** | | | | | | | | |
| a) | Chemical Composition | Chemical Test | Sample per Lot | -do- | TC | 3/2 | - | 1 | TC |
| b) | Mechanical Properties | Mechanical Test | -do- | -do- | TC | 3/2 | - | 1 | TC |
| c) | NDT of Casting / Plates | UT, MPI, DPT (as applicable) | 100% | -do- | TC | 3/2 | - | 1 | TC |
| **1.3** | **Babbit Material/Abrasion Resistent Elastomeric Material (As applicable)** | Chemical Test | 100% | -do- | TC | 3/2 | - | 1 | TC |
| **1.4** | **Heat Exchanger/Oil Cooler (If applicable)** | | | | | | | | |
| a) | Make, Model & Capacity | Visual | 100% | -do- | TC | 3/2 | - | 1 | TC |
| b) | Chemical Composition & Mechanical Analysis for Tube | Chemical Test | Sample per Lot | -do- | TC | 3/2 | - | 1 | TC |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| c) | Hydrostatic Pr. test | Test | 100% | -do- | TC | 3/2 | - | 1 | TC |
| **2** | **In Process Stage** | | | | | | | | |
| 2.1 | Heat Treatment for Casted / Welded components | Temp. Regulation | 100% | -do- | IR | 3/2 | - | 1 | TC |
| 2.2 | Welder Certification | Visual | 100% | -do- | TC | 3/2 | - | 1 | TC |
| 2.3 | NDT of weld joints after Heat Treatment | UT, MPI, DPT (as applicable) | -do- | -do- | TC | 3/2 | - | 1 | TC |
| 2.4 | Bonding of Babbit material/Abrasion Resistant Elastomeric Material on Segment / Shell (Bearing Pad) | | -do- | -do- | IR | 3/2 | - | 1 | TC |
| 2.5 | NDT of Machined Surface | | -do- | -do- | TC | 3/2 | - | 1 | TC |
| **3** | **Final Inspection** | | | | | | | | |
| 3.1 | Dimensional Check for Assembly of TGB, Thickness of Babbit material/Abrasion Resistant Elastomeric Material | Measurement | Critical Dim. | -do- | IR | 3/2 | - | 1 | TC |
| 3.2 | Surface defects of Babbit material/Abrasion Resistant Elastomeric Material | DPT | 100% | -do- | IR | 3/2 | - | 1 | TC |
| 3.3 | Leakage Test of TGB Housing (Oil/Water Tank) | Gravity Test | 100% | -do- | IR | 3/2 | - | 1 | TC |
| **4** | **Painting** | Visual / Measurement | -do- | -do- | TC | 3/2 | - | 1 | TC |
| Note : | a. In 'Inspection Agency'column figure 1,2,or 3 to be filled. 1- will indicate'Employer', 2- will indicate 'supplier' & 3- will indicate 'sub-supplier'. | | | | | | | | |
| | b. In 'Remarks' column following abbreviations shall be used - RR-Review of Records, T.C. - Test Certificate Submission, JIR-Joint Inspection Report & CHP - Customer Hold Point. | | | | | | | | |
| | c. The firm shall obtain acceptance/clearance of finished product for further activities based on Test Certificates & Internal Report (IR) | | | | | | | | |
| | d. At the time of Inspection the supplier shall arrange the requisite calibrated measuring instruments i.e.micrometer, vernier caliper, pie tape, surface roughness tester, dial gauge etc. | | | | | | | | |
| | e.This QAP does not absolve the Contractor/sub-contractor of his responsibility to supply the correct products, strictly in conformity to the specifications given in the purchase order/contract. The above Model QAP stipulates the bare minimum requirements which shall be complied by the contractor. The above QAP has been made presuming subletting of work shall be allowed in the tender. In case subletting of work is not allowed in the tender, then"3/2" shall be considered as "2" under the column " Perform" . | | | | | | | | |
| | f.Material testing shall be conducted from Govt. Lab, NABL Lab or NABL accredited lab having valid Scope of accreditation of all specified tests mentioned in approved QAP. NDT shall be conducted from NABL accredited lab/Govt. approved lab/Level 2 or level 3 certified person. | | | | | | | | |
| | g. Any additional test required as per the requirement of equipment in accordance with Contract Agreement/Relevent standard apart from QAP will be carried out by the firm without any additional financial implication. | | | | | | | | |
| | | | **Signature** | | | **Signature & Seal** | | | |
| | | | **EMPLOYER ( QA&I DEPT.)** | | **(VENDORS Q.C. DEPT. OR REPRESENTATIVE)** | | | | |

| परियोजना (PROJECT) : | | | | ग्राहक (CLIENT) : | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| उपस्कर का नाम (NAME OF EQUIPMENT) : -Shaft Seal Assembly | | | | विक्रेता (VENDOR) : | | | | | |
| | | | | एनआईटी/ क्रय आदेश संदर्भ (NIT/P.O. REFERENCE) : | | | | | |
| क्र. सं. SR. NO. | मद/घटक एवं विशेषता ITEM /COMPONENTS & CHARACTERISTICS | जाँच की प्रकृति NATURE OF CHECKS | जाँच की मात्रा QUANTUM OF CHECKS | संदर्भ दस्तावेज़ / स्वीकृति मानदंड REFERENCE DOCUMENTS/ ACCEPTANCE NORMS | रिकॉर्ड प्रारूप RECORD FORMAT | निरीक्षण एजेंसी (INSP. AGENCY) | | | टिप्पणी REMARKS |
| | | | | | | प्रदर्शन Perform | गवाह Witness | सत्यापन Verify | |
| **1** | **Raw Material** | | | Appd. Drawings/Tech. specs./IS/IEC/Equivalent | | | | | |
| 1.1 | Plates | | | | | | | | |
| a) | Chemical Composition | Chemical Test | Sample per Lot | -do- | TC | 3/2 | - | 1 | TC |
| b) | Mechanical Analysis-As applicable (Tensile Test and Hardness Test) | Mechanical Test | - do- | -do- | TC | 3/2 | - | 1 | TC |
| 1.2 | NDT of Plates | UT, MPI, DPT (as applicable) | 100% | -do- | TC | 3/2 | - | 1 | TC |
| **2** | **In Process Stage** | | | | | | | | |
| 2.1 | Welder Certification | Visual | 100% | -do- | TC | 3/2 | - | 1 | TC |
| 2.2 | NDT and Visual examination on weld joints | UT, MPI, DPT (as applicable) | -do- | -do- | TC | 3/2 | - | 1 | TC |
| 2.3 | Dimensional check of components after Machining | Measurement | -do- | -do- | IR | 3/2 | - | 1 | TC |
| **3** | **Final Inspection** | | | | | | | | |
| 3.1 | Dimensional check of Assembly | Measurement | Critical Dim. | -do- | JIR | 3/2 | 1 | - | CHP |
| 3.2 | Co-axiality and Surface Finish of Revolving Sleeve | -do- | 100% | -do- | JIR | 3/2 | 1 | - | CHP |
| 3.3 | Attachment/Tagging of atleast five sample pieces with one lot before start of coating (If HVOF coating is applicable) | Visual | Sample | -Do- | IR | 3/2 | - | 1 | TC |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **4** | **HVOF Coating (If applicable)** | | | | | | | | |
| 4.1 | Chemical Composition of coating Powder | Measurement | Lot/ sample | -Do- | TC | 3/2 | - | 1 | TC |
| 4.2 | Detachment of sample pieces after coating | Visual | Sample | -Do- | IR | 3/2 | - | 1 | TC |
| 4.3 | Mechanical Property- Bond Strength, Porosity, Hardness of coating | Visual & Measurement | Sample per Lot | -do- | IR | 3/2 | - | 1 | TC |
| 4.4 | Coating thickness | Measurement | Sample | -do- | IR | 3/2 | - | 1 | TC |
| Note : | a. In 'Inspection Agency'column figure 1,2,or 3 to be filled. 1- will indicate'Employer', 2- will indicate 'supplier' & 3- will indicate 'sub-supplier'. | | | | | | | | |
| | b. In 'Remarks' column following abbreviations shall be used - RR-Review of Records, T.C. - Test Certificate Submission, JIR-Joint Inspection Report & CHP - Customer Hold Point. | | | | | | | | |
| | c. The firm shall obtain acceptance/clearance of finished product for further activities based on Test Certificates & Internal Report (IR) | | | | | | | | |
| | d. At the time of Inspection the supplier shall arrange the requisite calibrated measuring instruments i.e.micrometer, vernier caliper, pie tape, surface roughness tester, dial gauge etc. | | | | | | | | |
| | e.This QAP does not absolve the Contractor/sub-contractor of his responsibility to supply the correct products, strictly in conformity to the specifications given in the purchase order/contract. The above Model QAP stipulates the bare minimum requirements which shall be complied by the contractor. The above QAP has been made presuming subletting of work shall be allowed in the tender. In case subletting of work is not allowed in the tender, then"3/2" shall be considered as "2" under the column " Perform" . | | | | | | | | |
| | f.Material testing shall be conducted from Govt. Lab, NABL Lab or NABL accredited lab having valid Scope of accreditation of all specified tests mentioned in approved QAP. NDT shall be conducted from NABL accredited lab/Govt. approved lab/Level 2 or level 3 certified person. | | | | | | | | |
| | g. Any additional test required as per the requirement of equipment in accordance with Contract Agreement/Relevent standard apart from QAP will be carried out by the firm without any additional financial implication. | | | | | | | | |
| | | | **Signature** | | | **Signature & Seal** | | | |
| | | | **EMPLOYER ( QA&I DEPT.)** | | **(VENDORS Q.C. DEPT. OR REPRESENTATIVE)** | | | | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **परियोजना (PROJECT) :** | | | | **ग्राहक (CLIENT) :** | | | |
| **उपस्कर का नाम (NAME OF EQUIPMENT) : Pelton Turbine-Injector (Nozzle Assy. with Deflector)** | | | | **विक्रेता (VENDOR) :** | | | |
| | | | | **एनआईटी/ क्रय आदेश संदर्भ (NIT/P.O. REFERENCE) :** | | | |
| **क्र.** | **मद/घटक एवं विशेषता ITEM /COMPONENTS & CHARACTERISTICS** | **जाँच की** | **जाँच की** | **संदर्भ दस्तावेज़ /** | **रिकॉर्ड** | **निरीक्षण एजेंसी (INSP. AGENCY)** | **टिप्पणी REMARK** |

| सं. SR. NO. | | प्रकृति NATURE OF CHECKS | मात्रा QUANTUM OF CHECKS | स्वीकृति मानदंड REFERENCE DOCUMENTS/ ACCEPTANCE NORMS | प्रारूप RECORD FORMAT | प्रदर्शन Perform | गवाह Witness | सत्यापन Verify | S |
|---|---|---|---|---|---|---|---|---|---|
| **1** | **Raw Material** | | | | | | | | |
| 1.1 | Nozzle Body, Main Injector, Needle, Seat Ring, Deflector & Fasteners (above M32) etc | | | Appd. Drawings/Tech. specs./IS/IEC/Equivalent | | | | | |
| a) | Chemical Composition | Chemical Test | Sample per Lot | | TC | 3/2 | - | 1 | TC |
| b) | Mechanical Analysis-As Applicable (Tensile Test, Impact Test , Hardness Test) | Mechanical Test | - do- | -do- | TC | 3/2 | - | 1 | TC |
| c) | NDT of Cast/Forged steel | UT, MPI, DPT (as applicable) | 100% | -do- | IR | 3/2 | - | 1 | RR |
| **1.2** | **Deflector- Bearing** | | | | | | | | |
| a) | Chemical Composition | Chemical Test | Sample per Lot | -do- | TC | 3/2 | - | 1 | TC |
| b) | Mechanical Analysis-As Applicable (Tensile Test, Impact Test , Hardness Test) | Mechanical Test | - do- | -do- | TC | 3/2 | - | 1 | TC |
| **1.3** | **Nozzle Spring** | Mechanical Test | - do- | -do- | TC | 3/2 | - | 1 | TC |
| a) | Mechanical Analysis-As Applicable (Tensile Test, Impact Test , Hardness Test) | Mechanical Test | - do- | -do- | TC | 3/2 | - | 1 | TC |
| **2** | **In-process Inspection** | | | | | | | | |
| 2.1 | Welding as applicable | | | | | | | | |
| a) | Fillet welds NDT | UT, MPI, DPT (as applicable) | 100% | -do- | TC | 3/2 | - | 1 | TC |
| b) | Full strength welds NDT | UT | 100% | -do- | TC | 3/2 | - | 1 | TC |
| 2.2 | HVOF Tungsten Carbide coating (Needle Tips & Seat Ring)- thickness | Measurement | 100% | Appd. Drawings/Tech. specs./IS/IEC/Equivalent | TC | 3/2 | - | 1 | TC |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 2.3 | Machining Dimension | Measurement | 100% | | TC | 3/2 | - | 1 | TC |
| **3** | **Final Inspection** | | | | | | | | |
| **3.1** | **Injector (Nozzle Assembly with Deflector)** | | | | | | | | |
| a) | Dimension check | Measurement | -do- | -do- | IR | 3/2 | - | 1 | TC |
| b) | Surface Finish check | Visual / Measurement | -do- | -do- | IR | 3/2 | - | 1 | TC |
| c) | Hydraulic Pressure Test on Nozzle, Servomotor Cylinder, Nozzle Body & Tip | Measurement | - do- | -do- | JIR | 3/2 | 1 | - | CHP |
| d) | Operational Test | | | | | | | | |
| i) | Alignment and free movement of needle with servometer | Visual | - do- | -do- | JIR | 3/2 | 1 | - | CHP |
| ii) | Needle full opening and closing with servomotor | -do- | - do- | -do- | JIR | 3/2 | 1 | - | CHP |
| iii) | Nozzle Servomotor-Stroking & Stroke | Measurement | - do- | -do- | JIR | 3/2 | 1 | - | CHP |
| iv) | Free Movement of Deflector (with overhead crane) | Visual | - do- | -do- | JIR | 3/2 | 1 | - | CHP |
| **3.2** | **Painting** | Visual / Measurement | 100% | -do- | TC | 3/2 | - | 1 | TC |
| Note : | a. In 'Inspection Agency'column figure 1,2,or 3 to be filled. 1- will indicate'Employer', 2- will indicate 'supplier' & 3- will indicate 'sub-supplier'. | | | | | | | | |
| | b. In 'Remarks' column following abbreviations shall be used - RR-Review of Records, T.C. - Test Certificate Submission, JIR-Joint Inspection Report & CHP - Customer Hold Point. | | | | | | | | |
| | c. The firm shall obtain acceptance/clearance of finished product for further activities based on Test Certificates & Internal Report (IR) | | | | | | | | |
| | d. At the time of Inspection the supplier shall arrange the requisite calibrated measuring instruments i.e.micrometer, vernier caliper, pie tape, surface roughness tester, dial gauge etc. | | | | | | | | |
| | e.This QAP does not absolve the Contractor/sub-contractor of his responsibility to supply the correct products, strictly in conformity to the specifications given in the purchase order/contract. The above Model QAP stipulates the bare minimum requirements which shall be complied by the contractor. The above QAP has been made presuming subletting of work shall be allowed in the tender. In case subletting of work is not allowed in the tender, then"3/2" shall be considered as "2" under the column " Perform" . | | | | | | | | |
| | f.Material testing shall be conducted from Govt. Lab, NABL Lab or NABL accredited lab having valid Scope of accreditation of all specified tests mentioned in approved QAP. NDT shall be conducted from NABL accredited lab/Govt. approved lab/Level 2 or level 3 certified person. | | | | | | | | |
| | g. Any additional test required as per the requirement of equipment in accordance with Contract Agreement/Relevent standard apart from QAP will be carried out by the firm without any additional financial implication. | | | | | | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | | **Signature** | | | **Signature & Seal** |
| | | | **EMPLOYER ( QA&I DEPT.)** | | **(VENDORS Q.C. DEPT. OR REPRESENTATIVE)** | |

| **परियोजना (PROJECT) :** | | | | **ग्राहक (CLIENT) :** | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **उपस्कर का नाम (NAME OF EQUIPMENT) : Pelton Runner** | | | | **विक्रेता (VENDOR) :** | | | | | |
| | | | | **एनआईटी/ क्रय आदेश संदर्भ (NIT/P.O. REFERENCE) :** | | | | | |
| **क्र. सं. SR. NO.** | **मद/घटक एवं विशेषता ITEM /COMPONENTS & CHARACTERISTICS** | **जाँच की प्रकृति NATURE OF CHECKS** | **जाँच की मात्रा QUANTUM OF CHECKS** | **संदर्भ दस्तावेज़ / स्वीकृति मानदंड REFERENCE DOCUMENTS/ ACCEPTANCE NORMS** | **रिकॉर्ड प्रारूप RECORD FORMAT** | **निरीक्षण एजेंसी (INSP. AGENCY)** | | | **टिप्पणी REMARKS** |
| | | | | | | **प्रदर्शन Perform** | **गवाह Witness** | **सत्यापन Verify** | |
| **1** | **Raw Material-Runner** | | | Appd. Drawings/Tech. specs./IS/IEC/Equivalent | | | | | |
| 1.1 | Keel Block Identification | Visual | Sample per Lot | | JIR | 3/2 | 1 | - | CHP |
| 1.2 | Chemical Composition | Chemical Test | - do- | | JIR | 3/2 | 1 | - | CHP |
| 1.3 | Mechanical Analysis (Tensile Test, Impact Test and Hardness Test) | Mechanical Test | - do- | -do- | JIR | 3/2 | 1 | - | CHP |
| 1.4 | Microstructure of material | Metallurgical Test | - do- | -do- | JIR | 3/2 | 1 | - | CHP |
| 1.5 | Welder Certification | Visual | 100% | -do- | IR | 3/2 | - | 1 | TC |
| 1.6 | Heat Treatment of Complete Runner | H-T Chart | -do- | -do- | IR | 3/2 | - | 1 | TC |
| 1.7 | NDT of Runner after heat treatment | UT, MPI, DPT (as applicable) | -do- | -do- | IR | 3/2 | - | 1 | TC |
| **2** | **In Process Stage Inspection** | | | | | | | | |
| 2.1 | Dimension Checking after rough machining | Measurement | -do- | -do- | IR | 3/2 | - | 1 | TC |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 2.2 | Bucket Pitch, Thickness & profile check | Measurement with template | -do- | -do- | IR | 3/2 | - | 1 | TC |
| **3** | **Final Inspection** | | | | | | | | |
| 3.1 | Dimension Check and Surface Finish | Measurement | Critical Dim. | -do- | JIR | 3/2 | 1 | - | CHP |
| 3.2 | Bucket Pitch, Thickness & profile check | Measurement with template | -do- | -do- | JIR | 3/2 | 1 | - | CHP |
| 3.3 | NDT of finished Surface / Sub-surface Defects | UT, MPI, DPT (as applicable) | 100% | -do- | JIR | 3/2 | 1 | - | CHP |
| 3.4 | Static Balancing of Runner | Measurement | -do- | -do- | JIR | 3/2 | 1 | - | CHP |
| **4** | **Painting** | Visual/Measurement | 100% | -do- | TC | 3/2 | - | 1 | TC |
| Note : | a. In 'Inspection Agency'column figure 1,2,or 3 to be filled. 1- will indicate 'Employer. ', 2- will indicate 'supplier' & 3- will indicate 'sub-supplier'. | | | | | | | | |
| | b. In 'Remarks' column following abbreviations shall be used - RR-Review of Records, T.C. - Test Certificate Submission, JIR-Joint Inspection Report & CHP - Customer Hold Point. | | | | | | | | |
| | c. The firm shall obtain acceptance/clearance of finished product for further activities based on Test Certificates & Internal Report (IR) | | | | | | | | |
| | d. At the time of Inspection the supplier shall arrange the requisite calibrated measuring instruments i.e.micrometer, vernier caliper, pie tape, surface roughness tester, dial gauge etc. | | | | | | | | |
| | e.This QAP does not absolve the Contractor/sub-contractor of his responsibility to supply the correct products, strictly in conformity to the specifications given in the purchase order/contract. The above Model QAP stipulates the bare minimum requirements which shall be complied by the contractor. The above QAP has been made presuming subletting of work shall be allowed in the tender. In case subletting of work is not allowed in the tender, then"3/2" shall be considered as "2" under the column " Perform" . | | | | | | | | |
| | f.Material testing shall be conducted from Govt. Lab, NABL Lab or NABL accredited lab having valid Scope of accreditation of all specified tests mentioned in approved QAP. NDT shall be conducted from NABL accredited lab/Govt. approved lab/Level 2 or level 3 certified person. | | | | | | | | |
| | g. Any additional test required as per the requirement of equipment in accordance with Contract Agreement/Relevent standard apart from QAP will be carried out by the firm without any additional financial implication. | | | | | | | | |
| | | | | | | | | | |
| | | | **Signature** | | | **Signature & Seal** | | | |
| | | | **Employer ( QA&I DEPT.)** | | **(VENDORS Q.C. DEPT. OR REPRESENTATIVE)** | | | | |

| परियोजना (PROJECT) : | | | | ग्राहक (CLIENT) : | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| उपस्कर का नाम (NAME OF EQUIPMENT) : Guide Apparatus Assembly | | | | विक्रेता (VENDOR) : | | | | | |
| | | | | एनआईटी/ क्रय आदेश संदर्भ (NIT/P.O. REFERENCE) : | | | | | |
| क्र. सं. SR. NO. | मद/घटक एवं विशेषता ITEM /COMPONENTS & CHARACTERISTICS | जाँच की प्रकृति NATURE OF CHECKS | जाँच की मात्रा QUANTUM OF CHECKS | संदर्भ दस्तावेज़ / स्वीकृति मानदंड REFERENCE DOCUMENTS/ ACCEPTANCE NORMS | रिकॉर्ड प्रारूप RECORD FORMAT | निरीक्षण एजेंसी (INSP. AGENCY) | | | टिप्पणी REMARKS |
| | | | | | | प्रदर्शन Perform | गवाह Witness | सत्यापन Verify | |
| 1 | **Shop Assembly of Turbine Guide Appratus** | | | | | | | | |
| 1.1 | Matching & Doweling of Head cover, Bottom Ring and Discharge Ring | Visual / Measurement | 100% | Appd. drawings/ Tech. specs./IS/IEC/Equivalent | JIR | 3/2 | 1 | - | CHP |
| 1.2 | Match Marking of X-Y axis | - do- | -do- | -do- | JIR | 3/2 | 1 | - | CHP |
| 1.3 | Co-axiality and Level check | Measurement | -do- | -do- | JIR | 3/2 | 1 | - | CHP |
| 1.4 | Dimension check for Height between Top Cover and Bottom Ring liners | - do- | -do- | -do- | JIR | 3/2 | 1 | - | CHP |
| 1.5 | Top & Bottom clearances of Guide Vanes | - do- | -do- | -do- | JIR | 3/2 | 1 | - | CHP |
| 1.6 | Free movement of Guide Vanes (opening & closing) and Top & Bottom clearances | Visual / Measurement | -do- | -do- | JIR | 3/2 | 1 | - | CHP |
| 1.7 | Clearance between two consecutive guide vanes in closed position. | Measurement | -do- | -do- | JIR | 3/2 | 1 | - | CHP |
| 1.8 | Gap between Consecutive Guide Vanes at 25%, 50%, 75% and 100% (opening & closing). | Visual / Measurement | -do- | -do- | JIR | 3/2 | 1 | - | CHP |
| Note: | a. In 'Inspection Agency'column figure 1,2,or 3 to be filled. 1- will indicate 'Employer', 2- will indicate 'supplier' & 3- will indicate 'sub-supplier'. | | | | | | | | |
| | b. In 'Remarks' column following abbreviations shall be used - RR-Review of Records, T.C. - Test Certificate Submission & CHP - Customer Hold Point. | | | | | | | | |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | c. The firm shall obtain acceptance/clearance of finished product for further activities based on Test Certificates & Internal Report (IR) | | | | | | | | |
| | d. At the time of Inspection the supplier shall arrange the requisite calibrated measuring instruments i.e.micrometer, vernier caliper, pie tape, surface roughness tester, dial gauge etc. | | | | | | | | |
| | e.This QAP does not absolve the Contractor/sub-contractor of his responsibility to supply the correct products, strictly in conformity to the specifications given in the purchase order/contract. The above Model QAP stipulates the bare minimum requirements which shall be complied by the contractor. The above QAP has been made presuming subletting of work shall be allowed in the tender. In case subletting of work is not allowed in the tender, then"3/2" shall be considered as "2" under the column " Perform" . | | | | | | | | |
| | f.Material testing shall be conducted from Govt. Lab, NABL Lab or NABL accredited lab having valid Scope of accreditation of all specified tests mentioned in approved QAP. NDT shall be conducted from NABL accredited lab/Govt. approved lab/Level 2 or level 3 certified person. | | | | | | | | |
| | g. Any additional test required as per the requirement of equipment in accordance with Contract Agreement/Relevent standard apart from QAP will be carried out by the firm without any additional financial implication. | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | **Signature** | | | **Signature & Seal** | | | |
| | | | **EMPLOYER ( QA&I DEPT.)** | | | **(VENDORS Q.C. DEPT. OR REPRESENTATIVE)** | | | |

| **परियोजना (PROJECT) :** | | | | **ग्राहक (CLIENT) :** | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **उपस्कर का नाम (NAME OF EQUIPMENT) : Digital Governing System** | | | | **विक्रेता (VENDOR) :** | | | | | |
| | | | | **एनआईटी/ क्रय आदेश संदर्भ (NIT/P.O. REFERENCE) :** | | | | | |
| **क्र.सं. SR. NO.** | **मद/घटक एवं विशेषता ITEM /COMPONENTS & CHARACTERISTICS** | **जाँच की प्रकृति NATURE OF CHECKS** | **जाँच की मात्रा QUANTUM OF CHECKS** | **संदर्भ दस्तावेज़ / स्वीकृति मानदंड REFERENCE DOCUMENTS / ACCEPTANCE NORMS** | **रिकॉर्ड प्रारूप RECORD FORMAT** | **निरीक्षण एजेंसी (INSP. AGENCY)** | | | **टिप्पणी REMARKS** |
| | | | | | | **प्रदर्शन Perform** | **गवाह Witness** | **सत्यापन Verify** | |
| **1** | **Digital Electronic Controller** | | | | | | | | |
| a) | Type, Make and Rating | Visual | 100% | Tech. Spec./ Apprd. Drawing / IS/IEC/Equivalent | TC | 3/2 | - | 1 | TC |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| b) | Range of adjustment | Test | 100% | -do- | TC | 3/2 | - | 1 | TC |
| c) | Functional Test for Governor Characteristics / Parameter | Test | 100% | -do- | TC | 3/2 | - | 1 | TC |
| 1.1 | **Digital Micro Processor** | | | | | | | | |
| a) | Make,Type & Rating | Visual | 100% | -do- | TC | 3/2 | - | 1 | TC |
| b) | Performance | Test | 100% | -do- | TC | 3/2 | - | 1 | TC |
| **1.2** | **Governor Local control cubicle (Relay, Control and Indication etc )** | | | | | | | | |
| a) | Make,Type & Rating | Visual | 100% | -do- | TC | 3/2 | - | 1 | TC |
| b) | Functional Test | Test | 100% | -do- | TC | 3/2 | - | 1 | TC |
| **1.3** | **Power Supply Unit** | | | | | | | | |
| a) | Make,Type & Rating | Visual | 100% | -do- | TC | 3/2 | - | 1 | TC |
| b) | Routine Test | Test | 100% | -do- | TC | 3/2 | - | 1 | TC |
| **1.4** | **PLC Unit for control logic, Digital I/O** | | | | | | | | |
| a) | Make,Type & Rating | Visual | 100% | -do- | TC | 3/2 | - | 1 | TC |
| b) | Routine Test | Test | 100% | -do- | TC | 3/2 | - | 1 | TC |
| **1.5** | **Terminal Card, Signal Converter, Transducers, sensors, speed switches, communication facilities with control system, control and indication system, shielded cable, surge supression devices, Actuator Lock & other accessories (As applicable)** | | | | | | | | |
| a) | Make,Type & Rating | Visual | 100% | -do- | TC | 3/2 | - | 1 | TC |
| b) | Routine Test | Test | 100% | -do- | TC | 3/2 | - | 1 | TC |
| **1.6** | **Mobile Work Station** | | | | | | | | |
| a) | Make,Type & Rating | Visual | 100% | -do- | TC | 3/2 | - | 1 | TC |
| **2.** | **Digital Electronic Cubicle** | | | | | | | | |
| a) | Lay out and BOM Check | Visual | 100% | -do- | JIR | 3/2 | 1 | - | CHP |
| b) | Dimension , Thickness of Sheet & Door lock arrangement and Paint Shed | Measurement | 100% | -do- | JIR | 3/2 | 1 | - | CHP |
| c) | Scheme & Functional Checking | Measurement | 100% | -do- | JIR | 3/2 | 1 | - | CHP |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **3.** | **Electro Hydraulic Actuator(Valve Table Assembly), Pilot/ Servomotor Valve, Relay Valve, Solenoid Valves, DC Switches, Limit Switches, Manifold Blocks, Emergency Shut Down Valve (As applicable)** | | | Tech. Spec./ Apprd. Drawing / IS/IEC/Equivalent | | | | | |
| a) | Make, Type & Rating | Visual | 100% | -do- | TC | 3/2 | - | 1 | TC |
| b) | Routine Test | Test | 100% | -do- | TC | 3/2 | - | 1 | TC |
| c) | Calibration / Setting of Electro Hydraulic Actuator | Test | 100% | -do- | JIR | 3/2 | 1 | - | CHP |
| **4** | **Valves and Pressure Switches, Mainfold Block etc.(As applicable)** | | | | | | | | |
| a) | Pressure Test | Test | 100% | -do- | TC | 3/2 | - | 1 | TC |
| **5** | **Dual oil filtration unit with changeover facility along with clogging indication** | | | | | | | | |
| a) | Mesh Size | Visual | 100% | -do- | TC | 3/2 | - | 1 | TC |
| b) | Functional Test | Test | 100% | -do- | TC | 3/2 | - | 1 | TC |
| **6** | **Pipes and Fittings** | | | | | | | | |
| a) | Pressure Test | Test | 100% | -do- | TC | 3/2 | - | 1 | TC |
| **7** | **Speed Signal Generator / Potential Transformer(Transducer)** | | | | | | | | |
| a) | Routine Test | Test | 100% | -do- | TC | 3/2 | - | 1 | TC |
| **8** | **Complete Assembly of Governor With Control and Electro- Hydraulic Actuator** | | | | | | | | |
| a) | Verification of Items as per Bill of Material & Scheme Check | Visual & Test | 1 unit at random | -do- | JIR | 3/2 | 1 | - | CHP |
| b) | Check of Protection Devices | Test | 1 unit at random | -do- | JIR | 3/2 | 1 | - | CHP |
| c) | Functional Check | Test | 1 unit at random | -do- | JIR | 3/2 | 1 | - | CHP |
| **9** | **Centrifugal Type Over Speed Limiter (Mechanical Overspeed Devices)** | | | | | | | | |
| a) | Performance Test | Test | 100% | -do- | TC | 3/2 | - | 1 | TC |
| **10** | **Control and Power Cable for interconnection of** | | | | | | | | |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | **Governor with SCADA** | | | | | | | | |
| a) | Make, Type & Rating | Visual | 100% | -do- | TC | 3/2 | - | 1 | TC |
| b) | Routine Test | Test | 100% | -do- | TC | 3/2 | - | 1 | TC |
| Note: | a. In 'Inspection Agency'column figure 1,2,or 3 to be filled. 1- will indicate 'Employer', 2- will indicate 'supplier' & 3- will indicate 'sub-supplier'. | | | | | | | | |
| | b. In 'Remarks' column following abbreviations shall be used - RR-Review of Records, T.C. - Test Certificate Submission, CHP - Customer Hold Point & JIR-Joint Inspection Report. | | | | | | | | |
| | c. The firm shall obtain acceptance/clearance of finished product for further activities based on Test Certificates & Internal Report (IR) | | | | | | | | |
| | d.Any additional test required as per the requirement of equipment in accordance with Contract Agreement/Relevent standard apart from QAP will be carried out by the firm without any additional financial implication. | | | | | | | | |
| | e.This QAP does not absolve the Contractor/sub-contractor of his responsibility to supply the correct products, strictly in conformity to the specifications given in the purchase order/contract. The above Model QAP stipulates the bare minimum requirements which shall be complied by the contractor. The above QAP has been made presuming subletting of work shall be allowed in the tender. In case subletting of work is not allowed in the tender, then"3/2" shall be replaced by "2" under the column " Perform" except testing of material. | | | | | | | | |
| | f. At the time of Inspection the supplier shall arrange the requisite calibrated measuring instruments i.e.micrometer, vernier caliper, pie tape, surface roughness tester, dial gauge etc. | | | | | | | | |
| | g.Material testing shall be conducted from Govt. Lab, NABL Lab or NABL accredited lab having valid Scope of accreditation of all specified tests mentioned in approved QAP. NDT shall be conducted from NABL accredited lab/Govt. approved lab/Level 2 or level 3 certified person. | | | | | | | | |
| | | | | | | | | | |
| | | | **Signature** | | | **Signature & Seal** | | | |
| | | | **Employer ( QA&I DEPT.)** | | **(VENDORS Q.C. DEPT. OR REPRESENTATIVE)** | | | | |

| **परियोजना (PROJECT) :** | | | | **ग्राहक (CLIENT) :** | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **उपस्कर का नाम (NAME OF EQUIPMENT) : Digital Governing System - Oil Pressure Unit** | | | | **विक्रेता (VENDOR) :** | | | | | |
| | | | | **एनआईटी/ क्रय आदेश संदर्भ (NIT/P.O. REFERENCE) :** | | | | | |
| **क्र. सं. SR. NO.** | **मद/घटक एवं विशेषता ITEM /COMPONENTS & CHARACTERISTICS** | **जाँच की प्रकृति NATURE OF CHECKS** | **जाँच की मात्रा QUANTUM OF CHECKS** | **संदर्भ दस्तावेज़ / स्वीकृति मानदंड REFERENCE DOCUMENTS / ACCEPTANCE NORMS** | **रिकॉर्ड प्रारूप RECORD FORMAT** | **निरीक्षण एजेंसी (INSP. AGENCY)** | | | **टिप्पणी REMARKS** |
| | | | | | | **प्रदर्शन Perform** | **गवाह Witness** | **सत्यापन Verify** | |
| **1** | **Sump Tank** | | | Appd. Drgs./ Tech. specs./IS/IEC/Equivalent | | | | | |
| 1.1 | Material for Tank | | | | TC | 3/2 | - | 1 | TC |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| a) | Chemical Composition | Chemical | Sample | -do- | TC | 3/2 | - | 1 | TC |
| b) | Mechanical Strength | Mechanical | - do- | -do- | TC | 3/2 | - | 1 | TC |
| 1.2 | Welder Certification | Visual | 100% | -do- | TC | 3/2 | - | 1 | TC |
| 1.3 | NDT of weld joints | DPT | 100% | -do- | TC | 3/2 | - | 1 | TC |
| 1.4 | Gravity Leakage test for tank | Test | - do- | -do- | TC | 3/2 | - | 1 | TC |
| 1.5 | Dimensional Check | Measurement | - do- | -do- | TC | 3/2 | - | 1 | TC |
| **2** | **Pressure Vessel/Oil Pressure Accumulator** | | | | | | | | |
| 2.1 | Material for Tank | NDT | 100% | -do- | TC | 3/2 | - | 1 | TC |
| a) | Chemical Composition | Chemical | Sample | -do- | TC | 3/2 | - | 1 | TC |
| b) | Mechanical Strength | Mechanical | - do- | -do- | TC | 3/2 | - | 1 | TC |
| 2.2 | Welder Certification | Visual | 100% | -do- | TC | 3/2 | - | 1 | TC |
| 2.3 | NDT of weld joints | UT/DPT | 100% | -do- | TC | 3/2 | - | 1 | TC |
| 2.4 | Post Weld stress releiving | Temp. Regulator | - do- | -do- | TC | 3/2 | - | 1 | TC |
| 2.5 | Hydrostatic pressure test for pressure vessel | Test | - do- | -do- | JIR | 3/2 | 1 | - | CHP |
| 2.6 | Dimensional Check | Measurement | - do- | -do- | JIR | 3/2 | 1 | - | CHP |
| **3** | **Pipes & Fittings** | | | | | | | | |
| 3.1 | Chemical Composition | Chemical | Sample | -do- | TC | 3/2 | - | 1 | TC |
| 3.2 | Mechanical Strength | Mechanical | - do- | -do- | TC | 3/2 | - | 1 | TC |
| 3.3 | Hydrostatic pressure test | Test | 100% | -do- | TC | 3/2 | - | 1 | TC |
| 3.4 | Dimensional Check | Measurement | - do- | -do- | IR | 3/2 | - | 1 | RR |
| **4** | **Pressure gauge, Pressure Switch, Float Switch, Temp gauge,moisture indicator, temperature gauges, temperature switches, level transducer, level gauges, level switch etc. (As applicable)** | | | | | | | | |
| 4.1 | Make, Model & Type | Visual | 100% | -do- | TC | 3/2 | - | 1 | TC |
| 4.2 | Calibration Test | Test | - do- | -do- | TC | 3/2 | - | 1 | TC |
| 4.3 | Functional Test | Test | - do- | -do- | TC | 3/2 | - | 1 | TC |
| **5** | **Distributing valve, Proportional valve, control valve, emergency shutdown valve, Unloader Valve, Check Valve, Pilot valve, Safety relief** | | | | | | | | |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | **valve, Air blow off valve, By Pass Valve, Solonoid Valve and Isolating Valve, Nitrogen Charging kit etc.(As applicable)** | | | | | | | | |
| 5.1 | Make, Model & Type | Visual | - do- | -do- | TC | 3/2 | - | 1 | TC |
| 5.2 | Functional Check | Test | - do- | -do- | TC | 3/2 | - | 1 | TC |
| 5.3 | Hydrostatic pressure test | Test | - do- | -do- | TC | 3/2 | - | 1 | TC |
| **6** | **Oil Pump** | | | Appd. Drgs./ Tech. specs./IS/IEC/Equivalent | | | | | |
| 6.1 | Make, Model, Type & Capacity | Visual | - do- | | TC | 3/2 | - | 1 | TC |
| 6.2 | Routine Test | Test | - do- | -do- | TC | 3/2 | - | 1 | TC |
| **7** | **Electric Motor** | | | | | | | | |
| 7.1 | Make, Type & rating | Visual | - do- | -do- | TC | 3/2 | - | 1 | TC |
| 7.2 | Routine Test | Test | - do- | -do- | TC | 3/2 | - | 1 | TC |
| **8** | **Strainer** | | | | | | | | |
| 8.1 | Mesh Size | Measurement | - do- | -do- | TC | 3/2 | - | 1 | TC |
| 8.2 | Chemical Composition | Chemical | Sample | -do- | TC | 3/2 | - | 1 | TC |
| **9** | **Dual oil filtration unit with changeover facility along with clogging indication** | | | | | | | | |
| 9.1 | Mesh Size | Visual | 100% | -do- | TC | 3/2 | - | 1 | TC |
| 9.2 | Functional Test | Test | 100% | -do- | TC | 3/2 | - | 1 | TC |
| **10** | **Oil** | | | | | | | | |
| 10.1 | Make & type | Visual | 100% | -do- | TC | 3/2 | - | 1 | TC |
| **11** | **Nitrogen Cylinder** | | | | | | | | |
| 11.1 | Chemical Composition | Chemical | Sample | -do- | TC | 3/2 | - | 1 | TC |
| 11.2 | Mechanical Strength | Mechanical | - do- | -do- | TC | 3/2 | - | 1 | TC |
| 11.3 | Hydrostatic pressure test & Leakage Test for Nitrogen Cylinder | Test | 100% | -do- | TC | 3/2 | - | 1 | TC |
| **12** | **Complete assembly of Oil Pressure Unit with Test/ Actual Control Panel** | | | | | | | | |
| 12.1 | Dimensional Check | Measurement | 100% | -do- | JIR | 3/2 | 1 | - | CHP |
| 12.2 | Capacity | Measurement | - do- | -do- | JIR | 3/2 | 1 | - | CHP |

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|---|---|---|---|---|---|---|---|---|---|
| 12.3 | Functional Test/ Operational Test of Pumps, Motors, Electromagnatic Valves, Pressure Switch, Temp switch & Accessories (As applicable) | Test | - do- | -do- | JIR | 3/2 | 1 | - | CHP |
| **13** | **Control panel / Starter pnel for Oil Sump Tank** | | | | | | | | |
| 13.1 | Verification of bill of material | Visual | - do- | -do- | JIR | 3/2 | 1 | - | CHP |
| 13.2 | Functional test | Test | - do- | -do- | JIR | 3/2 | 1 | - | CHP |
| 13.3 | IR & HV Test | Test | - do- | -do- | JIR | 3/2 | 1 | - | CHP |
| **14** | **Painting** | Visual/ Measurement | - do- | -do- | TC | 3/2 | - | 1 | TC |
| Note: | a. In 'Inspection Agency'column figure 1,2,or 3 to be filled. 1- will indicate 'Employer', 2- will indicate 'supplier' & 3- will indicate 'sub-supplier'. | | | | | | | | |
| | b. In 'Remarks' column following abbreviations shall be used - RR-Review of Records, T.C. - Test Certificate Submission, CHP - Customer Hold Point & JIR-Joint Inspection Report. | | | | | | | | |
| | c. The firm shall obtain acceptance/clearance of finished product for further activities based on Test Certificates & Internal Report (IR) | | | | | | | | |
| | d.Any additional test required as per the requirement of equipment in accordance with Contract Agreement/Relevent standard apart from QAP will be carried out by the firm without any additional financial implication. | | | | | | | | |
| | e.This QAP does not absolve the Contractor/sub-contractor of his responsibility to supply the correct products, strictly in conformity to the specifications given in the purchase order/contract. The above Model QAP stipulates the bare minimum requirements which shall be complied by the contractor. The above QAP has been made presuming subletting of work shall be allowed in the tender. In case subletting of work is not allowed in the tender, then"3/2" shall be replaced by "2" under the column " Perform" except testing of material. | | | | | | | | |
| | f. At the time of Inspection the supplier shall arrange the requisite calibrated measuring instruments i.e.micrometer, vernier caliper, pie tape, surface roughness tester, dial gauge etc. | | | | | | | | |
| | g.Material testing shall be conducted from Govt. Lab, NABL Lab or NABL accredited lab having valid Scope of accreditation of all specified tests mentioned in approved QAP. NDT shall be conducted from NABL accredited lab/Govt. approved lab/Level 2 or level 3 certified person. | | | | | | | | |
| | h. Site/Field test shall be conducted in presence of Project's representative only. | | | | | | | | |
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| | | | **Signature** | | | **Signature & Seal** | | | |
| | | | **Employer ( QA&I DEPT.)** | | **(VENDORS Q.C. DEPT. OR REPRESENTATIVE)** | | | | |

| परियोजना (PROJECT) : | | | | ग्राहक (CLIENT) : | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| उपस्कर का नाम (NAME OF EQUIPMENT) : Digital Governing System - Oil Leakage Unit (If required) | | | | विक्रेता (VENDOR) : | | | | | |
| | | | | एनआईटी/ क्रय आदेश संदर्भ (NIT/P.O. REFERENCE) : | | | | | |
| क्र. सं. SR. NO. | मद/घटक एवं विशेषता ITEM /COMPONENTS & CHARACTERISTICS | जाँच की प्रकृति NATURE OF CHECKS | जाँच की मात्रा QUANTUM OF CHECKS | संदर्भ दस्तावेज़ / स्वीकृति मानदंड REFERENCE DOCUMENTS / ACCEPTANCE NORMS | रिकॉर्ड प्रारूप RECORD FORMAT | निरीक्षण एजेंसी (INSP. AGENCY) | | | टिप्पणी REMARKS |
| | | | | | | प्रदर्शन Perform | गवाह Witness | सत्यापन Verify | |
| **1** | **Oil Leakage Unit** | | | Appd. Drgs./ Tech. specs./IS/IEC/Equivalent | | | | | |
| 1.1 | Pump | | | | | | | | |
| a) | Make, Model, Type & Capacity | Visual | 100% | -do- | TC | 3/2 | - | 1 | TC |
| b) | Routine Test | Test | - do- | -do- | TC | 3/2 | - | 1 | TC |
| **1.2** | **Electric Motor** | | | | | | | | |
| a) | Make, Type & rating | Visual | - do- | -do- | TC | 3/2 | - | 1 | TC |
| b) | Routine Test | Test | - do- | -do- | TC | 3/2 | - | 1 | TC |
| **1.3** | **Float, Level Switch** | | | | | | | | |
| a) | Make, Type & rating | Visual | - do- | -do- | TC | 3/2 | - | 1 | TC |
| **1.4** | **Oil Tank** | | | | | | | | |
| a) | Leakage test | Test | - do- | -do- | TC | 3/2 | - | 1 | TC |
| b) | Dimensional Check | Measurement | - do- | -do- | TC | 3/2 | - | 1 | TC |
| **1.5** | **Functional test on complete oil leakage unit** | Test | - do- | -do- | TC | 3/2 | - | 1 | TC |
| **1.6** | **Dimensional & BOM Check** | Visual/ Measurement | - do- | -do- | TC | 3/2 | - | 1 | TC |
| **2** | **Painting** | Visual/ Measurement | - do- | -do- | TC | 3/2 | - | 1 | TC |
| Note: | a. In 'Inspection Agency'column figure 1,2,or 3 to be filled. 1- will indicate 'Employer', 2- will indicate 'supplier' & 3- will indicate 'sub-supplier'. | | | | | | | | |
| | b. In 'Remarks' column following abbreviations shall be used - RR-Review of Records, T.C. - Test Certificate Submission, CHP - Customer Hold Point & JIR-Joint Inspection Report. | | | | | | | | |

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| | c. The firm shall obtain acceptance/clearance of finished product for further activities based on Test Certificates & Internal Report (IR) |
| | d.Any additional test required as per the requirement of equipment in accordance with Contract Agreement/Relevent standard apart from QAP will be carried out by the firm without any additional financial implication. |
| | e.This QAP does not absolve the Contractor/sub-contractor of his responsibility to supply the correct products, strictly in conformity to the specifications given in the purchase order/contract. The above Model QAP stipulates the bare minimum requirements which shall be complied by the contractor. The above QAP has been made presuming subletting of work shall be allowed in the tender. In case subletting of work is not allowed in the tender, then"3/2" shall be replaced by "2" under the column " Perform" except testing of material. |
| | f. At the time of Inspection the supplier shall arrange the requisite calibrated measuring instruments i.e.micrometer, vernier caliper, pie tape, surface roughness tester, dial gauge etc. |
| | g.Material testing shall be conducted from Govt. Lab, NABL Lab or NABL accredited lab having valid Scope of accreditation of all specified tests mentioned in approved QAP. NDT shall be conducted from NABL accredited lab/Govt. approved lab/Level 2 or level 3 certified person. |

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| | | | **Signature** | | | **Signature & Seal** | | | |
| | | | **Employer ( QA&I DEPT.)** | | **(VENDORS Q.C. DEPT. OR REPRESENTATIVE)** | | | | |
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**कार्य स्थल गुणवत्ता योजना (FIELD QUALITY PLAN) :**

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|---|---|
| **परियोजना (PROJECT) :** | **ग्राहक (CLIENT) :** |
| **उपस्कर का नाम (NAME OF EQUIPMENT) : Digital Governing System & Accessories** | **विक्रेता (VENDOR) :** |
| | **एनआईटी/ क्रय आदेश संदर्भ (NIT/P.O. REFERENCE) :** |

| **क्र. सं. SR. NO.** | **Activity & Operation of Component** | **जाँच की प्रकृति NATURE OF CHECKS** | **जाँच की मात्रा QUANTUM OF CHECKS** | **संदर्भ दस्तावेज़ / स्वीकृति मानदंड REFERENCE DOCUMENTS/ ACCEPTANCE NORMS** | **रिकॉर्ड प्रारूप RECORD FORMAT** | **निरीक्षण एजेंसी (INSP. AGENCY)** | | | **टिप्पणी REMARKS** |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | **प्रदर्शन Perform** | **गवाह Witness** | **सत्यापन Verify** | |
| **1** | **Digital Governing System & Accessories** | | | | | | | | |

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|---|---|---|---|---|---|---|---|---|---|
| 1.1 | Leakage tests on all pressure oil and Nitrogen system piping, | Test | 100% | Tech. Spec./ Apprd. Drawing /IS/IEC/Equivalent | TC/TR | 3/2 | 1 | - | TC/TR |
| 1.2 | Hydrostatic tests on pressure vessel, all pressure oil piping and all Nitrogen pressure piping systems at a pressure 50 % greater than the maximum design pressure after installation. (As per Standard) | Test | 100% | -do- | TC/TR | 3/2 | 1 | - | TC/TR |
| 1.3 | Functional check of Measuring Instruments, Switches & Controller provided in the Governing System, Oil Pressure System & Nitrogen System | Functional | 100% | -do- | TC/TR | 3/2 | 1 | - | TC/TR |
| 1.4 | Leakage & Pressure Test on OPU Tank | Test | 100% | -do- | TC/TR | 3/2 | 1 | - | TC/TR |
| 1.5 | Functional Tests of Level Switch, Pr. Switch & Pr. Relief Valve etc of OPU Tank | Functional | 100% | -do- | TC/TR | 3/2 | 1 | - | TC/TR |
| 1.6 | IR test on Electrical Panels | Test | 100% | -do- | TC/TR | 3/2 | 1 | - | TC/TR |
| 1.7 | Test to verify logic control scheme from local / remote including start/stop, load control, locking & other features | Test | 100% | -do- | TC/TR | 3/2 | 1 | - | TC/TR |
| 1.8 | Transducers/Detecting device of Guide Vane Servomotor & Main Distributor Valve (MDV) shall be installed, positioned and tested by the Contractor. | Test | 100% | -do- | TC/TR | 3/2 | 1 | - | TC/TR |
| 1.9 | Check on the range of action of the set point generator | Functional | 100% | -do- | TC/TR | 3/2 | 1 | - | TC/TR |
| 1.10 | The sensitivity of the set point generator's in regard to positioning/speed to pulse orders from governor cabinet and to external orders shall be checked and comply with the agreed values. The allowable discrepancy in the values shall be guaranteed by the manufacturer in advance in load, no-load and exceptional conditions, viz black start, load rejection etc. | Functional | 100% | -do- | TC/TR | 3/2 | 1 | - | TC/TR |
| 1.11 | In case of load rejection, restoration of no-load operation after load rejection has to be tested, with the governor ensuring the return to no-load operation with maximum efficiency in complying with over speeding and maximum pressure guarantees and time taken to return to stabilized speed. | Functional | 100% | -do- | TC/TR | 3/2 | 1 | - | TC/TR |

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|---|---|---|---|---|---|---|---|---|---|
| 1.12 | On load mechanical tripping | Functional | 100% | Tech. Spec./ Apprd. Drawing /IS/IEC/Equivalent | TC/TR | 3/2 | 1 | - | TC/TR |
| 1.13 | On load electrical tripping | Functional | 100% | -do- | TC/TR | 3/2 | 1 | - | TC/TR |
| 1.14 | Check on opening adjustment and the value of permanent speed droop, | Functional | 100% | -do- | TC/TR | 3/2 | 1 | - | TC/TR |
| 1.15 | Determination of the frequency insensitivity threshold | Functional | 100% | -do- | TC/TR | 3/2 | 1 | - | TC/TR |
| 1.16 | Adjustment of Main Distribution Valve (MDV) opening & checking of opening & closing times, | Functional | 100% | -do- | TC/TR | 3/2 | 1 | - | TC/TR |
| 1.17 | Checking the response to a set point load step in no-load operation | Functional | 100% | -do- | TC/TR | 3/2 | 1 | - | TC/TR |
| 1.18 | Recording of the speed build-up and loading | Functional | 100% | -do- | TC/TR | 3/2 | 1 | - | TC/TR |
| 1.19 | Functional check of Mobile Work Station (LAPTOP) for Programming/Diagnostic of the System at the time of commissioning. | Functional | 100% | -do- | TC/TR | 3/2 | 1 | - | TC/TR |
| 1.20 | Testing for Interfacing with Complete Governor System with Plant SCADA System & testing of FGMO, RGMO and Auto control mode of operation. | Functional | 100% | -do- | TC/TR | 3/2 | 1 | - | TC/TR |
| 1.21 | Checking the speed sensing sensor and feedback mechanism for proper operation and calibration. | Functional | 100% | -do- | TC/TR | 3/2 | 1 | - | TC/TR |
| Note: | a. In 'Inspection Agency'column figure 1,2,or 3 to be filled. 1- will indicate 'Representative of Engineer-In -Charge , Employer', 2- will indicate 'Contractor' & 3- will indicate 'sub-Contractor'. | | | | | | | | |
| | b. In 'Remarks' column following abbreviations shall be used - TC-Test Certificate, TR- Test Report | | | | | | | | |
| | c. At the time of Inspection the Contractor shall arrange the requisite calibrated measuring instruments/Tools . | | | | | | | | |
| | d. The above FQP stipulates the bare minimum requirements which shall be complied by the contractor. The above FQP has been made presuming subletting of work shall be allowed in the tender. In case subletting of work is not allowed in the tender, then"3/2" shall be considered as "2" under the column " Perform" . | | | | | | | | |
| | e. Any additional activity/test required as per the requirement of equipment in accordance with Contract Agreement/Relevent standard apart from FQP will be carried out by the firm without any additional financial implication. | | | | | | | | |
| | f. The contractor shall furnish the details of test methods to the Engineer-In charge, Employer for approval in the time line as specified in contract agreement. | | | | | | | | |
| | g. All the Test in FQP shall be witnessed by Engineer-in-charge or his representative at site. | | | | | | | | |
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| | **Signature** | | | | | **Signature & Seal** | | | |
| | **Engineer-in-charge** | | | | **(VENDORS Q.C. DEPT. OR REPRESENTATIVE)** | | | | |

| कार्य स्थल गुणवत्ता योजना (FIELD QUALITY PLAN) : | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| परियोजना (PROJECT) : | | | | ग्राहक (CLIENT) : | | | | | |
| उपस्कर का नाम (NAME OF EQUIPMENT) :Field Test on each Turbine shall include | | | | विक्रेता (VENDOR) : | | | | | |
| | | | | एनआईटी/ क्रय आदेश संदर्भ (NIT/P.O. REFERENCE) : | | | | | |
| क्र. सं. SR. NO. | Activity & Operation of Component | जाँच की प्रकृति NATURE OF CHECKS | जाँच की मात्रा QUANTUM OF CHECKS | संदर्भ दस्तावेज़ / स्वीकृति मानदंड REFERENCE DOCUMENTS/ ACCEPTANCE NORMS | रिकॉर्ड प्रारूप RECORD FORMAT | निरीक्षण एजेंसी (INSP. AGENCY) | | | टिप्पणी REMARKS |
| | | | | | | प्रदर्शन Perform | गवाह Witness | सत्यापन Verify | |
| 1 | **Final Assembly Inspection of Turbine & its associated Component** | | | Appd. drawings/ Tech. specs./IS/IEC/Equivalent | | | | | |
| 1.1 | Check horizontality of draft tube flange, flange radius & elevation, knee liner elevation and the distance between machine center line & knee liner end, after erection and concreting of knee liner | Measurement /Visual | 100% | -do- | TC/TR | 3/2 | 1 | - | TC/TR |
| 1.2 | Check match spiral members with top & bottom contour of stay ring & center line marked on spiral member with reference to center line of stay ring. | Measurement /Visual | 100% | -do- | TC/TR | 3/2 | 1 | - | TC/TR |
| 1.3 | Check leveling & Centring of Spiral casing assembly before and after welding of Spiral case. | Measurement /Visual | 100% | -do- | TC/TR | 3/2 | 1 | - | TC/TR |
| 1.4 | Checking of Spiral case final welding | RT,UT,MPI,DPT (as applicable) | 100% | - do- | TC/TR | 3/2 | 1 | - | TC/TR |
| 1.5 | Hydrostatic pressure test of Spiral Casing | Test | 100% | -do- | TC/TR | 3/2 | 1 | - | TC/TR |
| 1.6 | Check height & level of mating faces of Stay Ring with Head Cover & Bottom Ring before & after stay ring flange machining . | Measurement /Visual | 100% | -do- | TC/TR | 3/2 | 1 | - | TC/TR |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 1.7 | Checking of Weld condition/bolts tightness of Stay Ring & Bottom Ring assembly and level checking of bottom ring after assembly. | Measurement /Visual | 100% | -do- | TC/TR | 3/2 | 1 | - | TC/TR |
| 1.8 | Concentricity of guide vane bores in Bottom ring & Head Cover | Measurement /Visual | 100% | -do- | TC/TR | 3/2 | 1 | - | TC/TR |
| 1.9 | Measure distance between Head Cover and Bottom Ring at 8 points. | - do- | 100% | -do- | TC/TR | 3/2 | 1 | - | TC/TR |
| 1.10 | Check Verticality & Free movement of Guide Vanes | - do- | 100% | -do- | TC/TR | 3/2 | 1 | - | TC/TR |
| 1.11 | Measure Guide Vane Bedding Gap, Top & Bottom Clearance. | Measurement /Visual | 100% | -do- | TC/TR | 3/2 | 1 | - | TC/TR |
| 1.12 | Check Guide Vane Servomotor stroke length and Guide Vane opening & closing time | Measurement /Visual | 100% | -do- | TC/TR | 3/2 | 1 | - | TC/TR |
| 1.13 | Check the dimensions between the Main shafts and guide bearing housing | - do- | 100% | -do- | TC/TR | 3/2 | 1 | - | TC/TR |
| 1.14 | Static components of the unit are centered along the rotation axis. Check Concentricity of Guide Bearing Housing, Head Cover Labyrinth, Bottom Ring Labyrinth, Discharge Ring/Draft Tube Upper Cone w.r.t Unit Vertical Axis. | - do- | 100% | -do- | TC/TR | 3/2 | 1 | - | TC/TR |
| 1.15 | Level Check, Relative heights of Bottom Ring, Head Cover, Guide Bearing housing top and Operating Ring. | Measurement | 100% | -do- | TC/TR | 3/2 | 1 | - | TC/TR |
| 1.16 | Checking of Radial Clearance between operating Ring and wearing Pads and check angular position of Operating Ring. | Measurement /Visual | 100% | -do- | TC/TR | 3/2 | 1 | - | TC/TR |
| 1.17 | Checking of bolts tightness of Stay Ring & Bottom Ring assembly and level checking of bottom ring after assembly. | - do- | 100% | -do- | TC/TR | 3/2 | 1 | - | TC/TR |
| 1.18 | Check the fitment & alignment of Turbine shaft with Runner | - do- | 100% | -do- | TC/TR | 3/2 | 1 | - | TC/TR |
| 1.19 | Check tightness of Coupling Bolts between Runner & Turbine Shaft | - do- | 100% | -do- | TC/TR | 3/2 | 1 | - | TC/TR |
| 1.20 | Check tightness of Coupling Bolts between Turbine Shaft & Generator Shaft | - do- | 100% | -do- | TC/TR | 3/2 | 1 | - | TC/TR |
| 1.21 | Alignment, leveling and Centring of Complete Shaft line (Turbine & Generator Shaft) | - do- | 100% | -do- | TC/TR | 3/2 | 1 | - | TC/TR |
| Note : | a. In ‘Inspection Agency’column figure 1,2,or 3 to be filled. 1- will indicate 'Representative of Engineer-In -Charge , Employer', 2- will indicate ‘Contractor’ & 3- will indicate ‘sub-Contractor’. | | | | | | | | |
| | b. In ‘Remarks’ column following abbreviations shall be used - TC-Test Certificate, TR-Test Report | | | | | | | | |
| | c. At the time of Inspection the Contractor shall arrange the requisite calibrated measuring instruments/Tools | | | | | | | | |
| | d. The above FQP stipulates the bare minimum requirements which shall be complied by the contractor. The above FQP has been made presuming subletting of work shall be allowed in the tender. In case subletting of work is not allowed in the tender, then"3/2" shall be considered as "2" under the column " Perform" . | | | | | | | | |

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| | e. Any additional activity/test required as per the requirement of equipment in accordance with Contract Agreement/Relevent standard apart from FQP will be carried out by the firm without any additional financial implication. | | | | | |
| | f. The contractor shall furnish the details of test methods to the Engineer-In charge, Employer for approval in the time line as specified in contract agreement. | | | | | |
| | g. All the Test in FQP shall be witnessed by Engineer-in-charge or his representative at site. | | | | | |
| | **Signature** | | | | | **Signature & Seal** |
| | **Engineer-in-charge** | | | | **(VENDORS Q.C. DEPT. OR REPRESENTATIVE)** | |

**कार्य स्थल गुणवत्ता योजना (FIELD QUALITY PLAN) :**

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| **परियोजना (PROJECT) :** | **ग्राहक (CLIENT) :** |
| **उपस्कर का नाम (NAME OF EQUIPMENT) : Commissioning Test of Unit** | **विक्रेता (VENDOR) :** |
| | **एनआईटी/ क्रय आदेश संदर्भ (NIT/P.O. REFERENCE) :** |

| **क्र. सं. SR. NO.** | **Activity & Operation of Component** | **जाँच की प्रकृति NATURE OF CHECKS** | **जाँच की मात्रा QUANTUM OF CHECKS** | **संदर्भ दस्तावेज़ / स्वीकृति मानदंड REFERENCE DOCUMENTS/ ACCEPTANCE NORMS** | **रिकॉर्ड प्रारूप RECORD FORMAT** | **निरीक्षण एजेंसी (INSP. AGENCY)** | | | **टिप्पणी REMARKS** |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | **प्रदर्शन Perform** | **गवाह Witness** | **सत्यापन Verify** | |
| **1** | **Commissioning Test** (All applicable tests listed in IEC Guide for Commissioning Operation and Maintenance of Hydraulic Turbines shall be carried out in accordance with specified procedures. Pre-start tests and checks shall be carried out before filling of waterways as per approved procedure. After filling waterways, necessary checks shall be made before initial run.) | | | Appd. drawings/ Tech. specs./IS/IEC/Equivalent | | | | | |
| 1.1 | Run Test (Initial run test) | | | | | | | | |
| a) | Check for Abnormal noise/sound all around the unit during slight opening and closing of Wicket gates manually | Visual | 100% | -do- | TC/TR | 3/2 | 1 | - | TC/TR |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **1.2** | **Bearing run test** | | | | | | | | |
| a) | Check oil temperatures, Shaft seal flow, Shaft vibration at 25%, 50%, 75%, 100% & 110% of rated speed. | Measurement/Visual | 100% | -do- | TC/TR | 3/2 | 1 | - | TC/TR |
| b) | Verify Proper operation of stopping sequence | Visual | 100% | -do- | TC/TR | 3/2 | 1 | - | TC/TR |
| c) | Record units slow down speed versus time until speed is close to zero. | Measurement/Visual | 100% | -do- | TC/TR | 3/2 | 1 | - | TC/TR |
| d) | Function test of Brake | Visual | 100% | -do- | TC/TR | 3/2 | 1 | - | TC/TR |
| e) | Over speed test to be performed if temperatures, Vibrations and balance are correct | Test | 100% | -do- | TC/TR | 3/2 | 1 | - | TC/TR |
| **1.3** | **Heating run test** | | | | | | | | |
| a) | Heat run test shall be undertaken at full load if load rejection at 75% of rated power has been successfully performed. | Test | 100% | -do- | TC/TR | 3/2 | 1 | - | TC/TR |
| b) | Bearing temperatures, shaft seal temperatures and shaft seal flow at every 5 minutes shall be checked and recorded. | Measurement/Visual | 100% | -do- | TC/TR | 3/2 | 1 | - | TC/TR |
| c) | Check temperature rise versus load position | Measurement/Visual | 100% | -do- | TC/TR | 3/2 | 1 | - | TC/TR |
| d) | Check shaft vibrations. | Visual | 100% | -do- | TC/TR | 3/2 | 1 | - | TC/TR |
| **1.4** | **Over Speed Test** | | | | | | | - | |
| a) | Function of mechanical over speed detector at desired tripping value. | Visual/Test | 100% | -do- | TC/TR | 3/2 | 1 | - | TC/TR |
| **1.5** | **Load rejection test** | | | | | | | | |
| a) | Load rejection tests at 75, 100 and 110 percent load of the turbine output to verify speed rise and pressure rise, | Test | 100% | Appd. drawings/ Tech. specs./IS/IEC/Equivalent | TC/TR | 3/2 | 1 | - | TC/TR |
| b) | Unit shut down –Check the entire unit stopping sequence at full output: normal stop, emergency stop due to mechanical fault, emergency stop due to electrical fault. | Visual | 100% | -do- | TC/TR | 3/2 | 1 | - | TC/TR |
| **1.6** | **Gate opening versus turbine Output** | | | | | | | | |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| a) | Draw the gate opening vs output chart. Estimate the turbine flow and calculate the head loses and the net heads for all testing points. Outline the gate opening value corresponding to the contractual maximum output. Set the output limitation and the Gate opening limitation stored inside the governor. | Visual | 100% | -do- | TC/TR | 3/2 | 1 | - | TC/TR |
| **1.7** | **Performance testing** | | | | | | | | |
| a) | If nothing unusual has been observed in load run and load rejection tests, the test service period of 72 hours shall follow. During this test service period, the unit must operate continuously at rated condition without any interruption except of those beyond the control of the Contractor. However, such interrupted period shall not be counted for in the test service period. | Test | 100% | -do- | TC/TR | 3/2 | 1 | - | TC/TR |
| **1.8** | **Field Efficiency Test (All field acceptance tests in accordance with provision in IEC 60041-1991/Latest standard shall be conducted at site before acceptance of turbine by the Engineer-in-charge or his representative.)** | | | | | | | | |
| b) | Output and Efficiency tests shall be conducted at different heads and guide vanes openings on any one turbine, chosen by the Engineer-in-charge or his representative, to determine guaranteed efficiency parameters .Efficiency shall be measured by ultrasonic or other acceptable method prescribed in IEC. The Contractor shall furnish details of test methods, agency which will conduct the test, provisions to be made for field testing, calibration of instruments for purposes of test and all other relevant details for approval. | Test | 100% | -do- | TC/TR | 3/2 | 1 | - | TC/TR |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **1.9** | **Testing for Interfacing of operation for Turbine and its component with Plant SCADA System .** | Test | 100% | -do- | TC/TR | 3/2 | 1 | - | TC/TR |
| Note: | a. In 'Inspection Agency' column figure 1,2,or 3 to be filled. 1- will indicate 'Representative of Engineer-In -Charge , Employer', 2- will indicate 'Contractor' & 3- will indicate 'sub-Contractor'. | | | | | | | | |
| | b. In 'Remarks' column following abbreviations shall be used - TC-Test Certificate, TR-Test Report | | | | | | | | |
| | c. At the time of Inspection the Contractor shall arrange the requisite calibrated measuring instruments/Tools | | | | | | | | |
| | d. The above FQP stipulates the bare minimum requirements which shall be complied by the contractor. The above FQP has been made presuming subletting of work shall be allowed in the tender. In case subletting of work is not allowed in the tender, then"3/2" shall be considered as "2" under the column " Perform" . | | | | | | | | |
| | e. Any additional activity/test required as per the requirement of equipment in accordance with Contract Agreement/Relevent standard apart from FQP will be carried out by the firm without any additional financial implication. | | | | | | | | |
| | f. The contractor shall furnish the details of test methods to the Engineer-In charge, Employer for approval in the time line as specified in contract agreement. | | | | | | | | |
| | g. All the Test in FQP shall be witnessed by Engineer-in-charge or his representative at site. | | | | | | | | |
| | **Signature** | | | | | **Signature & Seal** | | | |
| | **Engineer-in-charge** | | | | **(VENDORS Q.C. DEPT. OR REPRESENTATIVE)** | | | | |

## 2) GENERATOR

| परियोजना (PROJECT) : | | | | ग्राहक (CLIENT): | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| उपष्कर का नाम (NAME OF EQUIPMENT) : Generator Stator (Frame) | | | | विक्रेता (VENDOR): | | | | | |
| | | | | एनआईटी/ क्रय आदेश संदर्भ( NIT / P.O. Reference) : | | | | | |
| क्र. सं. S.N. | मद/घटक एवं विशेषता ITEM/ COMPONENT & CHARACTERISTICS | जाँच की प्रकृति NATURE OF CHECKS | जाँच की मात्रा QUANTUM OF CHECKS | संदर्भ दस्तावेज़ / स्वीकृति मानदंड REFERENCE DOCUMENT/ ACCEPTANCE NORMS | रेकॉर्ड फ़ारमैट RECORD FORMAT | निरीक्षण एजैंसी Inspecting Agency | | | टिप्पणी Remarks |
| | | | | | | प्रदर्शन PERFORM | गवाह WITNESS | सत्यापन VERIFY | |
| **A** | **Raw Material (Carbon Steel Plate)** | | | | | | | | |
| i) | Chemical Composition | Chem. | Sample per Lot | Tech spec./ Appd Drg./ IS/IEC/Equivalent Standard | TC | 3/2 | - | 1 | TC |
| ii) | Mechanical Properties | Mech. | -do- | -do- | TC | 3/2 | - | 1 | TC |
| iii) | NDT on Steel Plate (>20 mm thick plates) | UT | -do- | -do- | TC | 3/2 | - | 1 | TC |
| **B** | **In process Inspection** | | | | | | | | |
| i) | Check of Full Strength Welding | UT | Sample | Tech spec./ Appd Drg./ IS/IEC/Equivalent Standard | TC | 3/2 | - | 1 | TC |
| ii) | NDT of welds | RT, UT, MPI, DPT (as applicable) | -do- | -do- | TC | 3/2 | - | 1 | TC |
| **C** | **Final Inspection** | | | | | | | | |
| i) | Sole Plate Mounting Face - Level Checking & Check of Flatness | Measurement | Sample | Tech spec./ Appd Drg./ IS/IEC/Equivalent Standard | JIR | 3/2 | 1 | - | CHP |
| ii) | Sole Plate- Dimensional & Flatness | -do- | -do- | -do- | JIR | 3/2 | 1 | - | CHP |
| iii) | Dimensional Check of Stator Frame | -do- | -do- | -do- | JIR | 3/2 | 1 | - | CHP |
| iv) | Surface finish of Machined surface | Visual | -do- | -do- | JIR | 3/2 | 1 | - | CHP |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| v) | Flatness Check of Seating Surface of Air Cooler | -do- | -do- | -do- | TC | 3/2 | - | 1 | TC |
| vi) | Painting | -do- | -do- | -do- | JIR | 3/2 | 1 | - | CHP |
| Note : | a. In 'Inspection Agency' column figure 1,2,or 3 to be filled. 1- will indicate 'Employer', 2- will indicate 'supplier' & 3- will indicate 'sub-supplier'. | | | | | | | | |
| | b. In 'Remarks' column following abbreviations shall be used - RR-Review of Records, T.C. - Test Certificate, JIR - Joint Inspection Report & CHP - Customer Hold Point, | | | | | | | | |
| | c. The firm shall obtain acceptance/clearance of finished product for further activities based on Test Certificates & Internal Report (IR) | | | | | | | | |
| | d. Any additional test required as per the requirement of equipment in accordance with Contract Agreement/Relevent standard apart from QAP will be carried out by the firm without any additional financial implication. | | | | | | | | |
| | e.This QAP does not absolve the Contractor/sub-contractor of his responsibility to supply the correct products, strictly in conformity to the specifications given in the purchase order/contract. The above Model QAP stipulates the bare minimum requirements which shall be complied by the contractor. The above QAP has been made presuming subletting of work shall be allowed in the tender. In case subletting of work is not allowed in the tender, then"3/2" shall be considered as "2" under the column " Perform" . | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | **Signature** | | | | | **Signature & Seal** | | | |
| | **EMPLOYER ( QA&I DEPT.)** | | | | **(VENDORS Q.C. DEPT. OR REPRESENTATIVE)** | | | | |

| **परियोजना (PROJECT) :** | | | | **ग्राहक (CLIENT):** | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **उपष्कर का नाम (NAME OF EQUIPMENT) : Generator Stator (Stator Punchings)** | | | | **विक्रेता (VENDOR):** | | | | | |
| | | | | **एनआईटी/ क्रय आदेश संदर्भ( NIT / P.O. Reference) :** | | | | | |
| **क्र. सं.** S.N. | **मद/घटक एवं विशेषता** ITEM/ COMPONENT & CHARACTERISTICS | **जाँच की प्रकृति** NATURE OF CHECKS | **जाँच की मात्रा** QUANTUM OF CHECKS | **संदर्भ दस्तावेज़ / स्वीकृति मानदंड** REFERENCE DOCUMENT/ ACCEPTANCE NORMS | **रेकॉर्ड फ़ारमैट** RECORD FORMAT | **निरीक्षण एजैंसी** Inspecting Agency | | | **टिप्पणी** Remarks |
| | | | | | | प्रदर्शन PERFORM | गवाह WITNESS | सत्यापन VERIFY | |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **A** | **Raw Material (CRNGO)** | | | | | | | | |
| i) | Material Properties | | | | | | | | |
| | Grade of Material, Nominal Thickness, Specific Loss, Magnetic Polarization, Anisotropy of loss, Stacking factor, Conventional Density | Visual/ Measurement/ Electrical | Sample | Tech spec./ Appd Drg./ IS/IEC/Equivalent Standard | TC | 3/2 | - | 1 | TC |
| **B** | **In Process** | | | | | | | | |
| i) | Check of Burr Level in Punching | Measurement | Sample | -do- | TC | 3/2 | - | 1 | TC |
| ii) | Stacking factor | Measurement | -do- | -do- | TC | 3/2 | - | 1 | TC |
| iii) | Check for Quality of Lamination Varnishing, Thickness & IR value | Measurement/ Electrical | -do- | -do- | JIR | 3/2 | 1 | - | CHP |
| iv) | Dimensional check of Punchings | Measurement | -do- | -do- | TC | 3/2 | - | 1 | TC |
| v) | Specific Total Loss | Electrical | -do- | -do- | TC | 3/2 | - | 1 | TC |
| vi) | Magnetic Polarization | -do- | -do- | -do- | TC | 3/2 | - | 1 | TC |
| vii) | Trial Assembly of Punching ( Core dia , height etc) | Measurement | -do- | -do- | TC | 3/2 | - | 1 | TC for core assembly |
| | # If stacking done at site then above " CHP* " mentioned test shall be performed at site otherwise at manufacturer's works | | | | | | | | |
| Note: | a. In ‘Inspection Agency’ column figure 1,2,or 3 to be filled. 1- will indicate 'Employer', 2- will indicate ‘supplier’ & 3- will indicate ‘sub-supplier’. | | | | | | | | |
| | b. In ‘Remarks’ column following abbreviations shall be used - RR-Review of Records, T.C. - Test Certificate, JIR - Joint Inspection Report & CHP - Customer Hold Point, | | | | | | | | |
| | c. The firm shall obtain acceptance/clearance of finished product for further activities based on Test Certificates & Internal Report (IR) | | | | | | | | |
| | d. Any additional test required as per the requirement of equipment in accordance with Contract Agreement/Relevent standard apart from QAP will be carried out by the firm without any additional financial implication. | | | | | | | | |
| | e.This QAP does not absolve the Contractor/sub-contractor of his responsibility to supply the correct products, strictly in conformity to the specifications given in the purchase order/contract. The above Model QAP stipulates the bare minimum requirements which shall be complied by the contractor. The above QAP has been made presuming subletting of work shall be allowed in the tender. In case subletting of work is not allowed in the tender, then"3/2" shall be considered as "2" under the column " Perform" . | | | | | | | | |
| | | | | | | | | | |
| | **Signature** | | | | | **Signature & Seal** | | | |

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|---|---|---|---|---|---|
| | **EMPLOYER ( QA&I DEPT.)** | | | | **(VENDORS Q.C. DEPT. OR REPRESENTATIVE)** |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **परियोजना (PROJECT) :** | | | | **ग्राहक (CLIENT):** | | | | | |
| **उपष्कर का नाम (NAME OF EQUIPMENT) : Generator Stator (Unwound Stator)** | | | | **विक्रेता (VENDOR):** | | | | | |
| | | | | **एनआईटी/ क्रय आदेश संदर्भ( NIT / P.O. Reference) :** | | | | | |
| क्र. सं. S.N. | मद/घटक एवं विशेषता ITEM/ COMPONENT & CHARACTERISTICS | जाँच की प्रकृति NATURE OF CHECKS | जाँच की मात्रा QUANTUM OF CHECKS | संदर्भ दस्तावेज़ / स्वीकृति मानदंड REFERENCE DOCUMENT/ ACCEPTANCE NORMS | रेकॉर्ड फ़ारमैट RECORD FORMAT | निरीक्षण एजैंसी Inspecting Agency | | | टिप्पणी Remarks |
| | | | | | | प्रदर्शन PERFORM | गवाह WITNESS | सत्यापन VERIFY | |
| **A** | **Studs & End Plate** | | | | | | | | |
| i) | Material Properties. | Chem/Mech. | Sample | Tech spec./ Appd Drg./ IS/IEC/Equivalent Standard | TC | 3/2 | - | 1 | TC |
| **B** | **Core Assembly** | | | | | | | | |
| i) | Dimensional checking (check of core for waviness, core dia, Packet size and height after assembly) | Measurement | Sample plan | -do- | JIR | 3/2 | 1 | - | CHP |
| ii) | Core Loss Test and Hot Spot Detection | Electrical | 5% (TC for 100%) | -do- | JIR | 3/2 | 1 | - | CHP |
| Note: | a. In 'Inspection Agency' column figure 1,2,or 3 to be filled. 1- will indicate 'Employer', 2- will indicate 'supplier' & 3- will indicate 'sub-supplier'. | | | | | | | | |
| | b. In 'Remarks' column following abbreviations shall be used - RR-Review of Records, T.C. - Test Certificate, JIR - Joint Inspection Report & CHP - Customer Hold Point, | | | | | | | | |
| | c. The firm shall obtain acceptance/clearance of finished product for further activities based on Test Certificates & Internal Report (IR) | | | | | | | | |
| | d. Any additional test required as per the requirement of equipment in accordance with Contract Agreement/Relevent standard apart from QAP will be carried out by the firm without any additional financial implication. | | | | | | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| | e.This QAP does not absolve the Contractor/sub-contractor of his responsibility to supply the correct products, strictly in conformity to the specifications given in the purchase order/contract. The above Model QAP stipulates the bare minimum requirements which shall be complied by the contractor. The above QAP has been made presuming subletting of work shall be allowed in the tender. In case subletting of work is not allowed in the tender, then"3/2" shall be considered as "2" under the column " Perform" . | | | | | |
| | | | | | | |
| | **Signature** | | | | | **Signature & Seal** |
| | **EMPLOYER ( QA&I DEPT.)** | | | | **(VENDORS Q.C. DEPT. OR REPRESENTATIVE)** | |

| **परियोजना (PROJECT) :** | | | | **ग्राहक (CLIENT):** | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **उपष्कर का नाम (NAME OF EQUIPMENT) : Generator Stator (Stator Winding Bars)** | | | | **विक्रेता (VENDOR):** | | | | | |
| | | | | **एनआईटी/ क्रय आदेश संदर्भ( NIT / P.O. Reference) :** | | | | | |
| **क्र. सं.** **S.N.** | **मद/घटक एवं विशेषता** **ITEM/ COMPONENT & CHARACTERISTICS** | **जाँच की प्रकृति** **NATURE OF CHECKS** | **जाँच की मात्रा** **QUANTUM OF CHECKS** | **संदर्भ दस्तावेज़ / स्वीकृति मानदंड** **REFERENCE DOCUMENT/ ACCEPTANCE NORMS** | **रेकॉर्ड फ़ारमैट** **RECORD FORMAT** | **निरीक्षण एजैंसी** **Inspecting Agency** | | | **टिप्पणी** **Remarks** |
| | | | | | | प्रदर्शन PERFORM | गवाह WITNESS | सत्यापन VERIFY | |
| **1** | **Raw Material** | | | | | | | | |
| A. | Copper Wire Bars/ Ingots/ CC Wire Rods/ Extruded Sections Strands (Material Grade) (As applicable) | | | | | | | | |
| i) | Chemical Composition | Chemical | Sample | Tech spec./ Appd Drg./ IS/IEC/Equivalent Standard | TC | 3/2 | - | 1 | TC |
| ii) | Resistivity Test | Electrical | -do- | -do- | TC | 3/2 | - | 1 | TC |
| B. | Fiber Glass Covered Polyesterimide/ Epoxy Varnish Bonded Rectangular Copper Conductor | | | | | | | | |
| i) | Dimensional check of Bare & Covered Conductor & Insulation Thickness | Measurement | Sample | Tech spec./ Appd Drg./ IS/IEC/Equivalent Standard | TC | 3/2 | - | 1 | TC |
| ii) | Flexibility/ Bending , Tensile & Elongation | Mechanical | -do- | -do- | TC | 3/2 | - | 1 | TC |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Test | | | | | | | | |
| iii) | Breakdown Voltage Test at Room & elevated temp. | Electrical | -do- | -do- | TC | 3/2 | - | 1 | TC |
| iv) | Cure Test | Thermal | -do- | -do- | TC | 3/2 | - | 1 | TC |
| v) | Electrical Resistivity Measurement | Electrical | -do- | -do- | TC | 3/2 | - | 1 | TC |
| C. | Mica Tape | | | | | | | | |
| i) | Thickness | Measurement | Sample | Tech spec./ Appd Drg./ IS/IEC/Equivalent Standard | TC | 3/2 | - | 1 | TC |
| ii) | Tensile Strength | Mechanical | -do- | -do- | TC | 3/2 | - | 1 | TC |
| iii) | Mica content | Chemical | -do- | -do- | TC | 3/2 | - | 1 | TC |
| iv) | Bond/ Binder/ Resin Content | -do- | -do- | -do- | TC | 3/2 | - | 1 | TC |
| v) | Backing/ Glass Fabric | -do- | -do- | -do- | TC | 3/2 | - | 1 | TC |
| vi) | Shelf life (Tape life) | Chemical/Thermal | -do- | -do- | TC | 3/2 | - | 1 | TC |
| **2** | **In Process Inspection** | | | | | | | | |
| A. | After Hot Press | | | | | | | | |
| i) | Transposition angle verification | Visual | Sample | Tech spec./ Appd Drg./ IS/IEC/Equivalent Standard | TC | 3/2 | - | 1 | TC |
| ii) | Inter Strand Test | Electrical | 100% | -do- | TC | 3/2 | - | 1 | TC |
| **3)** | **Final Inspection** | | | | | | | | |
| i) | Tan delta measurement | Electrical | 5% (TC for 100%) | -do- | JIR | 3/2 | 1 | - | CHP |
| ii) | Impulse Voltage Withstand Test (Type Test) | -do- | 1 random bar for complete order | -do- | JIR | 3/2 | 1 | - | CHP |
| iii) | HV Test on Straight & Overhang portion | -do- | 5% (TC for 100%) | -do- | JIR | 3/2 | 1 | - | CHP |
| iv) | IR after HV Test | -do- | 5% (TC for 100%) | -do- | JIR | 3/2 | 1 | - | CHP |
| v) | Dimensional & Model Checking | Measurement/ Visual | 1 full cradle after every 200 bars (5%) | -do- | JIR | 3/2 | 1 | - | CHP |
| vi) | Inter Turn Test (Applicable for coil design only) | Electrical | 100% | -do- | TC | 3/2 | - | 1 | TC |
| Note : | a. In 'Inspection Agency' column figure 1,2,or 3 to be filled. 1- will indicate 'Employer', 2- will indicate 'supplier' & 3- will indicate 'sub-supplier'. | | | | | | | | |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | b. In 'Remarks' column following abbreviations shall be used - RR-Review of Records, T.C. - Test Certificate, JIR - Joint Inspection Report & CHP - Customer Hold Point, | | | | | | | | |
| | c. The firm shall obtain acceptance/clearance of finished product for further activities based on Test Certificates & Internal Report (IR) | | | | | | | | |
| | d. Any additional test required as per the requirement of equipment in accordance with Contract Agreement/Relevent standard apart from QAP will be carried out by the firm without any additional financial implication. | | | | | | | | |
| | e.This QAP does not absolve the Contractor/sub-contractor of his responsibility to supply the correct products, strictly in conformity to the specifications given in the purchase order/contract. The above Model QAP stipulates the bare minimum requirements which shall be complied by the contractor. The above QAP has been made presuming subletting of work shall be allowed in the tender. In case subletting of work is not allowed in the tender, then"3/2" shall be considered as "2" under the column " Perform" . | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | **Signature** | | | | | **Signature & Seal** | | | |
| | **EMPLOYER ( QA&I DEPT.)** | | | | **(VENDORS Q.C. DEPT. OR REPRESENTATIVE)** | | | | |

| **परियोजना (PROJECT) :** | | | | **ग्राहक (CLIENT):** | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **उपष्कर का नाम (NAME OF EQUIPMENT) : Generator Stator (Wound Stator)** | | | | **विक्रेता (VENDOR):** | | | | | |
| | | | | **एनआईटी/ क्रय आदेश संदर्भ( NIT / P.O. Reference) :** | | | | | |
| | | | | | | | | | |
| **क्र. सं. S.N.** | **मद/घटक एवं विशेषता ITEM/ COMPONENT & CHARACTERISTICS** | **जाँच की प्रकृति NATURE OF CHECKS** | **जाँच की मात्रा QUANTUM OF CHECKS** | **संदर्भ दस्तावेज़ / स्वीकृति मानदंड REFERENCE DOCUMENT/ ACCEPTANCE NORMS** | **रेकॉर्ड फ़ारमैट RECORD FORMAT** | **निरीक्षण एजैंसी Inspecting Agency** | | | **टिप्पणी Remarks** |
| | | | | | | प्रदर्शन PERFORM | गवाह WITNESS | सत्यापन VERIFY | |
| 1) | HV Test after placing the Bottom Bars in Stator Slot, Test Bottom Bar Only | Electrical | 100% | Tech spec./ Appd Drg./ IS/IEC/Equivalent Standard | TC | 3/2 | - | 1 | TC |
| 2) | HV Test after placing the Top Bars in Stator Slot, Test Bottom Bar and Top Bar togather | -do- | -do- | -do- | TC | 3/2 | - | 1 | TC |
| 3) | RTD Laying, continuity test, HV & IR test and Resistance measurement | Visual/Elect. | -do- | -do- | TC | 3/2 | - | 1 | TC |
| 4) | Insulation Resistance (IR) and Polarisation Index (PI) of Stator Winding of individual | Electrical | -do- | -do- | TC | 3/2 | - | 1 | TC |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | sector | | | | | | | | |
| 5) | HV test on Segments | Electrical | -do- | -do- | JIR | 3/2 | 1 | - | CHP* |
| | # If winding of stator done at manufacturer's works then " CHP* " mark mentioned tests shall be performed at manufacturer works otherwise same shall be carried out at site. | | | | | | | | |
| Note : | a. In 'Inspection Agency' column figure 1,2,or 3 to be filled. 1- will indicate 'Employer', 2- will indicate 'supplier' & 3- will indicate 'sub-supplier'. | | | | | | | | |
| | b. In 'Remarks' column following abbreviations shall be used - RR-Review of Records, T.C. - Test Certificate, JIR - Joint Inspection Report & CHP - Customer Hold Point, | | | | | | | | |
| | c. The firm shall obtain acceptance/clearance of finished product for further activities based on Test Certificates & Internal Report (IR) | | | | | | | | |
| | d. Any additional test required as per the requirement of equipment in accordance with Contract Agreement/Relevent standard apart from QAP will be carried out by the firm without any additional financial implication. | | | | | | | | |
| | e.This QAP does not absolve the Contractor/sub-contractor of his responsibility to supply the correct products, strictly in conformity to the specifications given in the purchase order/contract. The above Model QAP stipulates the bare minimum requirements which shall be complied by the contractor. The above QAP has been made presuming subletting of work shall be allowed in the tender. In case subletting of work is not allowed in the tender, then"3/2" shall be considered as "2" under the column " Perform" . | | | | | | | | |
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| | **Signature** | | | | | **Signature & Seal** | | | |
| | **EMPLOYER ( QA&I DEPT.)** | | | | **(VENDORS Q.C. DEPT. OR REPRESENTATIVE)** | | | | |
| | | | | | | | | | |

| **परियोजना (PROJECT) :** | | | | **ग्राहक (CLIENT):** | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **उपष्कर का नाम (NAME OF EQUIPMENT) : Generator Rotor (Rim assembly)** | | | | **विक्रेता (VENDOR):** | | | | | |
| | | | | **एनआईटी/ क्रय आदेश संदर्भ( NIT / P.O. Reference) :** | | | | | |
| **क्र. सं.** **S.N.** | **मद/घटक एवं विशेषता** **ITEM/ COMPONENT & CHARACTERISTICS** | **जाँच की प्रकृति** **NATURE OF CHECKS** | **जाँच की मात्रा** **QUANTUM OF CHECKS** | **संदर्भ दस्तावेज़ / स्वीकृति मानदंड** **REFERENCE DOCUMENT/ ACCEPTANCE NORMS** | **रेकॉर्ड फ़ारमैट** **RECORD FORMAT** | **निरीक्षण एजेंसी** **Inspecting Agency** | | | **टिप्पणी** **Remarks** |
| | | | | | | प्रदर्शन PERFOR | गवाह WITNES | सत्यापन | |

| | | | | | | M | S | VERIFY | |
|---|---|---|---|---|---|---|---|---|---|
| **1** | **Rim Punching** | | | | | | | | |
| **A** | **Raw Material (High Tensile Magnetic Steel Sheet)** | | | | | | | | |
| i) | Chemical Composition | Chemical | Sample | Tech spec./ Appd Drg./ IS/IEC/Equivalent Standard | TC | 3/2 | - | 1 | TC |
| ii) | Mechanical Properties | Mechanical | -do- | -do- | TC | 3/2 | - | 1 | TC |
| **B** | **Bolts / Studs & Nuts** | | | | | | | | |
| i) | Material Properties | Chem/Mech | -do- | Tech spec./ Appd Drg./ IS/IEC/Equivalent Standard | TC | 3/2 | - | 1 | TC |
| **C)** | **Final Inspection** | | | | | | | | |
| i) | Visual inspection | Visual | -do- | Tech spec./ Appd Drg./ IS/IEC/Equivalent Standard | TC | 3/2 | - | 1 | TC |
| ii) | Thicknes of Punching & Burr level Measurement | Measurement | -do- | -do- | TC | 3/2 | - | 1 | TC |
| iii) | Trial Assembely of Rotor Rim Punching without spider (inner & outer diameter verification, slot width & depth measurement) | Visual/ Measurement | -do- | -do- | TC | 3/2 | - | 1 | TC |
| **2** | **Rim Stud & Nuts** | | | | | | | | |
| **A** | **Raw Material** | | | | | | | | |
| i) | Test Piece Marking | Visual | Sample per Lot | Tech spec./ Appd Drg./ IS/IEC/Equivalent Standard | TC | 3/2 | - | 1 | TC |
| ii) | Chemical Composition | Chemical Test | -do- | -do- | TC | 3/2 | - | 1 | TC |
| iii) | Mechanical Testing (Tensile , Impact , Hardness, Bend Test )- As applicable | Mechanical Test | -do- | -do- | TC | 3/2 | - | 1 | TC |
| **3** | **Braking ring & Rotor Fan Assembly** | | | | | | | | |
| **A** | **Raw Material** | | | | | | | | |
| i) | Chemical & Mechanical Properties | Chem/Mech | Sample | Tech spec./ Appd Drg./ IS/IEC/Equivalent Standard | TC | 3/2 | - | 1 | TC |
| **B** | **Final Inspection** | | | | | | | | |

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|---|---|---|---|---|---|---|---|---|---|
| i) | Dimensions of Rotor Fan :<br>i) Radial<br>ii) Axial | Measurement | -do- | Tech spec./ Appd Drg./ IS/IEC/Equivalent Standard | JIR<br>/<br>TC | 3/2<br>/<br>3/2 | 1<br>/<br>- | -<br>/<br>1 | i) Radial - CHP<br>ii) Axial - TC |
| ii) | UT of brake ring ( After machining and before hole punching ) | UT | -do- | -do- | JIR | 3/2 | 1 | - | CHP |
| iii) | NDT of Welds | RT, UT, MPI, DPT (as applicable) | -do- | -do- | JIR | 3/2 | 1 | - | CHP |
| Note : | a. In 'Inspection Agency' column figure 1,2,or 3 to be filled. 1- will indicate 'Employer', 2- will indicate 'supplier' & 3- will indicate 'sub-supplier'. | | | | | | | | |
| | b. In 'Remarks' column following abbreviations shall be used - RR-Review of Records, T.C. - Test Certificate, JIR - Joint Inspection Report & CHP - Customer Hold Point, | | | | | | | | |
| | c. The firm shall obtain acceptance/clearance of finished product for further activities based on Test Certificates & Internal Report (IR) | | | | | | | | |
| | d. Any additional test required as per the requirement of equipment in accordance with Contract Agreement/Relevent standard apart from QAP will be carried out by the firm without any additional financial implication. | | | | | | | | |
| | e.This QAP does not absolve the Contractor/sub-contractor of his responsibility to supply the correct products, strictly in conformity to the specifications given in the purchase order/contract. The above Model QAP stipulates the bare minimum requirements which shall be complied by the contractor. The above QAP has been made presuming subletting of work shall be allowed in the tender. In case subletting of work is not allowed in the tender, then"3/2" shall be considered as "2" under the column " Perform" . | | | | | | | | |
| | | | | | | | | | |
| | **Signature** | | | | | **Signature & Seal** | | | |
| | **EMPLOYER ( QA&I DEPT.)** | | | | **(VENDORS Q.C. DEPT. OR REPRESENTATIVE)** | | | | |

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| **परियोजना (PROJECT) :** | | | | **ग्राहक (CLIENT):** | | | | | |
| **उपष्कर का नाम (NAME OF EQUIPMENT) : Generator Rotor (Pole Assembly)** | | | | **विक्रेता (VENDOR):** | | | | | |
| | | | | **एनआईटी/ क्रय आदेश संदर्भ( NIT / P.O. Reference) :** | | | | | |
| | | | | | | | | | |
| **क्र. सं. S.N.** | **मद/घटक एवं विशेषता ITEM/ COMPONENT & CHARACTERISTICS** | **जाँच की प्रकृति NATURE OF CHECKS** | **जाँच की मात्रा QUANTUM OF CHECKS** | **संदर्भ दस्तावेज़ / स्वीकृति मानदंड REFERENCE DOCUMENT/ ACCEPTANCE NORMS** | **रेकॉर्ड फ़ारमैट RECORD FORMAT** | **निरीक्षण एजैंसी Inspecting Agency** | | | **टिप्पणी Remarks** |
| | | | | | | प्रदर्शन PERFORM | गवाह WITNESS | सत्यापन | |

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| | | | | | | | | VERIFY | |
| | **Pole Punching, End Plate, Pole Coils & Damper Bars** | | | | | | | | |
| **1** | **Pole punching** | | | | | | | | |
| **A** | **Raw Material (High Tensile Magnetic Steel sheet & Copper)** | | | | | | | | |
| i) | Chemical Composition | Chemical | Sample per Lot | Tech spec./ Appd Drg./ IS/IEC/Equivalent Standard | TC | 3/2 | - | 1 | TC |
| ii) | Mechanical Properties | Mechanical | -do- | -do- | TC | 3/2 | - | 1 | TC |
| iii) | Electrical Properties | Electrical | -do- | -do- | TC | 3/2 | - | 1 | TC |
| **B** | **Final Inspection** | | | | | | | | |
| i) | Visual Finish & Dimensional Check | Visual/ Measurement | 100% | Tech spec./ Appd Drg./ IS/IEC/Equivalent Standard | TC | 3/2 | - | 1 | TC |
| **2** | **Material properties of End plate , damper winding bars, Nuts & Bolts** | Chem/Mech/Elec t (as applicable) | Sample | -do- | TC | 3/2 | - | 1 | TC |
| **3** | **Pole coils** | | | | | | | | |
| **A** | **Raw material (Copper)** | | | | | | | | |
| i) | Material Properties | Chem/Mech/Elec t | Sample | Tech spec./ Appd Drg./ IS/IEC/Equivalent Standard | TC | 3/2 | - | 1 | TC |
| **B** | **In Process Inspection** | | | | | | | | |
| i) | Inter Turn Test / Millivolt Drop Test | Electrical | Sample | Tech spec./ Appd Drg./ IS/IEC/Equivalent Standard | JIR | 3/2 | 1 | - | CHP |
| **C** | **Final Inspection (wound pole assembly)** | | | | | | | | |
| i) | Visual Finish , Weight & Dimensional Check | Visual/ Measurement | 100% | Tech spec./ Appd Drg./ IS/IEC/Equivalent Standard | JIR | 3/2 | 1 | - | CHP |
| ii) | HV & IR Test | Electrical | -do- | -do- | JIR | 3/2 | 1 | - | CHP |
| iii) | DC Resistance Measurement | Electrical | -do- | -do- | JIR | 3/2 | 1 | - | CHP |
| iv) | Impedance Measurement | Electrical | -do- | -do- | JIR | 3/2 | 1 | - | CHP |
| Note : | a. In 'Inspection Agency' column figure 1,2,or 3 to be filled. 1- will indicate 'Employer', 2- will indicate 'supplier' & 3- will indicate 'sub-supplier'. | | | | | | | | |
| | b. In 'Remarks' column following abbreviations shall be used - RR-Review of Records, T.C. - Test Certificate, JIR - Joint Inspection Report & CHP - Customer Hold Point, | | | | | | | | |
| | c. The firm shall obtain acceptance/clearance of finished product for further activities based on Test Certificates & Internal Report (IR) | | | | | | | | |

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| | d. Any additional test required as per the requirement of equipment in accordance with Contract Agreement/Relevent standard apart from QAP will be carried out by the firm without any additional financial implication. | | | | | |
| | e.This QAP does not absolve the Contractor/sub-contractor of his responsibility to supply the correct products, strictly in conformity to the specifications given in the purchase order/contract. The above Model QAP stipulates the bare minimum requirements which shall be complied by the contractor. The above QAP has been made presuming subletting of work shall be allowed in the tender. In case subletting of work is not allowed in the tender, then"3/2" shall be considered as "2" under the column " Perform" . | | | | | |
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| | **Signature** | | | | | **Signature & Seal** |
| | **EMPLOYER ( QA&I DEPT.)** | | | | **(VENDORS Q.C. DEPT. OR REPRESENTATIVE)** | |

| **परियोजना (PROJECT) :** | | | | **ग्राहक (CLIENT):** | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **उपष्कर का नाम (NAME OF EQUIPMENT) : Generator Rotor (Spider)** | | | | **विक्रेता (VENDOR):** | | | | | |
| | | | | **एनआईटी/ क्रय आदेश संदर्भ( NIT / P.O. Reference) :** | | | | | |
| | | | | | | | | | |
| **क्र. सं. S.N.** | **मद/घटक एवं विशेषता ITEM/ COMPONENT & CHARACTERISTICS** | **जाँच की प्रकृति NATURE OF CHECKS** | **जाँच की मात्रा QUANTUM OF CHECKS** | **संदर्भ दस्तावेज़ / स्वीकृति मानदंड REFERENCE DOCUMENT/ ACCEPTANCE NORMS** | **रेकॉर्ड फ़ारमैट RECORD FORMAT** | **निरीक्षण एजैंसी Inspecting Agency** | | | **टिप्पणी Remarks** |
| | | | | | | प्रदर्शन PERFORM | गवाह WITNESS | सत्यापन VERIFY | |
| **A** | **Raw Material (Steel Plate)** | | | | | | | | |
| i) | Chemical Composition | Chem | Sample per Lot | Tech spec./ Appd Drg./ IS/IEC/Equivalent Standard | TC | 3/2 | - | 1 | TC |
| ii) | Mechanical Properties | Mech | -do- | -do- | TC | 3/2 | - | 1 | TC |
| iii) | NDT of Steel Plates ( >20 mm thick plates) | UT | -do- | -do- | TC | 3/2 | - | 1 | TC |
| **B** | **In-process Inspection** | | | | | | | | |
| i) | NDT of welds | RT, UT, MPI, DPT | 100% | Tech spec./ Appd Drg./ IS/IEC/Equivalent Standard | TC | 3/2 | - | 1 | TC |

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| | | (as applicable) | | | | | | | |
| ii) | Post weld Stress Relieving-Heat Tratment (if applicable) | Heat Chart | -do- | -do- | TC | 3/2 | - | 1 | TC |
| iii) | Machining Dimensional check | Measurement | -do- | -do- | TC | 3/2 | - | 1 | TC |
| **C** | **Final Inspection** | | | | | | | | |
| i) | Machining Dimensional check | Measurement | -do- | -do- | JIR | 3/2 | 1 | - | CHP |
| ii) | Surface Finish of machined surface | Visual | -do- | -do- | JIR | 3/2 | 1 | - | CHP |
| iii) | Flange Flatness & Gap Checking | Measurement | -do- | -do- | JIR | 3/2 | 1 | - | CHP |
| iv) | Painting | Visual | -do- | -do- | JIR | 3/2 | 1 | - | CHP |
| Note : | a. In 'Inspection Agency' column figure 1,2,or 3 to be filled. 1- will indicate 'Employer', 2- will indicate 'supplier' & 3- will indicate 'sub-supplier'. | | | | | | | | |
| | b. In 'Remarks' column following abbreviations shall be used - RR-Review of Records, T.C. - Test Certificate, JIR - Joint Inspection Report & CHP - Customer Hold Point, | | | | | | | | |
| | c. The firm shall obtain acceptance/clearance of finished product for further activities based on Test Certificates & Internal Report (IR) | | | | | | | | |
| | d. Any additional test required as per the requirement of equipment in accordance with Contract Agreement/Relevent standard apart from QAP will be carried out by the firm without any additional financial implication. | | | | | | | | |
| | e.This QAP does not absolve the Contractor/sub-contractor of his responsibility to supply the correct products, strictly in conformity to the specifications given in the purchase order/contract. The above Model QAP stipulates the bare minimum requirements which shall be complied by the contractor. The above QAP has been made presuming subletting of work shall be allowed in the tender. In case subletting of work is not allowed in the tender, then"3/2" shall be considered as "2" under the column " Perform" . | | | | | | | | |
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| | **Signature** | | | | | **Signature & Seal** | | | |
| | **EMPLOYER ( QA&I DEPT.)** | | | | | **(VENDORS Q.C. DEPT. OR REPRESENTATIVE)** | | | |
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| **परियोजना (PROJECT) :** | | | | **ग्राहक (CLIENT):** | | | | |
| **उपष्कर का नाम (NAME OF EQUIPMENT) : Generator Shaft (Top & bottom)** | | | | **विक्रेता (VENDOR):** | | | | |
| | | | | **एनआईटी/ क्रय आदेश संदर्भ( NIT / P.O. Reference)** | | | | |

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|---|---|---|---|---|---|---|---|---|---|
| क्र. सं. S.N. | मद/घटक एवं विशेषता ITEM/ COMPONENT & CHARACTERISTICS | जाँच की प्रकृति NATURE OF CHECKS | जाँच की मात्रा QUANTUM OF CHECKS | संदर्भ दस्तावेज़ / स्वीकृति मानदंड REFERENCE DOCUMENT/ ACCEPTANCE NORMS | रेकॉर्ड फ़ारमैट RECORD FORMAT | निरीक्षण एजेंसी Inspecting Agency | | | टिप्पणी Remarks |
| | | | | | | प्रदर्शन PERFORM | गवाह WITNESS | सत्यापन VERIFY | |
| **A** | **Raw Material** | | | | | | | | |
| | Forged Shaft-Forged Carbon Steel | | | | | | | | |
| i) | Test Piece Marking | Visual | Sample per Lot | Tech spec./ Appd Drg./ IS/IEC/Equivalent Standard | JIR | 3/2 | 1 | - | CHP |
| ii) | Chemical Composition | Chemical Test | - do- | -do- | JIR | 3/2 | 1 | - | CHP |
| iii) | Mechanical Analysis-As applicable (Tensile Test, Impact Test, Hardness Test & Bend Test) | Mechanical Test | - do- | -do- | JIR | 3/2 | 1 | - | CHP |
| iv) | NDT of Shaft | RT, UT, MPI, DPT (as applicable) | 100% | - do- | TC | 3/2 | - | 1 | TC |
| **B** | **Inprocess inspection** | | | | | | | | |
| i) | Heat Treatment | Heat Chart | 100% | Tech spec./ Appd Drg./ IS/IEC/Equivalent Standard | TC | 3/2 | - | 1 | TC |
| ii) | NDT After Heat Treatment | RT, UT, MPI, DPT (as applicable) | -do- | -do- | TC | 3/2 | - | 1 | TC |
| **C** | **Final Inspection** | | | | | | | | |
| i) | Boroscopic Examination of Shaft - Centre Bore Dia | Visual / Measurement | 100% | Tech spec./ Appd Drg./ IS/IEC/Equivalent Standard | JIR | 3/2 | 1 | - | CHP |
| ii) | NDT for Surface / Sub-surface Defects | RT, UT, MPI, DPT (as applicable) | - do- | - do- | JIR | 3/2 | 1 | - | CHP |
| iii) | Runout Check of Shaft and Shaft with Thrust Collar Assembly (if applicable) | -do- | -do- | -do- | JIR | 3/2 | 1 | - | CHP |
| iv) | Dimension check of Shaft | Visual / Measurement | Critical Dim. | - do- | JIR | 3/2 | 1 | - | CHP |
| v) | Concavity & Convexity of Flanges | Measurement | 100% | - do- | JIR | 3/2 | 1 | - | CHP |

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| vi) | Surface Finish Check of Guide Bearing Journals & Flanges | Visual / Measurement | Sample | - do- | JIR | 3/2 | 1 | - | CHP |
| vii) | Interchangeability check & Dimensional check for coupling holes & bolts | Visual / Measurement | 100% | - do- | JIR | 3/2 | 1 | - | CHP |
| Note : | a. In 'Inspection Agency' column figure 1,2,or 3 to be filled. 1- will indicate 'Employer', 2- will indicate 'supplier' & 3- will indicate 'sub-supplier'. | | | | | | | | |
| | b. In 'Remarks' column following abbreviations shall be used - RR-Review of Records, T.C. - Test Certificate, JIR - Joint Inspection Report & CHP - Customer Hold Point, | | | | | | | | |
| | c. The firm shall obtain acceptance/clearance of finished product for further activities based on Test Certificates & Internal Report (IR) | | | | | | | | |
| | d. Any additional test required as per the requirement of equipment in accordance with Contract Agreement/Relevent standard apart from QAP will be carried out by the firm without any additional financial implication. | | | | | | | | |
| | e.This QAP does not absolve the Contractor/sub-contractor of his responsibility to supply the correct products, strictly in conformity to the specifications given in the purchase order/contract. The above Model QAP stipulates the bare minimum requirements which shall be complied by the contractor. The above QAP has been made presuming subletting of work shall be allowed in the tender. In case subletting of work is not allowed in the tender, then"3/2" shall be considered as "2" under the column " Perform" . | | | | | | | | |
| | | | | | | | | | |
| | **Signature** | | | | | **Signature & Seal** | | | |
| | **EMPLOYER ( QA&I DEPT.)** | | | | **(VENDORS Q.C. DEPT. OR REPRESENTATIVE)** | | | | |

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| **परियोजना (PROJECT) :** | | | | **ग्राहक (CLIENT):** | | | | | |
| **उपष्कर का नाम (NAME OF EQUIPMENT) : Generator Bracket (Upper & Lower)** | | | | **विक्रेता (VENDOR):** | | | | | |
| | | | | **एनआईटी/ क्रय आदेश संदर्भ( NIT / P.O. Reference) :** | | | | | |
| **क्र. सं. S.N.** | **मद/घटक एवं विशेषता ITEM/ COMPONENT & CHARACTERISTICS** | **जाँच की प्रकृति NATURE OF CHECKS** | **जाँच की मात्रा QUANTUM OF CHECKS** | **संदर्भ दस्तावेज़ / स्वीकृति मानदंड REFERENCE DOCUMENT/ ACCEPTANCE NORMS** | **रेकॉर्ड फ़ारमैट RECORD FORMAT** | **निरीक्षण एजैंसी Inspecting Agency** | | | **टिप्पणी Remarks** |
| | | | | | | प्रदर्शन PERFORM | गवाह WITNESS | सत्यापन VERIFY | |
| **A)** | **Raw Material** | | | | | | | | |
| i) | Chemical Composition | Chemical | Sample | Tech spec./ Appd Drg./ IS/IEC/Equivalent Standard | TC | 3/2 | - | 1 | TC |
| ii) | Mechanical Properties | Mechanical | -do- | -do- | TC | 3/2 | - | 1 | TC |

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| **B)** | **Inprocess Inspection** | | | | | | | | |
| i) | Dimensional Check | Measurement | 100% | Tech spec./ Appd Drg./ IS/IEC/Equivalent Standard | TC | 3/2 | - | 1 | TC |
| ii) | NDT of Welds | RT, UT, MPI, DPT (as applicable) | -do- | -do- | TC | 3/2 | - | 1 | TC |
| **C)** | **Final Inspection** | | | | | | | | |
| i) | Surface finish & Dimensional Check | Measurement | 100% | Tech spec./ Appd Drg./ IS/IEC/Equivalent Standard | JIR | 3/2 | 1 | - | CHP |
| ii) | Leakage Test | Measurement | -do- | -do- | JIR | 3/2 | 1 | - | CHP |
| iii) | Flatness & Level checking of Sole Plate face | -do- | -do- | -do- | JIR | 3/2 | 1 | - | CHP |
| iv) | Trial assembly of bottom bracket arm with central part & upper bracket arm with central part | -do- | -do- | -do- | JIR | 3/2 | 1 | - | CHP |
| vi) | Painting | Visual | -do- | -do- | JIR | 3/2 | 1 | - | CHP |
| Note : | a. In 'Inspection Agency' column figure 1,2,or 3 to be filled. 1- will indicate 'Employer', 2- will indicate 'supplier' & 3- will indicate 'sub-supplier'. | | | | | | | | |
| | b. In 'Remarks' column following abbreviations shall be used - RR-Review of Records, T.C. - Test Certificate, JIR - Joint Inspection Report & CHP - Customer Hold Point, | | | | | | | | |
| | c. The firm shall obtain acceptance/clearance of finished product for further activities based on Test Certificates & Internal Report (IR) | | | | | | | | |
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| | e.This QAP does not absolve the Contractor/sub-contractor of his responsibility to supply the correct products, strictly in conformity to the specifications given in the purchase order/contract. The above Model QAP stipulates the bare minimum requirements which shall be complied by the contractor. The above QAP has been made presuming subletting of work shall be allowed in the tender. In case subletting of work is not allowed in the tender, then"3/2" shall be considered as "2" under the column " Perform" . | | | | | | | | |
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| | | | | | | | | | |
| | **Signature** | | | | | **Signature & Seal** | | | |
| | **EMPLOYER ( QA&I DEPT.)** | | | | **(VENDORS Q.C. DEPT. OR REPRESENTATIVE)** | | | | |
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| **परियोजना (PROJECT) :** | | | | **ग्राहक (CLIENT):** | | | | | |
| **उपष्कर का नाम (NAME OF EQUIPMENT) : Generator Bearing Pads (Thrust, Upper & Lower Guide Bearing Pads)** | | | | **विक्रेता (VENDOR):** | | | | | |
| | | | | **एनआईटी/ क्रय आदेश संदर्भ( NIT / P.O. Reference) :** | | | | | |
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| **क्र. सं.** S.N. | **मद/घटक एवं विशेषता** ITEM/ COMPONENT & CHARACTERISTICS | **जाँच की प्रकृति** NATURE OF CHECKS | **जाँच की मात्रा** QUANTUM OF CHECKS | **संदर्भ दस्तावेज़ / स्वीकृति मानदंड** REFERENCE DOCUMENT/ ACCEPTANCE NORMS | **रेकॉर्ड फ़ारमैट** RECORD FORMAT | **निरीक्षण एजैंसी** Inspecting Agency | | | **टिप्पणी** Remarks |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | प्रदर्शन PERFORM | गवाह WITNESS | सत्यापन VERIFY | |
| **A** | **Raw Material (Supports & Pads)** | | | | | | | | |
| i) | Chemical Composition | Chemical | Sample | Tech spec./ Appd Drg./ IS/IEC/Equivalent Standard | TC | 3/2 | - | 1 | TC |
| ii) | Mechanical Properties | Mechanical | -do- | -do- | TC | 3/2 | - | 1 | TC |
| iii) | NDT of Pad base /Cast Part | RT, UT, MPI, DPT (as applicable) | -do- | -do- | TC | 3/2 | - | 1 | TC |
| iv) | Babbit Material - Chemical | Chemical | -do- | -do- | TC | 3/2 | - | 1 | TC |
| **B** | **Final Inspection** | | | | | | | | |
| i) | UT & DP test of Bearing pads | UT & DPT | Sample | Tech spec./ Appd Drg./ IS/IEC/Equivalent Standard | JIR | 3/2 | 1 | - | CHP |
| ii) | Dimensional & Surface finish check | Measurement | -do- | -do- | JIR | 3/2 | 1 | - | CHP |

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| Note: | a. In 'Inspection Agency' column figure 1,2,or 3 to be filled. 1- will indicate 'Employer', 2- will indicate 'supplier' & 3- will indicate 'sub-supplier'. |
| | b. In 'Remarks' column following abbreviations shall be used - RR-Review of Records, T.C. - Test Certificate, JIR - Joint Inspection Report & CHP - Customer Hold Point, |
| | c. The firm shall obtain acceptance/clearance of finished product for further activities based on Test Certificates & Internal Report (IR) |
| | d. Any additional test required as per the requirement of equipment in accordance with Contract Agreement/Relevent standard apart from QAP will be carried out by the firm without any additional financial implication. |

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| | e.This QAP does not absolve the Contractor/sub-contractor of his responsibility to supply the correct products, strictly in conformity to the specifications given in the purchase order/contract. The above Model QAP stipulates the bare minimum requirements which shall be complied by the contractor. The above QAP has been made presuming subletting of work shall be allowed in the tender. In case subletting of work is not allowed in the tender, then"3/2" shall be considered as "2" under the column " Perform" . | | | | | |
| | | | | | | |
| | **Signature** | | | | | **Signature & Seal** |
| | **EMPLOYER ( QA&I DEPT.)** | | | | **(VENDORS Q.C. DEPT. OR REPRESENTATIVE)** | |

| **परियोजना (PROJECT) :** | | | | **ग्राहक (CLIENT):** | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **उपष्कर का नाम (NAME OF EQUIPMENT) : Generator Accessories & Instruments (Brake & Jacking)** | | | | **विक्रेता (VENDOR):** | | | | | |
| | | | | **एनआईटी/ क्रय आदेश संदर्भ( NIT / P.O. Reference) :** | | | | | |
| | | | | | | | | | |
| **क्र. सं. S.N.** | **मद/घटक एवं विशेषता ITEM/ COMPONENT & CHARACTERISTICS** | **जाँच की प्रकृति NATURE OF CHECKS** | **जाँच की मात्रा QUANTUM OF CHECKS** | **संदर्भ दस्तावेज़ / स्वीकृति मानदंड REFERENCE DOCUMENT/ ACCEPTANCE NORMS** | **रेकॉर्ड फ़ारमैट RECORD FORMAT** | **निरीक्षण एजेंसी Inspecting Agency** | | | **टिप्पणी Remarks** |
| | | | | | | प्रदर्शन PERFORM | गवाह WITNESS | सत्यापन VERIFY | |
| | Brake and Jacking System (Brake-Jack Assembly, Brake-Jack Control Panel, Brake Liner and Seamless Pipe) | | | | | | | | |
| **A** | **Raw Material (Brake Liner and Seamless Pipe)** | | | | | | | | |
| i) | Material Chemical Properties | Chemical | Sample | Tech spec./ Appd Drg./ IS/IEC/Equivalent Standard | TC | 3/2 | - | 1 | TC |
| ii) | Mechanical Properties | Mechanical | -do- | -do- | TC | 3/2 | - | 1 | TC |
| **B** | **Final Inspection** | | | | | | | | |
| i) | Functional Test of individual brake jacks | Functional/ Hydraulic | -do- | -do- | JIR | 3/2 | 1 | - | CHP |
| ii) | Dimensions & UT of Brake Liner | UT | -do- | -do- | JIR | 3/2 | 1 | - | CHP |

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| **C)** | Brake & Jack Control Panel | | | | | | | | |
| i) | BOM Verification | Visual | 100% | Tech spec./ Appd Drg./ IS/IEC/Equivalent Standard | JIR | 3/2 | 1 | - | CHP |
| ii) | Scheme Checking | Visual | -do- | -do- | JIR | 3/2 | 1 | - | CHP |
| iii) | IR & HV Test | Electrical | -do- | -do- | JIR | 3/2 | 1 | - | CHP |
| iv) | Functional Check of Brake-Jack Control Panel | Functional/ Hydraulic | -do- | -do- | JIR | 3/2 | 1 | - | CHP |
| Note : | a. In 'Inspection Agency' column figure 1,2,or 3 to be filled. 1- will indicate 'Employer', 2- will indicate 'supplier' & 3- will indicate 'sub-supplier'. | | | | | | | | |
| | b. In 'Remarks' column following abbreviations shall be used - RR-Review of Records, T.C. - Test Certificate, JIR - Joint Inspection Report & CHP - Customer Hold Point, | | | | | | | | |
| | c. The firm shall obtain acceptance/clearance of finished product for further activities based on Test Certificates & Internal Report (IR) | | | | | | | | |
| | d. Any additional test required as per the requirement of equipment in accordance with Contract Agreement/Relevent standard apart from QAP will be carried out by the firm without any additional financial implication. | | | | | | | | |
| | e.This QAP does not absolve the Contractor/sub-contractor of his responsibility to supply the correct products, strictly in conformity to the specifications given in the purchase order/contract. The above Model QAP stipulates the bare minimum requirements which shall be complied by the contractor. The above QAP has been made presuming subletting of work shall be allowed in the tender. In case subletting of work is not allowed in the tender, then"3/2" shall be considered as "2" under the column " Perform" . | | | | | | | | |
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| | **Signature** | | | | | **Signature & Seal** | | | |
| | **EMPLOYER ( QA&I DEPT.)** | | | | | **(VENDORS Q.C. DEPT. OR REPRESENTATIVE)** | | | |

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| **परियोजना (PROJECT) :** | | | | **ग्राहक (CLIENT):** | | | | |
| **उपष्कर का नाम (NAME OF EQUIPMENT) : Generator Accessories & Instruments (Shaft Coupling Bolts)** | | | | **विक्रेता (VENDOR):** | | | | |
| | | | | **एनआईटी/ क्रय आदेश संदर्भ( NIT / P.O. Reference) :** | | | | |
| **क्र.** | **मद/घटक एवं विशेषता** | **जाँच की** | **जाँच की मात्रा QUANTUM OF** | **संदर्भ दस्तावेज़ / स्वीकृति** | **रेकॉर्ड** | **निरीक्षण एजैंसी Inspecting Agency** | | **टिप्पणी Remarks** |

| सं. S.N. | ITEM/ COMPONENT & CHARACTERISTICS | प्रकृति NATURE OF CHECKS | CHECKS | मानदंड REFERENCE DOCUMENT/ ACCEPTANCE NORMS | फ़ारमैट RECORD FORMAT | प्रदर्शन PERFORM | गवाह WITNESS | सत्यापन VERIFY | |
|---|---|---|---|---|---|---|---|---|---|
| **1)** | **Coupling Bolts** | | | | | | | | |
| **A** | **Raw Material- Forged Coupling Bolts** | | | | | | | | |
| i) | Chemical Composition | Chemical Test | -do- | -do- | JIR | 3/2 | 1 | - | CHP |
| ii) | Mechanical Testing (Tensile , Impact , Hardness, Bend Test )- As applicable | Mechanical Test | -do- | -do- | JIR | 3/2 | 1 | - | CHP |
| iii) | NDT of Coupling Bolts before machining | RT,UT,MPI,DPT (As applicable) | 100% | -do- | TC | 3/2 | - | 1 | TC |
| **B** | **In Process Stage** | | | | | | | | |
| i) | Dimensional examination after machining | Measurement | -do- | Tech spec./ Appd Drg./ IS/IEC/Equivalent Standard | TC | 3/2 | - | 1 | TC |
| **C** | **Final Inspection** | | | | | | | | |
| i) | Dimensional check | Visual / Measurement | Critical Dim. | -do- | JIR | 3/2 | 1 | - | CHP |
| ii) | Painting | Visual / Measurement | 100% | -do- | TC | 3/2 | - | 1 | TC |
| Note : | a. In 'Inspection Agency' column figure 1,2,or 3 to be filled. 1- will indicate 'Employer', 2- will indicate 'supplier' & 3- will indicate 'sub-supplier'. | | | | | | | | |
| | b. In 'Remarks' column following abbreviations shall be used - RR-Review of Records, T.C. - Test Certificate, JIR - Joint Inspection Report & CHP - Customer Hold Point, | | | | | | | | |
| | c. The firm shall obtain acceptance/clearance of finished product for further activities based on Test Certificates & Internal Report (IR) | | | | | | | | |
| | d. Any additional test required as per the requirement of equipment in accordance with Contract Agreement/Relevent standard apart from QAP will be carried out by the firm without any additional financial implication. | | | | | | | | |
| | e.This QAP does not absolve the Contractor/sub-contractor of his responsibility to supply the correct products, strictly in conformity to the specifications given in the purchase order/contract. The above Model QAP stipulates the bare minimum requirements which shall be complied by the contractor. The above QAP has been made presuming subletting of work shall be allowed in the tender. In case subletting of work is not allowed in the tender, then"3/2" shall be considered as "2" under the column " Perform" . | | | | | | | | |
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| | **Signature** | | | | | **Signature & Seal** | | | |

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| | **EMPLOYER ( QA&I DEPT.)** | | | | **(VENDORS Q.C. DEPT. OR REPRESENTATIVE)** |

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| **परियोजना (PROJECT) :** | | | | **ग्राहक (CLIENT):** | | | | | |
| **उपष्कर का नाम (NAME OF EQUIPMENT) : Generator Accessories & Instruments ( Disc, Collar, Springs etc)** | | | | **विक्रेता (VENDOR):** | | | | | |
| | | | | **एनआईटी/ क्रय आदेश संदर्भ( NIT / P.O. Reference) :** | | | | | |
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| **क्र. सं. S.N.** | **मद/घटक एवं विशेषता ITEM/ COMPONENT & CHARACTERISTICS** | **जाँच की प्रकृति NATURE OF CHECKS** | **जाँच की मात्रा QUANTUM OF CHECKS** | **संदर्भ दस्तावेज़ / स्वीकृति मानदंड REFERENCE DOCUMENT/ ACCEPTANCE NORMS** | **रेकॉर्ड फ़ारमैट RECORD FORMAT** | **निरीक्षण एजेंसी Inspecting Agency** | | | **टिप्पणी Remarks** |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | **प्रदर्शन PERFORM** | **गवाह WITNESS** | **सत्यापन VERIFY** | |
| **1** | **Disc, Collar & Spring** | | | | | | | | |
| **A)** | **Raw Material** | | | | | | | | |
| i) | Chemical Composition | Chemical | Sample | Tech spec./ Appd Drg./ IS/IEC/Equivalent Standard | TC | 3/2 | - | 1 | TC |
| ii) | Mechanical Properties | Mechanical | -do- | -do- | TC | 3/2 | - | 1 | TC |
| **B)** | **Inprocess Inspection** | | | | | | | | |
| i) | Heat Treatment procedure - Thrust Collar | Heat Chart | -do- | -do- | TC | 3/2 | - | 1 | TC |
| ii) | NDT of Thrust Collar after Heat Treatment (radial &axial) | RT, UT, MPI, DPT (as applicable) | -do- | -do- | JIR | 3/2 | 1 | - | CHP |
| iii) | Surface Finish of Thrust Collar Runner Disc | Measurement | -do- | -do- | JIR | 3/2 | 1 | - | CHP |
| **C)** | **Final Inspection** | | | | | | | | |
| i) | UT of Runner Disc | UT | Sample | Tech spec./ Appd Drg./ IS/IEC/Equivalent Standard | JIR | 3/2 | 1 | - | CHP |
| ii) | Flatness & Parallelity of surfaces | Measurement | 100% | -do- | JIR | 3/2 | 1 | - | CHP |

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|---|---|---|---|---|---|---|---|---|---|
| iii) | Match marking of Thrust Collar, Shaft & Disc | Visual | -do- | -do- | JIR | 3/2 | 1 | - | CHP |
| Note : | a. In 'Inspection Agency' column figure 1,2,or 3 to be filled. 1- will indicate 'Employer', 2- will indicate 'supplier' & 3- will indicate 'sub-supplier'. | | | | | | | | |
| | b. In 'Remarks' column following abbreviations shall be used - RR-Review of Records, T.C. - Test Certificate, JIR - Joint Inspection Report & CHP - Customer Hold Point, | | | | | | | | |
| | c. The firm shall obtain acceptance/clearance of finished product for further activities based on Test Certificates & Internal Report (IR) | | | | | | | | |
| | d. Any additional test required as per the requirement of equipment in accordance with Contract Agreement/Relevent standard apart from QAP will be carried out by the firm without any additional financial implication. | | | | | | | | |
| | e.This QAP does not absolve the Contractor/sub-contractor of his responsibility to supply the correct products, strictly in conformity to the specifications given in the purchase order/contract. The above Model QAP stipulates the bare minimum requirements which shall be complied by the contractor. The above QAP has been made presuming subletting of work shall be allowed in the tender. In case subletting of work is not allowed in the tender, then"3/2" shall be considered as "2" under the column " Perform" . | | | | | | | | |
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| | **Signature** | | | | | **Signature & Seal** | | | |
| | **EMPLOYER ( QA&I DEPT.)** | | | | **(VENDORS Q.C. DEPT. OR REPRESENTATIVE)** | | | | |

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| **परियोजना (PROJECT) :** | | | | **ग्राहक (CLIENT):** | | | | | |
| **उपष्कर का नाम (NAME OF EQUIPMENT) : Generator Accessories & Instruments (Slip Ring)** | | | | **विक्रेता (VENDOR):** | | | | | |
| | | | | **एनआईटी/ क्रय आदेश संदर्भ( NIT / P.O. Reference) :** | | | | | |
| **क्र. सं. S.N.** | **मद/घटक एवं विशेषता ITEM/ COMPONENT & CHARACTERISTICS** | **जाँच की प्रकृति NATURE OF CHECKS** | **जाँच की मात्रा QUANTUM OF CHECKS** | **संदर्भ दस्तावेज़ / स्वीकृति मानदंड REFERENCE DOCUMENT/ ACCEPTANCE NORMS** | **रेकॉर्ड फ़ारमैट RECORD FORMAT** | **निरीक्षण एजैंसी Inspecting Agency** | | | **टिप्पणी Remarks** |
| | | | | | | **प्रदर्शन PERFORM** | **गवाह WITNESS** | **सत्यापन VERIFY** | |
| **A)** | **Raw Material (Steel)** | | | | | | | | |
| i) | Chemical Composition | Chemical | Sample | Tech spec./ Appd Drg./ IS/IEC/Equivalent Standard | TC | 3/2 | - | 1 | TC |
| ii) | Mechanical Properties | Mechanical | -do- | -do- | TC | 3/2 | - | 1 | TC |

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|---|---|---|---|---|---|---|---|---|---|
| iii) | Carbon Brush | | | | | | | | |
| iv) | Material Grade, Size, Current Density, Hardness, Appaarent Density, Resistivity, etc. | Chem/Mech./Elect. | -do- | -do- | TC | 3/2 | - | 1 | TC |
| **B)** | **Inprocess Inspection** | | | | | | | | |
| i) | UT of Slip Ring | UT | 100% | Tech spec./ Appd Drg./ IS/IEC/Equivalent Standard | TC | 3/2 | - | 1 | TC |
| **C)** | **Final Inspection** | | | | | | | | |
| i) | Dimensional check of assembly after machining | Measurement | 100% | Tech spec./ Appd Drg./ IS/IEC/Equivalent Standard | JIR | 3/2 | 1 | - | CHP |
| ii) | HV & IR testing of slip ring assy. | Electrical | -do- | -do- | JIR | 3/2 | 1 | - | CHP |
| iii) | Run out measurement of assembly | Measurement | -do- | -do- | JIR | 3/2 | 1 | - | CHP |
| Note: | a. In 'Inspection Agency' column figure 1,2,or 3 to be filled. 1- will indicate 'Employer', 2- will indicate 'supplier' & 3- will indicate 'sub-supplier'. | | | | | | | | |
| | b. In 'Remarks' column following abbreviations shall be used - RR-Review of Records, T.C. - Test Certificate, JIR - Joint Inspection Report & CHP - Customer Hold Point, | | | | | | | | |
| | c. The firm shall obtain acceptance/clearance of finished product for further activities based on Test Certificates & Internal Report (IR) | | | | | | | | |
| | d. Any additional test required as per the requirement of equipment in accordance with Contract Agreement/Relevent standard apart from QAP will be carried out by the firm without any additional financial implication. | | | | | | | | |
| | e.This QAP does not absolve the Contractor/sub-contractor of his responsibility to supply the correct products, strictly in conformity to the specifications given in the purchase order/contract. The above Model QAP stipulates the bare minimum requirements which shall be complied by the contractor. The above QAP has been made presuming subletting of work shall be allowed in the tender. In case subletting of work is not allowed in the tender, then"3/2" shall be considered as "2" under the column " Perform" . | | | | | | | | |
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| | **Signature** | | | | | **Signature & Seal** | | | |
| | **EMPLOYER ( QA&I DEPT.)** | | | | **(VENDORS Q.C. DEPT. OR REPRESENTATIVE)** | | | | |

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| **परियोजना (PROJECT) :** | **ग्राहक (CLIENT):** | | | | | |
| **उपष्कर का नाम (NAME OF EQUIPMENT) : Generator Accessories & Instruments (Air & Oil Coolers)** | **विक्रेता (VENDOR):** | | | | | |

| | | | | एनआईटी/ क्रय आदेश संदर्भ( NIT / P.O. Reference) : | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| क्र. सं. S.N. | मद/घटक एवं विशेषता ITEM/ COMPONENT & CHARACTERISTICS | जाँच की प्रकृति NATURE OF CHECKS | जाँच की मात्रा QUANTUM OF CHECKS | संदर्भ दस्तावेज़ / स्वीकृति मानदंड REFERENCE DOCUMENT/ ACCEPTANCE NORMS | रेकॉर्ड फ़ारमैट RECORD FORMAT | निरीक्षण एजैंसी Inspecting Agency | | | टिप्पणी Remarks |
| | | | | | | प्रदर्शन PERFORM | गवाह WITNESS | सत्यापन VERIFY | |
| A) | **Raw Material (Cooling Tubes)** | | | | | | | | |
| i) | Chemical Composition | Chemical | Sample | Tech spec./ Appd Drg./ IS/IEC/Equivalent Standard | TC | 3/2 | - | 1 | TC |
| ii) | Mechanical Properties | Mechanical | -do- | -do- | TC | 3/2 | - | 1 | TC |
| iii) | Dimensional Check | Measurement | -do- | -do- | TC | 3/2 | - | 1 | TC |
| B) | **Final Inspection** | | | | | | | | |
| i) | Dimensional check of complete assembly of coolers | Measurement | Sample for each type | Tech spec./ Appd Drg./ IS/IEC/Equivalent Standard | JIR | 3/2 | 1 | - | CHP |
| ii) | Hydraulic test of assembled coolers | Pressure | Sample for each type | -do- | JIR | 3/2 | 1 | - | CHP |
| iii) | Painting | Visual | Sample for each type | -do- | JIR | 3/2 | 1 | - | CHP |
| Note : | a. In 'Inspection Agency' column figure 1,2,or 3 to be filled. 1- will indicate 'Employer', 2- will indicate 'supplier' & 3- will indicate 'sub-supplier'. | | | | | | | | |
| | b. In 'Remarks' column following abbreviations shall be used - RR-Review of Records, T.C. - Test Certificate, JIR - Joint Inspection Report & CHP - Customer Hold Point, | | | | | | | | |
| | c. The firm shall obtain acceptance/clearance of finished product for further activities based on Test Certificates & Internal Report (IR) | | | | | | | | |
| | d. Any additional test required as per the requirement of equipment in accordance with Contract Agreement/Relevent standard apart from QAP will be carried out by the firm without any additional financial implication. | | | | | | | | |
| | e.This QAP does not absolve the Contractor/sub-contractor of his responsibility to supply the correct products, strictly in conformity to the specifications given in the purchase order/contract. The above Model QAP stipulates the bare minimum requirements which shall be complied by the contractor. The above QAP has been made presuming subletting of work shall be allowed in the tender. In case subletting of work is not allowed in the tender, then"3/2" shall be considered as "2" under the column " Perform" . | | | | | | | | |
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| | **Signature** | | | | | **Signature & Seal** | | | |

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| | **EMPLOYER ( QA&I DEPT.)** | | | | **(VENDORS Q.C. DEPT. OR REPRESENTATIVE)** | |

| **परियोजना (PROJECT) :** | | | | **ग्राहक (CLIENT):** | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **उपष्कर का नाम (NAME OF EQUIPMENT) : Generator Accessories & Instruments (Other Devices)** | | | | **विक्रेता (VENDOR):** | | | | | |
| | | | | **एनआईटी/ क्रय आदेश संदर्भ( NIT / P.O. Reference) :** | | | | | |
| **क्र. सं. S.N.** | **मद/घटक एवं विशेषता ITEM/ COMPONENT & CHARACTERISTICS** | **जाँच की प्रकृति NATURE OF CHECKS** | **जाँच की मात्रा QUANTUM OF CHECKS** | **संदर्भ दस्तावेज़ / स्वीकृति मानदंड REFERENCE DOCUMENT/ ACCEPTANCE NORMS** | **रेकॉर्ड फ़ारमैट RECORD FORMAT** | **निरीक्षण एजेंसी Inspecting Agency** | | | **टिप्पणी Remarks** |
| | | | | | | **प्रदर्शन PERFORM** | **गवाह WITNESS** | **सत्यापन VERIFY** | |
| **1** | **Instruments** | | | | | | | | |
| i) | Test of accuracy and calibration of RTD and DTT (Thermometer) | -do- | -do- | -do- | TC | 3/2 | - | 1 | TC |
| **2** | **Other items/devices (As applicable)** | | | | | | | | |
| i) | Brake Dust Collection Device | Performance test | 100% | Tech spec./ Appd Drg./ IS/IEC/Equivalent Standard | TC | 3/2 | - | 1 | TC |
| ii) | Carbon Dust Collection Device | -do- | -do- | -do- | TC | 3/2 | - | 1 | TC |
| iii) | High Pressure Automatic lubrication system | Hydraulic test | -do- | -do- | TC | 3/2 | - | 1 | TC |
| iv) | Anti Condensation Heaters | Performance | -do- | -do- | TC | 3/2 | - | 1 | TC |
| v) | Vibration Detector with alarm and tripping contact | -do- | -do- | -do- | TC | 3/2 | - | 1 | TC |
| vi) | Partial Discharge Analyzer with permanent coupler | -do- | -do- | -do- | TC | 3/2 | - | 1 | TC |
| vii) | Moisture Detection System | -do- | -do- | -do- | TC | 3/2 | - | 1 | TC |
| viii) | Air Gap Measuring device | -do- | -do- | -do- | TC | 3/2 | - | 1 | TC |
| ix) | Speed Measuring Device | -do- | -do- | -do- | TC | 3/2 | - | 1 | TC |

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| x) | Fire protection system | -do- | -do- | -do- | TC | 3/2 | - | 1 | TC |
| Note : | a. In 'Inspection Agency' column figure 1,2,or 3 to be filled. 1- will indicate 'Employer', 2- will indicate 'supplier' & 3- will indicate 'sub-supplier'. | | | | | | | | |
| | b. In 'Remarks' column following abbreviations shall be used - RR-Review of Records, T.C. - Test Certificate, JIR - Joint Inspection Report & CHP - Customer Hold Point, | | | | | | | | |
| | c. The firm shall obtain acceptance/clearance of finished product for further activities based on Test Certificates & Internal Report (IR) | | | | | | | | |
| | d. Any additional test required as per the requirement of equipment in accordance with Contract Agreement/Relevent standard apart from QAP will be carried out by the firm without any additional financial implication. | | | | | | | | |
| | e.This QAP does not absolve the Contractor/sub-contractor of his responsibility to supply the correct products, strictly in conformity to the specifications given in the purchase order/contract. The above Model QAP stipulates the bare minimum requirements which shall be complied by the contractor. The above QAP has been made presuming subletting of work shall be allowed in the tender. In case subletting of work is not allowed in the tender, then"3/2" shall be considered as "2" under the column " Perform" . | | | | | | | | |
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| | | | | | | | | | |
| | **Signature** | | | | | **Signature & Seal** | | | |
| | **EMPLOYER ( QA&I DEPT.)** | | | | **(VENDORS Q.C. DEPT. OR REPRESENTATIVE)** | | | | |

**कार्य स्थल गुणवत्ता योजना (FIELD QUALITY PLAN) :**

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **परियोजना (PROJECT) :** | | | | **ग्राहक (CLIENT):** | | | | | |
| **उपष्कर का नाम (NAME OF EQUIPMENT) : Generator** | | | | **विक्रेता (VENDOR):** | | | | | |
| | | | | **एनआईटी/ क्रय आदेश संदर्भ( NIT / P.O. Reference) :** | | | | | |
| | | | | | | | | | |
| **क्र. सं. S.N.** | **घटक की गतिविधि और संचालन ACTIVITY & OPERATION OF COMPONENT** | **जाँच की प्रकृति NATURE OF CHECKS** | **जाँच की मात्रा QUANTUM OF CHECKS** | **संदर्भ दस्तावेज़ / स्वीकृति मानदंड REFERENCE DOCUMENT/ ACCEPTANCE NORMS** | **रेकॉर्ड फ़ारमैट RECORD FORMAT** | **निरीक्षण एजैंसी Inspecting Agency** | | | **टिप्पणी Remarks** |
| | | | | | | **प्रदर्शन PERFORM** | **गवाह WITNESS** | **सत्यापन VERIFY** | |
| **A)** | **Field test on each Generator shall include:** | | | | | | | | |
| a) | Visual inspection and dimensional check. | Visual/ Measurement | 100% | Tech spec./ Appd Drg./ IS/IEC/Equivalent Standard | TC/TR | 3/2 | 1 | - | TC/TR |

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|---|---|---|---|---|---|---|---|---|---|
| b) | Check of stator bore for exact roundness at the upper and lower edges of the Iron Core. | -do- | -do- | -do- | TC/TR | 3/2 | 1 | - | TC/TR |
| c) | Checking of the uniformity of the air gap. | -do- | -do- | -do- | TC/TR | 3/2 | 1 | - | TC/TR |
| d) | Rotor roundness measurement. | -do- | -do- | -do- | TC/TR | 3/2 | 1 | - | TC/TR |
| e) | Measurement of deflection of thrust bearing on loading. | -do- | -do- | -do- | TC/TR | 3/2 | 1 | - | TC/TR |
| f) | Checking of the alignment of the ready assembled turbine and generator shaft. | -do- | -do- | -do- | TC/TR | 3/2 | 1 | - | TC/TR |
| g) | Checking of bearing clearances, Dimensions, Insulation resistance & blue matching of pads with shaft journal | -do- | -do- | -do- | TC/TR | 3/2 | 1 | - | TC/TR |
| h) | Checking of the bearing oil cooling installation for complete and correct assembly. | Visual | -do- | -do- | TC/TR | 3/2 | 1 | - | TC/TR |
| i) | Checking of the generator cooling system for complete and correct assembly. | -do- | -do- | -do- | TC/TR | 3/2 | 1 | - | TC/TR |
| j) | Hydrostatic pressure and tightness tests of all equipment containing/carrying water, oil and compressed air. | Pressure | -do- | -do- | TC/TR | 3/2 | 1 | - | TC/TR |
| k) | Checking of jacks in braking and lifting operation respectively | Visual | -do- | -do- | TC/TR | 3/2 | 1 | - | TC/TR |
| l) | Measurement of the DC resistance of the field winding. | Electrical | -do- | -do- | TC/TR | 3/2 | 1 | - | TC/TR |
| m) | Measurement of the stator winding DC resistance per phase. | -do- | -do- | -do- | TC/TR | 3/2 | 1 | - | TC/TR |
| n) | Insulation test and H.V. test of the field winding. | -do- | -do- | -do- | TC/TR | 3/2 | 1 | - | TC/TR |
| o) | Insulation test (1 min. and 10 min. value) & H. V. test of the stator winding and determination of | -do- | -do- | -do- | TC/TR | 3/2 | 1 | - | TC/TR |

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| | polarization factor. | | | | | | | | |
| p) | Corona visibility test of stator for determination of corona initial and ending voltages and inspection of the corona at 120% of the rated voltage. | -do- | -do- | -do- | TC/TR | 3/2 | 1 | - | TC/TR |
| q) | Operational tests on all generator auxiliary equipment, including calibration of related electric indicating, control and metering instruments, and checks for correctness of wiring and piping. | Electrical/ Visual | 100% | Tech spec./ Appd Drg./ IS/IEC/Equivalent Standard | TC/TR | 3/2 | 1 | - | TC/TR |
| r) | Checking of alarm and protection devices. | Electrical | -do- | -do- | TC/TR | 3/2 | 1 | - | TC/TR |
| s) | Checking the functioning of Generator fire fighting devices i.e. valve, sensors,switches,relays,panels etc. | Electrical | -do- | -do- | TC/TR | 3/2 | 1 | - | TC/TR |
| t) | Magnetization test of the ready assembled Iron Core to verify the absence of hot spots (local overheating, if core built at site). | -do- | -do- | -do- | TC/TR | 3/2 | 1 | - | TC/TR |
| u) | High voltage withstand test on individual windings in accordance with IEC 60034-1. | -do- | -do- | -do- | TC/TR | 3/2 | 1 | - | TC/TR |
| v) | High voltage withstand test of the ready assembled stator winding in accordance with the IEC 60034--1. | -do- | -do- | -do- | TC/TR | 3/2 | 1 | - | TC/TR |
| **B)** | **At least the following tests shall be performed on each generator:** | | | | | | | | |
| a) | Test of shaft movement, bearing run and shaft eccentricity. | Visual | 100% | Tech spec./ Appd Drg./ IS/IEC/Equivalent Standard | TC/TR | 3/2 | 1 | - | TC/TR |
| b) | Checking of start-up and shut-down sequence including mechanical braking. | Visual/ Mechanical | -do- | -do- | TC/TR | 3/2 | 1 | - | TC/TR |

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|---|---|---|---|---|---|---|---|---|---|
| c) | Short -circuit and Open circuit test | Electrical | -do- | -do- | TC/TR | 3/2 | 1 | - | TC/TR |
| d) | Measurement of shaft voltages and bearing currents. | -do- | -do- | -do- | TC/TR | 3/2 | 1 | - | TC/TR |
| e) | Over speed test, noise and vibration measurement including balancing of the unit. | Mechanical | -do- | -do- | TC/TR | 3/2 | 1 | - | TC/TR |
| f) | Synchronization with the grid system. | Electrical | -do- | -do- | TC/TR | 3/2 | 1 | - | TC/TR |
| g) | Load rejection tests at different load steps, including at 110 % of rated unit load. | -do- | -do- | -do- | TC/TR | 3/2 | 1 | - | TC/TR |
| h) | Rated output test of the unit including temperature run. | Electrical/ thermal | 100% | Tech spec./ Appd Drg./ IS/IEC/Equivalent Standard | TC/TR | 3/2 | 1 | - | TC/TR |
| i) | Measurement of partial discharge of stator insulation. | Electrical | -do- | -do- | TC/TR | 3/2 | 1 | - | TC/TR |
| j) | Testing of on-line monitoring systems and verification of various sensors and Instruments. | -do- | -do- | -do- | TC/TR | 3/2 | 1 | - | TC/TR |
| **C)** | **The following tests shall be performed on one of the generator selected by Engineer in Charge** | | | | | | | | |
| a) | Guaranteed Characteristics of Generator. | Electrical | On one Unit | Tech spec./ Appd Drg./ IS/IEC/Equivalent Standard | TC/TR | 3/2 | 1 | - | TC/TR |
| b) | Stator and Rotor Winding Resistance Measurement. | -do- | -do- | -do- | TC/TR | 3/2 | 1 | - | TC/TR |
| c) | Water Flow Measurement (If applicable). | Measurement | -do- | -do- | TC/TR | 3/2 | 1 | - | TC/TR |
| d) | No Load Saturation Curve. | Electrical | -do- | -do- | TC/TR | 3/2 | 1 | - | TC/TR |
| e) | Wave form Deviation. | -do- | -do- | -do- | TC/TR | 3/2 | 1 | - | TC/TR |
| f) | Shaft Voltage Measurement. | -do- | -do- | -do- | TC/TR | 3/2 | 1 | - | TC/TR |
| g) | Temperature Rise test. | Thermal | -do- | -do- | TC/TR | 3/2 | 1 | - | TC/TR |
| h) | Measurement of the Total harmonic Distortion (THD) and evaluation of waveform irregularities | Electrical | -do- | Tech spec./ Appd Drg./ IS/IEC/Equivalent Standard | TC/TR | 3/2 | 1 | - | TC/TR |

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| i) | Plotting of oscillograms for the examination of the no- load voltage sine wave. | Electrical | -do- | -do- | TC/TR | 3/2 | 1 | - | TC/TR |
| j) | Measurement of the individual losses and determination of the efficiency | Electrical | -do- | -do- | TC/TR | 3/2 | 1 | - | TC/TR |
| **D)** | **Testing for interfacing of operation for Generator and its components with Plant Scada System.** | Electrical | 100% | Tech spec./ Appd Drg./ IS/IEC/Equivalent Standard | TC/TR | 3/2 | 1 | - | TC/TR |
| Note: | a. In 'Inspection Agency'column figure 1,2,or 3 to be filled. 1- will indicate Representative of Engineer-in-charge, 2- will indicate 'Contractor' & 3- will indicate 'Sub-contractor'. | | | | | | | | |
| | b. In 'Remarks' column following abbreviations shall be used - TC/TR - Test Certificate/ Test Report | | | | | | | | |
| | c.The above FQP stipulates the bare minimum requirements which shall be complied by the contractor. The above FQP has been made presuming subletting of work shall be allowed in the tender. In case subletting of work is not allowed in the tender, then"3/2" shall be considered as "2" under the column " Perform" . | | | | | | | | |
| | d. Any additional acitivity/ test required as per the requirement of equipment in accordance with Contract Agreement/Relevent standard apart from FQP will be carried out by the firm without any additional financial implication. | | | | | | | | |
| | e. The contractor shall furnish the details of test method to the Engineer-in-Charge for approval in the time line as specified in contract agreement | | | | | | | | |
| | f. All the Test in FQP shall be witnessed by Engineer-in-charge or his representative at site. | | | | | | | | |
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| | **Signature** | | | | | **Signature & Seal** | | | |
| | **Engineer-in-charge** | | | | **(VENDORS Q.C. DEPT. OR REPRESENTATIVE)** | | | | |

## 3) MAIN INLET VALVE (SPHERICAL/ BUTTERFLY VALVE) &
## 4) PENSTOCK VALVE (BUTTERFLY VALVE)

| परियोजना (PROJECT) : | | | | ग्राहक (CLIENT) : | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| उपस्कर का नाम (NAME OF EQUIPMENT) : Spherical Valve/Butterfly Valve for MIV & Penstock Valve | | | | विक्रेता (VENDOR) : | | | | | |
| | | | | एनआईटी/ क्रय आदेश संदर्भ (NIT/P.O. REFERENCE) : | | | | | |
| क्र. सं. SR. NO. | मद/घटक एवं विशेषता ITEM /COMPONENTS & CHARACTERISTICS | जाँच की प्रकृति NATURE OF CHECKS | जाँच की मात्रा QUANTUM OF CHECKS | संदर्भ दस्तावेज़ / स्वीकृति मानदंड REFERENCE DOCUMENTS/ ACCEPTANCE NORMS | रिकॉर्ड प्रारूप RECORD FORMAT | निरीक्षण एजेंसी (INSP. AGENCY) | | | टिप्पणी REMARKS |
| | | | | | | प्रदर्शन Perform | गवाह Witness | सत्यापन Verify | |
| **1** | **Raw Material** | | | | | | | | |
| 1.1 | Spherical Valve Body, Disc & Trunnion, Up stream & Downstream Connection pipe | | | Appd. Drg. / Tech. Spec. / IS/IEC/Equivalent | | | | | |
| a) | Chemical Composition | Chemical | Sample | -do- | TC | 3/2 | - | 1 | TC |
| b) | Mechanical Properties | Mechanical | -do- | -do- | TC | 3/2 | - | 1 | TC |
| c) | NDT of Cast/ Weldeable Plate/ Forged steel | UT, MPI, DPT (as applicable) | 100% | -do- | TC | 3/2 | - | 1 | TC |
| d) | Heat Treatment | Temp. Regulation | 100% | -do- | IR | 3/2 | - | 1 | TC |
| 1.2 | Bush, Lever, Counter Weight | | | | | | | | |
| a) | Chemical Composition | Chemical | Sample | -do- | TC | 3/2 | - | 1 | TC |
| b) | Mechanical Properties | Mechanical | -do- | -do- | TC | 3/2 | - | 1 | TC |
| c) | NDT of Cast/ Weldeable plate/ Forged steel | RT, UT, MPI, DPT (as applicable) | 100% | -do- | TC | 3/2 | - | 1 | TC |
| 1.3 | Seal Seat, Seal Retainer & Fastener | | | | | | | | |
| a) | Chemical Composition | Chemical | Sample | -do- | TC | 3/2 | - | 1 | TC |
| b) | Mechanical Properties | Mechanical | -do- | -do- | TC | 3/2 | - | 1 | TC |

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| 1.4 | Seal | | | | | | | | |
| a) | Mechanical Analysis & Chemical Composition | Test | Sample | -do- | TC | 3/2 | - | 1 | TC |
| b) | Hardness | Test | -do- | -do- | TC | 3/2 | - | 1 | TC |
| c) | Dimensional Check | Measurement | 100% | -do- | IR | 3/2 | - | 1 | TC |
| 1.5 | By-Pass Valve | | | | | | | | |
| a) | Chemical Composition | Chemical | Sample | -do- | TC | 3/2 | - | 1 | TC |
| b) | Mechanical Properties | Mechanical | -do- | -do- | TC | 3/2 | - | 1 | TC |
| c) | NDT of Cast/ Forged steel | UT, MPI, DPT (as applicable) | 100% | -do- | TC | 3/2 | - | 1 | TC |
| d) | Heat Treatment | Temp. Regulation | 100% | -do- | IR | 3/2 | - | 1 | TC |
| 1.6 | Grease, Water & Oil Pipe Line | | | | | | | | |
| a) | Chemical Composition | Chemical | Sample | -do- | TC | 3/2 | - | 1 | TC |
| b) | Mechanical Properties | Mechanical | -do- | -do- | TC | 3/2 | - | 1 | TC |
| c) | Hydro-Static pressure Test | Test | -do- | -do- | TC | 3/2 | - | 1 | TC |
| 1.7 | Guard Valve, Isolating Gate Valve,Drain Valve, Air Admission & Release Valve etc | | | | | | | | |
| a) | Hydro-Static pressure Test | Test | -do- | -do- | TC | 3/2 | - | 1 | TC |
| **2** | **In-process Inspection** | | | | | | | | |
| a) | NDT of weld joints before Stress Relieving | MPI,DPT,UT (As applicable) | -do- | -do- | IR | 3/2 | - | 1 | TC |
| b) | Valve Body & Disc - Stress Relieving after welding | Temp. Regulation | -do- | -do- | IR | 3/2 | - | 1 | TC |
| c) | NDT of all weld joints after stress relieving | MPI,DPT,UT (As applicable) | -do- | Appd. Drg. / Tech. Spec. / IS/IEC/Equivalent | TC | 3/2 | - | 1 | TC |
| d) | Dim. Check & Surface Finish of Machined Surface for Body, Disc, Journal, Seal & Seal Seat | Measurement | 100% | -do- | IR | 3/2 | - | 1 | TC |
| **3** | **Final Inspection** | | | | | | | | |
| **3.1** | **Spherical Valve Assembly** | | | | | | | | |
| a) | Dimensional Check of complete assembly | Measurement | Critical dim. | -do- | JIR | 3/2 | 1 | - | CHP |
| b) | Operational Test - Free movement of Disc | Visual & Measurement | 100% | -do- | JIR | 3/2 | 1 | - | CHP |

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|---|---|---|---|---|---|---|---|---|---|
| c) | Hydro-Static Test on B.F. Valve Body & Disc with Upstream Pipes | -do- | -do- | -do- | JIR | 3/2 | 1 | - | CHP |
| d) | Leakage Test on Valve Seals | -do- | -do- | -do- | JIR | 3/2 | 1 | - | CHP |
| **3.2** | **BY Pass valve Assembly** | | | | | | | | |
| a) | Hydro Static Pressure Test | Pressure Test | 100% | -do- | IR | 3/2 | - | 1 | TC |
| b) | Leakage Test | Test | - do- | -do- | IR | 3/2 | - | 1 | TC |
| c) | Dimensional check | Measurement | - do- | -do- | IR | 3/2 | - | 1 | TC |
| d) | Operational Test | Test | - do- | -do- | IR | 3/2 | - | 1 | TC |
| **3.3** | **Air Release Valve & Drain Valve etc.** | | | | | | | | |
| a) | Hydro Static Pressure Test | Pressure Test | 100% | -do- | IR | 3/2 | - | 1 | TC |
| b) | Leakage Test | Test | - do- | -do- | IR | 3/2 | - | 1 | TC |
| c) | Dimensional check | Measurement | - do- | -do- | IR | 3/2 | - | 1 | TC |
| d) | Operational Test | Test | - do- | -do- | IR | 3/2 | - | 1 | TC |
| **4** | **Control panel** | | | | | | | | |
| 4.1 | Verification of bill of material | Visual | - do- | -do- | JIR | 3/2 | - | 1 | TC |
| 4.2 | Functional test | Test | - do- | -do- | JIR | 3/2 | - | 1 | TC |
| 4.3 | IR & HV Test | Test | - do- | -do- | JIR | 3/2 | - | 1 | TC |
| **5** | **Painting** | Visual/ Measurement | - do- | -do- | TC | 3/2 | - | 1 | TC |
| Note : | a. In 'Inspection Agency'column figure 1,2,or 3 to be filled. 1- will indicate 'Employer', 2- will indicate 'supplier' & 3- will indicate 'sub-supplier'. | | | | | | | | |
| | b. In 'Remarks' column following abbreviations shall be used - RR-Review of Records, T.C. - Test Certificate Submission, JIR-Joint Inspection Report & CHP - Customer Hold Point. | | | | | | | | |
| | c. The firm shall obtain acceptance/clearance of finished product for further activities based on Test Certificates & Internal Report (IR) | | | | | | | | |
| | d. At the time of Inspection the supplier shall arrange the requisite calibrated measuring instruments i.e.micrometer, vernier caliper, pie tape, surface roughness tester, dial gauge etc. | | | | | | | | |
| | e.This QAP does not absolve the Contractor/sub-contractor of his responsibility to supply the correct products, strictly in conformity to the specifications given in the purchase order/contract. The above Model QAP stipulates the bare minimum requirements which shall be complied by the contractor. The above QAP has been made presuming subletting of work shall be allowed in the tender. In case subletting of work is not allowed in the tender, then"3/2" shall be considered as "2" under the column " Perform" . | | | | | | | | |
| | f. Material testing shall be conducted from Govt. Lab, NABL Lab or NABL accredited lab having valid Scope of accreditation of all specified tests mentioned in approved QAP. NDT shall be conducted from NABL accredited lab/Govt. approved lab/Level 2 or level 3 certified person. | | | | | | | | |
| | g. Any additional test required as per the requirement of equipment in accordance with Contract Agreement/Relevent standard apart from QAP will be carried out by the firm without any additional financial implication. | | | | | | | | |
| | | | | | | | | | |
| | | | Signature | | | **Signature & Seal** | | | |

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|---|---|---|---|---|---|
| | | | **Employer ( QA&I DEPT.)** | | **(VENDORS Q.C. DEPT. OR REPRESENTATIVE)** |

| **परियोजना (PROJECT) :** | | | | **ग्राहक (CLIENT) :** | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **उपस्कर का नाम (NAME OF EQUIPMENT) : - Oil Pressure Unit for MIV & Penstock Valve** | | | | **विक्रेता (VENDOR) :** | | | | | |
| | | | | **एनआईटी/ क्रय आदेश संदर्भ (NIT/P.O. REFERENCE) :** | | | | | |
| **क्र. सं. SR. NO.** | **मद/घटक एवं विशेषता ITEM /COMPONENTS & CHARACTERISTICS** | **जाँच की प्रकृति NATURE OF CHECKS** | **जाँच की मात्रा QUANTUM OF CHECKS** | **संदर्भ दस्तावेज़ / स्वीकृति मानदंड REFERENCE DOCUMENTS/ ACCEPTANCE NORMS** | **रिकॉर्ड प्रारूप RECORD FORMAT** | **निरीक्षण एजेंसी (INSP. AGENCY)** | | | **टिप्पणी REMARKS** |
| | | | | | | **प्रदर्शन Perform** | **गवाह Witness** | **सत्यापन Verify** | |
| **1** | **Sump Tank** | | | Appd. Drg. / Tech. Spec. / IS/IEC/Equivalent | | | | | |
| 1.1 | Material for Tank | | | | | | | | |
| a) | Chemical Composition | Chemical | Sample | -do- | TC | 3/2 | - | 1 | TC |
| b) | Mechanical Strength | Mechanical | - do- | -do- | TC | 3/2 | - | 1 | TC |
| 1.2 | NDT of weld joints | UT, MPI, DPT (as applicable) | 100% | -do- | TC | 3/2 | - | 1 | TC |
| 1.3 | Leakage test check for tank | Test | - do- | -do- | TC | 3/2 | - | 1 | TC |
| 1.4 | Dimensional Check | Measurement | - do- | -do- | TC | 3/2 | - | 1 | TC |
| **2** | **Pressure Vessel/Oil Pressure Accumulator** | | | | | | | | |
| 2.1 | Material for Tank | | | | | | | | |
| a) | Chemical Composition | Chemical | Sample | -do- | TC | 3/2 | - | 1 | TC |
| b) | Mechanical Strength | Mechanical | - do- | -do- | TC | 3/2 | - | 1 | TC |
| 2.2 | NDT of weld joints | UT, MPI, DPT (as applicable) | 100% | -do- | TC | 3/2 | - | 1 | TC |
| 2.3 | Post Weld stress releiving | Temp. Regulator | - do- | -do- | TC | 3/2 | - | 1 | TC |
| 2.4 | Hydrostatic pressure test for pressure vessel | Test | - do- | -do- | TC | 3/2 | - | 1 | TC |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 2.5 | Dimensional Check | Measurement | - do- | -do- | TC | 3/2 | - | 1 | TC |
| **3** | **Pipes & Fittings** | | | | | | | | |
| 3.1 | Chemical Composition | Chemical | Sample | -do- | TC | 3/2 | - | 1 | TC |
| 3.2 | Mechanical Strength | Mechanical | - do- | -do- | TC | 3/2 | - | 1 | TC |
| 3.3 | Hydrostatic pressure test | Test | 100% | -do- | TC | 3/2 | - | 1 | TC |
| **4** | **Pressure gauge, Pressure Switch, Pressure Transducer, Moisure Indicator, Float Switch, Temp gauge, Temp switch, Level Transducer etc.** | | | | | | | | |
| 4.1 | Make, Model & Type | Visual | 100% | -do- | TC | 3/2 | - | 1 | TC |
| 4.2 | Calibration Test | Test | - do- | -do- | TC | 3/2 | - | 1 | TC |
| 4.3 | Functional Test (wherever applicable) | Test | - do- | -do- | TC | 3/2 | - | 1 | TC |
| **5** | **Unloader Valve, Check Valve, Pilot valve, Safety valve, Air blow off valve, By Pass Valve, Solonoid Valve and Isolating Valve etc.** | | | | | | | | |
| 5.1 | Make, Model & Type | Visual | - do- | -do- | TC | 3/2 | - | 1 | TC |
| 5.2 | Functional Check (wherever applicable) | Test | - do- | -do- | TC | 3/2 | - | 1 | TC |
| 5.3 | Hydrostatic pressure test (wherever applicable) | Test | - do- | -do- | TC | 3/2 | - | 1 | TC |
| **6** | **Oil Pump** | | | | | | | | |
| 6.1 | Make, Model, Type & Capacity | Visual | - do- | -do- | TC | 3/2 | - | 1 | TC |
| 6.2 | Routine Test | Test | - do- | -do- | TC | 3/2 | - | 1 | TC |
| **7** | **Electric Motor** | | | | | | | | |
| 7.1 | Make, Type & rating | Visual | - do- | -do- | TC | 3/2 | - | 1 | TC |
| 7.2 | Routine Test | Test | - do- | -do- | TC | 3/2 | - | 1 | TC |
| **8** | **Strainer** | | | Appd. Drg. / Tech. Spec. / IS/IEC/Equivalent | | | | | |
| 8.1 | Mesh Size | Measurement | - do- | | TC | 3/2 | - | 1 | TC |
| 8.2 | Chemical Composition | Chemical | Sample | -do- | TC | 3/2 | - | 1 | TC |
| **9** | **Oil** | | | | | | | | |
| 9.1 | Make & type | Visual | 100% | -do- | TC | 3/2 | - | 1 | TC |
| **10** | **Nitrogen Cylinder/Bottle** | | | | | | | | |
| 10.1 | Chemical Composition & Mech. Properties | Chem/Mech Test | Sample | -do- | TC | 3/2 | - | 1 | TC |

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|---|---|---|---|---|---|---|---|---|---|
| 10.2 | NDT of weld joints | UT,DPT, MPI (As applicable) | 100% | -do- | TC | 3/2 | - | 1 | TC |
| 10.3 | Hydrostatic pressure test & Leakage Test for Nitrogen Cylinder | Test | - do- | -do- | TC | 3/2 | - | 1 | TC |
| **11** | **Heat Exchanger/Oil Cooler (If applicable)** | | | | | | | | |
| 11.1 | Make, Model & Capacity | Visual | 100% | -do- | TC | 3/2 | - | 1 | TC |
| 11.2 | Chemical Composition for Tube | Chemical Test | Sample per Lot | -do- | TC | 3/2 | - | 1 | TC |
| 11.3 | Hydrostatic Test | Pressure Test | 100% | -do- | TC | 3/2 | - | 1 | TC |
| **12** | **Complete assembly of Oil Pressure Unit with Test/ Actual Control Panel** | | | | | | | | |
| 12.1 | Dimensional Check | Measurement | 100% | -do- | JIR | 3/2 | 1 | - | CHP |
| 12.2 | Capacity | Measurement | - do- | -do- | JIR | 3/2 | 1 | - | CHP |
| 12.3 | Functional Test/ Operational Test of Pumps, Motors, Electromagnatic Valves, Pressure Switch, Temp switch & Accessories | Test | - do- | -do- | JIR | 3/2 | 1 | - | CHP |
| 12.4 | Pressure Tank relief valve setting | Visual | - do- | -do- | JIR | 3/2 | 1 | - | CHP at site |
| **13** | **Control panel** | | | | | | | | |
| 13.1 | Verification of bill of material | Visual | - do- | -do- | JIR | 3/2 | 1 | - | CHP |
| 13.2 | Functional test | Test | - do- | -do- | JIR | 3/2 | 1 | - | CHP |
| 13.3 | IR & HV Test | Test | - do- | -do- | JIR | 3/2 | 1 | - | CHP |
| **14** | **Painting** | Visual/ Measurement | - do- | -do- | TC | 3/2 | - | 1 | TC |

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| Note: | a. In 'Inspection Agency'column figure 1,2,or 3 to be filled. 1- will indicate 'Employer', 2- will indicate 'supplier' & 3- will indicate 'sub-supplier'. |
| | b. In 'Remarks' column following abbreviations shall be used - RR-Review of Records, T.C. - Test Certificate Submission, JIR-Joint Inspection Report & CHP - Customer Hold Point. |
| | c. The firm shall obtain acceptance/clearance of finished product for further activities based on Test Certificates & Internal Report (IR) |
| | d. At the time of Inspection the supplier shall arrange the requisite calibrated measuring instruments i.e.micrometer, vernier caliper, pie tape, surface roughness tester, dial gauge etc. |
| | e.This QAP does not absolve the Contractor/sub-contractor of his responsibility to supply the correct products, strictly in conformity to the specifications given in the purchase order/contract. The above Model QAP stipulates the bare minimum requirements which shall be complied by the contractor. The above QAP has been made presuming subletting of work shall be allowed in the tender. In case subletting of work is not allowed in the tender, then"3/2" shall be considered as "2" under the column " Perform" . |
| | f. Material testing shall be conducted from Govt. Lab, NABL Lab or NABL accredited lab having valid Scope of accreditation of all specified tests mentioned in approved QAP. NDT shall be conducted from NABL accredited lab/Govt. approved lab/Level 2 or level 3 certified person. |
| | g. Any additional test required as per the requirement of equipment in accordance with Contract Agreement/Relevent standard apart from QAP will be carried out by the firm without any additional financial implication. |

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| | h. CHP*-Test shall be conducted at site in presence of Power Station representative. | | | | | | | | |
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| | | | **Signature** | | | **Signature & Seal** | | | |
| | | | **Employer ( QA&I DEPT.)** | | **(VENDORS Q.C. DEPT. OR REPRESENTATIVE)** | | | | |

| **परियोजना (PROJECT) :** | | | | **ग्राहक (CLIENT) :** | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **उपस्कर का नाम (NAME OF EQUIPMENT) : Servomotor for MIV & Penstock Valve** | | | | **विक्रेता (VENDOR) :** | | | | | |
| | | | | **एनआईटी/ क्रय आदेश संदर्भ (NIT/P.O. REFERENCE) :** | | | | | |
| **क्र. सं. SR. NO.** | **मद/घटक एवं विशेषता ITEM /COMPONENTS & CHARACTERISTICS** | **जाँच की प्रकृति NATURE OF CHECKS** | **जाँच की मात्रा QUANTUM OF CHECKS** | **संदर्भ दस्तावेज़ / स्वीकृति मानदंड REFERENCE DOCUMENTS/ ACCEPTANCE NORMS** | **रिकॉर्ड प्रारूप RECORD FORMAT** | **निरीक्षण एजेंसी (INSP. AGENCY)** | | | **टिप्पणी REMARKS** |
| | | | | | | **प्रदर्शन Perform** | **गवाह Witness** | **सत्यापन Verify** | |
| **1** | **Raw Material** | | | | | | | | |
| **1.1** | **Piston & Cylinder** | | | Appd. Drg. / Tech. Spec. / IS/IEC/Equivalent | | | | | |
| a) | Chemical Composition | Chemical | Sample per Lot | | TC | 3/2 | - | 1 | TC |
| b) | Mechanical Properties | Mechanical | - do- | -do- | TC | 3/2 | - | 1 | TC |
| c) | NDT of Cast / Weldeable Steel | UT, MPI, DPT (as applicable) | 100% | -do- | TC | 3/2 | - | 1 | TC |
| **2** | **In Process Stage Inspection** | | | | | | | | |
| 2.1 | Heat treatment of Piston & cylinder | Temp. Regulation | -do- | -do- | IR | 3/2 | - | 1 | TC |
| 2.2 | NDT of weld joints after Heat Treatment | RT, UT, MPI, DPT (as applicable) | -do- | -do- | TC | 3/2 | - | 1 | TC |

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| 2.3 | Dimensional exam after machining | Measurement | -do- | -do- | IR | 3/2 | - | 1 | TC |
| **3** | **Final Inspection** | | | | | | | | |
| 3.1 | Dimensional check of Final Assembly | Measurement | Critical Dim. | -do- | JIR | 3/2 | 1 | - | CHP |
| 3.2 | Hydraulic pressure test of Servomotor-On test Pressure (Design Pressure) | Test | 100% | -do- | JIR | 3/2 | 1 | - | CHP |
| 3.3 | Leakage across Piston Check in fully open & fully close -On Working pressure | -do- | -do- | -do- | JIR | 3/2 | 1 | - | CHP |
| 3.4 | Stroke Length measurement-On Working Pressure | Visual / Measurement | -do- | -do- | JIR | 3/2 | 1 | - | CHP |
| 3.5 | Functional Test of servo-motor (Stroking 10 cycles)-on Working Pressure | -do- | -do- | -do- | JIR | 3/2 | 1 | - | CHP |
| **4** | **Painting** | | -do- | -do- | TC | 3/2 | - | 1 | TC |
| Note : | a. In 'Inspection Agency'column figure 1,2,or 3 to be filled. 1- will indicate 'Employer', 2- will indicate 'supplier' & 3- will indicate 'sub-supplier'. | | | | | | | | |
| | b. In 'Remarks' column following abbreviations shall be used - RR-Review of Records, T.C. - Test Certificate Submission, JIR-Joint Inspection Report & CHP - Customer Hold Point. | | | | | | | | |
| | c. The firm shall obtain acceptance/clearance of finished product for further activities based on Test Certificates & Internal Report (IR) | | | | | | | | |
| | d. At the time of Inspection the supplier shall arrange the requisite calibrated measuring instruments i.e.micrometer, vernier caliper, pie tape, surface roughness tester, dial gauge etc. | | | | | | | | |
| | e.This QAP does not absolve the Contractor/sub-contractor of his responsibility to supply the correct products, strictly in conformity to the specifications given in the purchase order/contract. The above Model QAP stipulates the bare minimum requirements which shall be complied by the contractor. The above QAP has been made presuming subletting of work shall be allowed in the tender. In case subletting of work is not allowed in the tender, then"3/2" shall be considered as "2" under the column " Perform" . | | | | | | | | |
| | f. Material testing shall be conducted from Govt. Lab, NABL Lab or NABL accredited lab having valid Scope of accreditation of all specified tests mentioned in approved QAP. NDT shall be conducted from NABL accredited lab/Govt. approved lab/Level 2 or level 3 certified person. | | | | | | | | |
| | g. Any additional test required as per the requirement of equipment in accordance with Contract Agreement/Relevent standard apart from QAP will be carried out by the firm without any additional financial implication. | | | | | | | | |
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| | | | **Signature** | | | **Signature & Seal** | | | |
| | | | **Employer ( QA&I DEPT.)** | | **(VENDORS Q.C. DEPT. OR REPRESENTATIVE)** | | | | |

| परियोजना (PROJECT) : | | | | ग्राहक (CLIENT) : | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| उपस्कर का नाम (NAME OF EQUIPMENT) : -Oil Leakage Unit for MIV & Penstock Valve (if required) | | | | विक्रेता (VENDOR) : | | | | | |
| | | | | एनआईटी/ क्रय आदेश संदर्भ (NIT/P.O. REFERENCE) : | | | | | |
| क्र. सं. SR. NO. | मद/घटक एवं विशेषता ITEM /COMPONENTS & CHARACTERISTICS | जाँच की प्रकृति NATURE OF CHECKS | जाँच की मात्रा QUANTUM OF CHECKS | संदर्भ दस्तावेज़ / स्वीकृति मानदंड REFERENCE DOCUMENTS/ ACCEPTANCE NORMS | रिकॉर्ड प्रारूप RECORD FORMAT | निरीक्षण एजेंसी (INSP. AGENCY) | | | टिप्पणी REMARKS |
| | | | | | | प्रदर्शन Perform | गवाह Witness | सत्यापन Verify | |
| **1** | **Oil Leakage Unit** | | | Appd. Drg. / Tech. Spec. / IS/IEC/Equivalent | | | | | |
| **1.1** | **Pump** | | | | | | | | |
| a) | Make, Model, Type & Capacity | Visual | 100% | -do- | TC | 3/2 | - | 1 | TC |
| b) | Routine Test | Test | - do- | -do- | TC | 3/2 | - | 1 | TC |
| **1.2** | **Electric Motor** | | | | | | | | |
| a) | Make, Type & rating | Visual | - do- | -do- | TC | 3/2 | - | 1 | TC |
| b) | Routine Test | Test | - do- | -do- | TC | 3/2 | - | 1 | TC |
| **1.3** | **Float Switch** | | | | | | | | |
| a) | Make, Type & rating | Visual | - do- | -do- | TC | 3/2 | - | 1 | TC |
| **1.4** | **Oil Tank** | | | | | | | | |
| a) | Leakage test | Test | - do- | -do- | TC | 3/2 | - | 1 | TC |
| b) | Dimensional Check | Measurement | - do- | -do- | TC | 3/2 | - | 1 | TC |
| **1.5** | **Functional test on complete oil leakage unit** | Test | - do- | -do- | TC | 3/2 | - | 1 | TC |
| **1.6** | **Dimensional & BOM Check** | Visual/ Measurement | - do- | -do- | TC | 3/2 | - | 1 | TC |
| **2** | **Painting** | | - do- | -do- | TC | 3/2 | - | 1 | TC |
| Note : | a. In 'Inspection Agency'column figure 1,2,or 3 to be filled. 1- will indicate 'Employer', 2- will indicate 'supplier' & 3- will indicate 'sub-supplier'. | | | | | | | | |
| | b. In 'Remarks' column following abbreviations shall be used - RR-Review of Records, T.C. - Test Certificate Submission, JIR-Joint Inspection Report & CHP - Customer Hold Point. | | | | | | | | |
| | c. The firm shall obtain acceptance/clearance of finished product for further activities based on Test Certificates & Internal Report (IR) | | | | | | | | |
| | d. At the time of Inspection the supplier shall arrange the requisite calibrated measuring instruments i.e.micrometer, vernier caliper, pie tape, surface roughness tester, dial gauge etc. | | | | | | | | |

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| | e.This QAP does not absolve the Contractor/sub-contractor of his responsibility to supply the correct products, strictly in conformity to the specifications given in the purchase order/contract. The above Model QAP stipulates the bare minimum requirements which shall be complied by the contractor. The above QAP has been made presuming subletting of work shall be allowed in the tender. In case subletting of work is not allowed in the tender, then"3/2" shall be considered as "2" under the column " Perform" . | | | | | | | | | |
| | f. Material testing shall be conducted from Govt. Lab, NABL Lab or NABL accredited lab having valid Scope of accreditation of all specified tests mentioned in approved QAP. NDT shall be conducted from NABL accredited lab/Govt. approved lab/Level 2 or level 3 certified person. | | | | | | | | | |
| | g. Any additional test required as per the requirement of equipment in accordance with Contract Agreement/Relevent standard apart from QAP will be carried out by the firm without any additional financial implication. | | | | | | | | | |
| | | | | | | | | | | |
| | | | **Signature** | | | **Signature & Seal** | | | | |
| | | | **Employer ( QA&I DEPT.)** | | | **(VENDORS Q.C. DEPT. OR REPRESENTATIVE)** | | | | |

| **कार्य स्थल गुणवत्ता योजना (FIELD QUALITY PLAN) :** | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **परियोजना (PROJECT) :** | | | | **ग्राहक (CLIENT) :** | | | | | |
| **उपस्कर का नाम (NAME OF EQUIPMENT) : Butterfly Valve/Spherical Valve for Main Inlet Valve & Penstock Valve** | | | | **विक्रेता (VENDOR) :** | | | | | |
| | | | | **एनआईटी/ क्रय आदेश संदर्भ (NIT/P.O. REFERENCE) :** | | | | | |
| **क्र. सं. SR. NO.** | **Activity & Operation of Component** | **जाँच की प्रकृति NATURE OF CHECKS** | **जाँच की मात्रा QUANTUM OF CHECKS** | **संदर्भ दस्तावेज़ / स्वीकृति मानदंड REFERENCE DOCUMENTS/ ACCEPTANCE NORMS** | **रिकॉर्ड प्रारूप RECORD FORMAT** | **निरीक्षण एजेंसी (INSP. AGENCY)** | | | **टिप्पणी REMARKS** |
| | | | | | | **प्रदर्शन Perform** | **गवाह Witness** | **सत्यापन Verify** | |
| **1** | **Dry Test** | | | Appd. Drg. / Tech. Spec. / IS/IEC/Equivalent | | | | | |
| 1.1 | Setting of MIV opening & Closing Time | Visual | 100% | -do- | TC/TR | 3/2 | 1 | - | TC/TR |
| 1.2 | Check tightness of Service Seal & Maintenance Seal | Visual | 100% | -do- | TC/TR | 3/2 | 1 | - | TC/TR |

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|---|---|---|---|---|---|---|---|---|---|
| 1.3 | Check Plug alignment with servomotor in full open & close position. | Visual | 100% | -do- | TC/TR | 3/2 | 1 | - | TC/TR |
| 1.4 | Record operating pressure of servomotor during closing & opening | Visual | 100% | -do- | TC/TR | 3/2 | 1 | - | TC/TR |
| 1.5 | Check clearance between the plug & seals in closed position of MIV | Visual/Measurement | 100% | -do- | TC/TR | 3/2 | 1 | - | TC/TR |
| 1.6 | Check seal ring mechanical locks & measure all pads strokes | Visual/Measurement | 100% | -do- | TC/TR | 3/2 | 1 | - | TC/TR |
| **2** | **Wet Test** | | | | TC/TR | | | | TC/TR |
| 2.1 | Functional check of all detection devices (Limit switchs, Pr. Switchs etc) | Visual | 100% | -do- | TC/TR | 3/2 | 1 | - | TC/TR |
| 2.2 | Check bypass valve proper operation under water flow and operating time | Visual | 100% | -do- | TC/TR | 3/2 | 1 | - | TC/TR |
| 2.3 | Check bypass valve water leakage | Visual | 100% | | TC/TR | 3/2 | 1 | - | TC/TR |
| 2.4 | Verify sealing under mechanical lock application | Visual | 100% | -do- | TC/TR | 3/2 | 1 | - | TC/TR |
| 2.5 | Measurement of servomotor stroke | Visual/Measurement | 100% | -do- | TC/TR | 3/2 | 1 | - | TC/TR |
| 2.6 | Pressure test of all field installed piping for oil and air at 1.5 times the maximum design pressure (As per standard) | Test | 100% | | TC/TR | 3/2 | 1 | - | TC/TR |
| 2.7 | Leakage test of all field piping at requisite pressure | Test | 100% | -do- | TC/TR | 3/2 | 1 | - | TC/TR |
| 2.8 | Opening and closing of valve and by-pass valve at rated pressure/head, | Test | 100% | -do- | TC/TR | 3/2 | 1 | - | TC/TR |
| 2.9 | Tests to determine leakage from valve seal under specified head conditions | Test | 100% | -do- | TC/TR | 3/2 | 1 | - | TC/TR |
| 2.10 | Tests to determine closing and opening time of butterfly valve/Spherical valve and by-pass valve at conditions defined, | Test | 100% | -do- | TC/TR | 3/2 | 1 | - | TC/TR |
| 2.11 | Closure of the valve by use of counter weights for maximum turbine discharge conditions, | Visual | 100% | -do- | TC/TR | 3/2 | 1 | - | TC/TR |
| 2.12 | Pressure testing of service and maintenance seal and check Service and Maintenance seal stroke | Test | 100% | -do- | TC/TR | 3/2 | 1 | - | TC/TR |
| 2.13 | Functional check of Control Circuit. | Functional Test | 100% | -do- | TC/TR | 3/2 | 1 | - | TC/TR |
| 2.14 | Testing for Interfacing of operation for MIV system with Plant SCADA System . | Test | 100% | -do- | TC/TR | 3/2 | 1 | - | TC/TR |
| Note : | a. In ‘Inspection Agency’column figure 1,2,or 3 to be filled. 1- will indicate 'Representative of Engineer-In -Charge , Employer 2- will indicate ‘Contractor’ & 3- will indicate ‘sub-Contractor’. | | | | | | | | |

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| | b. In 'Remarks' column following abbreviations shall be used - TC-Test Certificate, TR-Test Report | | | | | | | | |
| | c. At the time of Inspection the Contractor shall arrange the requisite calibrated measuring instruments/Tools . | | | | | | | | |
| | d. The above FQP stipulates the bare minimum requirements which shall be complied by the contractor. The above FQP has been made presuming subletting of work shall be allowed in the tender. In case subletting of work is not allowed in the tender, then"3/2" shall be considered as "2" under the column " Perform" . | | | | | | | | |
| | e. Any additional activity/test required as per the requirement of equipment in accordance with Contract Agreement/Relevent standard apart from FQP will be carried out by the firm without any additional financial implication. | | | | | | | | |
| | f. The contractor shall furnish the details of test methods to the Engineer-In charge,Employer for approval in the time line as specified in contract agreement. | | | | | | | | |
| | g. All the Test in FQP shall be witnessed by Engineer-in-charge or his representative at site. | | | | | | | | |
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| | **Signature** | | | | | **Signature & Seal** | | | |
| | **Engineer-in-charge** | | | | **(VENDORS Q.C. DEPT. OR REPRESENTATIVE)** | | | | |

## 5) (i) STATIC EXCITATION SYSTEM FOR SYNCHRONOUS MACHINES

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|---|---|---|---|---|---|---|---|---|---|
| **परियोजना (PROJECT) :** | | | | | **ग्राहक (CLIENT):** | | | | |
| **उपष्कर का नाम (NAME OF EQUIPMENT) : Static Excitation System** | | | | | **विक्रेता (VENDOR):** | | | | |
| | | | | | **एनआईटी/ क्रय आदेश संदर्भ( NIT / P.O. Reference) :** | | | | |
| | | | | | | | | | |
| **क्र. सं. S.N.** | **मद/घटक एवं विशेषता ITEM/ COMPONENT & CHARACTERISTICS** | **जाँच की प्रकृति NATURE OF CHECKS** | **जाँच की मात्रा QUANTUM OF CHECKS** | **संदर्भ दस्तावेज़ / स्वीकृति मानदंड REFERENCE DOCUMENT/ ACCEPTANCE NORMS** | **रेकॉर्ड फ़ारमैट RECORD FORMAT** | **निरीक्षण एजैंसी Inspecting Agency** | | | **टिप्पणी Remarks** |
| | | | | | | **प्रदर्शन PERFORM** | **गवाह WITNESS** | **सत्यापन VERIFY** | |
| **A)** | **Bought out items** | | | | | | | | |
| **1** | **Thyrister, Surge Supression Device, HMI/MMI etc. (As applicable)** | | | | | | | | |
| a) | Make and Rating | Visual | 100% | Tech spec./ Appd Drg./ IS/IEC/Equivalent Standard | TC | 3/2 | - | 1 | TC |
| b) | Functional Test | Electrical | -do- | -do- | TC | 3/2 | - | 1 | TC |
| **2** | **Power Supply** | | | | | | | | |
| a) | Make and Rating | Visual | 100% | Tech spec./ Appd Drg./ IS/IEC/Equivalent Standard | TC | 3/2 | - | 1 | TC |
| b) | Performance Test | Electrical | -do- | -do- | TC | 3/2 | - | 1 | TC |
| **3** | **DC field circuit breaker** | | | | | | | | |
| a) | Make and Rating | Visual | 100% | Tech spec./ Appd Drg./ IS/IEC/Equivalent Standard | TC | 3/2 | - | 1 | TC |
| b) | Performance Test | Electrical | -do- | -do- | TC | 3/2 | - | 1 | TC |

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|---|---|---|---|---|---|---|---|---|---|
| **4** | **Discharge Resistors** | | | | | | | | |
| a) | Make and Rating | Visual | 100% | Tech spec./ Appd Drg./ IS/IEC/Equivalent Standard | TC | 3/2 | - | 1 | TC |
| b) | Performance Test | Electrical | -do- | -do- | TC | 3/2 | - | 1 | TC |
| **5** | **Digital/ Analog Metering Equipment** | | | | | | | | |
| a) | Dimensional check, Make & Rating | Measurement / Visual | 100% | Tech spec./ Appd Drg./ IS/IEC/Equivalent Standard | TC | 3/2 | - | 1 | TC |
| b) | Class and Accuracy | Visual | -do- | -do- | TC | 3/2 | - | 1 | TC |
| c) | Calibration | Electrical | -do- | -do- | TC | 3/2 | - | 1 | TC |
| d) | Routine Test | Electrical | -do- | -do- | TC | 3/2 | - | 1 | TC |
| **6** | **Excitation Cable & other Interconnection cables (If any)** | | | | | | | | |
| a) | Make and Rating | Visual | 100% | Tech spec./ Appd Drg./ IS/IEC/Equivalent Standard | TC | 3/2 | - | 1 | TC |
| b) | Routine Test | Electrical | -do- | -do- | TC | 3/2 | - | 1 | TC |
| **7** | **Crowbar Circuit** | | | | | | | | |
| a) | Make and Rating | Visual | 100% | Tech spec./ Appd Drg./ IS/IEC/Equivalent Standard | TC | 3/2 | - | 1 | TC |
| b) | Performance Test | Electrical | -do- | -do- | TC | 3/2 | - | 1 | TC |
| **8** | **Clipper Circuit (If applicable)** | | | | | | | | |
| a) | Make and Rating | Visual | 100% | Tech spec./ Appd Drg./ IS/IEC/Equivalent Standard | TC | 3/2 | - | 1 | TC |
| b) | Performance Test | Electrical | -do- | -do- | TC | 3/2 | - | 1 | TC |
| **9** | **Earth fault detector (If applicable)** | | | | | | | | |
| a) | Make and Rating | Visual | 100% | Tech spec./ Appd Drg./ IS/IEC/Equivalent Standard | TC | 3/2 | - | 1 | TC |
| b) | Routine Test | Electrical | -do- | -do- | TC | 3/2 | - | 1 | TC |
| **10** | **Rectifier cooling fan** | | | | | | | | |
| a) | Make and Rating | Visual | 100% | Tech spec./ Appd Drg./ IS/IEC/Equivalent Standard | TC | 3/2 | - | 1 | TC |
| b) | Routine Test | Electrical | -do- | -do- | TC | 3/2 | - | 1 | TC |
| **B)** | **Monitoring & Protection features check** | | | | | | | | |

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|---|---|---|---|---|---|---|---|---|---|
| a) | Thyristor Failure Detection | -do- | -do- | -do- | TC/ IR | 3/2 | - | 1 | TC/ IR |
| b) | DC Short Circuit | -do- | -do- | -do- | TC/ IR | 3/2 | - | 1 | TC/ IR |
| c) | Check of AC system overvoltage(if applicable) and overcurrent protection | -do- | -do- | -do- | TC/ IR | 3/2 | - | 1 | TC/ IR |
| d) | Thyristor cooling fan failure | -do- | -do- | -do- | TC/ IR | 3/2 | - | 1 | TC/ IR |
| e) | Transient overvoltage monitoring due to lightning or switching surges | -do- | -do- | -do- | TC/ IR | 3/2 | - | 1 | TC/ IR |
| f) | Thyristor and field Overvoltage protection | -do- | -do- | -do- | TC/ IR | 3/2 | - | 1 | TC/ IR |
| **C)** | **Final Inspection of Excitation System** | | | | | | | | |
| **1** | **Dimensional check of panels, Sheet thickness** | Visual/ Measurement | 100% | Tech spec./ Appd Drg./ IS/IEC/Equivalent Standard | JIR | 3/2 | 1 | | CHP |
| **2** | **Painting** | | | | | | | | |
| a) | Paint Shade, Coating Thickness & Finish | Visual/ Measurement | 100% | Tech spec./ Appd Drg./ IS/IEC/Equivalent Standard | JIR | 3/2 | 1 | - | CHP |
| **3** | **BOM check** | Visual | 100% | -do- | JIR | 3/2 | 1 | - | CHP |
| **4** | **IR Test of Excitation System** | Electrical | 100% | -do- | TC | 3/2 | - | 1 | TC |
| **5** | **IP class** | Mech.Test | 100% | -do- | TC | 3/2 | - | 1 | TC |
| **6** | **HV Test on Excitation System** | | | | | | | | |
| a) | Main Circuit | Electrical | 100% | Tech spec./ Appd Drg./ IS/IEC/Equivalent Standard | TC | 3/2 | - | 1 | TC |
| b) | Auxilliary circuits | -do- | -do- | -do- | TC | 3/2 | - | 1 | TC |
| **7** | **Scheme & Interlocking checking** | Electrical | 100% | -do- | JIR | 3/2 | 1 | - | CHP |
| **8** | **Functional Check of Protection and Trip Logics & Indications** | | | | | | | | |
| a) | Failure of DVRs, Loss of regulator, Thyristor firing circuit failure, Field ground detector and PT fuse failure detection,V/f protection for alarm & tripping etc. (As applicable) | Electrical | 100% | Tech spec./ Appd Drg./ IS/IEC/Equivalent Standard | JIR | 3/2 | 1 | - | CHP |
| **9** | **Functional Check** | | | | | | | | |
| a) | Discharge Circuit | Electrical | 100% | Tech spec./ Appd Drg./ IS/IEC/Equivalent Standard | JIR | 3/2 | 1 | - | CHP |

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| b) | Field Flashing Circuit Contactor | -do- | 100% | -do- | JIR | 3/2 | 1 | - | CHP |
| c) | Functional Tests in all relays and other devices of comand and control | -do- | -do- | -do- | JIR | 3/2 | 1 | - | CHP |
| **10** | **Closed Loop simulation tests of the excitation system** | Test | 100% | -do- | JIR | 3/2 | 1 | - | CHP |
| **11** | **Functional Test** | | | | | | | | |
| a) | Check of Trigger Pulse Equipment (Firing Module & Power Supply Fault) | Electrical | 100% | Tech spec./ Appd Drg./ IS/IEC/Equivalent Standard | JIR | 3/2 | 1 | - | CHP |
| b) | Light load test | -do- | -do- | -do- | JIR | 3/2 | 1 | - | CHP |
| c) | Rectifier Leakage Test | -do- | -do- | -do- | TC | 3/2 | - | 1 | TC |
| d) | Current sharing tests of parallel branches (if applicable) | -do- | -do- | -do- | JIR | 3/2 | 1 | - | CHP |
| e) | PIV Test on Thyristor | Electrical | 100% | Tech spec./ Appd Drg./ IS/IEC/Equivalent Standard | TC | 3/2 | - | 1 | TC |
| f) | Check of redundant Thyrister Stack/ Manual Thyrister Stack (As applicable). | -do- | -do- | -do- | JIR | 3/2 | 1 | - | CHP |
| **12** | **Tests on DVRs :** | | | | | | | | |
| a) | Stator and Rotor Current Limiter Test | -do- | -do- | -do- | JIR | 3/2 | 1 | - | CHP |
| b) | Load Angle Limiter Test | -do- | -do- | -do- | JIR | 3/2 | 1 | - | CHP |
| c) | Over fluxing Limiter | -do- | -do- | -do- | JIR | 3/2 | 1 | - | CHP |
| d) | Check of Sequence/ Auto & Manual Operation | Electrical | -do- | Tech spec./ Appd Drg./ IS/IEC/Equivalent Standard | JIR | 3/2 | 1 | - | CHP |
| **13** | **Temperature rise test (Heat Run)** | -do- | On 01 unit | -do- | JIR | 3/2 | 1 | - | CHP |
| **14** | **Burn in Test of assembly** | -do- | -do- | -do- | TC | 3/2 | - | 1 | TC (Wherever module level burn-in is checked, this may be exempted.) |
| **15** | **Provision of necessary contacts and/or ports for integration with existing plant SCADA system (As** | Visual | 100% | Tech spec./ Appd Drg./ IS/IEC/Equivalent Standard | JIR | 3/2 | 1 | - | CHP |

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| | **applicable)** | | | | | | | | |
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| Note : | a. In 'Inspection Agency' column figure 1,2,or 3 to be filled. 1- will indicate 'Employer', 2- will indicate 'supplier' & 3- will indicate 'sub-supplier'. | | | | | | | | |
| | b. In 'Remarks' column following abbreviations shall be used - RR-Review of Records, T.C. - Test Certificate, JIR - Joint Inspection Report & CHP - Customer Hold Point, | | | | | | | | |
| | c. The firm shall obtain acceptance/clearance of finished product for further activities based on Test Certificates & Internal Report (IR) | | | | | | | | |
| | d. Any additional test required as per the requirement of equipment in accordance with Contract Agreement/Relevent standard apart from QAP will be carried out by the firm without any additional financial implication. | | | | | | | | |
| | e.This QAP does not absolve the Contractor/sub-contractor of his responsibility to supply the correct products, strictly in conformity to the specifications given in the purchase order/contract. The above Model QAP stipulates the bare minimum requirements which shall be complied by the contractor. The above QAP has been made presuming subletting of work shall be allowed in the tender. In case subletting of work is not allowed in the tender, then"3/2" shall be considered as "2" under the column " Perform" . | | | | | | | | |
| | f. The type test may not be mandatory if similar equipment has been type tested and test certificate(s) for relevant tests are accepted by the Employer | | | | | | | | |
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| | | | | | | | | | |
| | **Signature** | | | | | **Signature & Seal** | | | |
| | **EMPLOYER ( QA&I DEPT.)** | | | | **(VENDORS Q.C. DEPT. OR REPRESENTATIVE)** | | | | |

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| **<u>कार्य स्थल गुणवत्ता योजना (FIELD QUALITY PLAN) :</u>** | | | | | | | | | |
| **परियोजना (PROJECT) :** | | | | **ग्राहक (CLIENT):** | | | | | |
| **उपष्कर का नाम (NAME OF EQUIPMENT) :** **Excitation System** | | | | **विक्रेता (VENDOR):** | | | | | |
| | | | | **एनआईटी/ क्रय आदेश संदर्भ( NIT / P.O. Reference) :** | | | | | |
| | | | | | | | | | |

| क्र. सं.<br>S.N. | घटक की गतिविधि और संचालन<br>ACTIVITY & OPERATION OF COMPONENT | जाँच की प्रकृति<br>NATURE OF CHECKS | जाँच की मात्रा<br>QUANTUM OF CHECKS | संदर्भ दस्तावेज़ / स्वीकृति मानदंड<br>REFERENCE DOCUMENT/ ACCEPTANCE NORMS | रेकॉर्ड फ़ारमैट<br>RECORD FORMAT | निरीक्षण एजैंसी<br>Inspecting Agency | | | टिप्पणी<br>Remarks |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | प्रदर्शन<br>PERFORM | गवाह<br>WITNESS | सत्यापन<br>VERIFY | |
| a) | Accuracy Test on DVRs | -do- | -do- | Tech spec./ Appd Drg./ IS/IEC/Equivalent Standard | TC/TR | 3/2 | 1 | - | TC/TR |
| **A** | **Test of excitation and regulation with generator at standstill** | | | | | | | | |
| a) | Excitation equipment visual inspection | Visual/ | 100% | Tech spec./ Appd Drg./ IS/IEC/Equivalent Standard | TC/TR | 3/2 | 1 | - | TC/TR |
| b) | Connections check | Electrical | -do- | -do- | TC/TR | 3/2 | 1 | - | TC/TR |
| c) | Insulation tests for cables | -do- | -do- | -do- | TC/TR | 3/2 | 1 | - | TC/TR |
| d) | Check of the AC & DC supplies | -do- | -do- | -do- | TC/TR | 3/2 | 1 | - | TC/TR |
| e) | Check of the transducers and protections circuit. Tripping of Generator breaker/ Generator transformer breaker and field breaker by simulated operationof unit lockout relay. | Functional | -do- | -do- | TC/TR | 3/2 | 1 | - | TC/TR |
| f) | Operational Test on Field Flashing Circuit | -do- | -do- | -do- | TC/TR | 3/2 | 1 | - | TC/TR |
| g) | Test of the self – excitation point of the converter (for changeover from field flashing to thyristor bridge supply) | -do- | -do- | -do- | TC/TR | 3/2 | 1 | - | TC/TR |
| h) | Test of the rectifier bridges connected to a separate supply. | -do- | -do- | -do- | TC/TR | 3/2 | 1 | - | TC/TR |
| i) | i) Functional checking of commands to Excitation equipment, operation and status for Local commands<br>ii) Functional checking of commands to Excitation equipment, operation and status for control room commands | Functional | -do- | Tech spec./ Appd Drg./ IS/IEC/Equivalent Standard/ Scheme | TC/TR | 3/2 | 1 | - | TC/TR |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | iii) Excitation equipment status & alarm indications at control room and local.<br>iv) Checking alarms, trip conditions and Sequence of Events. | | | | | | | | |
| **B** | **Test of excitation and regulation with generator at No Load / Reduced load (As applicable)** | | | | | | | | |
| a) | Automatic Generator Voltage regulation (Upper & Lower Limits, Step Response) | Functional | 100% | Tech spec./ Appd Drg./ IS/IEC/Equivalent Standard / Commissioning procedure | TC/TR | 3/2 | 1 | - | TC/TR |
| b) | Manual Field Current regulation | -do- | -do- | -do- | TC/TR | 3/2 | 1 | - | TC/TR |
| c) | Regulator changeover | -do- | -do- | -do- | TC/TR | 3/2 | 1 | - | TC/TR |
| d) | Limiters Test ( Over Excitation Limit, Under -Excitation Limit) | -do- | -do- | -do- | TC/TR | 3/2 | 1 | - | TC/TR |
| e) | Generator Voltage Build up Test under Automatic and Manual regulator operating modes | -do- | -do- | -do- | TC/TR | 3/2 | 1 | - | TC/TR |
| f) | V/Hz limiter test | Electrical | -do- | -do- | TC/TR | 3/2 | 1 | - | TC/TR |
| **C** | **Test of excitation and regulation with generator at Load** | | | | | | | | |
| a) | Automatic Generator Voltage regulation | Functional | -do- | Tech spec./ Appd Drg./ IS/IEC/Equivalent Standard / Commissioning procedure | TC/TR | 3/2 | 1 | - | TC/TR |
| b) | Manual Field Current regulation | -do- | -do- | -do- | TC/TR | 3/2 | 1 | - | TC/TR |
| c) | Regulator changeover | -do- | -do- | -do- | TC/TR | 3/2 | 1 | - | TC/TR |
| d) | Limiters Test ( Underexcitation , Overexcitation) | -do- | -do- | -do- | TC/TR | 3/2 | 1 | - | TC/TR |
| e) | Field Suppression Test (Field Suppression by inverter operation and Discharge element) with Generator at Generator on – Load under field forcing operation | -do- | -do- | -do- | TC/TR | 3/2 | 1 | - | TC/TR (subject to permission from purchaser/ Grid authorities) |
| f) | PT failure Detection Verification | -do- | -do- | -do- | TC/TR | 3/2 | 1 | - | TC/TR (subject to permission from purchaser/ Grid authorities) |

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|---|---|---|---|---|---|---|---|---|---|
| g) | Positive & Negative Ceiling Curve | -do- | -do- | -do- | TC/TR | 3/2 | 1 | - | TC/TR (subject to permission from purchaser/ Grid authorities) |
| h) | Load rejection tests | -do- | -do- | -do- | TC/TR | 3/2 | 1 | - | TC/TR (subject to permission from purchaser/ Grid authorities) |
| i) | Transient response to a set point step in not – Synchronized operation & Isolated Network operation | Electrical | 100% | –do- | TC/TR | 3/2 | 1 | - | TC/TR |
| j) | Transient response to a set point step on load in reactive Power supply | -do- | -do- | -do- | TC/TR | 3/2 | 1 | - | TC/TR |
| k) | Transient response to a set point step on load in reactive Power absorption | -do- | -do- | -do- | TC/TR | 3/2 | 1 | - | TC/TR |
| l) | Closed – loop frequency analysis of excitation control system | -do- | -do- | -do- | TC/TR | 3/2 | 1 | - | TC/TR (subject to permission from purchaser/ Grid authorities) |
| m) | Positive & Negative Ceiling Voltage and Voltage Response Time, Voltage Time Response, Nominal Response tests of the Excitation system | -do- | -do- | -do- | TC/TR | 3/2 | 1 | - | TC/TR (subject to permission from purchaser/ Grid authorities) |
| n) | Power System Stabilizer (PSS) check (for Unit size > 100 MW ) | Functional | -do- | -do- | TC/TR | 3/2 | 1 | - | TC/TR |
| Note: | a. In 'Inspection Agency'column figure 1,2,or 3 to be filled. 1- will indicate Representative of Engineer-in-charge, 2- will indicate 'Contractor' & 3- will indicate 'Sub-contractor'. | | | | | | | | |
| | b. In 'Remarks' column following abbreviations shall be used - TC/TR - Test Certificate/ Test Report | | | | | | | | |
| | c.The above FQP stipulates the bare minimum requirements which shall be complied by the contractor. The above FQP has been made presuming subletting of work shall be allowed in the tender. In case subletting of work is not allowed in the tender, then"3/2" shall be considered as "2" under the column " Perform" . | | | | | | | | |
| | d. Any additional acitivity/ test required as per the requirement of equipment in accordance with Contract Agreement/Relevent standard apart from FQP will be carried out by the firm without any additional financial implication. | | | | | | | | |
| | e. The contractor shall furnish the details of test method to the Engineer-in-Charge for approval in the time line as specified in contract agreement | | | | | | | | |
| | f. All the Test in FQP shall be witnessed by Engineer-in-charge or his representative at site. | | | | | | | | |
| | | | | | | | | | |
| | **Signature** | | | | | **Signature & Seal** | | | |

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|---|---|---|---|---|---|
| | **Engineer-in-charge** | | | | **(VENDORS Q.C. DEPT. OR REPRESENTATIVE)** |

## 5) (ii) DYNAMIC EXCITATION SYSTEM FOR ASYNCHRONOUS MACHINES

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **परियोजना (PROJECT) :** | | | | **ग्राहक (CLIENT):** | | | | | |
| **उपष्कर का नाम (NAME OF EQUIPMENT) :** AC Excitation Variable Speed | | | | **विक्रेता (VENDOR):** | | | | | |
| | | | | **एनआईटी/ क्रय आदेश संदर्भ( NIT / P.O. Reference) :** | | | | | |
| **Sl. No.** | **Item / Components & Characteristics** | **Nature of Checks** | **Quantum of Checks** | **Reference Document / Acceptance Norms** | **Record Format** | **Inspection Agency** | | | **Remarks** |
| | | | | | | Sub supplier | Supplier | Employer | |
| **Inspections and tests on AC excitation boards** | | | | | | | | | |
| **1.1** | **Work Shop tests** | | | | | | | | |
| **1.1.1** | **Visual checks** | | | | | | | | |
| 1.1.1.1 | Visual inspection of sub assesmblies / modules / components before integration in converter | Mechanical | Sample - 30% | Acc. To drawings | TC | P | RR | RR | |
| 1.1.1.2 | Check of parts acc. Part lists | Mechanical | Sample - 10% | Acc. To drawings | TC | P | RR | RR | |
| 1.1.1.3 | Check of wiring (color, diameter, connection quality, labeling) | Mechanical | Sample | Acc. To drawings | TC | P | RR | RR | |
| 1.1.1.4 | Check of cubicle dimensions | Mechanical | Sample | Acc. To drawings | TC | P | RR | RR | |
| 1.1.1.5 | Check of cubicle finishing and labels | Mechanical | Sample | Acc. To drawings | TC | P | RR | RR | |
| **1.1.2** | **Functional tests** | | | | | | | | |
| 1.1.2.1 | Verificaiton of BOM | Mechanical | Complete converter | Acc. To drawings | JIR | P | W | CHP | |
| 1.1.2.2 | Insulation test of control circuits | Electrical | Complete Converter | 'IS/ IEC/ equivalent or above' | JIR | P | W | CHP | |
| 1.1.2.3 | Insulation test of power circuits | Electrical | Complete Converter | 'IS/ IEC/ equivalent or above' | JIR | P | W | CHP | |
| 1.1.2.4 | Voltage test of power circuits | Electrical | Complete Converter | Acc. To factory standard | JIR | P | W | CHP | |

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| 1.1.2.5 | Test of selected binary signals | Electrical | Complete Converter | Acc. To factory standard | JIR | P | W | CHP | |
| 1.1.2.6 | Monitoring of serial interfaces | Electrical | Complete Converter | Acc. To factory standard | JIR | P | W | CHP | |
| 1.1.2.7 | Fiber optics - assignment and check of firing signals | Electrical | Complete Converter | Acc. To factory standard | JIR | P | W | CHP | |
| 1.1.2.8 | Light load function test (W.reduced voltage) | Electrical | Complete Converter | Acc. To factory standard | JIR | P | W | CHP | |
| 1.1.2.9 | Function test of auxiliary devices | Electrical | Complete Converter | Acc. To factory standard | JIR | P | W | CHP | |
| 1.1.2.10 | Function test of protective devices | Electrical | Complete Converter | Acc. To factory standard | JIR | P | W | CHP | |
| 1.1.2.11 | Check of properties of control equipment | Electrical | Complete Converter | Acc. To factory standard | JIR | P | W | CHP | |
| **1.2** | **Site tests** | | | | | | | | |
| 1.2.1 | Tests after erection | | | | | | | | |
| 1.2.1.1 | Tests of external aux. power supplies | Electrical | 100% | Acc. Manufacturers commissioning instruction | JIR | P | W | RR | |
| 1.2.1.2 | Tests of external binary input signals | Electrical | 100% | | JIR | P | W | RR | |
| 1.2.1.3 | Tests of internal binary input signals | Electrical | 100% | | JIR | P | W | RR | |
| 1.2.1.4 | Tests of external analog input signals | Electrical | 100% | | JIR | P | W | RR | |
| 1.2.1.5 | Test of binary output signals | Electrical | 100% | | JIR | P | W | RR | |
| 1.2.1.6 | Test of analog output signals | Electrical | 100% | | JIR | P | W | RR | |
| 1.2.1.7 | Test of serial interfaces | Electrical | 100% | | JIR | P | W | RR | |
| 1.2.1.8 | Check of protection trips | Electrical | 100% | | JIR | P | W | RR | |
| 1.2.1.9 | Check of insulation resistance of power circuit | Electrical | 100% | | JIR | P | W | RR | |
| 1.2.1.10 | Check of insulation resistance of power cables | Electrical | 100% | | JIR | P | W | RR | |
| 1.2.1.11 | Adjustment of line side current and voltage measurement | Electrical | 100% | | JIR | P | W | RR | |
| 1.2.1.12 | Adjustment of unit side current and voltage measurement | Electrical | 100% | | JIR | P | W | RR | |
| 1.2.1.1 | Operation of converter with reduced voltage | Electrical | 100% | | JIR | P | W | RR | |

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|---|---|---|---|---|---|---|---|---|---|
| 3 | | | | | | | | | |
| 1.2.1.14 | Check of combined function of AC excitation system, control system and protection | Electrical | 100% | | JIR | P | W | RR | |
| 1.2.2 | Tests after first run of unit | | | | | | | | |
| 1.2.2.1 | First start up of unit with AC excitaiton | Electrical | 1 time | Acc. Manufacturers commissioning instruction | JIR | P | W | RR | |
| 1.2.2.2 | Startup of motor unitl rated speed | Electrical | 2 times | | JIR | P | W | RR | |
| 1.2.2.3 | Sinusoidal wave form distortion factor measurement | Electrical | All three phases | | JIR | P | W | RR | |
| 1.2.2.4 | First electrical braking of unit | Electrical | 1 time | | JIR | P | W | RR | |
| **Inspections and tests on Cooling unit** | | | | | | | | | |
| **2.1** | **Work Shop tests** | | | | | | | | |
| 2.1.1 | Visual checks | | | | | | | | |
| 2.1.1.1 | Visual inspection of sub assesmblies / modules / components before integration in converter | Mechanical | Sample - 30% | Acc. To drawings | TC | P | RR | RR | |
| 2.1.1.2 | Check of parts acc. Part lists | Mechanical | Sample - 10% | Acc. To drawings | TC | P | RR | RR | |
| 2.1.1.3 | Check of wiring (color, diameter, connection quality, labeling) | Mechanical | Sample | Acc. To drawings | TC | P | RR | RR | |
| 2.1.2 | Functional tests | | | | | | | | |
| 2.1.2.1 | Test rotation direction pumps | Mechanical | Complete converter | Acc. To factory standard | JIR | P | W | RR | |
| 2.1.2.2 | Functional test on sensors | Mechanical | Complete converter | Acc. To factory standard | JIR | P | W | RR | |
| 2.1.2.3 | Pressure test | Mechanical | Complete converter | Acc. To factory standard | JIR | P | W | RR | |
| **Inspections and tests on AC excitation Transformers** | | | | | | | | | |
| 3.1 | **Work Shop tests** | | | | | | | | |
| 3.1.1 | Visual checks | | | | | | | | |
| 3.1.1.1 | Goods receipt | Mechanical | 100% | Acc. To factory standard | TC | P | RR | RR | |
| 3.1.1.2 | Quantity | Mechanical | 100% | Acc. To factory standard | TC | P | RR | RR | |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 3.1.1.3 | Visual appearance | Mechanical | 100% | Acc. To drawings | TC | P | RR | RR | |
| 3.1.1.4 | Damages | Mechanical | 100% | Acc. To factory standard | TC | P | RR | RR | |
| 3.1.1.5 | Check of Transformer finishing and labels | Mechanical | 100% | Acc. To drawings | TC | P | RR | RR | |
| 3.1.2 | Routine Tests | | | | | | | | |
| 3.1.2.1 | Lightning impulse test | Electrical | 1 No. per lot | 'IS/ IEC/ equivalent or above' | JIR | P | W | CHP | |
| 3.1.2.2 | Separate-source AC withstand voltage test | Electrical | 100% | 'IS/ IEC/ equivalent or above' | JIR | P | W | CHP | |
| 3.1.2.3 | Measurement of voltage ratio & check phase displacement | Electrical | 100% | 'IS/ IEC/ equivalent or above' | JIR | P | W | CHP | |
| 3.1.2.4 | Measurement of winding resistance | Electrical | 100% | 'IS/ IEC/ equivalent or above' | JIR | P | W | CHP | |
| 3.1.2.5 | Induced AC withstand voltage test | Electrical | 100% | 'IS/ IEC/ equivalent or above' | JIR | P | W | CHP | |
| 3.1.2.6 | Measurement of no-load loss and current | Electrical | 100% | 'IS/ IEC/ equivalent or above' | JIR | P | W | CHP | |
| 3.1.2.7 | Measurement of short-circuit impedance & load loss | Electrical | 100% | 'IS/ IEC/ equivalent or above' | JIR | P | W | CHP | |
| 3.1.2.8 | Measurement of partial discharge | Electrical | 100% | 'IS/ IEC/ equivalent or above' | JIR | P | W | CHP | |
| 3.1.2.9 | Measurement of A-weighted sound level by sound pressure method at no load | Electrical | 100% | 'IS/ IEC/ equivalent or above' | JIR | P | W | CHP | |
| 3.1.2.10 | Temperature rise test | Electrical | 1 No. per lot | 'IS/ IEC/ equivalent or above' | JIR | P | W | CHP | |
| 3.1.2.11 | Paint adhesion / thickness | Electrical | 100% | Acc. To drawings | JIR | P | W | CHP | |
| 3.1.2.12 | Dimensional inspection | Electrical | 100% | Acc. To drawings | JIR | P | W | CHP | |
| 3.1.2.13 | Funtional test of auxiliary components | Electrical | 100% | Acc. To manufacturer standard | JIR | P | W | CHP | |
| 3.1.2.14 | Measurement of insulation resistance to earth | Electrical | 100% | 'IS/ IEC/ equivalent or above' | JIR | P | W | CHP | |
| 3.1.2.15 | Determination of capacitances: windings to earth and between windings | Electrical | 100% | 'IS/ IEC/ equivalent or above' | JIR | P | W | CHP | |

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|---|---|---|---|---|---|---|---|---|---|
| **3.2** | **Site tests** | | | | | | | | |
| 3.2.1 | Tests before energizing | | | | | | | | |
| 3.2.1.1 | Visual inspection (painting, oil tightness, etc.) | Mechanical | 100% | Acc. To manufacturer standard | JIR | P | W | RR | |
| 3.2.1.2 | Check of grounding connection between transformer parts and to ground | Mechanical | 100% | Acc. To manufacturer standard | JIR | P | W | RR | |
| 3.2.1.3 | Chech of tightness of all primary and secondary connections | Mechanical | 100% | Acc. To manufacturer standard | JIR | P | W | RR | |
| 3.2.1.4 | Measurement of winding resistance | Electrical | 100% | 'IS/ IEC/ equivalent or above' | JIR | P | W | RR | |
| 3.2.1.5 | Measurement of voltage ratio & check phase displacement | Electrical | 100% | 'IS/ IEC/ equivalent or above' | JIR | P | W | RR | |
| 3.2.1.6 | Measurement of insulation resistance to earth | Electrical | 100% | 'IS/ IEC/ equivalent or above' | JIR | P | W | RR | |
| 3.2.1.7 | Funtional test of auxiliary components | Electrical | 100% | Acc. To manufacturer standard | JIR | P | W | RR | |
| 3.2.1.8 | Check of all hardwired and bus signals | Electrical | 100% | Acc. To drawings | JIR | P | W | RR | |
| **Inspections and tests on Crowbar** | | | | | | | | | |
| **4.1** | **Work Shop tests** | | | | | | | | |
| 4.1.1 | Visual checks | | | | | | | | |
| 4.1.1.1 | Goods receipt | Mechanical | 100% | Acc. To factory standard | TC | P | RR | RR | |
| 4.1.1.2 | Quantity | Mechanical | 100% | Acc. To factory standard | TC | P | RR | RR | |
| 4.1.1.3 | Visual appearance | Mechanical | 100% | Acc. To drawings | TC | P | RR | RR | |
| 4.1.1.4 | Damages | Mechanical | 100% | Acc. To factory standard | TC | P | RR | RR | |
| 4.1.2 | Functional Tests | | | | | | | | |
| 4.1.2.1 | Identification of main components | Mechanical | 100% | Acc. To drawings | JIR | P | W | CHP | |
| 4.1.2.2 | Visual inspection | Mechanical | 100% | Acc. To drawings | JIR | P | W | CHP | |
| 4.1.2.3 | Insulation test | Electrical | 100% | Acc. To factory standard | JIR | P | W | CHP | |
| 4.1.2.4 | Test of auxiliary supply | Electrical | 100% | Acc. To factory standard | JIR | P | W | CHP | |
| 4.1.2.5 | Break over diode test | Electrical | 100% | Acc. To factory standard | JIR | P | W | CHP | |
| 4.1.2.6 | Crowbar trigger test | Electrical | 100% | Acc. To factory standard | JIR | P | W | CHP | |

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|---|---|---|---|---|---|---|---|---|---|
| **Note:** | | | | | | | | | |
| a. Abbreviations used - RR-Review of Records, TC - Test Certificate Submission, JIR - Joint Inspection Report & CHP - Customer Hold Point. | | | | | | | | | |
| b. Test Certificates shall be submitted at the time of final inspection. Valid calibration Certificate of Instruments used for Testing shall be provided during the Test. | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| **Signature** | | | | | | | | **Signature & Seal** | |
| **EMPLOYER ( QA&I DEPT.)** | | | | | | | | **(VENDORS Q.C. DEPT. OR REPRESENTATIVE )** | |

## 6) ISOLATED PHASE BUS DUCT (IPBD) / SEGREGATED PHASE BUS DUCT (SPBD)

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **परियोजना (PROJECT) :** | | | | | **ग्राहक (CLIENT):** | | | | |
| **उपष्कर का नाम (NAME OF EQUIPMENT) : Bus Duct** | | | | | **विक्रेता (VENDOR):** | | | | |
| | | | | | **एनआईटी/ क्रय आदेश संदर्भ( NIT / P.O. Reference) :** | | | | |
| | | | | | | | | | |
| **क्रम स. (SR. NO.)** | **मद/घटक एवं विशेषता ITEM /COMPONENTS & CHARACTERISTICS** | **जाँच की प्रकृति NATURE OF CHECKS** | **जाँच की मात्रा QUANTUM OF CHECKS** | **संदर्भ दस्तावेज / स्वीकृति मानदंड REFERENCE ACCEPTANCE DOCUMENTS NORMS** | **रिकॉर्ड फॉर्मेट RECORD FORMAT** | **निरीक्षण एजेंसी INSP. AGENCY** | | | **टिपण्णी REMARKS** |
| | | | | | | प्रदर्शन Perform | गवाह Witness | सत्यापन Verify | |
| **A** | **BUS DUCT** | | | | | | | | |
| **1** | **Raw Material & Bought-out Items** | | | | | | | | |
| **1.1** | **Aluminium for Enclosure** | | | | | | | | |
| a) | Dimension | Measurement | 100% | Tech spec./ Appd Drg./ IS/IEC/Equivalent Standard | TC | 3/2 | - | 1 | TC |
| b) | Mechanical Properties | Mechanical | Sample | -do- | TC | 3/2 | - | 1 | TC |
| c) | Chemical Composition (incl. Al Percent.) | Chemical | -do- | -do- | TC | 3/2 | - | 1 | TC |
| d) | Conductivity | Electrical | -do- | -do- | TC | 3/2 | - | 1 | TC |
| **1.2** | **Aluminium for Conductor** | | | | | | | | |
| a) | Dimension | Measurement | 100% | Tech spec./ Appd Drg./ IS/IEC/Equivalent Standard | TC | 3/2 | - | 1 | TC |
| b) | Mechanical Properties | Mechanical | Sample | -do- | TC | 3/2 | - | 1 | TC |
| c) | Chemical Composition (incl. Al Percent.) | Chemical | -do- | -do- | TC | 3/2 | - | 1 | TC |
| d) | Conductivity | Electrical | -do- | -do- | TC | 3/2 | - | 1 | TC |
| **1.3** | **Mounting Structure ( Steel, Angle Sections and Plates)** | | | | | | | | |
| a) | Physical Properties (Ultimate Strength,Yield Stress,% Elongation & Bend Test | Mechanical | Sample | Tech spec./ Appd Drg./ IS/IEC/Equivalent Standard | TC | 3/2 | - | 1 | TC |
| b) | Chemical Composition | Chemical | -do- | -do- | TC | 3/2 | - | 1 | TC |
| **1.4** | **Epoxy Insulator/Epoxy Bushing** | | | | | | | | |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| a) | Dimensional | Measurement | 100% | Tech spec./ Appd Drg./ IS/IEC/Equivalent Standard | TC | 3/2 | - | 1 | TC |
| b) | Creepage distance | -do- | Sample | -do- | TC | 3/2 | - | 1 | TC |
| c) | Dry PF Voltage Withstand & PD Test | Electrical | -do- | -do- | TC | 3/2 | - | 1 | TC |
| d) | Test for Mechanical Strength | Mechanical | -do- | -do- | TC | 3/2 | - | 1 | TC |
| e) | Temperature Cycle Test | Test | -do- | -do- | TC | 3/2 | - | 1 | TC |
| f) | Impulse voltage withstand test(For Bushing) | Electrical | -do- | -do- | TC | 3/2 | - | 1 | TC |
| **1.5** | **Expansion Compensator** | | | | | | | | |
| a) | Dimension | Measurement | 100% | Tech spec./ Appd Drg./ IS/IEC/Equivalent Standard | TC | 3/2 | - | 1 | TC |
| b) | Mechanical Properties | Mechanical | Sample | -do- | TC | 3/2 | - | 1 | TC |
| c) | Chemical Composition (incl. Al Percent.) | Chemical | -do- | -do- | TC | 3/2 | - | 1 | TC |
| d) | Conductivity | Electrical | -do- | -do- | TC | 3/2 | - | 1 | TC |
| **1.6** | **Metal Bellows** | | | | | | | | |
| a) | Chemical Composition, Thickness, Finish | Test | Sample | Tech spec./ Appd Drg./ IS/IEC/Equivalent Standard | TC | 3/2 | - | 1 | TC |
| **1.7** | **Ethylene - Propylene Bellows** | | | | | | | | |
| a) | Dimensional | Measurement | 100% | Tech spec./ Appd Drg./ IS/IEC/Equivalent Standard | TC | 3/2 | - | 1 | TC |
| b) | Mechanical Properties | Mechanical | Sample | -do- | TC | 3/2 | - | 1 | TC |
| c) | Insulation Resistance | Electrical | -do- | -do- | TC | 3/2 | - | 1 | TC |
| **2** | **IN PROCESS INSPECTION** | | | | | | | | |
| **2.1** | **Bus Duct enclosure** | | | | | | | | |
| a) | Dimensional check | Measurement | 100% | Tech spec./ Appd Drg./ IS/IEC/Equivalent Standard | TC | 3/2 | - | 1 | TC |
| b) | NDT (DPT) on welding | Test | Sample | -do- | TC | 3/2 | - | 1 | TC |
| **2.2** | **Busbar mounting** | | | | | | | | |
| a) | Size of busbar | Visual | Sample | Tech spec./ Appd Drg./ IS/IEC/Equivalent Standard | TC | 3/2 | - | 1 | TC |
| b) | Straightness of busbar | -do- | -do- | -do- | TC | 3/2 | - | 1 | TC |
| **2.3** | **Al./Cu. Flexible** | | | | | | | | |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| a) | Alignment, uniformity freedom from defects | -do- | Sample | Tech spec./ Appd Drg./ IS/IEC/Equivalent Standard | TC | 3/2 | - | 1 | TC |
| b) | Dimensions | -do- | -do- | -do- | TC | 3/2 | - | 1 | TC |
| **2.4** | **Short Links for testing purpose** | | | | | | | | |
| a) | Chemical Composition, Mechanical ,Thickness, Finish | Test | Sample | Tech spec./ Appd Drg./ IS/IEC/Equivalent Standard | TC | 3/2 | - | 1 | TC |
| b) | Conductivity | Electrical | -do- | -do- | TC | 3/2 | - | 1 | TC |
| **2.5** | **Air Pressurisation System/Hot air blowing system** | | | | | | | | |
| a) | BOM & Functional Check | -do- | -do- | Tech spec./ Appd Drg./ IS/IEC/Equivalent Standard | TC | 3/2 | - | 1 | TC |
| **3** | **FINAL INSPECTION OF BUS DUCT** | | | | | | | | |
| **3.1** | **Type Test** | | | | | | | | |
| a) | Temperature rise Test | Electrical | One Unit | Tech spec./ Appd Drg./ IS/IEC/Equivalent Standard | TC | 3/2 | - | 1 | TC |
| b) | Short Time Current Test | -do- | -do- | -do- | TC | 3/2 | - | 1 | TC |
| c) | Impulse Voltage Test | -do- | -do- | -do- | TC | 3/2 | - | 1 | TC |
| d) | Degree of Protection (Air & Water Tightness Test) | Test | -do- | Tech spec./ Appd Drg./ IS/IEC/Equivalent Standard | TC | 3/2 | - | 1 | TC |
| **3.2** | **Routine Test** | | | | | | | | |
| a) | Check for assembly, dimension, tightness of busbar joints, busbar support, clearance & freedom from surface defects & painting | Visual | 5% or 02 nos. whichever is higher | Tech spec./ Appd Drg./ IS/IEC/Equivalent Standard | JIR | 3/2 | 1 | - | CHP |
| b) | One Minute Power Frequency Voltage Withstand Test | Electrical | -do- | -do- | JIR | 3/2 | 1 | - | CHP |
| c) | IR Test before and after HV Test | -do- | -do- | -do- | JIR | 3/2 | 1 | - | CHP |
| d) | Mili Volt Drop Test | -do- | Sample | -do- | JIR | 3/2 | 1 | - | CHP |
| e) | Fuctional & BOM verification of Air Pressuration System | Visual & Fuctional | -do- | -do- | TC | 3/2 | - | 1 | TC |
| **B** | **LAVT & NG CUBICLE** | | | | | | | | |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **1** | **Raw Material** | | | | | | | | |
| **1.1** | **Steel Sheet & angle** | | | | | | | | |
| a) | Dimension | Measurement | 100% | Tech spec./ Appd Drg./ IS/IEC/Equivalent Standard | TC | 3/2 | - | 1 | TC |
| b) | Bend Test | Visual | Sample | -do- | TC | 3/2 | - | 1 | TC |
| **1.2** | **Copper Strip & Flats** | | | | | | | | |
| a) | Dimension | Measurement | 100% | Tech spec./ Appd Drg./ IS/IEC/Equivalent Standard | TC | 3/2 | - | 1 | TC |
| b) | Mechanical Test | Mechanical | Sample | -do- | TC | 3/2 | - | 1 | TC |
| c) | Conductivity | Electrical | -do- | -do- | TC | 3/2 | - | 1 | TC |
| **2** | **Bought Out Items** | | | | | | | | |
| **2.1** | **Epoxy Insulator** | | | | | | | | |
| a) | Dimensional | Measurement | -do- | Tech spec./ Appd Drg./ IS/IEC/Equivalent Standard | TC | 3/2 | - | 1 | TC |
| b) | Creepage distance | -do- | -do- | -do- | TC | 3/2 | - | 1 | TC |
| c) | Dry PF Voltage Withstand & PD Test | Electrical | -do- | -do- | TC | 3/2 | - | 1 | TC |
| d) | Test for Mechanical Strength | Mechanical | -do- | -do- | TC | 3/2 | - | 1 | TC |
| e) | Temperature Cycle Test | Test | -do- | -do- | TC | 3/2 | - | 1 | TC |
| **2.2** | **Epoxy seal off bushing** | | | | | | | | |
| a) | Dimension | Visual | 100% | Tech spec./ Appd Drg./ IS/IEC/Equivalent Standard | TC | 3/2 | - | 1 | TC |
| b) | Dry Power Frequency Withstand Test | Electrical | Sample | -do- | TC | 3/2 | - | 1 | TC |
| c) | Partial Discharge | -do- | -do- | -do- | TC | 3/2 | - | 1 | TC |
| d) | Creapage | -do- | -do- | -do- | TC | 3/2 | - | 1 | TC |
| **2.3** | **Current Transformer** | | | | | | | | |
| a) | **Routine Test** | | | | | | | | |
| i) | Make, Type, Rating & Visual Inspection | Visual | 100% | Tech spec./ Appd Drg./ IS/IEC/Equivalent Standard | TC | 3/2 | - | 1 | TC |
| ii) | Terminal Marking & Polarity Verification | Electrical | -do- | -do- | TC | 3/2 | - | 1 | TC |
| iii) | Power Frequency Test on Primary & Secondary Winding separately. | -do- | -do- | -do- | TC | 3/2 | - | 1 | TC |
| iv) | Determination of Error according to the requirements of the Appropriate Accuracy Class | -do- | -do- | -do- | TC | 3/2 | - | 1 | TC |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| v) | Over Voltage Inter Turn Test | -do- | -do- | -do- | TC | 3/2 | - | 1 | TC |
| b) | Type Test (Impulse & Temp. Rise Test) | Electrical | Sample | Tech spec./ Appd Drg./ IS/IEC/Equivalent Standard | TC | 3/2 | - | 1 | TC |
| **2.4** | **Disconecting Switch (As applicable)** | | | | | | | | |
| a) | Type & No.of Poles | Visual | Sample | Tech spec./ Appd Drg./ IS/IEC/Equivalent Standard | TC | 3/2 | - | 1 | TC |
| b) | Dimensional check | -do- | -do- | -do- | TC | 3/2 | - | 1 | TC |
| c) | Electrical & Mechanical Operation | Operation | 100% | -do- | TC | 3/2 | - | 1 | TC |
| d) | Aux.Contact Function | Electrical | -do- | -do- | TC | 3/2 | - | 1 | TC |
| e) | Contact Resistance | -do- | -do- | -do- | TC | 3/2 | - | 1 | TC |
| f) | Power Frequency Votage Test | -do- | -do- | -do- | TC | 3/2 | - | 1 | TC |
| i) | Pole & Body | -do- | -do- | -do- | TC | 3/2 | - | 1 | TC |
| ii) | Across The Isolating Distance | Measurement | -do- | -do- | TC | 3/2 | - | 1 | TC |
| **3** | **Neutral Grounding Cubicle** | | | | | | | | |
| **3.1** | **Neutral Grounding Resistor** | | | | | | | | |
| | **Routine Test** | | | | | | | | |
| a) | Visual & Dimensional Check | Visual | 100% | Tech spec./ Appd Drg./ IS/IEC/Equivalent Standard | TC | 3/2 | - | 1 | TC |
| b) | Resistance at amb.temp | Electrical | -do- | -do- | TC | 3/2 | - | 1 | TC |
| c) | Insulation Resistance | -do- | -do- | -do- | TC | 3/2 | - | 1 | TC |
| d) | H.V withstand Test | -do- | -do- | -do- | TC | 3/2 | - | 1 | TC |
| | **Type Test** | | | | | | | | |
| a) | Temperature Rise Test (Part Resistance test) | Electrical | Sample | Tech spec./ Appd Drg./ IS/IEC/Equivalent Standard | TC | 3/2 | - | 1 | TC |
| **3.2** | **Neutral Grounding Transformer** | | | | | | | | |
| a) | Type Test (Impulse & Temp. Rise Test) | Electrical | Sample | Tech spec./ Appd Drg./ IS/IEC/Equivalent Standard | TC | 3/2 | - | 1 | TC |
| b) | **Routine Tests** | | | | | | | | |
| i) | Measurement of Winding Resistance | Electrical | 100% | Tech spec./ Appd Drg./ IS/IEC/Equivalent Standard | JIR | 3/2 | 1 | - | CHP |
| ii) | Measurement of Voltage Ratio | -do- | -do- | -do- | JIR | 3/2 | 1 | - | CHP |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| iii) | Measurement of Short Circuit Impedance & Load Loss | -do- | -do- | -do- | JIR | 3/2 | 1 | - | CHP |
| iv) | Measurement of No Load Losses and current | -do- | -do- | -do- | JIR | 3/2 | 1 | - | CHP |
| v) | Measurement of Magetizing Current (before and after Dielectric Test) | -do- | -do- | -do- | JIR | 3/2 | 1 | - | CHP |
| vi) | Measurement of Insulation Resistance and Polarization Index | -do- | -do- | -do- | JIR | 3/2 | 1 | - | CHP |
| vii) | Dielectric Test: | | | | | | | | |
| | i)Separate source AC withstand voltage test | Electrical | 100% | Tech spec./ Appd Drg./ IS/IEC/Equivalent Standard | JIR | 3/2 | 1 | - | CHP |
| | ii)Induced AC voltage withstand test (IVW) | -do- | -do- | -do- | JIR | 3/2 | 1 | - | CHP |
| | iii)Partial discharge measurement | -do- | -do- | -do- | JIR | 3/2 | 1 | - | CHP |
| viii) | Complete Transformer - Overall Physical Verification & Dimensions | -do- | -do- | -do- | JIR | 3/2 | 1 | - | CHP |
| ix) | Paint shade, thickness & Adhesion Test | -do- | -do- | -do- | TC | 3/2 | - | 1 | TC |
| **4)** | **LAVT Cubicle** | | | | | | | | |
| **4.1** | **Voltage Transformer** | | | | | | | | |
| | **Routine Tests** | | | | | | | | |
| a) | Make, Type, Rating & Visual Inspection | Visual | 100% | Tech spec./ Appd Drg./ IS/IEC/Equivalent Standard | TC | 3/2 | - | 1 | TC |
| b) | Terminal Marking & Polarity Verification | Electrical | -do- | -do- | TC | 3/2 | - | 1 | TC |
| c) | Power Frequency Test on Primary & Secondary Winding separately | -do- | -do- | -do- | TC | 3/2 | - | 1 | TC |
| d) | Determination of Error according to the requirement of the Appropriate Accuracy Class | -do- | -do- | -do- | TC | 3/2 | - | 1 | TC |
| e) | Over Voltage Inter Turn Test | -do- | -do- | -do- | TC | 3/2 | - | 1 | TC |
| | **Type Test** | | | | | | | | |
| a) | Impulse Test | Electrical | Sample | Tech spec./ Appd Drg./ IS/IEC/Equivalent Standard | TC | 3/2 | - | 1 | TC |
| b) | Heat Run Test | -do- | -do- | -do- | TC | 3/2 | - | 1 | TC |
| **4.2** | **Lightning Arrestor** | | | | | | | | |
| a) | Visual & Dimension | Measurement | 100% | Tech spec./ Appd Drg./ IS/IEC/Equivalent Standard | TC | 3/2 | - | 1 | TC |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| b) | **Routine test** (Measurement of reference Voltage, PD & Seal Leak Test etc.) | Electrical | -do- | -do- | TC | 3/2 | - | 1 | TC |
| c) | **Type Test** (Lighting Impulse Residual Voltage, Switching Surge Operating Duty Test) | -do- | Sample | -do- | TC | 3/2 | - | 1 | TC |
| **4.3** | **Surge Capacitor** | | | | | | | | |
| a) | **Visual** | Measurement | 100% | Tech spec./ Appd Drg./ IS/IEC/Equivalent Standard | TC | 3/2 | - | 1 | TC |
| b) | **Routine Test** | Electrical | -do- | -do- | TC | 3/2 | - | 1 | TC |
| i) | Output Test (Capacitance & Tan Delta) | -do- | -do- | -do- | TC | 3/2 | - | 1 | TC |
| ii) | Voltage Test Between Terminals | -do- | -do- | -do- | TC | 3/2 | - | 1 | TC |
| iii) | Efficency test-discharge upto min voltage | -do- | -do- | -do- | TC | 3/2 | - | 1 | TC |
| iv) | Sealing Test | -do- | -do- | -do- | TC | 3/2 | - | 1 | TC |
| c) | **Type Test** (Impulse Test, PD Test) | -do- | Sample | -do- | TC | 3/2 | - | 1 | TC |
| **4.4** | **Earthing Switch** | | | | | | | | |
| a) | **Type Test** | Electrical | 100% | Tech spec./ Appd Drg./ IS/IEC/Equivalent Standard | TC | 3/2 | - | 1 | TC |
| b) | **Routine Test** | -do- | -do- | -do- | TC | 3/2 | - | 1 | TC |
| **4.5** | **H.T. Fuse** | | | | | | | | |
| a) | Continuity Test | Electrical | 100% | -do- | TC | 3/2 | - | 1 | TC |
| 4.6 | Mounting Structure | | | | | | | | |
| a) | Dimensional check | Measurement | 100% | Tech spec./ Appd Drg./ IS/IEC/Equivalent Standard | TC | 3/2 | - | 1 | TC |
| b) | Uniformity, mass and adhesion of Zn coating | -do- | -do- | -do- | TC | 3/2 | - | 1 | TC |
| **5** | **FINAL INSPECTION OF CUBICLE** | | | | | | | | |
| a) | Check of BOM, dimension, freedom from surface defect, layout, joints & clearance | Visual | 100% | Tech spec./ Appd Drg./ IS/IEC/Equivalent Standard | JIR | 3/2 | 1 | - | CHP |
| b) | Scheme checking | Electrical | -do- | -do- | JIR | 3/2 | 1 | - | CHP |
| c) | HV & IR Test on main and auxiliary circuit, Continuity check | -do- | -do- | -do- | JIR | 3/2 | 1 | - | CHP |
| d) | Heater & Thermostat | | | -do- | | | | | CHP |
| e) | Type & Rating | Visual | 100% | -do- | JIR | 3/2 | 1 | - | CHP |
| f) | Functional Test | Test | -do- | -do- | TC | 3/2 | - | 1 | TC |
| g) | Painting (Uniformity, Adhesion & Shade) | Visual | Sample | -do- | JIR | 3/2 | 1 | - | CHP |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| h) | Degree of Protection | -do- | -do- | -do- | TC | 3/2 | - | 1 | TC |
| Note: | a. In 'Inspection Agency' column figure 1,2,or 3 to be filled. 1- will indicate 'Employer', 2- will indicate 'supplier' & 3- will indicate 'sub-supplier'. | | | | | | | | |
| | b. In 'Remarks' column following abbreviations shall be used - RR-Review of Records, T.C. - Test Certificate, JIR - Joint Inspection Report & CHP - Customer Hold Point, | | | | | | | | |
| | c. The firm shall obtain acceptance/clearance of finished product for further activities based on Test Certificates & Internal Report (IR) | | | | | | | | |
| | d. Any additional test required as per the requirement of equipment in accordance with Contract Agreement/Relevent standard apart from QAP will be carried out by the firm without any additional financial implication. | | | | | | | | |
| | e.This QAP does not absolve the Contractor/sub-contractor of his responsibility to supply the correct products, strictly in conformity to the specifications given in the purchase order/contract. The above Model QAP stipulates the bare minimum requirements which shall be complied by the contractor. The above QAP has been made presuming subletting of work shall be allowed in the tender. In case subletting of work is not allowed in the tender, then"3/2" shall be considered as "2" under the column " Perform" . | | | | | | | | |
| | f. The type test may not be mandatory if similar equipment has been type tested and test certificate(s) for relevant tests are accepted by the Employer | | | | | | | | |
| | | | | | | | | | |
| | **Signature** | | | | | Signature & Seal | | | |
| | **EMPLOYER ( QA&I DEPT.)** | | | | **(VENDORS Q.C. DEPT. OR REPRESENTATIVE)** | | | | |

| **कार्य स्थल गुणवत्ता योजना (FIELD QUALITY PLAN) :** | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **परियोजना (PROJECT) :** | | | | **ग्राहक (CLIENT):** | | | | | |
| **उपष्कर का नाम (NAME OF EQUIPMENT) : Bus Duct** | | | | **विक्रेता (VENDOR):** | | | | | |
| | | | | **एनआईटी/ क्रय आदेश संदर्भ( NIT / P.O. Reference) :** | | | | | |
| | | | | | | | | | |
| **क्र. सं. S.N.** | **घटक की गतिविधि और संचालन ACTIVITY & OPERATION OF COMPONENT** | **जाँच की प्रकृति NATURE OF CHECKS** | **जाँच की मात्रा QUANTUM OF CHECKS** | **संदर्भ दस्तावेज़ / स्वीकृति मानदंड REFERENCE DOCUMENT/ ACCEPTANCE NORMS** | **रेकॉर्ड फ़ारमैट RECORD FORMAT** | निरीक्षण एजेंसी INSP. AGENCY | | | टिप्पणी Remarks |
| | | | | | | **प्रदर्शन PERFORM** | **गवाह WITNESS** | **सत्यापनVERIFY** | |
| **A** | **Bus Bar** | | | | | | | | |
| a) | Check assembly, dimension, tightness of busbar joints, busbar support, clearance & freedom from surface defects & painting | Visual | 100% | Tech spec./ Appd Drg./ IS/IEC/Equivalent Standard | TC/TR | 3/2 | 1 | - | TC/TR |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| b) | One Minute Power Frequency Voltage Withstand Test | Electrical | -do- | Tech spec./ Appd Drg./ IS/IEC/Equivalent Standard | TC/TR | 3/2 | 1 | - | TC/TR |
| c) | Insulation Resistance Test for Enclosure Circuit | -do- | -do- | -do- | TC/TR | 3/2 | 1 | - | TC/TR |
| **B** | **Current Transformer** | | | | | | | | |
| a) | Make, Type, Rating & Visual Inspection | Visual | 100% | Tech spec./ Appd Drg./ IS/IEC/Equivalent Standard | TC/TR | 3/2 | 1 | - | TC/TR |
| b) | Polarity Verification | Electrical | -do- | -do- | TC/TR | 3/2 | 1 | - | TC/TR |
| c) | Winding Resistance Test on Primary & Secondary Winding separately. | -do- | -do- | -do- | TC/TR | 3/2 | 1 | - | TC/TR |
| d) | Insulation resistance Test | -do- | -do- | -do- | TC/TR | 3/2 | 1 | - | TC/TR |
| e) | Ratio & Knee Voltage Test | -do- | -do- | -do- | TC/TR | 3/2 | 1 | - | TC/TR |
| **C** | **Potential Transformer** | | | | | | | | |
| a) | Make, Type, Rating & Visual Inspection | Visual | 100% | Tech spec./ Appd Drg./ IS/IEC/Equivalent Standard | TC/TR | 3/2 | 1 | - | TC/TR |
| b) | Polarity Verification | Electrical | -do- | -do- | TC/TR | 3/2 | 1 | - | TC/TR |
| c) | Winding Resistance Test on Primary & Secondary Winding separately. | -do- | -do- | -do- | TC/TR | 3/2 | 1 | - | TC/TR |
| d) | Insulation resistance Test | -do- | -do- | -do- | TC/TR | 3/2 | 1 | - | TC/TR |
| e) | Ratio Test | -do- | -do- | -do- | TC/TR | 3/2 | 1 | - | TC/TR |
| **D** | **Neutral Grounding Register** | | | | | | | | |
| a) | Make, Type, Rating & Visual Inspection | Visual | 100% | Tech spec./ Appd Drg./ IS/IEC/Equivalent Standard | TC/TR | 3/2 | 1 | - | TC/TR |
| b) | Insulation resistance Test | Electrical | -do- | -do- | TC/TR | 3/2 | 1 | - | TC/TR |
| c) | Resistance Test | Electrical | -do- | -do- | TC/TR | 3/2 | 1 | - | TC/TR |
| **E** | **Neutral Grounding Transformer** | | | | | | | | |
| a) | Make, Type, Rating & Visual Inspection | Visual | 100% | Tech spec./ Appd Drg./ IS/IEC/Equivalent Standard | TC/TR | 3/2 | 1 | - | TC/TR |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| b) | Winding Resistance Test on Primary & Secondary Winding separately. | Electrical | -do- | -do- | TC/TR | 3/2 | 1 | - | TC/TR |
| c) | Terminal Marking & Polarity Verification | Electrical | -do- | -do- | TC/TR | 3/2 | 1 | - | TC/TR |
| **F** | **Lightning Arrestor** | | | | | | | | |
| a) | Dimension Check | Measurement | 100% | Tech spec./ Appd Drg./ IS/IEC/Equivalent Standard | TC/TR | 3/2 | 1 | - | TC/TR |
| b) | Insulation resistance Test | Electrical | -do- | -do- | TC/TR | 3/2 | 1 | - | TC/TR |
| **G** | **Capacitor** | | | | | | | | |
| a) | Visual Check | Visual | 100% | Tech spec./ Appd Drg./ IS/IEC/Equivalent Standard | TC/TR | 3/2 | 1 | - | TC/TR |
| b) | Capacitance Measurement Test | Electrical | -do- | -do- | TC/TR | 3/2 | 1 | - | TC/TR |
| **H** | **Surge Protection Capacitor** | | | | | | | | |
| a) | Visual Check | Visual | 100% | Tech spec./ Appd Drg./ IS/IEC/Equivalent Standard | TC/TR | 3/2 | 1 | - | TC/TR |
| b) | Capacitance Measurement Test | Electrical | -do- | -do- | TC/TR | 3/2 | 1 | - | TC/TR |
| **I** | **Surge Monitor** | | | | | | | | |
| a) | Visual Check | Visual | 100% | Tech spec./ Appd Drg./ IS/IEC/Equivalent Standard | TC/TR | 3/2 | 1 | - | TC/TR |
| | | | | | | | | | |
| Note: | a. In 'Inspection Agency'column figure 1,2,or 3 to be filled. 1- will indicate Representative of Engineer-in-charge, 2- will indicate 'Contractor' & 3- will indicate 'Sub-contractor'. | | | | | | | | |
| | b. In 'Remarks' column following abbreviations shall be used - TC/TR - Test Certificate/ Test Report | | | | | | | | |
| | c.The above FQP stipulates the bare minimum requirements which shall be complied by the contractor. The above FQP has been made presuming subletting of work shall be allowed in the tender. In case subletting of work is not allowed in the tender, then"3/2" shall be considered as "2" under the column " Perform" . | | | | | | | | |
| | d. Any additional acitivity/ test required as per the requirement of equipment in accordance with Contract Agreement/Relevent standard apart from FQP will be carried out by the firm without any additional financial implication. | | | | | | | | |
| | e. The contractor shall furnish the details of test method to the Engineer-in-Charge for approval in the time line as specified in contract agreement | | | | | | | | |
| | f. All the Test in FQP shall be witnessed by Engineer-in-charge or his representative at site. | | | | | | | | |
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|---|---|---|---|---|---|---|
| | **Signature** | | | | | **Signature & Seal** |
| | **Engineer-in-charge** | | | | **(VENDORS Q.C. DEPT. OR REPRESENTATIVE)** | |

## 7) EOT CRANE

| परियोजना (PROJECT) : | | | | ग्राहक (CLIENT) : | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| उपस्कर का नाम (NAME OF EQUIPMENT) : EOT Crane | | | | विक्रेता (VENDOR) : | | | | | |
| | | | | एनआईटी/ क्रय आदेश संदर्भ (NIT/P.O. REFERENCE) : | | | | | |
| क्र. सं. SR. NO. | मद/घटक एवं विशेषता ITEM /COMPONENTS & CHARACTERISTICS | जाँच की प्रकृति NATURE OF CHECKS | जाँच की मात्रा QUANTUM OF CHECKS | संदर्भ दस्तावेज़ / स्वीकृति मानदंड REFERENCE DOCUMENTS / ACCEPTANCE NORMS | रिकॉर्ड प्रारूप RECORD FORMAT | निरीक्षण एजेंसी (INSP. AGENCY) | | | टिप्पणी REMARKS |
| | | | | | | प्रदर्शन Perform | गवाह Witness | सत्यापन Verify | |
| **1** | **Raw Material** | | | | | | | | |
| 1.1 | Structural Steel (Box Girder, End Trucks, Trolly, Rails, Beam, Cabin etc.) | Chemical Composition Mech. Properties Ultasonic Test (UT for above 19 mm) | Sample/Batch 100% | Appd. drawings/ Tech. specs./IS/IEC/Equivalent | TC | 3/2 | - | 1 | TC |
| 1.2 | Cast/Forged Steel (Wheels, Shafts, Pins,Gears, Pinions, Brake Drum, Couplings, Hook, Buffer Stopper, etc. ) | Chemical Composition Mech. Properties Ultasonic Test (UT for above 50 mm) | Sample/Batch 100% | -do- | TC | 3/2 | - | 1 | TC |
| 1.3 | Bought Out Items | | | | | | | | |
| a) | Bushes, Bearings, Pulleys, Fasteners etc. | Material Properties | Sample per Lot | -do- | TC | 3/2 | - | 1 | TC |
| b) | Drive Motor, Gear Box, Plumber Block, EHT Brakes, EM Beakes, Wire Rope, Electrical Cables, Remote Radio Control, Load cell system etc | Make, Type &,Rating, Routine Test | 100% | -do- | TC | 3/2 | - | 1 | TC |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| c) | Detection devices (Anti collision limit switch, Over load detection device,Load control device, Detection of Brake Wear, Over speed detection device, Circumferential cable staggering on drum, Unbalancing detection device etc) - As applicable | Make, Type & Rating, Routine Test | 100% | -do- | TC | 3/2 | - | 1 | TC |
| **2** | **In Process Stage Inspection** | | | | | | | | |
| 2.1 | Welder certification | Visual | 100% | -do- | TC | 3/2 | - | 1 | TC |
| 2.2 | NDT-Welding Fillet Welds | UT, MPI, DPT (as applicable) | -do- | -do- | TC | 3/2 | - | 1 | TC |
| 2.3 | NDT-Butt Welds (Box Girder, Rope Drums and other full strength welds) | | 100% | -do- | TC | 3/2 | - | 1 | TC |
| 2.4 | Post Weld Heat Treatment (Fabricated Rope Drums, Gear Box Housing, Forged Crane hooks ) | Heat Treatment Chart | -do- | -do- | TC | 3/2 | - | 1 | TC |
| 2.5 | Machining | | | | | | | | |
| a) | Surface Finish (Rope drum shaft, Rope Drum grooves, Brake Drum) | Visual/Measurement | -do- | -do- | TC | 3/2 | - | 1 | TC |
| b) | Dimensions | Measurement | -do- | -do- | IR | 3/2 | - | 1 | RR |
| 2.6 | Sub-Assembly Stage- Drive Mechanism, Hoist / Trolly arrangements, Brakes | | | | | | | | |
| a) | Alignment/Layout | Visual/Measurement | 100% | -do- | IR | 3/2 | - | 1 | RR |
| b) | Fitment and Clearance | Visual/Measurement | -do- | -do- | IR | 3/2 | - | 1 | RR |
| c) | Dimensional check | Visual/Measurement | -do- | -do- | IR | 3/2 | - | 1 | RR |
| d) | Running Performance (Drive Motors, Gear Boxes)-Noise level, Vibration, Temp. rise Leakage Test - Gear Boxes | Visual/Measurement | -do- | -do- | TC | 3/2 | - | 1 | TC |
| e) | Crane Hook-Proof Load Test | Load Test | -do- | -do- | TC | 3/2 | - | 1 | TC |
| f) | NDT-after Proof Load Test Butt Welds (Box Girder, Rope Drums and other full strength welds) | UT, MPI, DPT (as applicable) | -do- | -do- | TC | 3/2 | - | 1 | TC |
| **3** | **Final inspection/Tests on assembled Crane at manufacturer's works** | | | | | | | | |
| 3.1 | Operator's cabin- Dim. Check & its accessories check | Visual/Measurement | -do- | -do- | JIR | 3/2 | 1 | - | CHP |
| 3.2 | BOM Checking & Verification of TR of drawing | Visual | -do- | -do- | JIR | 3/2 | 1 | - | CHP |
| 3.3 | Examination of Welding | Visual | -do- | -do- | TC | 3/2 | - | 1 | TC |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 3.4 | Welding- NDT | UT, MPI, DPT (as applicable) | -do- | -do- | TC | 3/2 | - | 1 | TC |
| 3.5 | Dimensional check on assembled crane - bridge structure (Box girders, end trucks) hoisting trolly frame, travelling mechanism | Measurement | 100% | Appd. drawings/ Tech. specs./IS/IEC/Equivalent | JIR | 3/2 | 1 | - | CHP |
| 3.6 | Crane Girder Camber (If applicable) | -do- | -do- | -do- | TC | 3/2 | - | 1 | TC |
| 3.7 | Deflection test at full load/ Rated load & Over load | -do- | -do- | -do- | JIR | 3/2 | 1 | - | CHP |
| 3.8 | Hook Approach | -do- | -do- | -do- | JIR | 3/2 | 1 | - | CHP |
| 3.9 | Operational/functional test | | | | | | | | |
| a) | Hoisting and LT & CT Speeds - without load | Measurement | -do- | -do- | JIR | 3/2 | 1 | - | CHP |
| b) | Hoisting and LT & CT Speeds at Rated load | -do- | -do- | -do- | JIR | 3/2 | 1 | - | CHP |
| c) | Hoisting and LT &CT travel test at 125% of rated load | -do- | -do- | -do- | JIR | 3/2 | 1 | - | CHP |
| d) | Function of brakes for trolly and hoistings | Visual/Measurement | -do- | -do- | JIR | 3/2 | 1 | - | CHP |
| e) | Amperage at no load and full load for all motors | -do- | -do- | -do- | JIR | 3/2 | 1 | - | CHP |
| f) | Creepling speed/ Jog movement with rated load(VVVF Drive) | -do- | -do- | -do- | JIR | 3/2 | 1 | - | CHP |
| **4** | **Control Panel (At Control Panel's Supplier premises)** | | | | | | | | |
| 4.1 | Resisters, Capacitors, Limit Switches,Master Controllers, Thyresters, VVVF Modules, Transformers, Circuit Breakers, Switches etc. | Electrical Test | -do- | -do- | TC | 3/2 | - | 1 | TC |
| 4.2 | BOM,Verification of scheme, make and rating of componenets | Visual | -do- | -do- | JIR | 3/2 | 1 | - | CHP |
| 4.3 | Cubicle Dimensions | Measurement | -do- | -do- | JIR | 3/2 | 1 | - | CHP |
| 4.4 | Functional check including HV and IR tests | Visual/Test | -do- | -do- | JIR | 3/2 | 1 | - | CHP |
| 4.5 | Sequence of operation and interlock tests | Visual/Test | -do- | -do- | JIR | 3/2 | 1 | - | CHP |
| 4.6 | Protection Test (Single phase protection, over current protection, thermal over load, under voltage protection etc as per approved scheme. ) | Visual/Test | -do- | -do- | JIR | 3/2 | 1 | - | CHP |
| 4.7 | Radio control tests of speed control of bridge travel, trolly travel & hoist motion, control of master contactor, indication and alarm (if applicable) | -do- | -do- | -do- | JIR | 3/2 | 1 | - | CHP |
| 4.8 | Pendant control test (if applicable) | -do- | -do- | -do- | JIR | 3/2 | 1 | - | CHP |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **5** | **Sand blasting & Painting** | Visual / Measurement | -do- | -do- | TC | 3/2 | - | 1 | TC |
| Note : | a. In 'Inspection Agency'column figure 1,2,or 3 to be filled. 1- will indicate 'EMPLOYER ', 2- will indicate 'supplier' & 3- will indicate 'sub-supplier'. | | | | | | | | |
| | b. In 'Remarks' column following abbreviations shall be used - RR-Review of Records, T.C. - Test Certificate Submission , JIR- Joint Inspection Report & CHP - Customer Hold Point. | | | | | | | | |
| | c. The firm shall obtain acceptance/clearance of finished product for further activities based on Test Certificates & Internal Report (IR) | | | | | | | | |
| | d. At the time of Inspection the supplier shall arrange the requisite calibrated measuring instruments i.e.micrometer, vernier caliper, pie tape, surface roughness tester, dial gauge etc. | | | | | | | | |
| | e.This QAP does not absolve the Contractor/sub-contractor of his responsibility to supply the correct products, strictly in conformity to the specifications given in the purchase order/contract. The above Model QAP stipulates the bare minimum requirements which shall be complied by the contractor. The above QAP has been made presuming subletting of work shall be allowed in the tender. In case subletting of work is not allowed in the tender, then"3/2" shall be considered as "2" under the column " Perform" . | | | | | | | | |
| | f. Material testing shall be conducted from Govt. Lab, NABL Lab or NABL accredited lab having valid Scope of accreditation of all specified tests mentioned in approved QAP. NDT shall be conducted from NABL accredited lab/Govt. approved lab/Level 2 or level 3 certified person. | | | | | | | | |
| | g. Any additional test required as per the requirement of equipment in accordance with Contract Agreement/Relevent standard apart from QAP will be carried out by the firm without any additional financial implication. | | | | | | | | |
| | h. Site test shall be conducted in presence of Project's Representative only. | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | **Signature** | | | **Signature & Seal** | | | |
| | | | **EMPLOYER ( QA&I DEPT.)** | | **(VENDORS Q.C. DEPT. OR REPRESENTATIVE)** | | | | |

**कार्य स्थल गुणवत्ता योजना (FIELD QUALITY PLAN) :**

| | |
|---|---|
| **परियोजना (PROJECT) :** | **ग्राहक (CLIENT) :** |
| **उपस्कर का नाम (NAME OF EQUIPMENT) : EOT CRANE** | **विक्रेता (VENDOR) :** |
| | **एनआईटी/ क्रय आदेश संदर्भ (NIT/P.O. REFERENCE) :** |

| **क्र. सं. SR. NO.** | **Activity & Operation of Component** | **जाँच की प्रकृति NATURE OF CHECKS** | **जाँच की मात्रा QUANTUM OF CHECKS** | **संदर्भ दस्तावेज़ / स्वीकृति मानदंड REFERENCE DOCUMENTS/ ACCEPTANCE NORMS** | **रिकॉर्ड प्रारूप RECORD FORMAT** | **निरीक्षण एजेंसी (INSP. AGENCY)** | | | **टिप्पणी REMARKS** |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | प्रदर्शन Perform | गवाह Witness | सत्यापन Verify | |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **1** | **Installation and Pre Commissioning Test** | | | | | | | | |
| 1.1 | Operational and functional tests of components, sub-assemblies, auxiliaries i.e. lubrication etc | Functional | 100% | Appd. Drg. / Tech. Spec. / IS/IEC/Equivalent | TC/TR | 3/2 | 1 | - | TC/TR |
| 1.2 | Control logic field tests to prove control logic scheme for operation and interlocks of system components and controls, including annunciation and shutdown scheme shall be done in so far as practical | Functional | 100% | -do- | TC/TR | 3/2 | 1 | - | TC/TR |
| 1.3 | Calibration test - All instruments, sensors, switches, relays etc. shall be calibrated and adjusted after installation, wherever practical | Visual/Measurement | 100% | -do- | TC/TR | 3/2 | 1 | - | TC/TR |
| 1.4 | Operational tests for verification of correct operation of protective relays and safety devices shall be conducted | Visual | 100% | -do- | TC/TR | 3/2 | 1 | - | TC/TR |
| 1.5 | Operational tests for drives for verification of correct operation of each and every component of the drives | Visual/Measurement | 100% | -do- | TC/TR | 3/2 | 1 | - | TC/TR |
| 1.6 | Deflection Test - The deflection test shall be carried out with test load of 100 % of rated load at rest and with the crab in central position. The measurement shall not be taken on the first application of load. Datum line for measuring the deflection should be obtained by placing the crab on the extreme end of the crane span with smaller hook approach. | Visual | 100% | -do- | TC/TR | 3/2 | 1 | - | TC/TR |
| 1.7 | Load tests at 100% and 125% of rated load on each crane | Visual | 100% | -do- | TC/TR | 3/2 | 1 | - | TC/TR |
| 1.8 | Verification of crane clearance and lifts | Visual | 100% | | TC/TR | 3/2 | 1 | - | TC/TR |
| 1.9 | Incremental movement of hoists/travels | Visual | 100% | -do- | TC/TR | 3/2 | 1 | - | TC/TR |
| 1.10 | Tandem operation | Functional | 100% | -do- | TC/TR | 3/2 | 1 | - | TC/TR |
| 1.11 | Check Speed : Hoisting speed, Long travel, Cross travel | Visual/Measurement | 100% | -do- | TC/TR | 3/2 | 1 | - | TC/TR |
| **2** | **Commissioning Tests** | | | | | | | | |
| 2.1 | Insulation resistance test & Earthing Test of complete crane | Test | 100% | Appd. Drg. / Tech. Spec. / IS/IEC/Equivalent | TC/TR | 3/2 | 1 | - | TC/TR |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 2.2 | Run all the motions of crane in idle conditions and following needs to be observed:<br>(a) Eccentric running of moving parts.<br>(b) Alignment of shafts.<br>(c) Fauling of moving components.<br>(d) Any un-usual noise.<br>(e) Presence of lubricant at desired surfaces.<br>(f) Performance of motors, limit switches,brakes, controllers etc | Visual/Measurement | 100% | -do- | TC/TR | 3/2 | 1 | - | TC/TR |
| 2.3 | Operational test - Operational test with/without rated load in all hoisting/ travelling motions to check for any misalignment, improper adjustments, overheating and other possible defects. This shall also include operational test for limit switches correctness of circuits, interlocks, operation of protective devices, brakes etc | Functional | 100% | -do- | TC/TR | 3/2 | 1 | - | TC/TR |
| Note : | a. In 'Inspection Agency'column figure 1,2,or 3 to be filled. 1- will indicate 'Representative of Engineer-In -Charge , Employer', 2- will indicate 'Contractor' & 3- will indicate 'sub-Contractor'. | | | | | | | | |
| | b. In 'Remarks' column following abbreviations shall be used -TC-Test Certificate, TR- Test Report | | | | | | | | |
| | c. At the time of Inspection the Contractor shall arrange the requisite calibrated measuring instruments/Tools | | | | | | | | |
| | d. The above FQP stipulates the bare minimum requirements which shall be complied by the contractor. The above FQP has been made presuming subletting of work shall be allowed in the tender. In case subletting of work is not allowed in the tender, then"3/2" shall be considered as "2" under the column " Perform" . | | | | | | | | |
| | e. Any additional activity/test required as per the requirement of equipment in accordance with Contract Agreement/Relevent standard apart from FQP will be carried out by the firm without any additional financial implication. | | | | | | | | |
| | f. The contractor shall furnish the details of test methods to the Engineer-In charge, Employer for approval in the time line as specified in contract agreement. | | | | | | | | |
| | g. All the Test in FQP shall be witnessed by Engineer-in-charge or his representative at site. | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | **Signature** | | | | | **Signature & Seal** | | | |
| | **Engineer-in-charge** | | | | **(VENDORS Q.C. DEPT. OR REPRESENTATIVE)** | | | | |

## 8) LUBRICATING AND INSULATING OIL HANDLING SYSTEM

| परियोजना (PROJECT) : | | | | ग्राहक (CLIENT) : | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| उपस्कर का नाम (NAME OF EQUIPMENT) : Lubricating Oil purifier System | | | | विक्रेता (VENDOR) : | | | | | |
| | | | | एनआईटी/ क्रय आदेश संदर्भ (NIT/P.O. REFERENCE) : | | | | | |
| क्र. सं. SR. NO. | मद/घटक एवं विशेषता ITEM /COMPONENTS & CHARACTERISTICS | जाँच की प्रकृति NATURE OF CHECKS | जाँच की मात्रा QUANTUM OF CHECKS | संदर्भ दस्तावेज़ / स्वीकृति मानदंड REFERENCE DOCUMENTS/ ACCEPTANCE NORMS | रिकॉर्ड प्रारूप RECORD FORMAT | निरीक्षण एजेंसी (INSP. AGENCY) | | | टिप्पणी REMARKS |
| | | | | | | प्रदर्शन Perform | गवाह Witness | सत्यापन Verify | |
| **1** | **Centrifuge** | | | Appd. Drawings/ Tech. specs./ IS/IEC/Equivalent | | | | | |
| 1.1 | Centrifugal Oil Purifier-Bowl Body, Hood & Lock Ring | | | | | | | | |
| a) | Chemical & Mech Properties | Chem & Mech | Sample per Lot | -do- | TC | 3/2 | - | 1 | TC |
| 1.2 | In Process Control | | | | | | | | |
| a) | Bowl Assembly---Dynamic Balancing | Measurement | 100% | -do- | TC | 3/2 | - | 1 | TC |
| b) | Bearing Assembly, Idler Arm Assembly, Idler Bearing Assembly, Drag Assembly | Visual / Measurement | 100% | -do- | TC | 3/2 | - | 1 | TC |
| i) | Smoothness/Freeness of Rotation | Visual | - do- | -do- | TC | 3/2 | - | 1 | TC |
| **2** | **Bearings- Make, Type & rating** | Visual | 100% | -do- | TC | 3/2 | - | 1 | TC |
| **3** | **Valves, Pipes, Fitting & Hoses etc.** | | | | | | | | |
| 3.1 | Chemical & Mech Properties | Chem & Mech | Sample per Lot | -do- | TC | 3/2 | - | 1 | TC |
| 3.2 | Hydrostatic pressure test | Measurement | 100% | -do- | TC | 3/2 | - | 1 | TC |
| 3.3 | Dimensional Check | -do- | 100% | -do- | TC | 3/2 | - | 1 | TC |
| 3.4 | HV, IR test for Solonoid Valve | -do- | 100% | -do- | TC | 3/2 | - | 1 | TC |
| **4** | **Temperature Gauge, Flow Meter, Pressure Gauge, Level Switch, Solenoid Valve, Thermostat, Vacuum gauge etc** | | | | | | | | |
| 4.1 | Make, Type & rating | Visual | 1/Lot | -do- | TC | 3/2 | - | 1 | TC |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 4.2 | HV & IR test (As applicable) | Test | 100% | -do- | TC | 3/2 | - | 1 | TC |
| 4.3 | Performance, Accuracy, Repetability & Calibration( As applicable) | Test | 100% | -do- | TC | 3/2 | - | 1 | TC |
| **5** | **Circulating Pump, Oil Transfer Pump etc (As applicable)** | | | | | | | | |
| 5.1 | Make, Type & Capacity | Visual | 100% | -do- | TC | 3/2 | - | 1 | TC |
| 5.2 | Physical Analysis.& Chemical Composition | Test | Sample per Lot | -do- | TC | 3/2 | - | 1 | TC |
| 5.3 | Leak Tightness of casing | Test | 100% | -do- | TC | 3/2 | - | 1 | TC |
| 5.4 | Performance Test | | | | | | | | |
| a) | Q v/s Head, Q v/s Power, Q v/s Pump efficiency | Type Test | 1/type | -do- | TC | 3/2 | - | 1 | TC |
| b) | NPSH Test | -do- | - do- | -do- | TC | 3/2 | - | 1 | TC |
| c) | Leakage Test | -do- | - do- | -do- | TC | 3/2 | - | 1 | TC |
| d) | Vibration & Noise Test | -do- | - do- | -do- | TC | 3/2 | - | 1 | TC |
| 5.5 | Painting inspection (uniformity, shade, adhesion & DFT) | Visual/ Measurement | 100% | -do- | TC | 3/2 | - | 1 | TC |
| **6** | **Vacuum Pump** | | | | | | | | |
| 6.1 | Make, Type & Capacity | Visual | 100% | -do- | TC | 3/2 | - | 1 | TC |
| 6.2 | Physical Analysis & Chemical Composition | Test | Sample per Lot | -do- | TC | 3/2 | - | 1 | TC |
| 6.3 | Leak Tightness of Casing | Test | 100% | -do- | TC | 3/2 | - | 1 | TC |
| 6.4 | Performance Test | | | | | | | | |
| a) | Bearing temp. rise Test | Type Test | 1/type | -do- | TC | 3/2 | - | 1 | TC |
| b) | Free air displacement | -do- | - do- | -do- | TC | 3/2 | - | 1 | TC |
| c) | Ultimate Vaccume pulled by the pump | -do- | 1/type | -do- | TC | 3/2 | - | 1 | TC |
| 6.5 | Painting inspection (uniformity, shade, adhesion & DFT) | Visual/ Measurement | 100% | -do- | TC | 3/2 | - | 1 | TC |
| **7** | **Motors** | | | | | | | | |
| 7.1 | Make, Type & rating | Visual | 100% | -do- | TC | 3/2 | - | 1 | TC |
| 7.2 | Type test | Test | Sample | -do- | TC | 3/2 | - | 1 | TC |
| 7.3 | Routine Test | Test | 100% | -do- | TC | 3/2 | - | 1 | TC |
| | | | | | | प्रदर्शन Perform | गवाह Witness | सत्यापन Verify | |
| **8** | **Filters/Strainers** | | | Appd. Drawings/ Tech. | | | | | |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 8.1 | Make, Type & Capacity | Visual | 100% | specs./ IS/IEC/Equivalent | TC | 3/2 | - | 1 | TC |
| 8.2 | Physical Analysis & Chemical Composition | Test | Sample per Lot | -do- | TC | 3/2 | - | 1 | TC |
| 8.3 | Mesh Size | Measurement | 100% | -do- | TC | 3/2 | - | 1 | TC |
| 8.4 | Hydrostatic Test & Performance Test | Test | 100% | -do- | TC | 3/2 | - | 1 | TC |
| 8.5 | Painting inspection (uniformity, shade, adhesion & DFT) | Visual/ Measurement | 100% | -do- | TC | 3/2 | - | 1 | TC |
| **9** | **Direct type Electric Oil Heater & Degasing Chamber** | | | | | | | | |
| 9.1 | Make, Type & Capacity | Visual | 100% | -do- | TC | 3/2 | - | 1 | TC |
| 9.2 | Leak Tightness Test | Leak Test | 100% | -do- | TC | 3/2 | - | 1 | TC |
| 9.3 | IR test for heater | Elect. Test | 100% | -do- | TC | 3/2 | - | 1 | TC |
| **10** | **Vacuum & Oil Tank** | | | | | | | | |
| 10.1 | Chemical & Mech Properties | Chem & Mech | Sample per Lot | -do- | TC | 3/2 | - | 1 | TC |
| 10.2 | Dimension/Capacity | Measurement | 100% | -do- | JIR | 3/2 | 1 | - | CHP |
| 10.3 | Leakage Test | Test | 100% | -do- | JIR | 3/2 | 1 | - | CHP |
| **11** | **Final Inspection** | | | | | | | | |
| 11.1 | Purification Test of Lubricating Oil (single Pass) | | | | | | | | |
| a) | Moisture Content (Less than 50 PPM ) | Measurement | 100% | -do- | JIR | 3/2 | 1 | - | CHP for Sample Collection Only |
| b) | Filtration- Less than 1 micron | Test | 100% | -do- | JIR | 3/2 | 1 | - | |
| c) | Free Water-100% Reduction | Test | 100% | -do- | JIR | 3/2 | 1 | - | |
| 11.2 | Lubricating Oil Purifier system including Control panel | | | | | | | | |
| a) | Dimension Check of Assembly | Measurement | 100% | -do- | JIR | 3/2 | 1 | - | CHP |
| b) | Verification of Bill of material | Visual | -do- | -do- | JIR | 3/2 | 1 | - | CHP |
| c) | Capacity (Suction & Discharge Pressure) | Measurement | -do- | -do- | JIR | 3/2 | 1 | - | CHP |
| d) | Power Consumption Test for Motors & Heaters | Elect.Test | -do- | -do- | JIR | 3/2 | 1 | - | CHP |
| e) | Sequential Operation & Interlock Check | Functional Test | -do- | -do- | JIR | 3/2 | 1 | - | CHP |
| f) | Vacuum test at 650mm of Hg | Leak Test | -do- | -do- | JIR | 3/2 | 1 | - | CHP |
| g) | Vibration & Noise Measurement | Measuremen | -do- | -do- | JIR | 3/2 | 1 | - | CHP |

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| | | t | | | | | | | |
| h) | Tests of Control Panel | | | | | | | | |
| i) | Dimension Check of control panel | Measurement | -do- | -do- | JIR | 3/2 | 1 | - | CHP |
| ii) | HV & IR Test | Elect. Test | -do- | -do- | JIR | 3/2 | 1 | - | CHP |
| iii) | Wiring, Interlock & Sequence Check | Elect. Test | -do- | -do- | JIR | 3/2 | 1 | - | CHP |
| iv) | Degree of Protection | Test | -do- | -do- | TC | 3/2 | - | 1 | TC |
| v) | Painting inspection (uniformity, shade, adhesion & DFT) | Visual/ Measurement | Sample | -do- | JIR | 3/2 | 1 | - | CHP |
| Note : | a. In 'Inspection Agency'column figure 1,2,or 3 to be filled. 1- will indicate 'EMPLOYER', 2- will indicate 'supplier' & 3- will indicate 'sub-supplier'. | | | | | | | | |
| | b. In 'Remarks' column following abbreviations shall be used - RR-Review of Records, T.C. - Test Certificate Submission, JIR- Joint Inspection Report & CHP - Customer Hold Point. | | | | | | | | |
| | c. The firm shall obtain acceptance/clearance of finished product for further activities based on Test Certificates & Internal Report (IR) | | | | | | | | |
| | d. At the time of Inspection the supplier shall arrange the requisite calibrated measuring instruments i.e.micrometer, vernier caliper, pie tape, surface roughness tester, dial gauge etc. | | | | | | | | |
| | e.This QAP does not absolve the Contractor/sub-contractor of his responsibility to supply the correct products, strictly in conformity to the specifications given in the purchase order/contract. The above Model QAP stipulates the bare minimum requirements which shall be complied by the contractor. The above QAP has been made presuming subletting of work shall be allowed in the tender. In case subletting of work is not allowed in the tender, then"3/2" shall be considered as "2" under the column " Perform" . | | | | | | | | |
| | f.Material testing shall be conducted from Govt. Lab, NABL Lab or NABL accredited lab having valid Scope of accreditation of all specified tests mentioned in approved QAP. | | | | | | | | |
| | g. Any additional test required as per the requirement of equipment in accordance with Contract Agreement/Relevent standard apart from QAP will be carried out by the firm without any additional financial implication. | | | | | | | | |
| | | | | | | | | | |
| | | | **Signature** | | | **Signature & Seal** | | | |
| | | | **EMPLOYER ( QA&I DEPT.)** | | | **(VENDORS Q.C. DEPT. OR REPRESENTATIVE)** | | | |

| **परियोजना (PROJECT) :** | | | | **ग्राहक (CLIENT) :** | | | |
|---|---|---|---|---|---|---|---|
| **उपस्कर का नाम (NAME OF EQUIPMENT) : Insulating Oil purifier System** | | | | **विक्रेता (VENDOR) :** | | | |
| | | | | **एनआईटी/ क्रय आदेश संदर्भ (NIT/P.O. REFERENCE) :** | | | |
| **क्र.** | **मद/घटक एवं विशेषता ITEM /COMPONENTS & CHARACTERISTICS** | **जाँच की** | **जाँच की** | **संदर्भ दस्तावेज़ /** | **रिकॉर्ड** | **निरीक्षण एजेंसी (INSP. AGENCY)** | **टिप्पणी REMARK** |

| सं. SR. NO. | | प्रकृति NATURE OF CHECKS | मात्रा QUANTUM OF CHECKS | स्वीकृति मानदंड REFERENCE DOCUMENTS/ ACCEPTANCE NORMS | प्रारूप RECORD FORMAT | प्रदर्शन Perform | गवाह Witness | सत्यापन Verify | S |
|---|---|---|---|---|---|---|---|---|---|
| **1** | **Instruments (As applicable)** | | | Appd. Drawings/ Tech. specs./IS/IEC/Equivalent | | | | | |
| 1.1 | Dial Thermometer | Accuracy Test | 100% | | TC | 3/2 | - | 1 | TC |
| 1.2 | Regulation Thermostat | -do- | -do- | -do- | TC | 3/2 | - | 1 | TC |
| 1.3 | Safety Thermostat | Elect.Test | -do- | -do- | TC | 3/2 | - | 1 | TC |
| 1.4 | Optical Level Thermometer | | | | | | | | |
| a) | Continuity test | Elect.Test | -do- | -do- | TC | 3/2 | - | 1 | TC |
| b) | Performance test | Test | -do- | -do- | TC | 3/2 | - | 1 | TC |
| 1.5 | Flowmeter | Test | -do- | -do- | TC | 3/2 | - | 1 | TC |
| 1.6 | Float Switches | Functional Test | -do- | -do- | TC | 3/2 | - | 1 | TC |
| 1.7 | Pressure guage | Accuracy Test | -do- | -do- | TC | 3/2 | - | 1 | TC |
| 1.8 | Vacuum guage | -do- | -do- | -do- | TC | 3/2 | - | 1 | TC |
| 1.9 | Compound guage | -do- | -do- | -do- | TC | 3/2 | - | 1 | TC |
| 1.10 | Coarse Filter | Visual | -do- | -do- | TC | 3/2 | - | 1 | TC |
| 1.11 | Heater | Functional Test | -do- | -do- | TC | 3/2 | - | 1 | TC |
| **2** | **Pumps** | | | | | | | | |
| 2.1 | Inlet gear pump | | | | | | | | |
| a) | Make & Rating | Visual | -do- | -do- | TC | 3/2 | - | 1 | TC |
| b) | Leak tightness Test | Test | -do- | -do- | TC | 3/2 | - | 1 | TC |
| c) | Flow rate | Measurement | -do- | -do- | TC | 3/2 | - | 1 | TC |
| d) | Performance test | Test | -do- | -do- | TC | 3/2 | - | 1 | TC |
| e) | Type Test | Test | Sample | -do- | TC | 3/2 | - | 1 | TC |
| 2.2 | Outlet centrifugal Pump | | | | | | | | |
| a) | Make & Rating | Visual | 100% | -do- | TC | 3/2 | - | 1 | TC |
| b) | Leak tightness Test | Test | -do- | -do- | TC | 3/2 | - | 1 | TC |
| c) | Flow rate | Measurement | -do- | -do- | TC | 3/2 | - | 1 | TC |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| e) | Routine Test of motor & pump | Elect.Test | 100% | -do- | TC | 3/2 | - | 1 | TC |
| f) | Type Test | Elect.Test | Sample | -do- | TC | 3/2 | - | 1 | TC |
| 2.3 | Vacuum pump | | | | | | | | |
| a) | Make & Rating | Visual | 100% | -do- | TC | 3/2 | - | 1 | TC |
| b) | Ultimate vacuum | Mechanical | -do- | -do- | TC | 3/2 | - | 1 | TC |
| c) | RPM Check | -do- | -do- | -do- | TC | 3/2 | - | 1 | TC |
| d) | Temperature rise | -do- | -do- | -do- | TC | 3/2 | - | 1 | TC |
| e) | Free air displacement | -do- | -do- | -do- | TC | 3/2 | - | 1 | TC |
| f) | Type Test | Test | Sample | -do- | TC | 3/2 | - | 1 | TC |
| 2.4 | Oil Transfer Pump | | | | | | | | |
| a) | Make & Rating | Visual | 100% | -do- | TC | 3/2 | - | 1 | TC |
| b) | Perfomance Test | Functional Test | -do- | -do- | TC | 3/2 | - | 1 | TC |
| c) | Type Test | Test | Sample | -do- | TC | 3/2 | - | 1 | TC |
| **3** | **Valves** | | | | | | | | |
| 3.1 | Make & Rating | Visual | 100% | -do- | TC | 3/2 | - | 1 | TC |
| 3.2 | Leak tightness Test | Test | -do- | -do- | TC | 3/2 | - | 1 | TC |
| 3.3 | Type Test | Test | Sample | -do- | TC | 3/2 | - | 1 | TC |
| **4** | **Motors** | | | Appd. Drawings/ Tech. specs./IS/IEC/Equivalent | | | | | |
| 4.1 | Make & Rating | Visual | 100% | | TC | 3/2 | - | 1 | TC |
| 4.2 | Routine test | Elect.Test | 100% | -do- | TC | 3/2 | - | 1 | TC |
| 4.3 | Type Test | Test | Sample | -do- | TC | 3/2 | - | 1 | TC |
| **5** | **Vessels (Tank) (Heater Vessel, Filter Vessel, Degassing chamber)** | | | | | | | | |
| 5.1 | Visual Check | Visual | 100% | -do- | TC | 3/2 | - | 1 | TC |
| 5.2 | Dimensional Check | Measurement | 100% | -do- | TC | 3/2 | - | 1 | TC |
| 5.3 | Leak tightness Test | Test | 100% | -do- | TC | 3/2 | - | 1 | TC |
| **6** | **Pressure Relief Valve** | | | | | | | | |
| 6.1 | Make & Rating | Visual | 100% | -do- | TC | 3/2 | - | 1 | TC |
| 6.2 | Functional Test | Test | 100% | -do- | TC | 3/2 | - | 1 | TC |
| 6.3 | Type Test | Test | Sample | -do- | TC | 3/2 | - | 1 | TC |
| **7** | **Oil Tank** | | | | | | | | |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 7.1 | Chemical & Mech Properties | Chem & Mech | Sample per Lot | -do- | TC | 3/2 | - | 1 | TC |
| 7.2 | Dimension/Capacity | Measurement | 100% | -do- | JIR | 3/2 | 1 | - | CHP |
| 7.3 | Leakage Test | Test | 100% | -do- | JIR | 3/2 | 1 | - | CHP |
| **8** | **Air Dryers** | | | | | | | | |
| 8.1 | Make & Rating | Visual | 100% | -do- | TC | 3/2 | - | 1 | TC |
| 8.2 | Performance Test | Functional | 100% | -do- | JIR | 3/2 | 1 | - | CHP |
| **9** | **Oil hoses** | | | | | | | | |
| 9.1 | Make & Size | Visual | 100% | -do- | TC | 3/2 | - | 1 | TC |
| 9.2 | Before and after ageing Dimensional Check | Measurement | Sample | -do- | TC | 3/2 | - | 1 | TC |
| 9.3 | Leakage under air pressure | Pressure | Sample | -do- | TC | 3/2 | - | 1 | TC |
| 9.4 | Leakage under vacuum | -do- | Sample | -do- | TC | 3/2 | - | 1 | TC |
| **10** | **Trolly** | | | | | | | | |
| 10.1 | Overall Finish | Visual | 100% | -do- | TC | 3/2 | - | 1 | TC |
| 10.2 | Dimensional Check | Measurement | 100% | -do- | TC | 3/2 | - | 1 | TC |
| **11** | **Final Assembly** | | | Appd. Drawings/ Tech. specs./ IS/IEC/Equivalent | | | | | |
| 11.1 | BOM & Rating Check | Visual | 100% | | JIR | 3/2 | 1 | - | CHP |
| 11.2 | Overall Dimensions and Finish | Measurement | 100% | -do- | JIR | 3/2 | 1 | - | CHP |
| 11.3 | Leak tightness under vacuum at 1 Torr | -do- | 100% | -do- | JIR | 3/2 | 1 | - | CHP |
| 11.4 | Pressure Test on Pipes with assembly | -do- | 100% | -do- | JIR | 3/2 | 1 | - | CHP |
| 11.5 | Capacity Check | -do- | 100% | -do- | JIR | 3/2 | 1 | - | CHP |
| 11.6 | Power consumption of motor and heater | Elect. Test | 100% | -do- | JIR | 3/2 | 1 | - | CHP |
| 11.7 | Interlock Test and Annunciation check. | -do- | 100% | -do- | JIR | 3/2 | 1 | - | CHP |
| 11.8 | IR and HV Test | -do- | 100% | -do- | JIR | 3/2 | 1 | - | CHP |
| 11.9 | Continuity & Functional Check | -do- | 100% | -do- | JIR | 3/2 | 1 | - | CHP |
| 11.10 | Vacuum level | Test | 100% | -do- | JIR | 3/2 | 1 | - | CHP |
| **12** | **Performance Test of Oil Parameters (Single-Pass)** | | | | | | | | |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 12.1 | Dielectric strength- 70 kV across 2.5 mm gap | Elect. Test | Sample | -do- | TC | 3/2 | - | 1 | TC |
| 12.2 | Moisture content (Less than 5 PPM) | Measurement | Sample | -do- | JIR | 3/2 | 1 | - | CHP |
| 12.3 | Gas content (Less than 0.1% by volume) | -do- | Sample | -do- | TC | 3/2 | - | 1 | TC |
| 12.4 | Filtration (Less than 1 micron) | Mech. Test | Sample | -do- | JIR | 3/2 | 1 | - | CHP |
| 12.5 | Dielectric dissipation factor (Tan delta at 90°C): 0.002 | Elect. Test | Sample | -do- | TC | 3/2 | - | 1 | TC |
| 12.6 | Neutralisation value | -do- | Sample | -do- | TC | 3/2 | - | 1 | TC |
| Note : | a. In 'Inspection Agency'column figure 1,2,or 3 to be filled. 1- will indicate ' EMPLOYER', 2- will indicate 'supplier' & 3- will indicate 'sub-supplier'. | | | | | | | | |
| | b. In 'Remarks' column following abbreviations shall be used - RR-Review of Records, T.C. - Test Certificate Submission, JIR- Joint Inspection Report & CHP - Customer Hold Point. | | | | | | | | |
| | c. The firm shall obtain acceptance/clearance of finished product for further activities based on Test Certificates & Internal Report (IR) | | | | | | | | |
| | d. At the time of Inspection the supplier shall arrange the requisite calibrated measuring instruments i.e.micrometer, vernier caliper, pie tape, surface roughness tester, dial gauge etc. | | | | | | | | |
| | e.This QAP does not absolve the Contractor/sub-contractor of his responsibility to supply the correct products, strictly in conformity to the specifications given in the purchase order/contract. The above Model QAP stipulates the bare minimum requirements which shall be complied by the contractor. The above QAP has been made presuming subletting of work shall be allowed in the tender. In case subletting of work is not allowed in the tender, then"3/2" shall be considered as "2" under the column " Perform" . | | | | | | | | |
| | f.Material testing shall be conducted from Govt. Lab, NABL Lab or NABL accredited lab having valid Scope of accreditation of all specified tests mentioned in approved QAP. | | | | | | | | |
| | g. Any additional test required as per the requirement of equipment in accordance with Contract Agreement/Relevent standard apart from QAP will be carried out by the firm without any additional financial implication. | | | | | | | | |
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| | | | | | | | | | |
| | | | **Signature** | | | **Signature & Seal** | | | |
| | | | **EMPLOYER ( QA&I DEPT.)** | | | **(VENDORS Q.C. DEPT. OR REPRESENTATIVE)** | | | |

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| **कार्य स्थल गुणवत्ता योजना (FIELD QUALITY PLAN) :** | | | | | | | |
| **परियोजना (PROJECT) :** | | | | **ग्राहक (CLIENT) :** | | | |
| **उपस्कर का नाम (NAME OF EQUIPMENT) : Oil Handling System** | | | | **विक्रेता (VENDOR) :** | | | |
| | | | | **एनआईटी/ क्रय आदेश संदर्भ (NIT/P.O. REFERENCE) :** | | | |
| क्र. सं. SR. | Activity & Operation of Component | **जाँच की** | **जाँच की** | **संदर्भ दस्तावेज़ /** | **रिकॉर्ड** | **निरीक्षण एजेंसी (INSP. AGENCY)** | **टिप्प** |

| NO. | | प्रकृति NATURE OF CHECKS | मात्रा QUANTUM OF CHECKS | स्वीकृति मानदंड REFERENCE DOCUMENTS/ ACCEPTANCE NORMS | प्रारूप RECORD FORMAT | प्रदर्शन Perform | गवाह Witness | सत्यापन Verify | णी REMARKS |
|---|---|---|---|---|---|---|---|---|---|
| **1** | **Oil Handling System** | | | | | | | | |
| 1.1 | Leakage and vacuum test | Test | 100% | Tech. Spec./ Apprd. Drawing /IS/IEC/Equivalent | TC/TR | 3/2 | 1 | - | TC/TR |
| 1.2 | Operating condition of all pumps | Test | 100% | -do- | TC/TR | 3/2 | 1 | - | TC/TR |
| 1.3 | Test to demonstrate operational capabilities of the system as per the intended requirement | Test | 100% | -do- | TC/TR | 3/2 | 1 | - | TC/TR |
| 1.4 | Functional check of Measuring Instruments, Switches & Controller provided in the Oil Handling System | Functional Test | 100% | -do- | TC/TR | 3/2 | 1 | - | TC/TR |
| 1.5 | IR Test on Control Panels | Test | 100% | -do- | TC/TR | 3/2 | 1 | - | TC/TR |
| 1.6 | Test to verify logic control scheme from Local / Remote including start/stop,Interlocks, Saftey Devices & other features | Test | 100% | -do- | TC/TR | 3/2 | 1 | - | TC/TR |
| Note: | a. In 'Inspection Agency'column figure 1,2,or 3 to be filled. 1- will indicate 'Representative of Engineer-In -Charge , Employer', 2- will indicate 'Contractor' & 3- will indicate 'sub-Contractor'. | | | | | | | | |
| | b. In 'Remarks' column following abbreviations shall be used - TC-Test Certificate, TR- Test Report | | | | | | | | |
| | c. At the time of Inspection the Contractor shall arrange the requisite calibrated measuring instruments/Tools . | | | | | | | | |
| | d. The above FQP stipulates the bare minimum requirements which shall be complied by the contractor. The above FQP has been made presuming subletting of work shall be allowed in the tender. In case subletting of work is not allowed in the tender, then"3/2" shall be considered as "2" under the column " Perform" . | | | | | | | | |
| | e. Any additional activity/test required as per the requirement of equipment in accordance with Contract Agreement/Relevent standard apart from FQP will be carried out by the firm without any additional financial implication. | | | | | | | | |
| | f. The contractor shall furnish the details of test methods to the Engineer-In charge, Employer for approval in the time line as specified in contract agreement. | | | | | | | | |
| | g. All the Test in FQP shall be witnessed by Engineer-in-charge or his representative at site. | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | **Signature** | | | | | **Signature & Seal** | | | |
| | **Engineer-in-charge** | | | | **(VENDORS Q.C. DEPT. OR REPRESENTATIVE)** | | | | |

## 9) (i) STATIC FREQUENCY CONVERTER (SFC) SYSTEM

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | **ग्राहक (CLIENT):** | | | |
| **परियोजना (PROJECT) :** | | | | | **विक्रेता (VENDOR):** | | | |
| **उपष्कर का नाम (NAME OF EQUIPMENT) : Static Frequency Converter** | | | | | **एनआईटी/ क्रय आदेश संदर्भ( NIT / P.O. Reference) :** | | | |
| **Sl. No.** | **Item / Components & Characteristics** | **Nature of Checks** | **Quantum of Checks** | **Reference Document / Acceptance Norms** | **Record Format** | **Inspection Agency** | | **Remarks** |
| | | | | | | Sub supplier | Supplier | Employer |
| **1.1** | **Incoming goods inspection** | | | | | | | |
| | **BOUGHT OUT MATERIALS** | | | | | | | |
| | **Thyrister/IGBTs , Heat sink, Surge Supression Device, HMI/MMI etc. (As applicable)** | | | | | | | |
| 1.1.1 | Make and Rating | Visual | 100% | Tech specifications/approved drawing | TC | P | RR | - |
| 1.1.2 | Functional test check | Electrical | 100% | Tech specifications/approved drawing | TC | P | RR | - |
| | Power Supply | | | | | | | |
| 1.1.3 | Make and Rating | Visual | 100% | Tech specifications/approved drawing | TC | P | RR | - |
| 1.1.4 | Performance test | Electrical | 100% | Tech specifications/approved drawing | TC | P | RR | - |
| | Digital/Analog Metering Equipment | | | | | | | |
| 1.1.5 | Dimensional Check , Make and Rating | Measurement/Visual | 100% | Tech specifications/approved drawing | TC | P | RR | - |
| 1.1.6 | Class of Accuracy | Visual | 100% | Tech specifications/approved drawing | TC | P | RR | - |
| 1.1.7 | Calibration | Electrical | 100% | Tech specifications/approved drawing | TC | P | RR | - |
| | Cooling Fan | | | | | | | |
| 1.1.8 | Make and Rating | Visual | 100% | Tech specifications/approved drawing | TC | P | RR | - |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 1.1.9 | Routine test | Electrical | 100% | Tech specifications/approved drawing | TC | P | RR | - | |
| **1.2** | **In process inspection** | | | | | | | | |
| 1.2.1 | Check of identity | Mechanical | Complete converter | Internal specification | TC | P | RR | - | |
| 1.2.2 | Condition test | Mechanical | Complete Converter | Acc. To drawings | TC | P | RR | - | |
| 1.2.3 | Labeling, marking | Mechanical | Complete Converter | Acc. To drawings | TC | P | RR | - | |
| 1.2.4 | Check of electrical components | Electrical | Complete Converter | Acc. To drawings | TC | P | RR | - | |
| 1.2.5 | mechanical construction | Mechanical | Complete Converter | Acc. To drawings | TC | P | RR | - | |
| 1.2.6 | Screw connections | Mechanical | Complete Converter | Acc. To factory standard | TC | P | RR | - | |
| 1.2.7 | Clearance + Creepage distances | Mechanical | Complete Converter | Acc. To drawings | TC | P | RR | - | |
| 1.2.8 | Cable inspection | Electrical | Complete Converter | Acc. To drawings | TC | P | RR | - | |
| **1.3** | **Internal routine test** | | | | | | | | |
| 1.3.1 | Visual check | | | | | | | | |
| 1.3.1.1 | Check degree of protection | Mechanical | Complete Converter | IEC 60529 | TC | P | RR | - | |
| 1.3.1.2 | Check earthing of cubicles & components of cubicles | Electrical | Complete Converter | Acc. To drawings | TC | P | RR | - | |
| 1.3.1.3 | Check marking of components in acc. With relevant drawings | Electrical | Complete Converter | Acc. To drawings | TC | P | RR | - | |
| 1.3.1.4 | Check rating plate | Electrical | Complete Converter | Acc. To drawings | TC | P | RR | - | |
| 1.3.1.5 | Check terminals & wiring for correct marking and diameters | Electrical | Complete Converter | Acc. To drawings | TC | P | RR | - | |
| 1.3.1.6 | wiring test, point to check | Electrical | Complete Converter | Acc. To drawings | TC | P | RR | - | |
| 1.3.2 | Insulation test | | | | | | | | |
| 1.3.2.1 | check clearance and creepage | Electrical | Complete Converter | Acc. To drawings | TC | P | RR | - | |
| 1.3.2.2 | AC high voltage test | Electrical | Complete Converter | 'IS/ IEC/ equivalent or above' | TC | P | RR | - | |
| 1.3.2.3 | insulation resistance test | Electrical | Complete Converter | 'IS/ IEC/ equivalent or above' | TC | P | RR | - | |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 1.3.2.4 | Impulse voltage test & Partial discharge test as per IEC 60146-1-1(Performed only if agreed upon prior to order) | Electrical | Complete Converter | 'IS/ IEC/ equivalent or above' | TC | P | RR | - | |
| **1.5** | **Routine test (function test) control cubicle** | | | | | | | | |
| 1.5.1 | Visual inspection (Dimensions, Bill of material etc) | Electrical | Complete Converter | Acc. To drawings | TC | P | RR | RR | |
| 1.5.2 | Checking of Sheet Thickness & paint thickness of cubicle | Mechanical | Complete Cubicle | Acc. To drawings | TC | P | RR | RR | |
| 1.5.3 | Insulation resistance test | Electrical | Complete Converter | Acc. To factory test plan | TC | P | RR | RR | |
| 1.5.4 | HV test on Auxiliary & Control Circuit | Electrical | Complete Converter | Acc. To factory test plan | TC | P | RR | RR | |
| 1.5.1 | Check of power supplies | Electrical | Complete Converter | Acc. To drawings | TC | P | RR | RR | |
| 1.5.2 | check of modules with self test routine | Electrical | Complete Converter | Acc. To factory test plan | TC | P | RR | RR | |
| 1.5.3 | check of operator panel | Electrical | Complete Converter | Acc. To factory test plan | TC | P | RR | RR | |
| 1.5.4 | check of synchonizing module | Electrical | Complete Converter | Acc. To factory test plan | TC | P | RR | RR | |
| 1.5.5 | check of actual values | Electrical | Complete Converter | Acc. To factory test plan | TC | P | RR | RR | |
| 1.5.6 | check of binary inputs/outputs | Electrical | Complete Converter | Acc. To factory test plan | TC | P | RR | RR | |
| 1.5.7 | Check of interlocking system | Electrical | Complete Converter | Acc. To factory test plan | TC | P | RR | RR | |
| **1.6** | **Routine test (function test) Converters & DC link (Internal)** | | | | | | | | |
| 1.6.1 | Check fibre optics | Electrical | Complete Converter | Acc. To factory test plan | TC | P | RR | RR | |
| 1.6.2 | Check the earthing switch and /or disconnector on line side | Electrical | Complete Converter | Acc. To factory test plan | TC | P | RR | RR | |
| 1.6.3 | Check the earthing switch and /or disconnector on motor side | Electrical | Complete Converter | Acc. To factory test plan | TC | P | RR | RR | |
| 1.6.4 | Check door switches | Electrical | Complete Converter | Acc. To factory test plan | TC | P | RR | RR | |
| 1.6.5 | Check current transducer and voltage sensing | Electrical | Complete Converter | Acc. To factory test plan | TC | P | RR | RR | |
| 1.6.6 | voltage distribution in the thyristor valve arms | Electrical | Complete Converter | Acc. To factory test plan | TC | P | RR | RR | |
| 1.6.7 | Funtional test of thyristor firing and monitoring | Electrical | Complete Converter | Acc. To factory test plan | TC | P | RR | RR | |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 1.6.8 | Monitoring and protective functions as far as possible | Electrical | Complete Converter | Acc. To factory test plan | TC | P | RR | RR | |
| 1.6.9 | Converter operation in DC-Link pulsation | Electrical | Complete Converter | Acc. To factory test plan | TC | P | RR | RR | |
| **1.7** | **Routine test FAT** | | | | | | | | |
| 1.7.1 | Visual inspection | Mechanical | Complete Converter | 'IS/ IEC/ equivalent or above' | JIR | P | W | CHP | |
| 1.7.2 | Insulation test | Electrical | Complete Converter | 'IS/ IEC/ equivalent or above' | JIR | P | W | CHP | |
| 1.7.3 | Check of auxiliary devices | Electrical | Complete Converter | 'IS/ IEC/ equivalent or above' | JIR | P | W | CHP | |
| 1.7.4 | Check of protective devices | Electrical | Complete Converter | 'IS/ IEC/ equivalent or above' | JIR | P | W | CHP | |
| 1.7.5 | Checking the properties of control equipment | Electrical | Complete Converter | 'IS/ IEC/ equivalent or above' | JIR | P | W | CHP | |
| 1.7.6 | Functional test | Electrical | Complete Converter | 'IS/ IEC/ equivalent or above' | JIR | P | W | CHP | |
| 1.7.7 | Light load test | Electrical | Complete Converter | 'IS/ IEC/ equivalent or above' | JIR | P | W | CHP | |
| **Inspections and tests on Cooling unit** | | | | | | | | | |
| 2 | **Water cooled units** | | | | | | | | |
| 2.1 | Hydraulic test | Mechanical | Complete Converter | Acc. To factory test plan | TC | P | RR | RR | |
| 2.2 | Pressure difference between converter in/output at rated flow | Mechanical | Complete Converter | Acc. To factory test plan | TC | P | RR | RR | |
| 2.3 | Rated flow rate on module tower at rated pressure difference | Mechanical | Complete Converter | Acc. To factory test plan | TC | P | RR | RR | |
| 2.4 | Rated flow rate on DC link reactor at rated pressure difference | Mechanical | Complete Converter | Acc. To factory test plan | TC | P | RR | RR | |
| 2.5 | Measurement on the PT100 | Electrical | Complete Converter | Acc. To factory test plan | TC | P | RR | RR | |
| 2.6 | Static pressure check | Mechanical | Complete Converter | Acc. To factory test plan | TC | P | RR | RR | |
| 2.7 | check leakage detectors | Mechanical | Complete Converter | Acc. To factory test plan | TC | P | RR | RR | |
| **3** | **Air cooled units** | | | | | | | | |
| 3.1 | Fan test | Mechanical | Complete Converter | Acc. To factory test plan | TC | P | RR | RR | |
| 3.2 | Check of fans correct rotation direction | Mechanical | Complete Converter | Acc. To factory test plan | TC | P | RR | RR | |
| 3.3 | Check of fans correct current input | Mechanical | Complete Converter | Acc. To factory test plan | TC | P | RR | RR | |
| 3.4 | Check of differential pressure monitor | Mechanical | Complete Converter | Acc. To factory test plan | TC | P | RR | RR | |

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| **Note:** | | | | | | | | | |
| a. Abbreviations used - RR-Review of Records, TC - Test Certificate Submission, JIR - Joint Inspection Report & CHP - Customer Hold Point. | | | | | | | | | |
| b. Test Certificates shall be submitted at the time of final inspection. Valid calibration Certificate of Instruments used for Testing shall be provided during the Test. | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | **Signature** | | | **Signature & Seal** | | | | | |
| | **EMPLOYER ( QA&I DEPT.)** | | | **(VENDORS Q.C. DEPT. OR REPRESENTATIVE)** | | | | | |

## 9) (ii) VARIABLE-FREQUENCY DRIVE (VFD)

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | **ग्राहक (CLIENT):** | | | |
| | **परियोजना (PROJECT) :** | | | | **विक्रेता (VENDOR):** | | | |
| **उपष्कर का नाम (NAME OF EQUIPMENT) : Variable Frequency Drives** | | | | | **एनआईटी/ क्रय आदेश संदर्भ( NIT / P.O. Reference) :** | | | |
| **Sl. No.** | **Item / Components & Characteristics** | **Nature of Checks** | **Quantum of Checks** | **Reference Document / Acceptance Norms** | **Record Format** | **Inspection Agency** | | **Remarks** |
| | | | | | | **Sub supplier** | **Supplier** | **Employer** |
| **1.1** | **Incoming goods inspection** | | | | | | | |
| | **BOUGHT OUT MATERIALS** | | | | | | | |
| | **Thyrister/IGBTs , Heat sink, Surge Supression Device, HMI/MMI etc. (As applicable)** | | | | | | | |
| 1.1.1 | Make and Rating | Visual | 100% | Tech specifications/approved drawing | TC | P | RR | - |
| 1.1.2 | Functional test check | Electrical | 100% | Tech specifications/approved drawing | TC | P | RR | - |
| | **Power Supply** | | | | | | | |
| 1.1.3 | Make and Rating | Visual | 100% | Tech specifications/approved drawing | TC | P | RR | - |
| 1.1.4 | Performance test | Electrical | 100% | Tech specifications/approved drawing | TC | P | RR | - |
| | **Digital/Analog Metering Equipment** | | | | | | | |
| 1.1.5 | Dimensional Check , Make and Rating | Measurement/Visual | 100% | Tech specifications/approved drawing | TC | P | RR | - |
| 1.1.6 | Class of Accuracy | Visual | 100% | Tech specifications/approved drawing | TC | P | RR | - |
| 1.1.7 | Calibration | Electrical | 100% | Tech specifications/approved drawing | TC | P | RR | - |
| | **Cooling Fan** | | | | | | | |
| 1.1.8 | Make and Rating | Visual | 100% | Tech specifications/approved drawing | TC | P | RR | - |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 1.1.9 | Routine test | Electrical | 100% | Tech specifications/approved drawing | TC | P | RR | - | |
| | | | | | | | | | |
| **1.1** | **Visual checks** | | | | | | | | |
| 1.1.1 | Rating plate | Mechanical | 100% | Acc. To drawings | JIR | P | W | CHP | |
| 1.1.2 | Housing degree of protection | Mechanical | 1 per lot | 'IS/ IEC/ equivalent or above' | JIR | P | W | CHP | |
| 1.1.3 | Electrical cabinet components | Mechanical | Sample | Acc. To drawings | JIR | P | W | CHP | |
| 1.1.4 | Cable installation | Mechanical | Sample | Acc. To drawings | JIR | P | W | CHP | |
| 1.1.5 | Cable markings | Mechanical | Sample | Acc. To drawings | JIR | P | W | CHP | |
| 1.1.6 | Setting values of circuit breakers | Mechanical | Sample | Acc. To drawings | JIR | P | W | CHP | |
| 1.1.7 | Dimensions | Mechanical | 100% | Acc. To drawings | JIR | P | W | CHP | |
| **1.2** | **Functional tests** | | | | | | | | |
| 1.2.1 | Auxiliary voltages | Electrical | Complete converter | Acc. To factory standard | JIR | P | W | CHP | |
| 1.2.2 | Interrupted cable to the operator panel | Electrical | Complete Converter | | JIR | P | W | CHP | |
| 1.2.3 | Temperature monitoring | Electrical | Complete Converter | Acc. To factory standard | JIR | P | W | CHP | |
| 1.2.4 | Door limit switches | Electrical | Complete Converter | 'IS/ IEC/ equivalent or above' | JIR | P | W | CHP | |
| 1.2.5 | Door inerlocking system | Electrical | Complete Converter | 'IS/ IEC/ equivalent or above' | JIR | P | W | CHP | |
| 1.2.6 | Ground fault monitoring | Electrical | Complete Converter | 'IS/ IEC/ equivalent or above' | JIR | P | W | CHP | |
| 1.2.7 | DC link precharging | Electrical | Complete Converter | Acc. To factory standard | JIR | P | W | CHP | |
| 1.2.8 | Sensing the actual DC link voltage | Electrical | Complete Converter | Acc. To factory standard | JIR | P | W | CHP | |
| 1.2.9 | Under voltage monitoring in the DC link | Electrical | Complete Converter | Acc. To factory standard | JIR | P | W | CHP | |
| 1.2.10 | Output current measurement. | Electrical | Complete Converter | Acc. To factory standard | JIR | P | W | CHP | |
| 1.2.11 | Overvoltage monitoring in the DC link | Electrical | Complete Converter | 'IS/ IEC/ equivalent or above' | JIR | P | W | CHP | |
| 1.2.12 | Failure of a power semi conductor module | Electrical | Complete Converter | Acc. To factory standard | JIR | P | W | CHP | |
| 1.2.13 | Safety shutdown | Electrical | Complete Converter | 'IS/ IEC/ equivalent or above' | JIR | P | W | CHP | |
| **Inspections and tests on Cooling unit** | | | | | | | | | |
| 2.1 | Air flow direction | Electrical | Complete Converter | Acc. To factory standard | JIR | P | W | CHP | |
| 2.2 | Air pressure monitoring | Electrical | Complete Converter | Acc. To factory standard | JIR | P | W | CHP | |

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| | | | | | | | | | |
| **Note:** | | | | | | | | | |
| a. Abbreviations used - RR-Review of Records, TC - Test Certificate Submission, JIR - Joint Inspection Report & CHP - Customer Hold Point. | | | | | | | | | |
| b. Test Certificates shall be submitted at the time of final inspection. Valid calibration Certificate of Instruments used for Testing shall be provided during the Test. | | | | | | | | | |
| | | | | | | | | | |
| | **Signature** | | | **Signature & Seal** | | | | | |
| | **EMPLOYER ( QA&I DEPT.)** | | | **(VENDORS Q.C. DEPT. OR REPRESENTATIVE)** | | | | | |

## 10) CURRENT LIMITING REACTORS

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | ग्राहक (CLIENT): | | | |
| | परियोजना (PROJECT) : | | | | विक्रेता (VENDOR): | | | |
| उपष्कर का नाम (NAME OF EQUIPMENT) : Current Limiting Reactor | | | | | एनआईटी/ क्रय आदेश संदर्भ( NIT / P.O. Reference) : | | | |
| **Sl. No.** | **Item / Components & Characteristics** | **Nature of Checks** | **Quantum of Checks** | **Reference Document / Acceptance Norms** | **Record Format** | **Inspection Agency** | | | **Remarks** |
| | | | | | | **Perform** | **Witness** | **Verify** | |
| **A** | **Raw material** | | | | | | | | |
| **1** | **Steel for End frame & Enclpsure sheet** | | | | | | | | |
| a) | Chemical composition | Chemical | Sample | Appd. Spec./ 'IS/ IEC/ equivalent or above' | TC | 2/3 | - | 1 | TC |
| b) | Mechanical test | Mechanical | Sample | Appd. Spec./ 'IS/ IEC/ equivalent or above' | TC | 2/3 | - | 1 | TC |
| c) | Thickness | Measurement | Sample | Appd. Spec./ 'IS/ IEC/ equivalent or above' | TC | 2/3 | - | 1 | TC |
| d) | Fittings and Accessories | Visual | Sample | Appd. Spec./drawing | TC | 2/3 | - | 1 | TC |
| **2** | **Conductor** | | | | | | | | |
| a) | Dimension | Measurement | Sample | Appd. Spec./ 'IS/ IEC/ equivalent or above' | TC | 2/3 | - | 1 | TC |
| b) | Tensile strength | Mechanical | Sample | Appd. Spec./ 'IS/ IEC/ equivalent or above' | TC | 2/3 | - | 1 | TC |
| c) | Hardness | Mechanical | Sample | Appd. Spec./ 'IS/ IEC/ equivalent or above' | TC | 2/3 | - | 1 | TC |
| d) | Conductivity | Electrical | Sample | Appd. Spec./ 'IS/ IEC/ equivalent or above' | TC | 2/3 | - | 1 | TC |
| e) | Elongation | Mechanical | Sample | Appd. Spec./ 'IS/ IEC/ equivalent or above' | TC | 2/3 | - | 1 | TC |
| f) | Chemical composition | Chemical | Sample | Appd. Spec./ 'IS/ IEC/ equivalent or above' | TC | 2/3 | - | 1 | TC |
| 3 | Insulation | | | | | | | | |
| a) | Physical properties | Physical | Sample | Appd. Spec./ 'IS/ IEC/ equivalent or above' | TC | 2/3 | - | 1 | TC |
| b) | Electrical Test | Electrical | Sample | Appd. Spec./ 'IS/ IEC/ equivalent or above' | TC | 2/3 | - | 1 | TC |
| c) | Insulating oil Testing (oil immersed current limiting reactor only) | Electrical | Sample | Appd. Spec./ 'IS/ IEC/ equivalent or above' | TC | 2/3 | - | 1 | TC |
| **B** | **Inprocess inspection** | | | | | | | | |
| **1** | **Coil Assembly** | | | | | | | | |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| a) | No. of turns | Visual | 100% | Tech Spec./Appd. Drg/'IS/ IEC/ equivalent or above' | TC | 2/3 | - | 1 | TC |
| b) | Brazing | Mechanical | 100% | Tech Spec./Appd. Drg/'IS/ IEC/ equivalent or above' | TC | 2/3 | - | 1 | TC |
| c) | Inter turn insulation | Electrical | 100% | Tech Spec./Appd. Drg/'IS/ IEC/ equivalent or above' | TC | 2/3 | - | 1 | TC |
| d) | Continuity | Electrical | 100% | Tech Spec./Appd. Drg/'IS/ IEC/ equivalent or above' | TC | 2/3 | - | 1 | TC |
| e) | End insulation | Electrical | 100% | Tech Spec./Appd. Drg/'IS/ IEC/ equivalent or above' | TC | 2/3 | - | 1 | TC |
| f) | Coil clamping pressure | Measurement | 100% | Tech Spec./Appd. Drg/'IS/ IEC/ equivalent or above' | TC | 2/3 | - | 1 | TC |
| **C** | **Routine Tests** | | | | | | | | |
| i) | Measurement of winding resistance | Electrical | 100% | Appd. Spec./ 'IS/ IEC/ equivalent or above' | JIR | 3/2 | 1 | - | CHP |
| ii) | Measurement of reactance | -do- | 100% | -do- | JIR | 3/2 | 1 | - | CHP |
| iii) | Measurement of loss | -do- | 100% | -do- | JIR | 3/2 | 1 | - | CHP |
| iv) | Measurement of Insulation resistance | -do- | 100% | Appd. Spec./ 'IS/ IEC/ equivalent or above' (To be recorded only for reference) | JIR | 3/2 | 1 | - | CHP |
| v) | Lightning impulse test | -do- | 100% | Appd. Spec./ 'IS/ IEC/ equivalent or above' | JIR | 3/2 | 1 | - | CHP |
| vi) | Dimensional checks | Visual | 100% | Approved General assembly drawings | JIR | 3/2 | 1 | - | CHP |
| vii) | Separate source ac withstand voltage test (For Liquid immersed reactors). | Electrical | 100% | Appd. Spec./ 'IS/ IEC/ equivalent or above' | JIR | 3/2 | 1 | - | CHP |
| viii) | Winding overvoltage test | Electrical | 100% | Appd. Spec./ 'IS/ IEC/ equivalent or above' | JIR | 3/2 | 1 | - | CHP |
| ix) | Capacitance and dissipation factor (tan delta) of the winding insulation to earth (For Liquid immersed reactors) | Electrical | 100% | Appd. Spec./ 'IS/ IEC/ equivalent or above' | JIR | 3/2 | 1 | - | CHP |
| Note: | | | | | | | | | |
| a. In 'Inspection Agency' column figure 1, 2 or 3 to be filled. 1- will indicate 'Owner', 2- will indicate 'Supplier' & 3- will indicate 'Sub-supplier'. | | | | | | | | | |
| b. In 'Remarks' column following abbreviations shall be used - RR-Review of Records, TC - Test Certificate Submission, JIR - Joint Inspection Report & CHP - Customer Hold Point. | | | | | | | | | |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| c. Test Certificates shall be submitted at the time of final inspection. Valid calibration Certificate of Instruments used for Testing shall be provided during the Test. | | | | | | | | | |
| | | | | | | | | | |
| | **Signature** | | | **Signature & Seal** | | | | | |
| | **EMPLOYER ( QA&I DEPT.)** | | | **(VENDORS Q.C. DEPT. OR REPRESENTATIVE)** | | | | | |

## 11) GENERATOR CIRCUIT BREAKER

| परियोजना (PROJECT) : | | | | ग्राहक (CLIENT): | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| उपष्कर का नाम (NAME OF EQUIPMENT) : Generator Circuit Breaker (GIS) | | | | विक्रेता (VENDOR): | | | | | |
| | | | | एनआईटी/ क्रय आदेश संदर्भ( NIT / P.O. Reference) : | | | | | |
| क्र. सं. S.N. | मद/घटक एवं विशेषता ITEM/ COMPONENT & CHARACTERISTICS | जाँच की प्रकृति NATURE OF CHECKS | जाँच की मात्रा QUANTUM OF CHECKS | संदर्भ दस्तावेज़ / स्वीकृति मानदंड REFERENCE DOCUMENT/ ACCEPTANCE NORMS | रेकॉर्ड फ़ारमैट RECORD FORMAT | निरीक्षण एजैंसी Inspecting Agency | | | टिप्पणी Remarks |
| | | | | | | प्रदर्शन PERFORM | गवाह WITNESS | सत्यापन VERIFY | |
| A) | **CIRCUIT BREAKER** | | | | | | | | |
| | **Routine Tests** | | | | | | | | |
| 1 | Pressure Test on Enclosure | Test | 100% | Tech spec./ Appd Drg./ IS/IEC/Equivalent Standard | TC | 2/3 | - | 1 | TC |
| 2 | Gas Leakage Test | -do- | -do- | -do- | JIR | 2/3 | 1 | - | CHP |
| 3 | Auxiliary & Control Circuit | | | | | | | | |
| a) | Wiring Check. | Visual | 100% | Tech spec./ Appd Drg./ IS/IEC/Equivalent Standard | JIR | 2/3 | 1 | - | CHP |
| b) | HV Test (2kV for One Minute) | Electrical | -do- | -do- | JIR | 2/3 | 1 | - | CHP |
| c) | Insulation Resistance Measurement | -do- | -do- | -do- | JIR | 2/3 | 1 | - | CHP |
| 4 | Mechanical Operating Test | | | | | | | | |
| a) | 5 Open & 5 Close Operations at Minimum Supply Voltage and Minimum Pressure | Electrical | 100% | Tech spec./ Appd Drg./ IS/IEC/Equivalent Standard | JIR | 2/3 | 1 | - | CHP |
| b) | 5 Open & 5 Close Operations at Maximum Supply Voltage and Maximum Pressure | -do- | -do- | -do- | JIR | 2/3 | 1 | - | CHP |
| c) | 5 Close-Open Operating Cycles at Rated Supply Voltage and Rated Pressure | -do- | -do- | -do- | JIR | 2/3 | 1 | - | CHP |
| d) | Measurement of Opening/Closing Time | Measurement | -do- | -do- | JIR | 2/3 | 1 | - | CHP |
| 5 | Electrical Tests | | | | | | | | |
| a) | Power Frequency Voltage Test of the Main Circuit. | Electrical | 100% | Tech spec./ Appd Drg./ IS/IEC/Equivalent Standard | JIR | 2/3 | 1 | - | CHP |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| b) | Measurement of Contact Resistance of Main Circuit | Measurement | -do- | -do- | JIR | 2/3 | 1 | - | CHP |
| c) | Measurement of Resistance of Circuit Breaker Closing and Trip Coils | -do- | -do- | -do- | JIR | 2/3 | 1 | - | CHP |
| d) | Partial Discharge Measurement | -do- | -do- | -do- | JIR | 2/3 | 1 | - | CHP |
| e) | Measurement of Power Consumption of Motor Operated Mechanism at Rated Supply Voltage | -do- | -do- | -do- | JIR | 2/3 | 1 | - | CHP |
| f) | Operational & Interlocks Check. | Functional | -do- | -do- | JIR | 2/3 | 1 | - | CHP |
| g) | Operational Check of Pressure Density Monitoring Switches | -do- | -do- | -do- | JIR | 2/3 | 1 | - | CHP |
| Note: | a. In 'Inspection Agency' column figure 1,2,or 3 to be filled. 1- will indicate 'Employer', 2- will indicate 'supplier' & 3- will indicate 'sub-supplier'. | | | | | | | | |
| | b. In 'Remarks' column following abbreviations shall be used - RR-Review of Records, T.C. - Test Certificate, JIR - Joint Inspection Report & CHP - Customer Hold Point, | | | | | | | | |
| | c. The firm shall obtain acceptance/clearance of finished product for further activities based on Test Certificates & Internal Report (IR) | | | | | | | | |
| | d. Any additional test required as per the requirement of equipment in accordance with Contract Agreement/Relevent standard apart from QAP will be carried out by the firm without any additional financial implication. | | | | | | | | |
| | e.This QAP does not absolve the Contractor/sub-contractor of his responsibility to supply the correct products, strictly in conformity to the specifications given in the purchase order/contract. The above Model QAP stipulates the bare minimum requirements which shall be complied by the contractor. The above QAP has been made presuming subletting of work shall be allowed in the tender. In case subletting of work is not allowed in the tender, then"3/2" shall be considered as "2" under the column " Perform" . | | | | | | | | |
| | f. The type test may not be mandatory if similar equipment has been type tested and test certificate(s) for relevant tests are accepted by the Employer | | | | | | | | |
| | | | | | | | | | |
| | **Signature** | | | | | **Signature & Seal** | | | |
| | **EMPLOYER ( QA&I DEPT.)** | | | | **(VENDORS Q.C. DEPT. OR REPRESENTATIVE)** | | | | |

| **कार्य स्थल गुणवत्ता योजना (FIELD QUALITY PLAN) :** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **परियोजना (PROJECT) :** | | | | **ग्राहक (CLIENT):** | | | | |
| **उपष्कर का नाम (NAME OF EQUIPMENT) :Generator Circuit Breaker(GIS)** | | | | **विक्रेता (VENDOR):** | | | | |
| **एनआईटी/ क्रय आदेश संदर्भ( NIT / P.O. Reference) :** | | | | | | | | |
| **क्र.** | **घटक की गतिविधि और संचालन ACTIVITY & OPERATION OF COMPONENT** | **जाँच की** | **जाँच की** | **संदर्भ दस्तावेज़ /** | **रेकॉर्ड** | **निरीक्षण एजैंसी Inspecting Agency** | | **टिप्पणी Remarks** |

| सं.<br>S.N. | | प्रकृति<br>NATURE OF CHECKS | मात्रा<br>QUANTUM OF CHECKS | स्वीकृति मानदंड<br>REFERENCE DOCUMENT/ ACCEPTANCE NORMS | फ़ारमैट<br>RECORD FORMAT | प्रदर्शन<br>PERFORM | गवाह<br>WITNESS | सत्यापन<br>VERIFY | |
|---|---|---|---|---|---|---|---|---|---|
| **A)** | **General Check** | | | | | | | | |
| a) | Equipment should be free from dirt/dust/rust/foreign material etc. | Visual | 100% | Tech spec./ Appd Drg./ IS/IEC/Equivalent Standard | TC/TR | 2/3 | 1 | - | TC/TR |
| b) | All nut and bolts should be tightened correctly as per specified torque | -do- | -do- | -do- | TC/TR | 2/3 | 1 | - | TC/TR |
| c) | Leveling and alignment of structure and base frame should be checked | -do- | -do- | -do- | TC/TR | 2/3 | 1 | - | TC/TR |
| d) | Earthing and wiring connection should be completed | -do- | -do- | -do- | TC/TR | 2/3 | 1 | - | TC/TR |
| e) | All trenches should be cleaned and covered | -do- | -do- | -do- | TC/TR | 2/3 | 1 | - | TC/TR |
| **B)** | **Commissioning check** | | | | | | | | |
| a) | SF6 Gas Quality test and checking of pressure monitoring system | Test | 100% | Tech spec./ Appd Drg./ IS/IEC/Equivalent Standard | TC/TR | 2/3 | 1 | - | TC/TR |
| b) | Gas Leakage Test | Test | -do- | -do- | TC/TR | 2/3 | 1 | - | TC/TR |
| c) | Measurement of operating time | Test | -do- | -do- | TC/TR | 2/3 | 1 | - | TC/TR |
| d) | Contact Resistance Measurement | Test | -do- | -do- | TC/TR | 2/3 | 1 | - | TC/TR |
| e) | Insulation resistance measurement test of motor | Electrical | -do- | -do- | TC/TR | 2/3 | 1 | - | TC/TR |
| f) | Measurement of coil resistance | -do- | -do- | -do- | TC/TR | 2/3 | 1 | - | TC/TR |
| g) | Breaker operation counter reading | Visual | -do- | -do- | TC/TR | 2/3 | 1 | - | TC/TR |
| h) | Auxiliary & Control Circuit | | | | | | | | |
| i) | Wiring Check. | Electrical | 100% | Tech spec./ Appd Drg./ IS/IEC/Equivalent Standard | TC/TR | 2/3 | 1 | - | TC/TR |
| ii) | HV Test (2kV for One Minute) | -do- | -do- | -do- | TC/TR | 2/3 | 1 | - | TC/TR |
| iii) | Insulation resistance Measurement | -do- | -do- | -do- | TC/TR | 2/3 | 1 | - | TC/TR |
| Note: | a. In 'Inspection Agency'column figure 1,2,or 3 to be filled. 1- will indicate Representative of Engineer-in-charge, 2- will indicate 'Contractor' & 3- will indicate 'Sub-contractor'. | | | | | | | | |
| | b. In 'Remarks' column following abbreviations shall be used - TC/TR - Test Certificate/ Test Report | | | | | | | | |
| | c.The above FQP stipulates the bare minimum requirements which shall be complied by the contractor. The above FQP has been made presuming subletting of work shall be allowed in the tender. In case subletting of work is not allowed in the tender, then"3/2" shall be considered as "2" under the column " Perform" . | | | | | | | | |
| | d. Any additional acitivity/ test required as per the requirement of equipment in accordance with Contract Agreement/Relevent standard apart from FQP will be carried out by the firm without any | | | | | | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| | additional financial implication. | | | | | |
| | e. The contractor shall furnish the details of test method to the Engineer-in-Charge for approval in the time line as specified in contract agreement | | | | | |
| | f. All the Test in FQP shall be witnessed by Engineer-in-charge or his representative at site. | | | | | |
| | | | | | | |
| | **Signature** | | | | | **Signature & Seal** |
| | **Engineer-in-charge** | | | | **(VENDORS Q.C. DEPT. OR REPRESENTATIVE)** | |

## 12) PHASE REVERSAL DISCONNECTING SWITCH

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | **ग्राहक (CLIENT):** | | | |
| | **परियोजना (PROJECT) :** | | | | **विक्रेता (VENDOR):** | | | |
| **उपष्कर का नाम (NAME OF EQUIPMENT) :Phase reversal Device** | | | | | **एनआईटी/ क्रय आदेश संदर्भ( NIT / P.O. Reference) :** | | | |
| **Sl. No.** | **Item / Components & Characteristics** | **Nature of Checks** | **Quantum of Checks** | **Reference Document / Acceptance Norms** | **Record Format** | **Inspection Agency** | | | **Remarks** |
| | | | | | | **Perform** | **Witness** | **Verify** | |
| | **RAW MATERIAL** | | | | | | | | |
| **A** | **Aluminium casings** | | | | | | | | |
| | | | | | | | | | |
| 1 | Material test certificates | Mechanical | 100% | Supplier report | TC | 3 | --- | 1/2 | |
| | | | | | | | | | |
| 2 | Traceability markings | Mechanical | 100% | End of Manufacturing report | TC | 3 | --- | 1/2 | |
| | **BOUGHT OUT MATERIAL** | | | | | | | | |
| **B** | **Ceramic or composite insulator** | | | | | | | | |
| 1 | Bending test | Mechanical | 100% | | TC | 3 | --- | 1/2 | |
| 2 | Visual examination / Dimensional check | Mechanical | 100% | | TC | 3 | --- | 1/2 | |
| | Only for composite insulator | | | | TC | 3 | --- | 1/2 | |
| 3 | Tightness test | Mechanical | 100% | | TC | 3 | --- | 1/2 | |
| 4 | Partial discharge measurement | Electrical test | 100% | | TC | 3 | --- | 1/2 | |
| **C** | **Control Cubicle** | | | | | | | | |
| i) | Visual and dimensional check | Visual | -do- | 'IS/ IEC/ equivalent or above' | JIR | 3/2 | 1 | - | CHP |
| ii) | Paint shade, thickness and adhesion Test | -do- | -do- | -do- | JIR | 3/2 | 1 | - | CHP |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| iii) | Dielectric tests on auxiliary circuits | Electrical | -do- | -do- | JIR | 3/2 | 1 | - | CHP |
| iv) | Insulation resistance test | -do- | -do- | -do- | JIR | 3/2 | 1 | - | CHP |
| v)) | Wiring continuity Test | Electrical | -do- | -do- | JIR | 3/2 | 1 | - | CHP |
| vi) | Interlock and sequential operation | -do- | -do- | -do- | JIR | 3/2 | 1 | - | CHP |
| vii) | Check of interface with plant SCADA | -do- | -do- | -do- | JIR | 3/2 | 1 | - | CHP |
| vii) | Mechanical and electrical operation test | -do- | -do- | -do- | JIR | 3/2 | 1 | - | CHP |
| viii) | Checking of the number of auxiliary contact | Visual | -do- | -do- | JIR | 3/2 | 1 | - | CHP |
| ix) | Varification visual of protection against electrical shock | Visual | -do- | -do- | JIR | 3/2 | 1 | - | CHP |
| x) | Functioning verification of heaters | Electrical | -do- | -do- | JIR | 3/2 | 1 | - | CHP |
| xi) | Functioning verification of lighting | -do- | -do- | -do- | JIR | 3/2 | 1 | - | CHP |
| | | | | | | | | | |
| **D** | **PRDS complete test** | | | | | | | | |
| | **Mechanical operation test** | | | | | 3/2 | 1 | - | CHP |
| 1 | - at maximum control voltage and springs fully charged | Mechanical | 100% | 'IS/ IEC/ equivalent or above' | JIR | 3/2 | 1 | - | CHP |
| 2 | - at minimum control voltage and springs in lockout condition | Mechanical | 100% | do | JIR | 3/2 | 1 | - | CHP |
| 3 | - at minimum control voltage and springs fully charged | Mechanical | 100% | do | JIR | 3/2 | 1 | - | CHP |
| 4 | - at rated control voltage and springs fully charged | Mechanical | 100% | do | JIR | 3/2 | 1 | - | CHP |
| 5 | - at rated control voltage and springs fully charged | Mechanical | 100% | do | JIR | 3/2 | 1 | - | CHP |
| 6 | Drive operating sequence check | Mechanical | 100% | do | JIR | 3/2 | 1 | - | CHP |
| | | | | | | | | | |
| **E** | **Measurement of operating times at rated conditions** | | | | | | | | |
| 1 | Motor Operation tests | | | | | | | | |
| a | At rated supply voltage | Electrical test | 100% | IS/ IEC/ equivalent or above' | JIR | 3/2 | 1 | - | CHP |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| b | measurement of the closing time and motor consumption | Electrical test | 100% | 'IS/ IEC/ equivalent or above' | JIR | 3/2 | 1 | - | CHP |
| c | measurement of the opening time and motor consumption | Electrical test | 100% | 'IS/ IEC/ equivalent or above' | JIR | 3/2 | 1 | - | CHP |
| 2 | Resistance measurement of the main circuit | Electrical test | 100% | do | JIR | 3/2 | 1 | - | CHP |
| 3 | Power frequency withstand voltage test to earth and across open contacts | Electrical test | 100% | do | JIR | 3/2 | 1 | - | CHP |
| **F** | **Voltage Transformers** | | | | | | | | |
| 1 | Visual and dimensional check | Visual | -do- | Appd. Spec. | JIR | 3/2 | 1 | - | CHP |
| 2 | Verification of markings | Visual | -do- | Appd. Spec. | JIR | 3/2 | 1 | - | CHP |
| 3 | Dielectric tests on secondary circuits | Electrical | -do- | Appd. Spec./ 'IS/ IEC/ equivalent or above' | JIR | 3/2 | 1 | - | CHP |
| 4 | Partial discharge measurement | Electrical | -do- | Appd. Spec./ 'IS/ IEC/ equivalent or above' | JIR | 3/2 | 1 | - | CHP |
| 5 | Test for Accuracy | Electrical | -do- | Appd. Spec./'IS/ IEC/ equivalent or above' | JIR | 3/2 | 1 | - | CHP |
| | | | | | | | | | |
| **Note:** | | | | | | | | | |
| a. In 'Inspection Agency' column figure 1, 2 or 3 to be filled. 1- will indicate 'Owner', 2- will indicate 'Supplier' & 3- will indicate 'Sub-supplier'. | | | | | | | | | |
| b. In 'Remarks' column following abbreviations shall be used - RR-Review of Records, TC - Test Certificate Submission, JIR - Joint Inspection Report & CHP - Customer Hold Point. | | | | | | | | | |
| c. Test Certificates shall be submitted at the time of final inspection. Valid calibration Certificate of Instruments used for Testing shall be provided during the Test. | | | | | | | | | |
| | | | | | | | | | |
| | **Signature** | | | **Signature & Seal** | | | | | |
| | **EMPLOYER ( QA&I DEPT.)** | | | **(VENDORS Q.C. DEPT. OR REPRESENTATIVE)** | | | | | |

## 13) (i) DYNAMIC BRAKING CUBICLE

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | **ग्राहक (CLIENT):** | | | |
| | **परियोजना (PROJECT) :** | | | | **विक्रेता (VENDOR):** | | | |
| **उपष्कर का नाम (NAME OF EQUIPMENT) :Dynamic Braking Equipment** | | | | | **एनआईटी/ क्रय आदेश संदर्भ( NIT / P.O. Reference) :** | | | |
| **Sl. No.** | **Item / Components & Characteristics** | **Nature of Checks** | **Quantum of Checks** | **Reference Document / Acceptance Norms** | **Record Format** | **Inspection Agency** | | | **Remarks** |
| | | | | | | **Perform** | **Witness** | **Verify** | |
| | **RAW MATERIAL** | | | | | | | | |
| **A** | **Aluminium casings** | | | | | | | | |
| | | | | | | | | | |
| 1 | Material test certificates | Mechanical | 100% | Supplier report | TC | 3 | --- | 1/2 | |
| | | | | | | | | | |
| 2 | Traceability markings | Mechanical | 100% | End of Manufacturing report | TC | 3 | --- | 1/2 | |
| | **BOUGHT OUT MATERIAL** | | | | | | | | |
| **B** | **Ceramic or composite insulator** | | | | | | | | |
| 1 | Bending test | Mechanical | 100% | | TC | 3 | --- | 1/2 | |
| 2 | Visual examination / Dimensional check | Mechanical | 100% | | TC | 3 | --- | 1/2 | |
| | Only for composite insulator | | | | TC | 3 | --- | 1/2 | |
| 3 | Tightness test | Mechanical | 100% | | TC | 3 | --- | 1/2 | |
| 4 | Partial discharge measurement | Electrical test | 100% | | TC | 3 | --- | 1/2 | |
| | | | | | | | | | |
| 1 | Test for Assembled Panel. | | | | | | | | |
| | Routine Test | | | | | | | | |
| a) | BOM & Rating Check | Visual | 100% | Tech. Spec./Appd.drg./'IS/ IEC/ equivalent or above' | JIR | 3-2 | 1 | - | CHP |
| b) | I.R Test (before & after HV Test) | -do- | -do- | Tech. Spec./Appd Drg/ 'IS/ IEC/ equivalent or above' | JIR | 3-2 | 1 | - | CHP |
| c) | H.V. Test | -do- | -do- | -do- | JIR | 3-2 | 1 | - | CHP |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| d) | Dimensional Check | Measurement | -do- | -do- | JIR | 3-2 | 1 | - | CHP |
| e) | Electric operation of the isolator motor | | | | | | | | |
| f) | Functional/Operational Check for all items | Elect/Mech. | -do- | -do- | JIR | 3-2 | 1 | - | CHP |
| g) | Continuity Check | Electrical | -do- | -do- | JIR | 3-2 | 1 | - | CHP |
| h) | Scheme Checking & Interlocks Testing | -do- | -do- | -do- | JIR | 3-2 | 1 | - | CHP |
| i) | Checking of Earthing circuit. | Electrical | 100% | Tech. Spec./Appd.drg./'IS/ IEC/ equivalent or above' | JIR | 3-2 | 1 | - | CHP |
| j) | Checking for clerances | Visual | 100% | Tech. Spec./Appd.drg./'IS/ IEC/ equivalent or above' | JIR | 3-2 | 1 | - | CHP |
| k) | Busduct Interface dimensional checks | Visual | 100% | Tech. Spec./Appd.drg./'IS/ IEC/ equivalent or above' | JIR | 3-2 | 1 | - | CHP |
| | | | | | | | | | |
| 2 | Verification of providing interfacing with SCADA System | Visual | 100% | -do- | JIR | 3/2 | 1 | - | CHP |
| | | | | | | | | | |
| Note: | | | | | | | | | |
| a. In 'Inspection Agency' column figure 1, 2 or 3 to be filled. 1- will indicate 'Owner', 2- will indicate 'Supplier' & 3- will indicate 'Sub-supplier'. | | | | | | | | | |
| b. In 'Remarks' column following abbreviations shall be used - RR-Review of Records, TC - Test Certificate Submission, JIR - Joint Inspection Report & CHP - Customer Hold Point. | | | | | | | | | |
| c. Test Certificates shall be submitted at the time of final inspection. Valid calibration Certificate of Instruments used for Testing shall be provided during the Test. | | | | | | | | | |
| | | | | | | | | | |
| | **Signature** | | | **Signature & Seal** | | | | | |
| | **EMPLOYER ( QA&I DEPT.)** | | | **(VENDORS Q.C. DEPT. OR REPRESENTATIVE)** | | | | | |

## 13) (ii) STARTING SWITCH

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| - | | | | | ग्राहक (CLIENT): | - | - | - |
| | परियोजना (PROJECT) : | | | | विक्रेता (VENDOR): | | | |
| उपष्कर का नाम (NAME OF EQUIPMENT) : Starting Switch | | | | | एनआईटी/ क्रय आदेश संदर्भ( NIT / P.O. Reference) : | | | |

| Sl. No. | Item / Components & Characteristics | Nature of Checks | Quantum of Checks | Reference Document / Acceptance Norms | Record Format | Inspection Agency | | | Remarks |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Sub supplier | Supplier | Employer | |
| | **RAW MATERIAL** | | | | | | | | |
| **A** | **Aluminium casings (Pressurized with SF6 gas- If applicable)** | | | | | | | | |
| | Foundry parts under pressure | | | | | | | | |
| 1 | Pressure & Tightness test ("HP" punch) by supplier / Traceability markings | Mechanical | 100% | Supplier report | TC | P | RR | - | |
| | Corrided parts under pressure | | | | | | | | |
| 2 | Traceability markings | Mechanical | 100% | End of Manufacturing report | TC | P | RR | - | |
| | **BOUGHT OUT MATERIAL** | | | | | | | | |
| **B** | **Ceramic or composite insulator (pressurized with SF6 gas- If applicable)** | | | | | | | | |
| 1 | Pressure test by supplier ("P" punch) | Mechanical | 100% | Supplier report | TC | P | RR | - | |
| 2 | Bending test ("F" punch) | Mechanical | 100% | | TC | P | RR | - | |
| 3 | Visual examination / Dimensional check | Mechanical | 100% | | TC | P | RR | - | |
| | Only for composite insulator | | | | | | | | |
| 4 | Tightness test ("H" punch) | Mechanical | 100% | | TC | P | RR | - | |
| 5 | Partial discharge measurement ("D" punch) | Electrical test | 100% | | TC | P | RR | - | |
| **C** | **Insulated Rod** | | | | | | | | |
| | **By supplier** | | | | | | | | |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 1 | General aspect / Dimensional control / Tesile test ("T" punch) | Mechanical | 100% | Supplier report | TC | P | RR | - | |
| | **In factory** | | | | | | | | |
| 2 | Power frequency voltage withstand test ("D" punch) | Electrical test | 100% | | TC | P | RR | - | |
| 3 | Partial discharge measurement ("D" punch) | Electrical test | 100% | | TC | P | RR | - | |
| **D** | **Spring operating mechanism** | | | | | | | | |
| | **By supplier** | | | Supplier report | | | | | |
| 1 | Spring energy adjustments & Operational tests | Mechanical | 100% | | TC | P | RR | - | |
| 2 | Records of operating times (at rated, minimum and maximum voltage) | Mechanical | | | | | | | |
| | **In factory** | | | | | | | | |
| 3 | Test report verification | | 100% | | TC | P | RR | - | |
| 4 | Adjustments and conformity control versus electric diagram during routine tests | Mechanical | 100% | | TC | P | RR | - | |
| **E** | **LV control cubicle** | | | | | | | | |
| | **Auxiliary & Control Circuit** | | | | | | | | |
| 1 | HV Test | Electrical test | 100% | Supplier report | TC | P | RR | - | |
| 2 | Insulation Resistance Measurement | Electrical test | 100% | | TC | P | RR | - | |
| 3 | Scheme Check (Interlock & operational) | Electrical test | 100% | | TC | P | RR | - | |
| | **By supplier** | | | | | | | | |
| 1 | Conformity control versus electric diagram | Mechanical | 100% | | TC | P | RR | - | |
| | **In factory** | | | | | | | | |
| 2 | Adjustments and conformity control versus electric diagram during routine tests | Mechanical | 100% | | TC | P | RR | - | |
| | **Factory Acceptance tests** | | | | | | | | |
| **A** | **Drive mechanism test** | | | | | | | | |
| 1 | Voltage test of aux. circuits | Electrical test | 100% | Appd. Spec./ 'IS/ IEC/ equivalent or above' | JIR | P | W | W | CHP |
| 2 | Performance test of pilot valves | Mechanical | 100% | Appd. Spec./ 'IS/ IEC/ equivalent or above' | JIR | P | W | W | CHP |
| 3 | Mechanical operation test | Mechanical | 100% | do | JIR | P | W | W | CHP |
| 4 | Performance test of pump motor | Electrical test | 100% | do | JIR | P | W | W | CHP |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 5 | Adjustment control gate and check of overpressure relieve device | Mechanical | 100% | do | JIR | P | W | W | CHP |
| 6 | Check of auxiliary switch & position indicators | Electrical test | 100% | do | JIR | P | W | W | CHP |
| 7 | Leak test (spring travel without operation) | Mechanical | 100% | do | JIR | P | W | W | CHP |
| 8 | Pressure test | Mechanical | 100% | do | JIR | P | W | W | CHP |
| | Circuit breaker complete test | | | | | | | | |
| 1 | Identification of drive mechanism | Mechanical | 100% | Appd. Spec./ 'IS/ IEC/ equivalent or above' | JIR | P | W | W | CHP |
| **B** | **Mechanical operation test** | | | | | | | | |
| 1 | - at maximum control voltage and springs fully charged | Mechanical | 100% | Appd. Spec./'IS/ IEC/ equivalent or above' | JIR | P | W | W | CHP |
| 2 | - at minimum control voltage and springs in lockout condition | Mechanical | 100% | do | JIR | P | W | W | CHP |
| 3 | - at minimum control voltage and springs fully charged | Mechanical | 100% | do | JIR | P | W | W | CHP |
| 4 | - at rated control voltage and springs fully charged | Mechanical | 100% | do | JIR | P | W | W | CHP |
| 5 | - at rated control voltage and springs fully charged | Mechanical | 100% | do | JIR | P | W | W | CHP |
| 6 | Totally 50 operations | Mechanical | 100% | do | JIR | P | W | W | CHP |
| 7 | Drive operating sequence check | Mechanical | 100% | do | JIR | P | W | W | CHP |
| | | | | | | | | | |
| **C** | **Measurement of operating times at rated conditions** | | | | | | | | |
| 1 | Contacts to close | Mechanical | 100% | Appd. Spec./ 'IS/ IEC/ equivalent or above' | JIR | P | W | W | CHP |
| 2 | Contacts to open - trip circuit 1 | Mechanical | 100% | do | JIR | P | W | W | CHP |
| 3 | Contacts to open - trip circuit 2 | Mechanical | 100% | do | JIR | P | W | W | CHP |
| 4 | Close-open time | Mechanical | 100% | do | JIR | P | W | W | CHP |
| 5 | SF6-Gas tightness test loss rate | Mechanical | 100% | Appd. Spec./ 'IS/ IEC/ equivalent or above' | JIR | P | W | W | CHP |
| 6 | Resistance measurement of the main circuit | Electrical test | 100% | do | JIR | P | W | W | CHP |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 7 | Resistance measurements of operating coils and heater | Electrical test | 100% | Appd. Spec./ 'IS/ IEC/ equivalent or above' | JIR | P | W | W | CHP |
| 8 | Power frequency withstand voltage test to earth and across open contacts | Electrical test | 100% | Appd. Spec./'IS/ IEC/ equivalent or above' | JIR | P | W | W | CHP |
| | | | | | | | | | |
| **Note:** | | | | | | | | | |
| a. In 'Remarks' column following abbreviations shall be used - RR-Review of Records, TC - Test Certificate Submission, JIR - Joint Inspection Report & CHP - Customer Hold Point. | | | | | | | | | |
| b. Test Certificates shall be submitted at the time of final inspection. Valid calibration Certificate of Instruments used for Testing shall be provided during the Test. | | | | | | | | | |
| | | | | | | | | | |
| | **Signature** | | | **Signature & Seal** | | | | | |
| | **EMPLOYER ( QA&I DEPT.)** | | | **(VENDORS Q.C. DEPT. OR REPRESENTATIVE)** | | | | | |

## 14) EHV XLPE CABLE AND TERMINATION BUSHINGS

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **परियोजना (PROJECT) :** | | | | **ग्राहक (CLIENT):** | | | | | |
| **उपष्कर का नाम नाम (NAME OF EQUIPMENT) : EHV XLPE Cable** | | | | **विक्रेता (VENDOR):** | | | | | |
| | | | | **एनआईटी/ क्रय आदेश संदर्भ( NIT / P.O. Reference) :** | | | | | |
| | | | | | | | | | |
| **क्र. सं. S.N.** | **मद/घटक एवं विशेषता ITEM/ COMPONENT & CHARACTERISTICS** | **जाँच की प्रकृति NATURE OF CHECKS** | **जाँच की मात्रा QUANTUM OF CHECKS** | **संदर्भ दस्तावेज़ / स्वीकृति मानदंड REFERENCE DOCUMENT/ ACCEPTANCE NORMS** | **रेकॉर्ड फ़ारमैट RECORD FORMAT** | **निरीक्षण एजैंसी Inspecting Agency** | | | **टिप्पणी Remarks** |
| | | | | | | **प्रदर्शन PERFORM** | **गवाह WITNESS** | **सत्यापन VERIFY** | |
| **1** | **Raw Material** | | | | | | | | |
| 1.1 | Copper conductor | | | | | | | | |
| a) | Diameter | Measurement | 100% | Tech spec./ Appd Drg./ IS/IEC/Equivalent Standard | TC | 2/3 | - | 1 | TC |
| b) | Surface Condition & Conductivity | Visual/ Electrical | Sample | -do- | TC | 2/3 | - | 1 | TC |
| c) | Tensile strength (T.S) and Elongation at break( E.B.) | Mechanical | -do- | -do- | TC | 2/3 | - | 1 | TC |
| d) | Chemical Composition | Chemical | -do- | -do- | TC | 2/3 | - | 1 | TC |
| 1.2 | Insulating Paper (If Applicable) | | | | | | | | |
| a) | Thickness | Measurement | Sample | Tech spec./ Appd Drg./ IS/IEC/Equivalent Standard | TC | 2/3 | - | 1 | TC |
| b) | Tensile Strength | Mechanical | -do- | -do- | TC | 2/3 | - | 1 | TC |
| c) | Elongation | -do- | -do- | -do- | TC | 2/3 | - | 1 | TC |
| 1.3 | Internal & External Semiconductive shield | | | | | | | | |
| a) | Check of compound grade | Verification | Sample | Tech spec./ Appd Drg./ IS/IEC/Equivalent Standard | TC | 2/3 | - | 1 | TC |
| b) | Volume Resistivity | Electrical | -do- | -do- | TC | 2/3 | - | 1 | TC |
| c) | Specific gravity/ Density test | Physical | -do- | -do- | TC | 2/3 | - | 1 | TC |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 1.4 | XLPE Compound | | | | | | | | |
| a) | Tensile strength & Elongation | Mechanical | Sample | Tech spec./ Appd Drg./ IS/IEC/Equivalent Standard | TC | 2/3 | - | 1 | TC |
| b) | Permittivity | Electrical | -do- | -do- | TC | 2/3 | - | 1 | TC |
| c) | Dielectric loss angle (Tan delta) | Electrical | -do- | -do- | TC | 2/3 | - | 1 | TC |
| 1.5 | Aluminium Tape / Cu Tape | | | | | | | | |
| a) | Dimension | Measurement | Sample | Tech spec./ Appd Drg./ IS/IEC/Equivalent Standard | TC | 2/3 | - | 1 | TC |
| b) | resistivity | Electrical | -do- | -do- | TC | 2/3 | - | 1 | TC |
| c) | Chemical purity | Chemical | -do- | -do- | TC | 2/3 | - | 1 | TC |
| d) | TS & EB, Annealing test (Cu only) | Mechanical | -do- | -do- | TC | 2/3 | - | 1 | TC |
| 1.6 | Sheathing compound | | | | | | | | |
| a) | Check for compound Grade | Visual | Sample | Tech spec./ Appd Drg./ IS/IEC/Equivalent Standard | TC | 2/3 | - | 1 | TC |
| b) | Hardness Shore (If applicable) | Mechanical | -do- | -do- | TC | 2/3 | - | 1 | TC |
| c) | Tensile strength & Elongation, Ageing test | Physical | -do- | -do- | TC | 2/3 | - | 1 | TC |
| d) | Specific gravity/ Density test | Physical | -do- | -do- | TC | 2/3 | - | 1 | TC |
| e) | Oxygen Index and Temp index | Physical | -do- | -do- | TC | 2/3 | - | 1 | TC |
| f) | Melt Index test | Physical | -do- | -do- | TC | 2/3 | - | 1 | TC |
| 1.7 | Aluminium Wires (if applicable) | | | | | | | | |
| a) | Surface Condition | Visual | Sample | Tech spec./ Appd Drg./ IS/IEC/Equivalent Standard | TC | 2/3 | - | 1 | TC |
| b) | Mechanical Strength | Mechanical | -do- | -do- | TC | 2/3 | - | 1 | TC |
| c) | Elongation | Mechanical | -do- | -do- | TC | 2/3 | - | 1 | TC |
| d) | Diameter | Measurement | -do- | -do- | TC | 2/3 | - | 1 | TC |
| 1.8 | Semi Conductive/ Non semiconducting tape | | | | | | | | |
| a) | Dimension | Measurement | Sample | Tech spec./ Appd Drg./ IS/IEC/Equivalent Standard | TC | 2/3 | - | 1 | TC |
| b) | Swellable height and speed | Measurement | -do- | -do- | TC | 2/3 | - | 1 | TC |
| c) | Tensile Strength & Elongation | Mechanical | -do- | -do- | TC | 2/3 | - | 1 | TC |
| 1.9 | Online PD Monitoring System (If applicable) | Test | 100% | Tech spec./ Appd Drg./ IS/IEC/Equivalent Standard | TC | 2/3 | - | 1 | TC |
| 1.10 | Cable Support system (Fixure, hardware etc.) | Physical | 1 sample per lot/size | -do- | TC | 2/3 | - | 1 | TC |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 1.11 | MVW Spray & LHS cable (if applicable) | Test | -do- | -do- | TC | 2/3 | - | 1 | TC |
| **2** | **Electrical Type Test on Complete Cable Systems** | | | | | | | | |
| a) | Bending Test | Physical | 1 sample per lot/size | Tech spec./ Appd Drg./ IS/IEC/Equivalent Standard | TC | 2/3 | - | 1 | TC |
| b) | Tan Delta measurement | Electrical | -do- | -do- | TC | 2/3 | - | 1 | TC |
| c) | Heating Cycle Voltage Test | Thermal | -do- | -do- | TC | 2/3 | - | 1 | TC |
| d) | Partial Discharge Tests | Electrical | -do- | -do- | TC | 2/3 | - | 1 | TC |
| e) | Switching Impulse Voltage Test (Um ≥ 300kV) | -do- | -do- | -do- | TC | 2/3 | - | 1 | TC |
| f) | Lightning Impulse Voltage Test followed power frequency voltage test | -do- | -do- | -do- | TC | 2/3 | - | 1 | TC |
| g) | Tests for outer protections for joints | Physical | -do- | -do- | TC | 2/3 | - | 1 | TC |
| **3** | **Non-Electrical Type Test** | | | | | | | | |
| 3.1 | XLPE insulation and Sheath | | | | | | | | |
| a) | Thickness eccentricity of Insulation and Outer sheath | Measurement | Sample | Tech spec./ Appd Drg./ IS/IEC/Equivalent Standard | TC | 2/3 | - | 1 | TC |
| b) | Tensile & Elongation of XLPE and Outersheath (before & after ageing) | Mechanical | -do- | -do- | TC | 2/3 | - | 1 | TC |
| c) | Loss of mass test on PVC oversheaths of type ST2 | Physical | -do- | -do- | TC | 2/3 | - | 1 | TC |
| d) | Pressure test at high temperature on oversheaths | Physical | -do- | -do- | TC | 2/3 | - | 1 | TC |
| e) | Ageing Test | Physical | -do- | -do- | TC | 2/3 | - | 1 | TC |
| f) | Heat shock test for PVC oversheaths (ST1 and ST2) | Thermal | Sample | Tech spec./ Appd Drg./ IS/IEC/Equivalent Standard | TC | 2/3 | - | 1 | TC |
| g) | Hot set test for XLPE insulations | Thermal | -do- | -do- | TC | 2/3 | - | 1 | TC |
| h) | | | | | | | | | |
| | Measurement of carbon black content of black PE oversheaths (ST3 and ST7) | Physical | -do- | -do- | TC | 2/3 | - | 1 | TC |
| i) | Water penetration test | -do- | -do- | -do- | TC | 2/3 | - | 1 | TC |
| j) | Tests on components of cables with a longitudinally applied metal tape or foil, bonded to the oversheath | -do- | -do- | -do- | TC | 2/3 | - | 1 | TC |
| k) | Shrinkage test of Insulation & Outer Sheath | -do- | -do- | -do- | TC | 2/3 | - | 1 | TC |
| l) | Hot deformation of Outer sheath | Thermal | -do- | -do- | TC | 2/3 | - | 1 | TC |
| 3.2 | Armouring material | | | | | | | | |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| a) | Dimensions | Measurement | Sample | Tech spec./ Appd Drg./ IS/IEC/Equivalent Standard | TC | 2/3 | - | 1 | TC |
| b) | Tensile & Elongation | Mechanical | -do- | -do- | TC | 2/3 | - | 1 | TC |
| c) | Wrapping Test | Physical | -do- | -do- | TC | 2/3 | - | 1 | TC |
| d) | Resistivity Test | Physical | -do- | -do- | TC | 2/3 | - | 1 | TC |
| 3.3 | Metallic Screen | | | | | | | | |
| a) | Test for concentric copper wire | Electrical | Sample | Tech spec./ Appd Drg./ IS/IEC/Equivalent Standard | TC | 2/3 | - | 1 | TC |
| b) | Test for concentric copper tape | Measurement | -do- | -do- | TC | 2/3 | - | 1 | TC |
| c) | Semi-conducting Screen resistivity test | -do- | -do- | -do- | TC | 2/3 | - | 1 | TC |
| **4** | **Routine Tests** | | | | | | | | |
| a) | Conductor Resistance Test | Electrical | 100% Drum | Tech spec./ Appd Drg./ IS/IEC/Equivalent Standard | TC | 2/3 | - | 1 | TC |
| b) | High Voltage Test | -do- | -do- | -do- | TC | 2/3 | - | 1 | TC |
| c) | Partial discharge test | -do- | -do- | -do- | TC | 2/3 | - | 1 | TC |
| **5** | **Acceptance Test** | | | | | | | | |
| a) | Conductor Examination (no.of strands, lay direction, lay length, dimension) | Measurement | Sample | Tech spec./ Appd Drg./ IS/IEC/Equivalent Standard | JIR | 2/3 | 1 | - | CHP |
| b) | Electrical Resistance of Conductor and of Mettalic Sheath/Screen | Electrical | -do- | -do- | JIR | 2/3 | 1 | - | CHP |
| c) | Measurement of Thickness of Insulation and Oversheath | Measurement | -do- | -do- | JIR | 2/3 | 1 | - | CHP |
| d) | Measurement of Thickness of Metallic Sheath | -do- | -do- | -do- | JIR | 2/3 | 1 | - | CHP |
| e) | Measurement of Diameter of core and overall diameter of cable | -do- | -do- | -do- | JIR | 2/3 | 1 | - | CHP |
| f) | Hot Set Test and permanent set test for XLPE Insulations | Thermal | Sample | Tech spec./ Appd Drg./ IS/IEC/Equivalent Standard | JIR | 2/3 | 1 | - | CHP |
| g) | Measurement of Capacitance | -do- | -do- | -do- | JIR | 2/3 | 1 | - | CHP |
| h) | Specific gravity/ density test of Outer Sheath | Physical | -do- | -do- | JIR | 2/3 | 1 | - | CHP |
| i) | Lightning Impulse Voltage Test | Electrical | -do- | -do- | JIR | 2/3 | 1 | - | CHP |
| j) | Water Penetration Test | | | -do- | | | | | |
| k) | IR & HV Test | Electrical | -do- | -do- | JIR | 2/3 | 1 | - | CHP |
| l) | Partial discharge test | Electrical | -do- | -do- | JIR | 2/3 | 1 | - | CHP |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| m) | Test on components of cables with a longitudinally applied metal tape or foil, bonded to the oversheath | | -do- | -do- | JIR | 2/3 | 1 | - | CHP |
| n) | Void and contamination test | Measurement | -do- | -do- | JIR | 2/3 | 1 | - | CHP |
| **6** | **Additional test (As applicable)** | | | | | | | | |
| a) | HCL Gas Generation Test | Chem. | Sample | Tech spec./ Appd Drg./ IS/IEC/Equivalent Standard | JIR | 2/3 | 1 | - | CHP |
| b) | Oxygen Index Test | Thermal | -do- | -do- | JIR | 2/3 | 1 | - | CHP |
| c) | Temperature Index Test | -do- | -do- | -do- | JIR | 2/3 | 1 | - | CHP |
| d) | Smoke Density Test | -do- | -do- | -do- | JIR | 2/3 | 1 | - | CHP |
| e) | Flammability Test | Flam. | -do- | -do- | JIR | 2/3 | 1 | - | CHP |
| f) | Ladder Test | -do- | -do- | -do- | JIR | 2/3 | 1 | - | CHP |
| g) | Anti Rodent & Termite Test | Chem. | -do- | -do- | JIR | 2/3 | 1 | - | CHP |
| h) | Cold Impact test | Physical | -do- | -do- | JIR | 2/3 | 1 | - | CHP |
| **7** | **Check for Embossing & Colour Coding etc.** | Visual | -do- | -do- | JIR | 2/3 | 1 | - | CHP |
| **8** | **Packing, Marking & End Sealing** | | | | | | | | |
| a) | Marking on Cable Drum | Visual | Each Drum | Tech spec./ Appd Drg./ IS/IEC/Equivalent Standard | JIR | 2/3 | 1 | - | CHP |
| b) | End Sealing | -do- | -do- | -do- | JIR | 2/3 | 1 | - | CHP |
| **9** | **Oil Immersed Sealing End** | | | | | | | | |
| a) | Appearance & Dimensional Check. | Measurement/ Visual | 100% | Tech spec./ Appd Drg./ IS/IEC/Equivalent Standard | TC | 2/3 | - | 1 | TC |
| b) | Dielectric Tests. | Electrical | -do- | -do- | TC | 2/3 | - | 1 | TC |
| c) | Pressure Leak Test. | -do- | -do- | -do- | TC | 2/3 | - | 1 | TC |
| d) | Partial Discharge Test. | -do- | -do- | -do- | TC | 2/3 | - | 1 | TC |
| **10** | **SF6 Sealing End** | | | | | | | | |
| a) | Appearance & Dimensional check. | Measurement | 100% | Tech spec./ Appd Drg./ IS/IEC/Equivalent Standard | TC | 2/3 | - | 1 | TC |
| b) | Dielectric Tests. | Electrical | -do- | -do- | TC | 2/3 | - | 1 | TC |
| c) | Pressure Leak Test. | -do- | -do- | -do- | TC | 2/3 | - | 1 | TC |
| d) | Partial Discharge Test. | -do- | -do- | -do- | TC | 2/3 | - | 1 | TC |
| **11** | **Pothead Yard Sealing End (if applicable)** | | | | | | | | |
| a) | Appearance & Dimensional check. | Measurement | 100% | Tech spec./ Appd Drg./ IS/IEC/Equivalent Standard | TC | 2/3 | - | 1 | TC |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| b) | Dielectric Tests. | Electrical | -do- | -do- | TC | 2/3 | - | 1 | TC |
| c) | Pressure Leak Test. | -do- | -do- | -do- | TC | 2/3 | - | 1 | TC |
| d) | Partial Discharge Test. | -do- | -do- | -do- | TC | 2/3 | - | 1 | TC |
| **12** | **Joints** | | | | | | | | |
| a) | Appearance & Dimensional Check. | Measurement | 100% | Tech spec./ Appd Drg./ IS/IEC/Equivalent Standard | TC | 2/3 | - | 1 | TC |
| b) | Dielectric Tests. | Electrical | -do- | -do- | TC | 2/3 | - | 1 | TC |
| c) | Pressure Leak Test. | -do- | -do- | -do- | TC | 2/3 | - | 1 | TC |
| d) | Partial Discharge Test. | -do- | -do- | -do- | TC | 2/3 | - | 1 | TC |
| **Note:** | a. In 'Inspection Agency' column figure 1,2,or 3 to be filled. 1- will indicate 'Employer', 2- will indicate 'supplier' & 3- will indicate 'sub-supplier'. | | | | | | | | |
| | b. In 'Remarks' column following abbreviations shall be used - RR-Review of Records, T.C. - Test Certificate, JIR - Joint Inspection Report & CHP - Customer Hold Point, | | | | | | | | |
| | c. The firm shall obtain acceptance/clearance of finished product for further activities based on Test Certificates & Internal Report (IR) | | | | | | | | |
| | d. Any additional test required as per the requirement of equipment in accordance with Contract Agreement/Relevent standard apart from QAP will be carried out by the firm without any additional financial implication. | | | | | | | | |
| | e.This QAP does not absolve the Contractor/sub-contractor of his responsibility to supply the correct products, strictly in conformity to the specifications given in the purchase order/contract. The above Model QAP stipulates the bare minimum requirements which shall be complied by the contractor. The above QAP has been made presuming subletting of work shall be allowed in the tender. In case subletting of work is not allowed in the tender, then"3/2" shall be considered as "2" under the column " Perform" . | | | | | | | | |
| | f. The type test may not be mandatory if similar equipment has been type tested and test certificate(s) for relevant tests are accepted by the Employer | | | | | | | | |
| | | | | | | | | | |
| | **Signature** | | | | | **Signature & Seal** | | | |
| | **EMPLOYER (QA&I Deptt.)** | | | | | **(Vendors Q.C Dept or Representative)** | | | |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **कार्य स्थल गुणवत्ता योजना (FIELD QUALITY PLAN) :** | | | | | | | | | |
| **परियोजना (PROJECT) :** | | | | **ग्राहक (CLIENT):** | | | | | |
| **उपष्कर का नाम (NAME OF EQUIPMENT) : EHV XLPE Cable** | | | | **विक्रेता (VENDOR):** | | | | | |
| | | | | **एनआईटी/ क्रय आदेश संदर्भ( NIT / P.O. Reference) :** | | | | | |
| | | | | | | | | | |

| क्र. सं. S.N. | घटक की गतिविधि और संचालन ACTIVITY & OPERATION OF COMPONENT | जाँच की प्रकृति NATURE OF CHECKS | जाँच की मात्रा QUANTUM OF CHECKS | संदर्भ दस्तावेज़ / स्वीकृति मानदंड REFERENCE DOCUMENT/ ACCEPTANCE NORMS | रेकॉर्ड फ़ारमैट RECORD FORMAT | निरीक्षण एजैंसी Inspecting Agency | | | टिप्पणी Remarks |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | प्रदर्शन PERFORM | गवाह WITNESS | सत्यापन VERIFY | |
| **A)** | **General Checks** | | | | | | | | |
| a) | Visual Inspection | Visual | Sample | Tech spec./ Appd Drg./ IS/IEC/Equivalent Standard | TC/TR | 3/2 | 1 | - | TC/TR |
| b) | Check fire detection/protection circuit | Electrical | -do- | -do- | TC/TR | 3/2 | 1 | - | TC/TR |
| **B)** | **XLPE Cable** | | | | | | | | |
| a) | Continuity Test | Electrical | Sample | Tech spec./ Appd Drg./ IS/IEC/Equivalent Standard | TC/TR | 3/2 | 1 | - | TC/TR |
| b) | Conductor Resistance checking. | -do- | -do- | -do- | TC/TR | 3/2 | 1 | - | TC/TR |
| c) | DC Voltage test of the oversheath | -do- | -do- | -do- | TC/TR | 3/2 | 1 | - | TC/TR |
| d) | Dielectric Test | -do- | -do- | -do- | TC/TR | 3/2 | 1 | - | TC/TR |
| e) | Insulation resistance measurement. | -do- | -do- | -do- | TC/TR | 3/2 | 1 | - | TC/TR |
| f) | Verification of phase order. | -do- | -do- | -do- | TC/TR | 3/2 | 1 | - | TC/TR |
| Note : | a. In 'Inspection Agency'column figure 1,2,or 3 to be filled. 1- will indicate Representative of Engineer-in-charge, 2- will indicate 'Contractor' & 3- will indicate 'Sub-contractor'. | | | | | | | | |
| | b. In 'Remarks' column following abbreviations shall be used - TC/TR - Test Certificate/Test Report | | | | | | | | |
| | c.The above FQP stipulates the bare minimum requirements which shall be complied by the contractor. The above FQP has been made presuming subletting of work shall be allowed in the tender. In case subletting of work is not allowed in the tender, then"3/2" shall be considered as "2" under the column " Perform" . | | | | | | | | |
| | d. Any additional acitivity/ test required as per the requirement of equipment in accordance with Contract Agreement/Relevent standard apart from FQP will be carried out by the firm without any additional financial implication. | | | | | | | | |
| | e. The contractor shall furnish the details of test method to the Engineer-in-Charge for approval in the time line as specified in contract agreement | | | | | | | | |
| | f. All the Test in FQP shall be witnessed by Engineer-in-charge or his representative at site. | | | | | | | | |
| | | | | | | | | | |
| | **Signature** | | | | | **Signature & Seal** | | | |
| | **Engineer-in-charge** | | | | | **(Vendors Q.C Dept or Representative)** | | | |

| | | | | |
|---|---|---|---|---|
| **परियोजना (PROJECT) :** | **ग्राहक (CLIENT):** | | | |
| **उपष्कर का नाम (NAME OF EQUIPMENT) : Bushing** | **विक्रेता (VENDOR):** | | | |

| | | | | | एनआईटी/ क्रय आदेश संदर्भ( NIT / P.O. Reference) : | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | |
| क्रम स. (SR. NO.) | मद/घटक एवं विशेषता ITEM /COMPONENTS & CHARACTERISTICS | जाँच की प्रकृति NATURE OF CHECKS | जाँच की मात्रा QUANTUM OF CHECKS | संदर्भ दस्तावेज / स्वीकृति मानदंड REFERENCE ACCEPTANCE DOCUMENTS NORMS | रिकॉर्ड फॉर्मेट RECORD FORMAT | निरीक्षण एजेंसी INSP. AGENCY | | | टिपण्णी REMARKS |
| | | | | | | प्रदर्शन Perform | गवाह Witness | सत्यापन Verify | |
| **1** | **Raw Material & Bought-out Items** | | | | | | | | |
| **1.1** | **Conductor** | | | | | | | | |
| a) | Dimension | Measurement | 100% | Tech spec./ Appd Drg./ IS/IEC/Equivalent Standard | TC | 3/2 | - | 1 | TC |
| b) | Mechanical Properties | Mechanical | Sample | -do- | TC | 3/2 | - | 1 | TC |
| c) | Chemical Composition (incl. Al Percent.) | Chemical | -do- | -do- | TC | 3/2 | - | 1 | TC |
| d) | Conductivity | Electrical | -do- | -do- | TC | 3/2 | - | 1 | TC |
| **1.2** | **Condenser Tissue Paper** | | | | | | | | |
| | Visual, Dimensions, PH Value, Density, Dielectric Strength, Mineral Ash Content, Chloride Content, & Dielectric Loss Angle. | Test | One Sample per lot | Tech spec./ Appd Drg./ IS/IEC/Equivalent Standard | TC | 2/3 | - | 1 | TC |
| **1.3** | **Porcelain Housing** | | | | | | | | |
| a) | Dimension | Measurement | 100% | Tech spec./ Appd Drg./ IS/IEC/Equivalent Standard | TC | 2/3 | - | 1 | TC |
| b) | Physical properties | Visual | -do- | -do- | TC | 2/3 | - | 1 | TC |
| c) | Routine Test | -do- | 100% | -do- | TC | 2/3 | - | 1 | TC |
| **1.4** | **Terminal Assembly** | | | | | | | | |
| a) | Dimension / Fitment | Measurement | -do- | -do- | TC | 2/3 | - | 1 | TC |
| b) | Physical (Galvanising or Tinning) | Chemical | -do- | -do- | TC | 2/3 | - | 1 | TC |
| **1.5** | **Mounting Structure ( Steel, Plates etc.), if any** | | | | | | | | |
| a) | Physical Properties (Ultimate Strength,Yield Stress,% Elongation & Bend Test) | Mechanical | Sample | Tech spec./ Appd Drg./ IS/IEC/Equivalent Standard | TC | 2/3 | - | 1 | TC |
| b) | Chemical Composition | Chemical | -do- | -do- | TC | 2/3 | - | 1 | TC |
| **2** | **IN PROCESS INSPECTION** | | | | | | | | |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| (a) | Visual & Dimensional | Visual & Measurement | 100% | Tech spec./ Appd Drg./ IS/IEC/Equivalent Standard | TC | 2/3 | - | 1 | TC |
| b) | Electrical Routine Test | Electrical | -do- | -do- | TC | 2/3 | - | 1 | TC |
| **3** | **FINAL INSPECTION** | | | | | | | | |
| **3.1** | **Type Test** | | | | | | | | |
| a) | long duration power-frequency voltage withstand test | Electrical | one unit | Tech spec./ Appd Drg./ IS/IEC/Equivalent Standard | TC | 3/2 | - | 1 | TC |
| b) | Dry lightning impulse voltage withstand test | -do- | -do- | -do- | TC | 3/2 | - | 1 | TC |
| c) | Dry or wet switching impulse voltage withstand test | -do- | -do- | -do- | TC | 3/2 | - | 1 | TC |
| d) | Electromagnetic compatibility | -do- | -do- | -do- | TC | 3/2 | - | 1 | TC |
| e) | Verification of thermal short-time current withstand | -do- | -do- | -do- | TC | 3/2 | - | 1 | TC |
| f) | Temperature rise test | -do- | -do- | -do- | TC | 3/2 | - | 1 | TC |
| g) | Cantilever load withstand test | Physical | -do- | -do- | TC | 3/2 | - | 1 | TC |
| h) | Tightness test on liquid-filled, compound-filled and liquid-insulated bushings | -do- | -do- | -do- | TC | 3/2 | - | 1 | TC |
| i) | Internal pressure test on gas-filled, gas-insulated and gas-impregnated bushings | -do- | -do- | -do- | TC | 3/2 | - | 1 | TC |
| j) | External pressure test on partly or completely gas-immersed bushings | -do- | -do- | -do- | TC | 3/2 | - | 1 | TC |
| k) | Verification of dimensions | Measurement | -do- | -do- | TC | 3/2 | - | 1 | TC |
| **3.2** | **Routine Test** | | | | | | | | |
| a) | Measurement of dielectric dissipation factor (tan $\delta$ ) and capacitance at ambient temperature | Electrical | Sample | Tech spec./ Appd Drg./ IS/IEC/Equivalent Standard | JIR | 3/2 | 1 | - | CHP |
| b) | Dry lightning impulse voltage withstand test | -do- | -do- | -do- | JIR | 3/2 | 1 | - | CHP |
| c) | Dry power-frequency voltage withstand test | -do- | -do- | -do- | JIR | 3/2 | 1 | - | CHP |
| d) | Measurement of partial discharge quantity | -do- | -do- | -do- | JIR | 3/2 | 1 | - | CHP |
| e) | Tests of tap insulation | -do- | -do- | -do- | JIR | 3/2 | 1 | - | CHP |
| f) | Internal pressure test of gas-filled, gas-insulated and gas-impregnated bushings | Measurement | -do- | -do- | JIR | 3/2 | 1 | - | CHP |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| g) | Tightness test on liquid-filled, compound-filled and liquid-insulated bushings | Physical | -do- | -do- | JIR | 3/2 | 1 | - | CHP |
| h) | Tightness test on gas-filled, gas-insulated and gas-impregnated bushings | -do- | -do- | -do- | JIR | 3/2 | 1 | - | CHP |
| i) | Tightness test at the flange or other fixing device | -do- | -do- | -do- | JIR | 3/2 | 1 | - | CHP |
| j) | Visual inspection and dimensional check | Visual & Measurement | -do- | -do- | JIR | 3/2 | 1 | - | CHP |
| **3.3** | **Special tests** | | | | | | | | |
| a) | Seismic test | Test | one unit | Tech spec./ Appd Drg./ IS/IEC/Equivalent Standard | JIR | 3/2 | 1 | - | CHP |
| Note: | a. In 'Inspection Agency' column figure 1,2,or 3 to be filled. 1- will indicate 'Employer', 2- will indicate 'supplier' & 3- will indicate 'sub-supplier'. | | | | | | | | |
| | b. In 'Remarks' column following abbreviations shall be used - RR-Review of Records, T.C. - Test Certificate, JIR - Joint Inspection Report & CHP - Customer Hold Point, | | | | | | | | |
| | c. The firm shall obtain acceptance/clearance of finished product for further activities based on Test Certificates & Internal Report (IR) | | | | | | | | |
| | d. Any additional test required as per the requirement of equipment in accordance with Contract Agreement/Relevent standard apart from QAP will be carried out by the firm without any additional financial implication. | | | | | | | | |
| | e.This QAP does not absolve the Contractor/sub-contractor of his responsibility to supply the correct products, strictly in conformity to the specifications given in the purchase order/contract. The above Model QAP stipulates the bare minimum requirements which shall be complied by the contractor. The above QAP has been made presuming subletting of work shall be allowed in the tender. In case subletting of work is not allowed in the tender, then"3/2" shall be considered as "2" under the column " Perform" . | | | | | | | | |
| | f. The type test may not be mandatory if similar equipment has been type tested and test certificate(s) for relevant tests are accepted by the Employer | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | **Signature** | | | | | **Signature & Seal** | | | |
| | **EMPLOYER (QA&I DEPT.)** | | | | **(VENDORS Q.C. DEPT. OR REPRESENTATIVE)** | | | | |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **कार्य स्थल गुणवत्ता योजना (FIELD QUALITY PLAN) :** | | | | | | | | | |
| **परियोजना (PROJECT) :** | | | | **ग्राहक (CLIENT):** | | | | | |
| **उपष्कर का नाम (NAME OF EQUIPMENT) : Bushing** | | | | **विक्रेता (VENDOR):** | | | | | |
| | | | | **एनआईटी/ क्रय आदेश संदर्भ( NIT / P.O. Reference) :** | | | | | |
| | | | | | | | | | |

| क्र. सं.<br>S.N. | घटक की गतिविधि और संचालन<br>ACTIVITY & OPERATION OF COMPONENT | जाँच की प्रकृति<br>NATURE OF CHECKS | जाँच की मात्रा<br>QUANTUM OF CHECKS | संदर्भ दस्तावेज़ / स्वीकृति मानदंड<br>REFERENCE DOCUMENT/ ACCEPTANCE NORMS | रेकॉर्ड फ़ारमैट<br>RECORD FORMAT | निरीक्षण एजैंसी<br>Inspecting Agency | | | टिप्पणी<br>Remarks |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | प्रदर्शन<br>PERFORM | गवाह<br>WITNESS | सत्यापन<br>VERIFY | |
| **A)** | **General Checks** | | | | | | | | |
| a) | Equipment should be free from dirt/dust/rust/foreign material etc. | Visual | 100% | Tech spec./ Appd Drg./ IS/IEC/Equivalent Standard | TC/TR | 2/3 | 1 | - | TC/TR |
| b) | All nut and bolts should be tightened correctly as per specified torque | -do- | -do- | -do- | TC/TR | 2/3 | 1 | - | TC/TR |
| c) | Leveling and alignment of structure and base frame should be checked | -do- | -do- | -do- | TC/TR | 2/3 | 1 | - | TC/TR |
| d) | Earthing and wiring connection should be completed | -do- | -do- | -do- | TC/TR | 2/3 | 1 | - | TC/TR |
| e) | All trenches should be cleaned and covered | -do- | -do- | -do- | TC/TR | 2/3 | 1 | - | TC/TR |
| f) | Tan delta measurement | -do- | -do- | -do- | TC/TR | 3/2 | 1 | - | TC/TR |
| Note: | a. In 'Inspection Agency'column figure 1,2,or 3 to be filled. 1- will indicate Representative of Engineer-in-charge, 2- will indicate 'Contractor' & 3- will indicate 'Sub-contractor'. | | | | | | | | |
| | b. In 'Remarks' column following abbreviations shall be used - TC/TR - Test Certificate/Test Report | | | | | | | | |
| | c.The above FQP stipulates the bare minimum requirements which shall be complied by the contractor. The above FQP has been made presuming subletting of work shall be allowed in the tender. In case subletting of work is not allowed in the tender, then"3/2" shall be considered as "2" under the column " Perform" . | | | | | | | | |
| | d. Any additional acitivity/ test required as per the requirement of equipment in accordance with Contract Agreement/Relevent standard apart from FQP will be carried out by the firm without any additional financial implication. | | | | | | | | |
| | e. The contractor shall furnish the details of test method to the Engineer-in-Charge for approval in the time line as specified in contract agreement | | | | | | | | |
| | f. All the Test in FQP shall be witnessed by Engineer-in-charge or his representative at site. | | | | | | | | |
| | | | | | | | | | |
| | **Signature** | | | | | **Signatue & Seal** | | | |
| | **Engineer-in-charge** | | | | | **(Vendors Q.C Dept or Representative)** | | | |

# ANNEXURE C

# MODEL QUALITY ASSURANCE PLAN (MQAP) FOR MAJOR EQUIPMENT IN THERMAL POWER PLANT

# QUALITY ASSURANCE PLAN

## 1.1 QUALITY ASSURANCE PROGRAMME

All materials, components and equipment covered under the scope of supply shall be procured, manufactured, erected and tested at all stages as per the comprehensive Quality Assurance (QA) programme. The QA document indicating the specific inspection and testing requirements to be followed shall be subject to the approval of the purchaser. The contractor shall submit his quality assurance programme for review by purchaser and shall generally cover the following:

i) Organizational structure for management and implementation of the proposed Quality Assurance programme.

ii) Quality system manual.

iii) Documentation control system.

iv) Qualification and experience data of contractor's key personnel.

v) The procedure for procurement of materials, parts, components and equipment.

vi) Procedure for inspection at source, inspection of incoming raw-materials/ parts/ components & verification of materials purchased.

vii) Procedure for selection of sub-vendors and sub- contractors.

viii) System for shop manufacturing including process controls, fabrication and assembly controls, and procedure for product identification & traceability.

ix) System for inspection and testing during manufacture, processing, fabrication, welding, assembly and other activities.

x) The reference documents, plant standards, acceptance norms, test and inspection procedure etc.

xi) Control of calibration and testing of measuring and testing equipment.

xii) System for quality audits, documentation to indicate conformance or non-conformance of the product to the specification and testing and inspection requirements; review and control of non- conforming items and system for corrective actions.

xiii) System for indication and appraisal of inspection status.

xiv) System for authorizing release of manufactured product to the purchaser.

xv) System for packaging, handling, transportation, storage and delivery.

xvi) System for generation and maintenance of inspection and test records.

xvii) All the accepted non-conformance reports (major/ minor) / deviation including complete technical details/ repair procedure.

xviii) Inspection reports duly signed by the Utilities and contractor for the agreed Customer Hold Points.

xix) Certificate of Conformance (CoC) wherever applicable.

xx) Inspection release note (IRN).

## TECHNICAL REQUIREMENTS FOR QUALITY PLAN

### 1.2 STEAM GENERATOR AND AUXILIARIES

Testing and inspection requirements of major equipment over and above the respective code/standard requirements are given hereunder:

#### 1.2.1 Pressure Parts

Only those materials shall be used in the manufacture of pressure parts which can be identified against mill sheet or manufacturer test certificates. Material shall meet all the mandatory requirements (and supplementary checks, if asked for) of specified specification, Indian Boiler Regulations (IBR), and relevant code/standard. All nondestructive testing as detailed against relevant equipment shall meet the requirement of ASTM section 3 Vol. 3.03 or equivalent BIS standard.

#### 1.2.1.1 Drum / Water Separator / Storage Tank

i) Each plate shall be subjected to a 100 % normal ultrasonic at the mill to meet the minimum requirements of BS: 5996 grade LC3/EN 10160:1999/ASTM or equivalent standards. Elevated temperature tensile tests shall also be carried out on plate material for each heat.

ii) After cutting to size and removal of cut outs, the plates shall be subjected to magnetic particle examination (MPE) along the edges of the plate and on areas adjacent to the cutouts.

iii) All forged connections shall be examined by 100% ultrasonic testing (UT) before machining.

iv) Fully machined connecting pieces of internal diameter 100mm and above, except for forgings, shall be subjected to magnetic particle examination / liquid penetrant examination.

v) Mechanical tests shall be carried out on specimens prepared from the production control test plates of the longitudinal welds.

vi) Mechanical tests shall be conducted on the specimens from manhole cutouts of dished ends.

vii) All butt welds shall be subjected to 100% UT/RT/PAUT+TOFD after stress relieving.

viii) On completion of welding, the entire drum / Separator / Storage Tank shall be subjected to stress relievingin the furnace.

ix) All butt welds shall be subjected to 100% UT/RT/PAUT+TOFD test and magnetic particle examination before stress relieving.

x) All full penetration nozzle welds and Lifting lug welds shall be subjected to

ultrasonic examination before stress relief.

xi) After stress relieving (SR) all welds, internal and external shall be examined by MPI methods depending on size and accessibility and all butt welds shall be subjected to 100% radiography.

xii) Complete drum / Separator/ storage tank/ Mixing Sphere etc. shall be subjected to hydraulic pressure test and all compensatingpads shall be pneumatically tested.

xiii) All connecting tubes & pipes shall be subjected to UT prior to fabrication as per BS 3602 or equivalent with longitudinal calibration notch of depth 5% of wall thickness (0.3 mm min. and 1.5 mm max.)

xiv) PT shall be carried out in inaccessible areas where MPI cannot be performed.

xv) Forged components of water separator shall be tested as per applicable forging ASME code and IBR.

**1.2.1.2 Headers**

i) Raw material for headers shall be subjected to UT prior to fabrication. Transverse test on headers (greater than 8") from one end (25% of lot). Flattening test on pipe from one end (25% of lot).

ii) Butt welds in Carbon steel and low alloy steel shall be subjected to RT/PAUT+TOFD before stress relieving except for P91/92 and X20 grade material. P91/92 and X20 grade shall be subjected to MPE + RT /PAUT+TOFD after stress relieving.

iii) Full penetration nozzle welds of carbon and low alloy steels shall be subjected to UT before PWHT . However, UT shall be carried out Gr 91/92 on full penetration welds after PWHT. All attachment welds shall be subjected to MPI/DPT.

iv) All nozzles, branches, stubs and load bearing attachment shall be examined by MPE/ PT techniques after the toes of the weld have been ground smooth and stress relieved.

v) Non-load bearing welds shall be examined by MPE/PT techniques after the toes of the welds have been ground smooth and stress relieved.

vi) Completed closed end headers shall be subjected to hydraulic pressure tests and all compensating pads shall be pneumatically tested as per IBR.

vii) All weld joints in alloy steel headers of P 91, X20 and X22 & other material of P15E group and above shall be checked for Hardness. 3% hardness check shall be carried out on welds of other alloy steel Headers.

viii) Boroscopy examination shall be carried out for those header which will be interconnected with other headers by welding.

ix) PT shall be carried out in inaccessible areas where MPI cannot be performed.

**1.2.1.3 Tubes and tube elements**

i) Raw material for tubes for water wall, superheater, reheater, economiser, riser, supply and connecting tubes including nozzle/stubs, connections for drum, headers, pipe work etc., shall be subjected to 100% UT prior to fabrication as per IBR or ASME E 213 or EN10246:7 1996 or equivalent with the longitudinal calibration notch of depth 5% of wall thickness (0.3mm minimum and 1.5mm maximum).

ii) All bent tubes, stubs shall be checked for ovality and thinning by ultrasonic method on first off lot and random checks on subsequent pieces. Critical bends, where PWHT is required after bending, shall be subjected to LPI/MPI. For FOT area reduction shall be calculated

iii) All tubes, stubs, panels, coils shall be checked for clearance by steel ball test and for cleanliness by sponge passage.

iv) Finished butt welds shall be subjected to RT or UT. Wherever the code/standard/process specifies random sampling, the same shall be minimum 20%. Finished field butt welds not covered under random sampling for RT/UT, shall be subjected to RT or PAUT.
Minimum 10 % of the fillet welds (including fins if any) shall be subjected to MPE or dye penetration test (DPT). However, fillet welds of material grades P15E and above or any other new material grade shall be subjected to 100% MPI / LPI.

v) After erection tubes and fabricated panels, coils shall be subjected to hydraulic pressure test excluding loose tubes but including water wall panel, burner panels, reheaters, superheaters and economizers.
However, Hydro test shall be carried out at Shop on 100% of the coils, SOFA Panels, Burner panels. For other panels, hydro test at shop shall be 100% for tube thickness ≤ 5.5mm; 20% for thickness > 5.5 mm and < 7 mm; NIL if thickness ≥ 7 mm.

vi) 10% hardness survey on butt welds of P15E material group and above. 10% Hardness checks shall also be carried out on welds of T23 material grade. 3% Hardness checks shall also be carried out on welds of T22 material grade used in water wall panels.

vii) In case of RT of tube welds with DWDI (elliptical view ) number of exposure shall be as per relevant code / plant standard and will not be less than two exposures for each weld wherever there is no limitation in carrying out two RT shots.

viii) In case of spiral water wall design, trial assembly of complete wall of each side including hopper shall be carried out.

ix) Austenitic Stainless-Steel tubes & coils shall be Solution Heat Treated, Stored, preserved and handled so as to avoid Stress Corrosion Cracking due to Chloride contamination.

**1.2.1.4 Integral piping**

i) All raw materials used shall have co-related mill test certificate meeting material specification. All pipe lengths shall be subjected to 100 % ultrasonic examination as per ASME E213 or BS 3602 or equivalent, with longitudinal calibration notch of

depth 5% of wall thickness (0.3mm minimum and 1.5mm maximum) or hydraulic tests and UT or RT on longitudinal welds at the tube mill.

ii) All mother pipes shall be subjected to 100% UT prior to fabrication as per ASMEE 213 or equivalent with longitudinal calibration notch of depth 5% of wall thickness (0.3mm minimum and 1.5mm maximum).

iii) All cold bent pipes shall be checked for ovality and thinning by UT on first off lot and on random samples for subsequent pieces. Outer surface of hot/ induction bent pipes shall be subjected to MPE.

iv) The edge preparation for shop and site welds in stainless steel and alloy steel shall be subjected to dye penetration check. Non-destructive examination ofwelds shall be carried out after post weld heat treatment, if any.

v) All butt welds shall be subjected to UT or RT and MPE/PT. For weld on alloy steel piping, UT or RT shall be done after stress relieving. Wherever the code/ standard/ process specifies random sampling, the same shall be minimum 20 %.

vi) All butt welds in alloy steel piping of P91, X20 and X 22 shall be checked for RT or UT and MPE after stress relieving (SR). UT shall be of digital recordable type.

ix) All weld joints in alloy steel piping of P 91, X20 and X22 shall be checked for hardness. For preheating and post weld heat treatment (PWHT) induction heating shall be deployed. However, PWHT can be done in furnace also. 3% hardness check shall be carried out on welds of other alloy steel piping.

x) All load-bearing attachment welds shall be subjected to MPE after stress relieving.

xi) For HP piping, non-destructive examination of welds shall be carried out in accordance with the relevant design/manufacturing codes. However, apart from above, the following requirements shall be met. Further statutory requirement, wherever applicable shall also be complied with the following:

a) Temperature > $400^0$C and/ or pressure exceeding 71 bar

- 100% RT or UT on butt welds and full penetration branch welds.
- 100% MPE.

b) Temperature > $175^0$C up to $400^0$C and/or pressure exceeding 17 bar and up to 71 bar

- 100% RT or UT on butt welds and full penetration branch welds for pipe diameter more than 100NB.
- 10% RT or UT on butt welds and full penetration branch welds for pipe diameter up to 100NB.
- 100% MPE.

c) All other pipes not covered above shall be subjected to 100% MPE or DPT in

case of underground pipes and 10% MPE or DPT in case of piping above the ground. Further, 10% of butt welds of underground piping shall be subjected to RT.

Wherever SR/PWHT is envisaged for alloy steel, above NDTs shall be before SR/PWHT except for Gr.91 /92 NDT shall be after PWHT.

1.2.1.5 **Fittings**:

i) Raw material of all forged fitting shall be ultrasonically tested. All mother pipes used for formed fitting shall be ultrasonically tested as per ASME 213 or BS 3602 or equivalent with longitudinal calibration notch of depth 5% of wall thickness (0.3mm min. and 1.5mm max.) shall be adhered to.

ii) Fittings shall be subjected to suitable NDT as per applicable standards. However following minimum NDE requirement shall also be applicable / met.

a) For fittings X20, P-91, P-92 and material group P15E & above
- 100% MPI/ PT &
- 10% hardness check &
- For fittings of 200 NB & above 100% UT/RT

b) 100% UT/RT for fittings of 200 NB & above for boiler feed discharge, recirculation and spray piping of boiler feed system.

c) 100% UT/RT for fittings of all other piping of size OD 508mm & above.

**1.2.1.6 Valves**

i) Pressure retaining parts of valves shall be subjected to NDT as per Table 1.

ii) Hardened and stellitted valve disc and seat shall be subjected to DPT andhardness check.

iii) All forgings rounds above diameter 40 mm shall be ultrasonically tested.

iv) NDT requirements for pressure retaining components of valves shall be as per Table 1 below.

v) Color matching of valve disc/plug and seat shall be carried out to ensure minimum 80% contact and no through passage. UT / RT of full penetration welds & MPE/ DPT of fillet joints (in case of cast valves).

vi) Hydraulic pressure test and seat leak test shall be carried out as per ASME / ANSI 16.34 or IBR.

vii) Air seat leak test shall be carried out as per applicable standards or codes.

viii) Functional tests shall be carried out on each valve to check the following as per the approved valve data sheet

a. Smooth operation.
b. Valve travel, closing and opening time.
c. Current drawn by actuators.

ix) Springs for safety valves shall be tested with suitable NDT and for springstiffness rate.

x) Safety relief valves shall be tested for performance. Lift set pressure, back pressure, reset pressure test in case of safety relief valves.

All critical valve components shall be tested for mechanical and chemical properties.

**Table 1: NDT requirements for pressure retaining components of valves**

| **Valve size NB in mm** | **ANSI Class up to 300** | **ANSI Class above 300 up to 600** | **ANSI Class above 600 below 900** | **ANSI Class 900 and above but below 4500** |
|---|---|---|---|---|
| Less than 50 | Visual | Visual | Visual | MPE / DPT |
| 50 & above but below 100 | Visual | Visual | MPE/DPT(for special class valves) | MPE/DPT and RT on 100% of valves area as per ANSI/ASME B16.34 |
| 100 & above but less than 300 | Visual | MPE/DPT | MPE/DPT and RTon 10% of valves on change of section and weld ends | MPE/DPT and RT on 100% of valves area as per ANSI/ASME B16.34 |
| 300 and above | MPE/DPT | MPE/DPT | MPE/DPT and RT on change ofsections and weld ends | MPE/DPT and RT on 100% of valves area as per ANSI/ASME B16.34 |

Note:

i) For body and bonnet forgings, UT with MPE may be adopted in place of RT. For Austenitic steel MPI may be replaced with LPI.

### 1.2.1.7 Non pressure bearing attachments

Load bearing welds shall be subjected to UT and MPE after stress relieving. Non load bearing welds shall be subjected to MPE after stress relief. The toes of the welds adjoining the drum shall be ground smooth prior to stress relieving before carrying out this examination. LPI shall be carried out in inaccessible areas where MPI cannot be performed

### 1.2.1.8 Hydraulic test

i) The drum and all components which are to be subjected to fluid pressure shall be tested to minimum of 150% of the design pressure. The duration of the pressure tests shall be sufficient, as approved by the purchaser, to show any leakage paths and to permit a thorough examination of the component whilst under pressure.

ii) The temperature of the fluid used for the pressure test shall be such as to avoid any possibility of brittle fracture at a low temperature and the same shall be modified and submitted to the purchaser for approval, before commencing the test.

iii) The fluid used shall be of a sufficient purity and where relevant, suitable inhibits shall be used to avoid excessive corrosion and /or damage to temporary parts either during the test or prior to drying and cleaning.

**1.2.1.9 Pneumatic test of compensating pads**

All compensating pads shall be provided with two-threaded weep holes to test welds at 0.5 $kg/cm^2$ (g) with soap solution and no leakage shall be ensured.

**1.2.2 Boiler water circulation pumps**

i) Raw material for casing, shaft and impeller shall be checked for high temperature physical properties, apart from mandatory and supplementarycheck of material specification.

ii) All forging and castings shall be subjected to 100% UT or RT and MPE orDPT check.

iii) Static and dynamic balancing of the rotary parts shall be carried out.

iv) Hydraulic pressure test shall be conducted on pump casing at minimum 1.5times the design pressure.

v) Each pump shall be subjected to performance test at the manufacturer's worksunder as near actual site conditions as possible.

vi) Following test shall be carried out on assembled units:

A) Type test:
   a) NPSH test
   b) Temperature rises test.
   c) Under voltage test.
   d) Quality assurance proof test.
   e) Tests to establish unit functioning of pump at operating temperatureand pressure.
   f) Hot standstill and start up tests.

Note :- Type test if already done on the same model will not be repeated. Documents will be submitted for review and approval of the purchaser.

B) Routine test:

a) Hydrostatic test of complete unit.

b) Over speed test.

c) Tests to determine unit characteristics.

d) Pump performance.

e) Unit run at rated voltage.

f) Starting current at rated voltage.

g) Cold start up test.

h) Endurance test of motor windings, joints and terminal seals

i) Noise level.

j) Inspection of dismantled unit.

k) High voltage test.

vii) For heat exchanger for these pumps, butt welds on pressure parts shall be tested with RT or UT and all other welds shall be tested with MPE or DPT.

viii) Hydraulic test shall be carried out both on tube side as well as shell side at minimum 1.5 times the design pressure.

**1.2.3 Air Preheaters, Steam Coil Air Pre-Heater and Fuel Oil Heaters**

**1.2.3.1 Air Preheaters**

i) Forged shafts for air preheater like stub shaft, main rotor forging, housing hub shall be subjected to 100% UT at mill and magnetic particle examination after machining.

ii) For non-modular design, trial assembly shall be carried out at shop prior to dispatch to site.

iii) Critical welds of rotor post shall be subjected to radiographic examination.

iv) Trial run of air preheater rotor drive assembly with gear box, pinion, motor at shop.

**1.2.3.2 Steam coil air pre-heater and fuel oil heaters**

Hydraulic pressure test shall be carried out on the heating coils. All pipes, valves, steam traps and mountings shall be subjected to hydraulic test as called for under IBR, BS or other approved codes.

**1.2.4 Soot Blowers**

i) Butt weld between nozzle and lance tube shall be subjected to 20 % MPI/ LPI.

ii) Hydraulic test shall be carried out on valve body.

iii) Soot blower shall be subjected to operational checks as below:

a) Smooth operation
b) Long tube travel, closing and opening time.
c) Current drawn.

### 1.2.5 ID, FD and PA fans

i) Rotor components shall be subjected to ultrasonic test at mill and magneticparticle examination/dye penetration examination after rough machining.

ii) Butt welds in rotor components shall be subjected to 100% UT and all welds shall be subjected to MPE or DPT after stress relieving.

iii) All rotating components of fans shall be dynamically balanced to quality grade 2.5 of ISO 1940.

iv) Test for natural frequency of all fan components, including fan blades shall be carried out for the fans.

v) Full range performance test shall be carried out on one fan of each type and size as per BSEN ISO 5801 or equivalent standard.

vi) Dimensional and profile checking of fan blades

vii) Hydraulic coupling of ID fan shall be checked for string test i.e. operational check of one fan assembly using hydraulic coupling to check temperature rise, smooth operation, vibration and noise level. Dry run test shall preferably be carried out during string test.

viii) Seal air Fan / Scanner air fans

(a) Rotor components i.e. shaft and hub shall be subjected to ultrasonic test at mill and magnetic particle examination after rough machining.

(b) 10% of Butt and fillet welds both in rotor and static components of the fan shall be subjected to MPI / DPT after stress relieving.

(c) Fan impeller shall be balanced dynamically to quality grade 2.5 of ISO 1940.

(d) All Fans performance test shall be carried out at the manufacturer's works under as near actual site conditions as possible.

### 1.2.6 Coal Mills, Pulverised Coal Piping and Burners

i) Raw material for shaft, coupling, gears and pinions, top and bottom races and other rotating components shall be subjected to UT. MPE or DPT shall be carried out to check surface soundness.

ii) Wear-resistant parts shall be subjected to UT or RT to check soundness after suitable heat treatment. Check for chemical composition and hardness shall be carried out. For ceramic materials check for various properties including hardness, density, wear rate and composition shall be carried out.

iii) Butt welds in the tube/ separator /body casing of the mill shall be tested by UT / RT and MPI/LPI. All other welds in main tube/separator shall be tested by MPI/LPI for acceptance. The tube shall be statically balanced.

iv) All gearboxes shall be run tested for adequate duration to check rise in oil temperature, noise level and vibration. Check for leak tightness of gear case also shall be performed.

v) Fabricated pipe welds shall be examined by MPE/LPI.

vi) Ceramic/ basalt lined piping and bends etc. shall be checked for proper layout.

vii) Weldments on burner components shall be checked with suitable NDT. The burner assembles shall be tested for operation at shop.

viii) Trial assembly of at least one mill complete with all major components at shop.

ix) All rotating components shall be dynamically balanced.

**1.2.7 Coal Feeders**

i) All welds in the casing and pulley fabrication shall be checked with MPE/PT.

ii) Type tests including degree of protection and routine tests shall be done as per relevant Indian Standards or equivalent International Standards.

iii) All major items like plates for casings, head pulley, tail pulley, pulley shaft and major castings shall be procured with respective material test certificates.

iv) Explosion proof test at 50 psi as per NFPA code shall be done as type test. Leak tightness test shall be done on individual feeder casing. Endurance test for load cell shall be carried out.

v) Test for weighing accuracy, calibration and repeatability shall be carried out at various speeds by coal flow on one feeder.

vi) Calibration check shall be carried out on all feeder cabinet and assemblies prior to dispatch.

**1.2.8 Boiler structure, ducts, hoppers, dampers etc.**

i) Only those materials which have been identified against mill sheet or test certificates shall be used for construction. Structural steel and built up plate girders for main boiler shall be fully killed fine grained and normalised. All plates of tension and compression flanges and connection material and plates above 40mm thickness shall be 100% ultrasonically tested.

ii) Visual inspection of all welds shall be performed in accordance with AWS D.1.1. Also the butt and fillet welds for built up plate girders shall be inspected 100% by magnetic particle examination.

iii) RT or UT shall be performed on all butt welds of thickness 32mm and above. For thickness below 32mm and up to 25mm, 100% MPE shall be carried out along with 10% RT/UT and for thickness below 25mm 10% MPE or DPT shall be performed. Edge preparations for field welding shall be examined by MPE for plate thickness 32mm and above. Field welds ends in ceiling girder shall be subjected to Ultrasonic examination for 100mm depth from the edges. All fillet welds of built up plate girders shall be inspected 100% by MPI.

iv) Ceiling girders, columns, ducts hoppers and tunnels shall be trial assembled and match marked prior to dispatch/erection. At least two consecutive girders along with cross member shall be assembled at a time. Production test coupons for Butt and Fillet welds of main columns and Ceiling girders shall be carried out.

v) Drum sling rods

a) Sling rods forging shall be subjected to ultrasonic examination.

b) Welds shall be examined by UT before stress relief and MPE after stress relief.

c) Trial fitment of the rods with the drum shell shall be carried out to ensure proper contact.

d) Screw thread of the rods shall be suitably protected to avoid damage during handling and transport.

x) Dampers

a) All the dampers shall be subjected to operational test/checks.

b) Gas tight dampers shall be subjected to shop leakage test to demonstrate the guaranteed tightness (minimum one damper of each type and sizeoffered). In case such type test is already done, the reports of the same shallbe submitted for review.

c) All dampers shall be checked for sealing dimensions to establish guaranteed tightness.

### 1.2.9 Electro- Static Precipitators (ESPs)

#### 1.2.9.1 Discharge and collecting electrodes

i) Work tests for discharge electrodes shall include the following (for the wire type electrodes):

a) Chemical and tensile tests.

b) Metallographic examination-longitudinal and transverse (250X)

c) Surface finish and surface purity from chloride ions.

d) Spring back and surface finish after coiling (applicable to helical discharge electrodes

For all other type of electrodes, testing to be carried out as per the applicable standards.

ii) Work tests for collecting electrodes and rigid discharges electrode shall includethe following:

a) Chemical and mechanical properties.

b) Check for profile and straightness.

c) Check for surface finish and dimensional accuracy.

d) Cupping test for deep drawn sheets as per IS 513.

**1.2.9.2 ESP structure**

i) All plates above 40mm thickness shall be 100% ultrasonically tested.

ii) Visual inspection of all welds shall be performed in accordance with AWS D1.1.

iii) Also the butt and fillet welds for built up plates and columns shall be inspected by 100% MPI.

iv) NDT requirements of structural steel welds shall be as under:-

a) 100% RT/UT on butt-welds of plate thickness $\geq$ 32 mm.

b) For plates of 25mm < thickness < 32mm - 10% RT/UT and 100% MPI.

c) For plates of thickness < 25mm - 10% MPI/LPI.

d) All fillet welds of structural members shall be inspected 100% by MPI.

v) Edge preparation for field welding shall be examined by MPI for thickness $\geq$ 32mm.

## 1.3 STEAM TURBINE GENERATOR AND AUXILIARIES

Testing and inspection requirement of major equipment over and above therequirements of respective codes/standards are given hereunder:

### 1.3.1 Steam Turbine

#### 1.3.1.1 High pressure (HP) and intermediate pressure (IP) enclosures

The following shall be applicable to high pressure cast steel enclosures (for example high pressure and intermediate pressure inner and outer cylinders, steam chests and liners, steam inlet pipes, nozzle boxes):

i) Test pieces fully representative of the material and condition of the casting shall be provided to the purchaser to enable the determination of the properties of material to be used. Casting suppliers should have established practices to ensure requirements of creep and rupture for long exposure of the component/ equipment to high temperatures and pressures. In case of new or non-established vendors, creep data shall be made available by the contractor.

ii) Tests shall be carried out on the casting material to establish its mechanical properties, chemical composition, and microstructure.

iii) Each casting shall be subjected to magnetic particle examination on the entire inner and outer surfaces after heat treatment.

iv) Each casting shall be subjected to visual examination and dimensional check before taking up the machining work on it. Dimensional check shall be carriedout after machining also.

v) Each casting shall be subjected to a 100% examination for internal flaws by UTor RT method after heat treatment and suitable preparation.

vi) Cast enclosure shall be subjected to a hydraulic pressure test based on established practice of manufacturer.

vii) Excavated area of all the defects shall be subjected to MPE to ensure excavation up to sound area. All the areas repaired/ upgraded by welding shall be examined by UT, RT (to confirm findings of UT wherever required) and MPE. Sketches/ reports of location of repair and reports of NDT carried out on repaired areasshall be submitted along with certificates. Hardness survey shall be carried out on the repaired areas.

viii) Where stub pipes and transition pieces are welded to the main body of anenclosure the following shall be carried out:

a) RT and MPE or DPT of weld preparations.

b) MPE of finished welds after stress relieving.

c) RT or UT of finished welds.

d) 100% RT or UT and MPE of site weld preparations on the stub pipes and transition pieces before dispatch to site.

e) Hardness survey on the weld joint, heat affected zone (HAZ) and parent material.

ix) Wall thickness measurement for critical and highly stressed zones of the casting shall be carried out by ultrasonic method.

x) Colour matching of castings by putting two halves together and feeler gauge tightness check from both sides, i.e. inside and outside to ensure required contact

area and joint tightness shall be carried out.

xi) Final dimensional check before dispatching should be carried out. Suitable arrangement should be taken care to avoid any distortion during transit/ transportation.

**1.3.1.2 Low pressure (LP) enclosure (fabricated)**

i) Tests shall be carried out on the plate material to establish its mechanical properties and chemical composition.

ii) Plates used for fabrication shall be subject to 100% UT.

iii) Where welds are made by chipping and grinding back to the first side weld before completing the weld from second side, a magnetic particle or dye penetrant examination of the chipped area shall be carried out.

iv) Fabricated enclosure shall be subjected to stress relieving as per manufacturer's standard practice.

v) Dimensional check shall be carried out on the fabricated enclosure.

vi) The following minimum requirements shall be met for NDT on the welds:

| | | | |
|---|---|---|---|
| a) | Butt welds & full penetration welds | : | 10% RT or UT and 10% MPE or DPT (100%) |
| b) | Fillet welds | : | 10% MPE or DPT (100%) |
| c) | Nozzle welds | : | 10% MPE or DPT (100%) |
| d) | Lifting lug and other load bearing fillet welds | : | 100% MPE or DPT |
| e) | Site weld edge preparations | : | 10% MPE or DPT |

vii) Fabricated enclosure shall be subject to hydraulic pressure tests. If it is not the manufacturer’s practice, the justification for not carrying out hydraulic test shall be furnished for purchaser’s approval.

viii) Feeler gauge tightness check from inside and outside to ensure required joint tightness shall be carried out.

ix) Suitable arrangement should be taken care to avoid any distortion during transit/ transportation.

**1.3.1.3 Turbine rotors**

**1.3.1.3.1 Forgings**

Rotor forgings (mono block and/ or discs), impulse wheel and nozzle box and coupling forgings:

i) Fully representative tangential, radial and axial test pieces shall be provided at each end of the body, at each shaft end and from the trepanned core (when a coreis

trepanned) to determine mechanical properties including impact, Brinell hardness etc. and tests for notch toughness (both transition temperature and room temperature impact values ).

ii) Forging supplier should have established practices to ensure requirements of creep and rupture for long exposure of the component to high temperatures and pressures.

iii) Heat treatment shall be carried out in such a way so as to ensure minimum residual stress in the rotor. Residual stress measurement will be carried out.

iv) Tests shall be carried out on the forging material to establish its mechanical properties, chemical composition and micro structure.

v) Thermal stability tests shall be carried out on HP and IP rotor forgings to ensure the thermal stability of the rotors in service and at over speed.

vi) Each forging shall be subjected to a 100% ultrasonic examination. Normal probes and angular probes with different probe angles shall be used for thorough examination to ensure complete soundness of the forging

vii) Each rotor shall be subjected to a 100% MPE after final machining on journal areas and before gashing on other areas.

viii) When a rotor forging is bored, a visual check and magnetic particle examination of the bore shall be carried out.

ix) Following tests shall be carried out on the rotor welds:

- Ultrasonic examination with normal and angular probes of the weld to ensure complete coverage and freedom from harmful defects.
- Run out of rotor before and after welding.
- MPE on finish welds.
- Hardness survey on the welds.
- Stress relieve annealing.
- Test reports of filler material used.
- Dimensional record of weld preparation.

x) Dimensional examination of the rotor blade grooves and other important dimensions shall be carried out to ensure the conformance to drawing dimensions and log sheets/records shall be prepared for all important dimensions.

**1.3.1.3.2 Complete rotors**

i) Axial & radial run-outs and surface finish checks shall be carried out before and after blading and after over speed tests. Run out examination shall be carried out at blade shrouds also.

ii) Check shall be carried out for clearance between rotor groove and blade at the root.

iii) Rotors shall be dynamically balanced at rated speed.

iv) An over speed test shall be carried out during which the rotor shall withstand an over speed of 120% for five continuous minutes or 125% for two continuous minutes. If bidder's practice is different from that stated above, then the same shall be furnished for purchaser's approval. During over speed test, vibration measurement and analysis shall also be carried out.

v) After blading and again after over speed testing, rotor stages with blades over 225 mm of active length are to be subject to standing vibration tests to determine natural frequencies in various vibration modes to ensure that the ranges are outside operating frequencies.

vi) In case impulse stage and or blade discs are fitted on the rotor, fit up between such disc and rotor shall be checked up before and after over speed test.

vii) Lock blade lift after the over speed test shall be checked and record for same shall be maintained.

**1.3.1.4 Stator and rotor blades and shroud bands**

i) Fully representative test pieces shall be provided to enable mechanical properties of the material to be determined. In case of blades machined from bar stock, mechanical tests shall be carried out on the hardest and softest specimens of each heat treatment batch. Hardness test will be carried out on 100% basis.

ii) Tests shall be carried out on the materials to establish its mechanical properties, chemical composition and micro structure. Creep requirement as per relevant standard.

iii) Each bar stock for machining blades and forging shall be subjected to 100% ultrasonic examination.

iv) When erosion shielded, the erosion shield and blade joint shall be radiographed. In case of flame & laser hardening MPI shall be done.

v) Dye penetrant test shall be made on the erosion shield and blade joint in manufacture prior to fitting to the wheel and after over speed tests.

vi) Magnetic particle examination or dye penetrant test (when MPE is not applicable) shall be carried out on finish machined blade profile, roots and shrouds.

vii) All moving blades of over 225mm active length are to be moment weighed and assembled on shaft in a prescribed sequence to ensure optimum balancing of rotor.

viii) Natural frequencies of the LP turbine blades shall be determined before mounting on rotors to ensure that the same are outside operating frequency range.

ix) Shroud bands after punching and after riveting shall be subjected to 100% DPT to ensure freedom from harmful surface defects.

x) In case of cast blades, following testing shall be done:

a) Chemical analysis and mechanical testing per heat/heat treatment batch.

b) MPE on rough machined and finish machined blade.

c) RT/UT on blades.

d) Before starting mass productions, following technological tests shall be carried out on the first lot of 10 to 15 blades:

- 100% RT and 100% MPE on blades
- 100% hardness testing.
- Mechanical testing and metallurgical testing.
- Weld repair shall not be permitted.

**1.3.1.5 Diaphragms**

i) Welded and fabricated diaphragms

- Concentricity checks shall be carried out on final machined diaphragms to ensure that there are no negative overlaps between guide and moving blades.

- 10% UT and 100% MPE shall be carried out on finished, stress relieved and machined welds. For inaccessible areas, DPT shall be carried out in place of MPE.

ii) Cast, forged and machined diaphragms

a) Tests shall be conducted to determine mechanical properties together with chemical analysis, metallographic/ metallurgical examination, and required heat treatment.
b) Concentricity, flatness, blade drop and area checks shall be carried out on finally machined diaphragms to ensure that there are no negative overlaps between guide and moving blades and port wall.
c) 100% ultrasonic examination shall be carried out on diaphragm materials. Blade junction areas with the side walls shall be checked by MPE or DPT.

iii) Colour matching of all the diaphragms by putting two halves together and feeler gauge tightness check shall be carried out.

**1.3.1.6 Exhaust hood**

All castings shall be subjected to chemical and mechanical tests as per relevant material

standards. In case of fabricated construction of exhaust hood, butt welds shall be subjected to 10% RT and 100% DPT. Exhaust hood shall be pressure tested. No repair of welding shall be carried out on cast iron castings. Blue matching shall be carried out on exhaust hood parting planes.

**1.3.1.7 Stop, control and bypass valves, actuators/ servo-motors and steam strainers**

i) Test pieces shall be provided to enable the determination of mechanical properties of valve bodies, bonnets, valve disc and seat, and valve spindle. Casting suppliers should have established practices to ensure requirements of creep and rupture for long exposure of the component/ equipment to high temperatures and pressures.

ii) Tests shall be carried out on the materials to establish their mechanical properties, and chemical compositions.

iii) Dye penetrant tests shall be carried out on stellited and nitrided areas of components and on stellite components in the finish ground or honed condition.

iv) Hardness check shall be carried out to ensure required hardness.

v) Valve body and bonnet castings or forgings shall be subjected to 100% RT or 100% UT. Body and bonnet shall also be subjected to 100% MPE on entire surface.

vi) All pressure containing welds in body and bonnet shall be subjected to 100% RT or UT and 100% MPE.

vii) Wall thickness of the body and bonnet after finish machining shall be measured by ultrasonic method and valve seat bore shall be checked for size and concentricity.

viii) Dimensions of valve spindle shall be measured and valve lift shall be checked.

ix) Bar stock of 40 mm and above size for valve stem shall be subjected to UT, and finish machined stem shall be subjected to MPE or DPT.

x) Each valve body and bonnet shall be hydraulically tested at minimum 1.5 times the maximum working pressure after applying temperature corrections for minimum 30 minutes.

xi) All the actuating cylinders and servomotors shall be performance tested.

xii) Performance testing shall be carried out on valve operators and actuators to check functional requirements like trip closing and opening time, valve lift and hysterisis.

xiii) Colour matching of the valve disc and seat to ensure the required contact area is to be carried out.

**1.3.1.8 Cast and forged steel components** (such as LP casing- in case of cast design, inlet, extraction and exhaust connections, shaft seal covers and rings, governor shaft, breach nut, threaded ring, angle ring, U-ring, servomotor parts such as body, piston, cover, yokes; turning gear casing and other items which are not specifically covered elsewhere)

i) Results of tests conducted to determine mechanical properties, chemical analysis, metallurgical/ metallographic examination, and heat treatment procedures recommended and actually followed shall be recorded on certificates.

ii) Each pressure containing enclosure shall be subjected to a hydraulic pressure test at 1.5 times the design pressure and after applying temperature corrections.

iii) All castings and forgings shall be subject to suitable non-destructive examination by RT or UT and MPE or DPT methods to ensure freedom from harmful defects in line with clause 1.3.1.1.

**1.3.1.9 Bolts and nuts for pressure retaining enclosures and rotor couplings**

i) Bar stock for bolts shall be subject to 100% UT (having more than 40mm dia.).

ii) Finish machined bolts shall be subject to preferably 100% MPE to detect surface defects. However, DPT can also be done in place of MPE.

iii) Coupling bolts and nuts shall be suitably identified after weight control checks.

**1.3.1.10 Governing and protection system equipment** (such as electro-hydraulic controller, hydraulic amplifier, hydraulic controller, electro hydraulic convertors, hydraulic convertors, hydraulic speed governor, trip devices etc.)

i) All pressure retaining parts shall be subjected to hydraulic testing.

ii) All the major castings and forgings shall be subjected to suitable NDT methods depending upon their application and criticality to ensure the freedom from harmful defects.

iii) All the main assemblies and sub-assemblies shall be subjected to functional test.

iv) All butt welds shall be subjected to minimum 10% RT or UT and all fillet and corner welds shall be subjected to MPE or DPT.

v) All control equipment shall be subjected to rig testing, if it is not possible to test it on the steam turbine light run. The purpose of rig testing shall be as far as practical to prove that the functioning of the control equipment is in accordance with the approved design.

vi) Nitrided and stellited components shall be subject to DPT and hardness check.

**1.3.1.11 Inspection of completed turbine**

i) HP, IP and LP turbines

The steam turbine shall be assembled in the manufacturer's works to such an extent that a thorough inspection can be carried out. The purpose of this inspection shall be to ensure that the fit between mating components is correct and that all clearances are in accordance with the design requirement. The following minimum checks/

measurements shall be carried out on the assembled turbine:

a) Check and measurement of clearance between shaft seal casing and shaft seal ring.

b) Check and measurement of clearance in anti- rotational device in shaft seal casing joint.

c) Check and measurement of axial and radial alignments of inner and outer casings.

d) Check and measurement for radial and axial blade clearances in blading section.

e) Check and measurement for axial and radial clearances in shaft seal.

f) Check and measurement for tightness and elongation of horizontal joint inner casing bolts.

g) Check and measurement of minimum axial clearances and minimum radial clearances in completely assembled steam turbine.

h) Check for alignment of over speed governor.

i) Check for axial distances for shroud bands for casings.

j) No load running test on the steam turbine including functional tests for steam turbine control and emergency control equipment (as per manufacturer's practice).

k) Pre- dispatch inspections including clearance check for transportation device.

ii) LP Turbines

For the LP turbine, the following minimum checks/ measurements shall be carried out on the assembled turbine at the manufacturer's works, as per manufacturer's standards:

a) Check and measurement of axial and radial alignments of inner and outer casings.

b) Check and measurement for radial and axial blade clearance in blading section.

c) Check and measurement of minimum axial clearances and minimum radial clearances in completely assembled steam turbine.

d) Check and measurement for alignment of stationary blade carriers.

e) No load running test on the steam turbine including functional tests for steam turbine control and emergency control equipment.

f) Pre- dispatch inspections including clearance check for transportationdevice.

iii) No load running tests on complete steam turbine shall be carried out as per manufacturer's standard practice.

**1.3.2 Integral Auxiliaries of Steam Turbine**

**1.3.2.1 Bearing pedestals, housings and bearings**

i) Leakage test shall be conducted on pedestals. For fabricated pedestals and housing, 10% weld shall be checked after stress relieving by magnetic particle test and minimum 10% of the butt welds shall be checked by RT or UT.

ii) Bearing shell

a) The shell shall be subjected to suitable nondestructive examination like RT or UT and/or MPE as applicable.

b) Colour matching of the shell by putting two halves together and feeler gauge tightness checks from inside and outside to ensure required contact area and joint tightness shall be carried out.

c) The shell shall be subjected to hydraulic pressure test.

d) Chemical analysis of white metal shall be carried out. The effectiveness of the white metal adhesion shall be checked by UT or other approved method, and the exposed edges of the white metal shall be subject to DPT.

e) Hydraulic test shall be carried out for bearing oil inlet piping and jacking oil piping.

f) Alignment check shall be made for bearing in bearing pedestal.

**1.3.2.2 Cross around pipes**

i) Weld edge preparation of shop and site welds shall be checked by 100% MPE/DPT.

ii) All butt welds shall be subjected to 100% RT/UT.

iii) 100% MPE shall be carried out on all welds.

iv) Check for dimensions and visual inspection shall be carried out on finished pipes.

**1.3.2.3 Lubricating oil, jacking oil and control oil systems**

i) Pumps

a) Main oil pump shaft shall be subjected to ultrasonic examination. Butt welds shall be subjected to RT or UT.

b) Pump impeller shall be subjected to suitable NDT method like MPE or DPT for surface defect examination. Impeller of main oil pumps shall also be subjected to an over speed test at 120% of rated speed for 5 minutes (as per the guidelines followed for HP Rotor)

c) Pump casing shall be subjected to hydraulic pressure test at 2 times the working pressure or 1.5 times the pump shut off head whichever is higher.

d) Rotor assemblies shall be dynamically balanced.

e) All pumps shall be performance tested at the manufacturer's works. Test shall include check for vibration and noise levels also.

ii) Coolers and lubricating oil tanks

a) All raw materials used shall have co-related mill test certificate meeting mandatory and supplementary checks of material specification.

b) Material for tube plates shall be ultrasonically tested. Drilled tube plates shall be checked for ovality of holes, ligaments, surface finish etc.

c) Dished ends shall be subjected to 100% MPE and RT or UT on welded joints. Knuckle portion shall be checked by MPE for surface defects and thinning shall be checked by UT.

d) Butt welds and full penetration welds shall be checked by suitable RT or UT. Fillet welds shall be checked by MPE or DPT.

e) Tubes shall be tested as per the relevant codes or standards.

f) Before tubes expansion in the tube sheets, the mockup test for expansions shall be carried out, in case not done earlier. Torque setting of expander shall be based on mock up tests. Joints shall be checked for tube thinning.

g) Completed assemblies shall be pressure tested. The twin oil coolers shall be tested on both tube side and shell side. After hydro test, the coolers shall be suitably dried.

h) Atmospheric tanks shall be tested for leakage by water fill test for at least 12 hrs.

iii) Oil purifiers

a) All pressure parts shall be subjected to hydraulic pressure test.

b) Components/ parts of the equipment shall be subjected to suitable NDT

depending upon the criticality of the application to ensure freedom from surface and sub-surface defects.

c) All rotating parts like bowl assembly etc. shall be subjected to static and dynamic balancing test.

d) The complete purifier shall be tested at manufacturer's works for capacity, mechanical running, sequential operation and interlocks, moisture content, vapour tightness, vibration, noise level, quality improvements etc. Sample shall be drawn from inlet and outlet of purifier after works test and shall be tested for moisture content, chemical tests and particle size of impurities. In case, type test has already been carried out by the contractor for the offered model of the oil purifier, the test shall not be repeated and certificates of test carried out earlier shall be furnished for review of the purchaser.

**1.3.3 Steam Condenser**

**1.3.3.1 Condenser**

i) Tests shall be carried out on the materials of plates, tubes and nozzles etc. to establish their mechanical properties, and chemical compositions.

ii) Plates shall be subject to 100% ultrasonic testing.

iii) Tubes shall be subject to dimensional check, 100% eddy current test and 100% hydraulic test. In place of hydraulic test, air under water or Helium leak detection test can also be carried out.

iv) Forgings of the nozzles shall be subject to 100% UT and 100% MPE.

v) All welds shall be visually examined. Radiographic examination or Ultrasonic testing of 10% of butt welds (including T-joints) shall be carried out. However, for vacuum containing welds, RT or UT on at least 10% of each butt weld shall be carried out. Surface defect examination by MPE or equivalent test method shall be carried out for minimum 10% weldments. Nozzle welds shall be subject to 100% MPE or DPT. These shall apply to site welds also.

vi) All edge preparations shall be examined for surface defects. Edge preparation for welds to be carried out at site shall be checked by magnetic particle examination or DP method before dispatch.

xi) In case of fabricated flanges, welds shall be checked by 100% RT or UT and 100% MPE to ensure freedom from internal and surface defects.

xii) To ensure dimensional control of condenser, parts/ sub-assemblies shall be trial assembled at shop. Trial insertion of a few tubes through main tube plates and support plates shall be carried out to ensure alignment of tube plates and proper fitting and matching of parts and sub-assemblies.

xiii) Dimensional check including tube hole diameter, ligament pitch etc. shall be carried out.

xiv) Mock-up test for tube to tube sheet expansion shall be carried out. In case such a test is already conducted for similar tube/ tube sheet thickness and materials, record for the same shall be furnished for purchaser's review and approval.

xv) Tube to tube sheet weld joints shall be subject to 100% DP test.

xvi) Water fill test on shell side of condenser shall be carried out. No leakage shall be permitted.

xvii) Water fill test of standpipe, Flash tank etc. shall be carried out. No leakage shall be permitted.

xviii) Hydraulic test of tube side of condenser shall be carried out. No leakage shall be permitted.

xix) All compensating pads (RF pads) shall be pneumatically tested.

**1.3.3.2 Spring assembly**

i) Static load testing of the springs shall be carried out and spring characteristics shall be drawn and verified.

ii) Surface defect test shall be carried out on all the springs after coiling and heat treatment.

**1.3.3.3 Condenser air evacuation system**

i) Vacuum pumps

a) Tests shall be carried out on the materials of Head, Body, Rotor/Impeller, Shaft and Bearing Housing etc. to establish their mechanical properties, and chemical compositions.

b) Vacuum pump shafts shall be subject to ultrasonic test. After finish machining, shaft shall be subject to 100% MPE or DPT.

c) Pump casings and impellers shall be subject to MPE or DPT. Finished pump rotor shall be subject to dynamic balancing.

d) Pump casings shall be subjected to hydraulic test at 1.5 times the shut off pressure or twice the maximum operating pressure, whichever is higher.

e) The heat exchangers shall be tested on both tube side and shell side. After hydro test, the heat exchangers shall be suitably dried.

f) Each pump shall be tested at supplier's works at full speed and load conditions to demonstrate successful operation and performance in accordance with the design requirements. Visual cavitation test shall also be carried out to demonstrate that pump shall be operating under all operating condition including blank off condition without any cavitation.

ii) The complete package shall be subjected to hydraulic pressure and leakage test and shop tested to check interlocks and functional requirements. The one complete unit shall also be subjected to demonstrate successful operation and performance testing, with saturated air conditions at condenser design vacuum point as well as vacuum pump design point with total minimum three points. The test shall be conducted with the respective motors to be supplied. The test shall include check for vibration and noise level also.

**1.3.3.4 Air cooled condensers for main turbine and drive turbine**

i) Fabrication of condenser and accessories

a) All welds shall be visually examined. Radiographic examination of 10% of butt welds shall be carried out. However, for vacuum containing welds, R.T on at least 10% of each butt weld shall be carried out. Surface defect examination by magnetic particle inspection or equivalent test method shall be carried out for minimum 10% weldments. This shall apply to site welds also.

b) All edge preparations shall be examined for surface defects. Edge preparation for welds to be carried out at site shall be checked by magnetic particle inspection/Dye penetrant examination method before despatch.

c) In case of fabricated flanges, welds shall be checked by 100% radiographic/ultrasonic and 100% magnetic particle inspection methods to ensure freedom from internal and surface defects.

ii) Fan

a) Ultrasonic Test shall be carried out on shaft material diameter ≥ 40 mm.

b) Fan hub and fan blade shall be tested as per relevant material code requirement and shall be tested for internal defects as per relevant code.

c) Moment weight test on blades, blade track variation, tip clearance shall be checked.

d) In case of fabrication of hub and blades by welding, the weld joint shall be tested by RT.

e) Assembly fit up and balancing shall be checked.

iii) Gear box

a) Gear box shall be tested as per relevant standard for performance, noise, vibration etc.

b) Gear box shall be tested for no load run test for 4 hours.

iv) Motor: The respective specification covered elsewhere is to be referred.

v) Piping

a) All piping joint shall be tested for 10% RT/UT. IBR code regulations 1950 shall be ensured for IBR piping and relevant original IBR certificates shall be furnished.

vi) Tubes

a) Condenser tubes/finned tubes shall be tested as per the requirements of relevant codes and standards.

**1.3.4 Feed water heaters, drain coolers, gland steam condenser and deaerator**

**1.3.4.1 Heaters, drain coolers and gland steam condensers**

i) Tests shall be carried out on the materials of forgings, plates and tubes etc. to establish their mechanical properties, and chemical compositions.

ii) Plates shall be subject to 100% ultrasonic testing.

iii) Nozzle forgings shall be subject to suitable heat treatment and 100% ultrasonic testing and 100% MPE.

iv) Tubes (U-tubes)

a) a) Tubes shall be subject to dimensional check including U-bending (bend radius & Mockup), Check for flatness, Min. thickness at minimum radius of bend for each thickness

b) 100% eddy current test shall be carried out for tube thickness < 3.6 mm and 100% UT for tube thickness ≥ 3.6 mm, 100% DPT on bend areas.

c) Tubes shall be subject to 100% hydraulic test.

d) Heat treatment after cold bending, U- bend thickness check, Hardness after bending check.

e) Check for Residual Chloride contamination on inside & outside of the tube.

f) Flattening and flaring tests, IGC (Practice-E), microstructure, residual stress measurement shall also be carried out for the tubes as per applicable codes.

g) Before tubes expansion in the tube sheets, the mockup test for expansions shall be carried out. Torque setting of expander shall be based on mock up tests. Joints shall be checked for tube thinning. Also, tube to tube sheet welding qualification tests (mock up) to check leak path.

v) Tube sheets

a) Tube sheets shall be subject to visual examination and dimensional check.

b) Impact test shall be carried out for the plate materials. Mechanical Properties of heat treated test coupon.

c) 100% UT and 100% DP test shall be carried out after overlay and machining. In case overlay is not applicable, only 100% UT shall be carried out.

d) For cladded plates, bonding shall be checked by UT. Drilled tube plates shall be checked for ovality of holes, ligaments, surface finish etc.

e) Tube to tube sheet weld joints shall be subject to 100% DP test. These joints shall also be subject to air test.

vi) Shell, dished ends and hemi heads

a) Impact test shall be carried out for the plate materials.

b) 100% UT shall be carried out on the finished and formed dished ends and hemi heads.

c) Dished ends shall be subject to dimensional check after dishing.

d) Knuckle portion shall be checked by 100% MPE or DPT for surface defects and check for thinning shall be carried out by UT.

e) Testing of production test coupons as applicable.

vii) Welding

a) Root run of butt welds shall be examined by 100% DPT or MPE.

b) Butt welded and full penetration joints and nozzle welds shall be checked by 100% RT or UT and 100% MPE or DPT.

c) Fillet welds shall be checked by 100% MPE or DPT.

e) All weldments shall be given suitable heat treatment.

f) Dished ends shall be subjected to 100% MPI and RT/UT on welded joint.

viii) Visual check and dimensional measurement shall be carried out on the completed equipment. All compensating pads (RF pads) shall be pneumatically tested.

ix) Completed assembly shall be pressure tested with working-fluid using hydraulic and pneumatic method. The heat exchangers shall be tested on both tube side and shell side. After hydro test, the heat exchangers shall be suitably dried and nitrogen capped.

**1.3.4.2 Deaerator**

i) Tests shall be carried out on the materials of forgings, plates and tubes etc. to establish their mechanical properties, and chemical compositions.

ii) Plates shall be subject to 100% ultrasonic testing.

iii) Forgings shall be subject to suitable heat treatment and 100% ultrasonic testing and 100% MPE.

iv) Shell and dished ends

a) Impact test shall be carried out for the plate materials.

b) 100% UT shall be carried out on the finished/ formed plates.

c) Dished ends shall be subject to dimensional check after dishing.

d) Knuckle portion shall be checked by 100% MPE or DP test for surface defects and check for thinning shall be carried out by UT.

e) Testing of production test coupons as applicable.

v) Welding

a) Root run of the butt welds shall be examined by 100% DPT or MPE.

b) Butt welded and full penetration joints and nozzle welds shall be checked by 100% RT or UT and 100% MPE or DPT.

- Fillet welds shall be checked by 100% MPE or DPT.
- Dished ends shall be subjected to 100% MPI and RT/UT on welded joint.

vi) Visual check and dimensional measurement shall be carried out on the completed equipment.

vii) Completed assembly shall be pressure tested with working-fluid using hydraulic method. After hydro test, same shall be suitably dried.

viii) All weldments shall be given suitable heat treatment.

ix) All compensating pads (RF pads) shall be pneumatically tested.

**1.3.4.3 Valves on heaters and deaerator**

i) Tests shall be carried out on the materials of forgings, plates and tubes etc. to establish their mechanical properties, and chemical compositions.

ii) 100% RT or UT shall be carried out on bodies, bonnets, nozzles and stem of valves of HP heaters.

iii) 100% DPT or MPE shall be carried out on machined surfaces of valve body, bonnet, stem, disc and springs.

iv) Valve body shall be subject to hydraulic testing.

v) Valve seat shall be subject to hydro leak test as per ANSI 16.34.

vi) Visual check and dimensional measurement shall be carried out on the completed valve assembly.

### 1.3.5 Boiler Feed Pumps

#### 1.3.5.1 Main pump

i) Tests shall be carried out on the materials on various components to establish their mechanical properties and chemical composition. Further, heat treatment shall be given as required.

ii) 100% UT shall be carried out on barrel casing, casing cover, suction & discharge branches, shaft, ring sections, and wearing rings.

iii) 100% RT shall be carried out on suction branch, impellers and diffusers.

iv) 100% MPE shall be carried out on barrel casing, casing cover, suction & discharge branches, gland housing, shaft, diffusers, balancing drum and spring disc.

v) 100% DPT shall be carried out on welds and overlay preparation on barrel casing, and machined components after final machining.

vi) Hydraulic test shall be carried out on barrel casing, discharge cover, and suction and discharge branches.

vii) Individual impellers and completed rotor assembly shall be subject to dynamic balancing test. Rotor assembly shall be subject to run out test also.

viii) Hardness test shall be carried out on wearing rings.

ix) Visual check and dimensional measurement shall be carried out for all the components and completely assembled pump.

x) Final tests

a) Performance testing shall be carried out as per Hydraulic Institute Standards (HIS) on each pump to determine its characteristic curve at design speed and to ensure compliance with design requirements. Tests shall be carried out with loop water at specified design temperature. Soften quality water shall be used for the performance testing.

b) Vibration on all pumps shall be measured in transverse, horizontal and vertical direction at all measuring points.

c) Noise Level on each pump shall be measured at a distance of 1.5 m above floor level in elevation and 1 m horizontally from the nearest surface of the equipment as per HIS. The measurement shall be taken at six points around the equipment for each flow condition.

d) Type tests

1. NPSH (R) test shall be carried out on one pump using cold water at pump flows of 25%, 50%, 80%, 100% and 125% of design flow at design speed. This shall be preferably done at 1% and 3% head break by suction throttling procedure. In case, NPSH (R) test has alreadybeen carried out by the contractor for the offered frame of BFP, the testshall not be repeated and certificates of test carried out earlier shall be furnished for review of the purchaser. The validity of the type test carried out earlier shall be limited to five (5) years.

2. Pressure pulsation and axial thrust measurement shall be carried out onone boiler feed pump at all measuring points. Pressure pulsation shall be measured at suction as well as at discharge in the operating range.

e) Strip down test

Complete strip down of one feed pump which undergoes NPSH test shall be done after completion of all the tests on it. The strip down shall check for the condition of thrust bearing and journal bearing, and problems such as internal rubbing damage, excessive wear on the components. For other feed pumps, strip down examination shall be restricted to inspection of bearings only. However,if excessive vibration, high noise, high bearing temperature etc. is observed during performance test of any feed pump, complete strip down shall be done for such pumps also.

Note: Tested pump parameters shall be within following tolerances.

| | | |
|---|---|---|
| At design head | : | + 10% of design capacity |
| At design capacity | : | + 5% of design head (for < 152.4 m)<br>+ 3% of design head (for ≥ 152.4 m) |

The results of the performance test must show no minus tolerance with regard to flow and head. No minus tolerance on efficiency or positive tolerance on power input at motor terminals shall be allowed.

**1.3.5.2 Booster pump**

i) Tests shall be carried out on the materials on various components to establish their mechanical properties and chemical composition. Further, heat treatment shall be given as required.

ii) 100% UT shall be carried out on shaft and wearing rings.

iii) 100% MPE shall be carried out on casing, impeller and seal cooling jacket.

iv) 100% DPT test shall be carried out on machined components after final machining.

v) Hydraulic test shall be carried out on pump casing at 1.5 times the shut off pressure

or 2 times the working pressure whichever is higher.

vi) Impeller and completed rotor assembly shall be subject to dynamic balancing test. Rotor assembly shall be subject to run out test also.

vii) Visual check and dimensional measurement shall be carried out for all the components and completely assembled pump.

viii) Final tests

a) Performance testing shall be carried out as per Hydraulic Institute Standards (HIS) on each pump to determine its characteristic curve at design speed and to ensure compliance with design requirements. Tests shall be carried out with loop water at specified design temperature. Soften quality water shall be used for the performance testing.

b) Vibration on all pumps shall be measured in transverse, horizontal and vertical direction at all measuring points.

c) Noise Level on each pump shall be measured at a distance of 1.5 m above floor level in elevation and 1 m horizontally from the nearest surface of the equipment as per HIS. The measurement shall be taken at six points around the equipment for each flow condition.

d) Type tests

1. NPSH (R) test shall be carried out on one pump using cold water at pump flows of 25%, 50%, 80%, 100% and 125% of design flow at design speed. This shall be preferably done at 1% and 3% head break by suction throttling procedure. In case, NPSH (R) test has alreadybeen carried out by the contractor for the offered frame of booster pump, the test shall not be repeated and certificates of test carried out earlier shall be furnished for review of the purchaser. The validity ofthe type test carried out earlier shall be limited to five (5) years.

f) After performance testing, thrust bearing and journal bearing shall be subject to visual check.

Note: Tested pump parameters shall be within following tolerances.

| | | |
|---|---|---|
| At design head | : | + 10% of design capacity |
| At design capacity | : | + 5% of design head (for < 152.4 m)<br>+ 3% of design head (for ≥ 152.4 m) |

The results of the performance test must show no minus tolerance with regard to flow and head. No minus tolerance on efficiency or positive tolerance on power input at motor terminals shall be allowed.

**1.3.5.3 Gear box and hydraulic coupling**

i) Tests shall be carried out on the materials on various components to establish their mechanical properties and chemical composition. Further, heat treatment shall be given to the internal components as required.

ii) Internal components such as gears, pinions, wheels and shafts shall be examined by 100% UT and 100% DPT or 100% MPE.

iii) Leak test shall be carried out for the casing.

iv) Dynamic balancing test shall be carried out for the assembled rotating component.

v) Full load speed and back to back locked rotor torque test shall be carried out on one gear box.

vi) Visual check and dimensional measurement shall be carried out for the completely assembled equipment.

**1.3.5.4 Strainers**

i) Tests shall be carried out on the materials on various components to establish their mechanical properties and chemical composition.

ii) In case of fabricated construction, the welds shall be examined for surface defects by 100% DPT.

iii) The strainer body shall be subject to hydraulic test.

iv) Pressure drop test shall be carried out for each type and size of the strainer assembly.

**1.3.5.5 BFP drive turbine and associated equipment**

The QA requirements for BFP drive turbine and associated auxiliaries shall be same as those applicable for main steam turbine and its auxiliaries described at clause 1.3.1 of this Section.

**1.3.6 Condensate Extraction Pumps (CEPs)**

**1.3.6.1 Pump**

i) Tests shall be carried out on the materials on various components to establish their mechanical properties and chemical composition. Further, heat treatment shall be carried out for materials of shaft and rotor.

ii) 100% UT shall be carried out on pump shaft.

iii) 10% RT shall be carried out for butt welds on fabricated components of thickness more than 10 mm.

iv) 100% MPE shall be carried out on pump shaft.

v) 100% DPT shall be carried out on welds on casing, suction bell, shaft, impeller and fabricated components.

vi) Hydraulic test shall be carried out on casing and pressure containing fabricated parts at 1.5 times the pump shut off pressure or 2 times the working pressure whichever is higher.

vii) Individual impellers and completed rotor assembly shall be subject to dynamic balancing test. Rotor assembly shall be subject to run out test also.

viii) Visual check and dimensional measurement shall be carried out for all the components and completely assembled pump.

ix) Final tests

a) Performance testing shall be carried out as per Hydraulic Institute Standards (HIS) on each pump to determine its characteristic curve atdesign speed and to ensure compliance with design requirements. Tests shall be carried out using cold soften quality water.

b) Vibration on all pumps shall be measured in transverse, horizontal and vertical direction at all measuring points.

c) Noise Level on each pump shall be measured at a distance of 1.5 m above floor level in elevation and 1 m horizontally from the nearest surface of the equipment as per HIS. The measurement shall be taken at six points around the equipment for each flow condition.

d) NPSH test

NPSH (R) test shall be carried out on one pump using cold water at pump flows of 25%, 50%, 80%, 100% and 125% of design flow at design speed. This shall be preferably done at 1 % and 3% head break. In case, NPSH (R) test has already been carried out by the contractor for the offered frameof CEP, the test shall not be repeated and certificates of test carried out earlier shall be furnished for review of the purchaser. The validity of the type test carried out earlier shall be limited to five (5) years.

e) Strip down test

Complete strip down of one pump which undergoes NPSH test shall be done after completion of all the tests on it. The strip down shall check for the condition of bearings and problems such as internal rubbing, excessive wear. For other pumps, strip down shall be restricted to inspection ofbearings only. However, if excessive vibration, high noise etc. is observed during performance test of any pump, complete strip down shall be donefor such pumps also.

Note: Tested pump parameters shall be within following tolerances.

| | | |
|---|---|---|
| At design head | : | + 10% of design capacity |
| At design capacity | : | + 5% of design head (for < 152.4 m)<br>+ 3% of design head (for ≥ 152.4 m) |

The results of performance test must show no minus tolerance with regard to flow and head. No minus tolerance on efficiency or positive tolerance on power input at motor terminals shall be allowed.

**1.3.6.2 Strainers**

The QA requirements for strainers at suction of the CEPs shall be same as those applicable for BFP strainers described at clause 1.3.5.4 of this Section.

**1.3.7 Condensate Polishing Unit (CPU)**

**1.3.7.1 CPU service vessels**

i) Tests shall be carried out on the materials of the vessels, internals and rubber used for lining to establish their mechanical properties, and chemical compositions. Heat treatment as required shall be done as per ASME code.

ii) Plates shall be subject to 100% ultrasonic testing.

iii) Impact test shall be carried out for the plate materials.

iv) 100% UT shall be carried out on the finished and formed dished ends and hemi heads. Knuckle portion shall be checked by 100% MPE or DP test for surface defects and check for thinning shall be carried out by UT.

v) Welding

a) Root run of butt welds shall be examined by 100% DPT or MPE.

b) Butt welds full penetration joints and nozzle welds shall be checked by 100% RT and 100% MPE or DPT.

c) Fillet welds shall be checked by 100% MPE or DPT.

vi) Rubber lining shall be subjected to following tests as per IS-4682 part-I or acceptable equivalent:

a) Tensile & Elongation, Specific Gravity, Ash content

b) Adhesion test

c) Measurement of thickness

d) Shore hardness test

e) Visual examination and spark test at 5 kV/mm of thickness

f) Bleeding resistance test with keeping the sample in 33% HCl, 48% NaOH and DM water for 72 hours.

g) Ozone resistance test: (50 PPHM) / 40° C / 20 % Strain /70 Hrs

h) Water Absorption Test, After ageing test & Compression Set test

i) Spark test for rubber lining

vii) Resin testing shall be carried out as per relevant IS.

viii) Visual check and dimensional measurement shall be carried out on the completed equipment.

ix) Internals of the vessel shall be subject to dimensional check and applicable tests as per relevant codes.

x) The fabricated vessel shall be hydraulically tested at 1.5 times the working pressure before the rubber lining and at the working pressure after the rubber lining.

**1.3.7.2 Acid/ alkali handling tanks**

i) Tests shall be carried out on the materials of the tanks to establish their mechanical properties, and chemical compositions

ii) Plates shall be subject to 100% ultrasonic testing.

iii) Welding

a) Root run of butt welds shall be examined by 100% DPT or MPE.

b) Butt welds, full penetration joints and nozzle welds shall be checked by 100% RT and 100% MPE or DPT.

c) Fillet welds shall be checked by 100% MPE or DPT.

iv) Rubber lining shall be subject to relevant tests as described for CPU vessels.

v) Visual check and dimensional measurement shall be carried out on the completed equipment.

vi) The fabricated tank shall be subject to water fill test to check for the leakage.

**1.3.7.3 Dosing pumps/ metering pumps**

i) Tests shall be carried out on the materials of the pumps to establish their properties, and chemical compositions

ii) Pump casings shall be subject to hydraulic test at 1.5 times the shut off pressure or 2 times the working pressure whichever is higher.

iii) 100% DPT or MPE shall be carried out for the screw set, shaft and machined surfaces of casing and impellers. UT on screw set, shaft (diameter greater than or equal to 40mm),

iv) Safety relief valve setting to be checked

v) Pumps shall be performance tested as per HIS, USA.

**1.3.7.4 Horizontal centrifugal pumps**

The QA requirements for horizontal centrifugal pumps shall be as per clause 1.5.1.1.17 of this Section.

**1.3.7.5 Rotary blowers**

i) Tests shall be carried out on the materials of the rotary blowers to establish their properties, and chemical compositions.

ii) 100% DPT or MPE shall be carried out for the rotor and machined surfaces of casing and impellers. UT on shaft (diameter greater than or equal to 40mm.

iii) The shaft and impellers shall be dynamically balanced.

iv) Assembly fit up check, and dimensional check shall be carried out for the completed blower assembly.

v) The blower casing shall be subject to hydraulic test at 1.5 times the shut off pressure or 2 times the working pressure whichever is higher.

vi) The blowers shall be performance tested as per relevant code/ standard for Free Air Delivery, Head, Power, Efficiency, Speed including Discharge Pressure and Temperature. The test shall include check for vibration and noise level also.

**1.3.7.6 Valves**

The QA requirements for high pressure valves such as for service vessels shall be as per clause 1.4.2 of this Section. The QA requirements for other valves shall be as per clause 1.4.6.2 of this Section.

**1.3.8 Condenser On-Line Tube Cleaning System**

**1.3.8.1 Ball recirculation pump**

i) All rotating parts shall be dynamically balanced.

ii) Pump casing shall be subjected to hydraulic test at 1.5 times the shut off head or twice the maximum working pressure whichever is higher.

iii) Complete pump assembly shall be subjected to shop performance test at supplier's works.

**1.3.8.2 Ball sorter/ fabricated body (housing)**

i) In the case of fabricated design, all butt welds shall be subject to 10% RT or UT. All welds shall also be subjected to 10% MPE to ensure freedom from surface and sub-surface defects.

ii) Body shall be subject to hydraulic pressure test at 1.5 times the design pressure.

iii) Performance test shall be carried out on ball sorter assembly.

**1.3.8.3 Strainer**

i) Tests shall be carried out on the materials on various components to establish their mechanical properties and chemical composition

ii) Strainer mesh shall be checked for chemical composition and mesh size.

iii) Strainer body shall be subject to hydraulic pressure test at 1.5 times the design pressure.

iv) Strainer assembly shall be checked for its functional performance.

**1.3.8.4 Piping and fittings**

i) Butt welds on piping shall be subject to 10% RT and 10% DPT. Butt welds on segmental flanges shall be checked by 100% RT and 100% DPT.

ii) Fillet welds with load transfer shall be subject to 100% MPE or DPT and fillet welds without load transfer shall be subjected to 10% MPE or DPT.

iii) Wrought and forged fittings shall be tested as per relevant codes or standards.

**1.3.8.5 Coating/ lining**

i) Coating shall be checked for DFT and adhesion. Further, Contractor shall furnish his practice for testing of coating to ensure the uniformity and freedom from pinholes

ii) Rubber lined items shall be hydraulically tested before rubber lining. All rubber lining shall be subjected to following tests as per IS-4682 part-I or acceptable equivalent:

a) Tensile & Elongation, Specific Gravity, Ash content

b) Adhesion test

c) Measurement of thickness

d) Shore hardness test

e) Visual examination and spark test at 5 kV/mm of thickness

f) Bleeding resistance test with keeping the sample in 33% HCl, 48% NaOH and DM water for 72 hours.

g) Ozone resistance test: (50 PPHM) / 40° C / 20 % Strain /70 Hrs.

h) Water Absorption Test, After ageing test & Compression Set test

**1.3.8.6 Valves**

The QA requirements for the valves shall be as per clause 1.4.6.2 of this Section.

**1.3.9 Debris Filter**

i) Body, strainer mesh and other components shall be checked for chemical composition.

ii) Strainer element shall be checked for mesh size.

iii) Body shall be subject to hydraulic pressure test at 1.5 times the design pressure.

iv) Filter assembly shall be checked for its functional requirements.

v) Valves shall be tested as per relevant standards.

## 1.4 HIGH PRESSURE PIPING, VALVES, THERMAL INSULATION AND MISCELLANEOUS SYSTEMS/ EQUIPMENT

**1.4.1 High Pressure Piping and Fittings**

i) All raw materials used shall have co-related mill test certificate meeting mandatory and supplementary checks of material specification.

ii) The pipes and fittings shall be subject to visual examination, identification, correlation and stamping.

iii) For alloy steel pipes (SA 335, P11, P22, & P91), 25% pipes per lot shall be subject to the following tests:

a) Product analysis

b) Transverse tension test on pipes from one end for pipe size 200 mm and above.

c) Flattening test on pipe from one end.

iv) All pipe lengths shall be subjected to 100% UT.

v) All mother pipes used for fittings shall be subject to a hydraulic test or an ultrasonic test. Raw material of all forged fittings shall be ultrasonically tested. Forged fittings shall be ultrasonically tested.

vi) All alloy and carbon steel pipes shall be subject to 100% UT for pipe thickness ≥ 3.6 mm and 100% eddy current test for thickness < 3.6 mm as per material specification standard with acceptable notch depth of 5% of the selected wall thickness (1.5mm maximum)

vii) Thickness of all pipe bends (cold/ hot formed) shall be checked by ultrasonic or other acceptable methods on sample basis for high pressure applications. Further, outer surface of bends shall be subject to 100% MPE or DPT. Pipe bend shall be checked for ovality and thinning by ultrasonic or other acceptable methods on first off lot & on random samples for subsequent pieces for high pressure applications. Outer surface of bends shall be subjected to magnetic particle examination/LPI.

viii) Welded and cast fittings, if any, shall be subjected to suitable NDT as perapplicable standards. However, as a minimum, 100% RT shall be carried out on all alloy steel fittings and on carbon steel fittings for use above 71 bar design conditions.

ix) The edge preparation for stainless steel/ alloy steel shall be subject to a 100% DPT. For other piping, the edge preparation for the welds shall be checked by100% MPE or DPT.

x) Non-destructive examination of welds shall be carried out in accordance with the relevant design and/or manufacturing codes. However, as a minimum, the following requirements shall be met (except for oil piping):

a) For temperature > 400 $^0$C and/or pressure exceeding 71 bar, the butt welds and full penetration branch welds shall be subject to 100% RT or UT and 100% MPE.

b) For temperature > 175$^0$C up to 400 $^0$C and/or pressure exceeding 17 bar and up to 71 bar, the butt welds & full penetration branch welds shall be subject to NDTs as below:

- pipe diameter > 100 NB 100% RT or UT and 100% MPE

- pipe diameter ≤ 100 NB 10% RT or UT and 100 % MPE

In addition to above, statutory requirement, wherever applicable, shall also be complied with.

xi) Finished welding for alloy steel piping, BFP discharge piping, MS piping, HRH piping, CRH piping and associated piping shall be subject to the following NDTs:

a) Butt welds 100% RT and 100% MT or DPT

b) Welds for nozzle, branch connections of size > 100NB 100% RT and 100% MT or DPT

c) Welds for all other attachments 100% MT or DPT

d) Removal of weld defects 100% MT or DPT

xii) Finished welding for Carbon Steel Class- I piping having design temperature > 218 deg. C or design pressure for steam > 17.6 kg/ $cm^2$ (g) or design pressure for feed water > 24.6 kg/$cm^2$ (g) shall be subject to the following NDTs:

a) Butt welds:
pipe size > 100 NB 100% RT and 100% MPE or DPT

pipe size ≤ 100 NB 10% RT and 10% MPE or DPT

b) Welds for nozzle, branch connections of size > 100NB and thickness > 19 mm 100% RT and 100% MPE or DPT

c) Welds for all other attachments 10% MPE or DPT

d) Removal of weld defects/weld repair 100% MPE or DPT

xiii) Finished welding for carbon steel class- I piping having design temperature ≤ 218 deg. C or design pressure for steam ≤ 17.6 kg/ $cm^2$ (g) or design pressure for feed water ≤ 24.6 kg/$cm^2$ (g) shall be subject to the following NDTs:

a) Butt welds:
pipe size > 100 NB 100% RT and 10% MPE or DPT
pipe size ≤ 100 NB 10% MPE or DPT

b) Welds for nozzle, branch attachments 10% MPE or DPT connections/

c) Removal of weld defects 100% MPE or DPT

xiv) Non-destructive examination of welds shall be carried out after post weld heat treatment, if any.

xv) Pre- heating, stress relieving and post weld heat treatment as applicable shall be carried out as per requirements of ASME B 31.1. For welds in P91, X20 & X22 materials, only induction type of heating shall be deployed for heat treatment.

xvi) Hardness survey of welds shall be carried out on alloy steel/ stainless steel piping. (100% hardness survey of welds on P91, X20 & X22 material grade piping).

xvii) All other pipes not covered above (except oil piping) shall be subjected 100% MPE or DPT in case of underground piping and 10% MPE or DPT in case of over ground piping. Further, 10% of butt welds of underground piping shall be subjected to RT.

xviii) Oil piping shall be subjected to following NDTs.

a) Butt welds of Oil piping shall be subjected to 10% RT/ UT and 10% DP Test. For Jacking oil lines 100% RT/UT and 100% DPT shall be carried out on butt

welds.

b) Fillet welds with load transfer shall be subjected to 100% MPE or DPT and fillet welds without load transfer shall be subjected to 10% MPE or DPT.

xix) Rubber lined pipes shall be hydraulically tested before rubber lining. All rubber lining shall be subject to following tests as per IS-4682 part-I or acceptable equivalent:

a) Tensile & Elongation, Specific Gravity, Ash content

b) Adhesion test

c) Measurement of thickness

d) Shore hardness test

e) Visual examination and spark test at 5 kV/mm of thickness

f) Bleeding resistance test with keeping the sample in 33% HCl, 48% NaOH and DM water for 72 hours.

g) Ozone resistance test: (50 PPHM) / 40° C / 20 % Strain /70 Hrs.

h) Water Absorption Test, After ageing test & Compression Set test

**1.4.2 Power Cycle Valves**

**1.4.2.1 Valves other than extraction line valves and butterfly valves**

i) Bar stock/forging above 40mm diameter for valve trim shall be subjected to UT.

ii) Hardened/ stellitted valve disc and seat are to be subjected to LPI and hardness check.

iii) Colour matching of valve disc, plug and seat shall be carried out to ensure contact ensure min. 80% contact and no through passage.

iv) Hydraulic pressure test and seat leak test shall be carried out as per ANSI 16.34.

v) Air seat leak test shall be carried out as per applicable standards/ codes.

vi) Pressure retaining parts of valves shall be subject to NDTs as below:

| **Valve size NB in mm** | **ANSI Class up to 300** | **ANSI Class above 300 up to 600** | **ANSI Class above 600 below 900** | **ANSI Class 900 & above & below 4500** |
|---|---|---|---|---|
| Less than | Visual | Visual | Visual | MPI/DPT |

| | | | | |
|---|---|---|---|---|
| 50 | | | | |
| 50 & above but below100 | Visual | Visual | MPI/DPT | MPI/DPT & RT (on 10% of valves on 100% area) |
| 100 & above but less than 300 | Visual | MPI/DPT | MPI/DPT & RT (on 10% of valves on change of section & weld ends) | MPI/DPT & RT (on 100% area) |
| 300 and above | MPI/DPT | MPI/DPT | MPI/DPT & RT (on change of sections & weld ends) | MPI/DPT & RT (on 100% area) |

vii) Weld edge preparations shall be subject to MPE or DPT.

viii) Functional testing shall be carried out on fully assembled valve to check the following:

a) Smooth operation

b) Valve travel, closing and opening time.

c) Current drawn by actuators.

d) Pressure resistance test of pneumatic actuator

e) CV test for control valve

ix) Springs for safety valves shall be tested with suitable NDT and for spring rate.

x) Safety and safety relief valves shall be tested for performance.

**1.4.2.2 Extraction line valves**

i) Surface crack examination and hardness check shall be carried out on all hard faced surfaces and stellieted surfaces, if any.

ii) As a minimum requirement of castings for all valves on cold reheat and extraction lines shall be subjected to 100% MPE on all areas and RT on butt weld ends and change of section. For forgings minimum requirement shall be 100% UT and 100% MPE.

iii) Bar stock for valves stem shall be subjected to UT. Finish machined valve stem shall be subjected to MPE or DPT.

iv) Wall thickness measurement by ultrasonic for critical and highly stressed zones of the casting and forging shall be carried out.

v) Colour matching of the valve disc and seat to ensure required contact area shall be carried out.

vi) Hydraulic pressure tests shall be carried out on each valve to check body and bonnet strength. Seat leakage and back seat leakage test (wherever applicable) shall be carried out. Air seat leakage test shall also be carried out. Minimum test requirements of pressure shall be as per ANSI B 16.34.

vii) Functional testing shall be carried out on each valve to check for freedom of movement, adherence to clearance, opening/ closing etc.

**1.4.2.3 Butterfly Valves**

i) Tests shall be carried out on the materials of body, disc etc. for determination of chemical and mechanical properties.

ii) In case of fabricated valves, the plates used for body, disc and flanges shall be subject to 100% UT.

iii) Valve body, disc and shaft shall be checked for surface and sub-surface defects by 100% MPE.

iv) For sea water application valves, austenitic stainless steel welds shall be subject to 100% IGC (inter-granular corrosion) test.

v) All wetted SS 316 components shall be subject to Molybdenum check.

vi) Stubs and driving shafts shall be tested for internal defects by ultrasonic method.

vii) Dye penetration test shall be carried out on shafts, seat rings etc.

viii) For fabricated components of the valves, all the longitudinal/ circumferential weld seams shall be subject to 100% RT. Further, all welds on magnetic material shall be subject to 100% MPE, and welds on non-magnetic material shall be subject to 100% DPT.

ix) Test samples for rubber seal shall be subjected to tensile, elongation and hardness test for vulcanising and after ageing. Hydraulic stability test (Bleed Resistance) and ozone crack resistance tests also be carried out.

x) Valve shall be subjected to hydraulic pressure test for body and air seat leakage tests as per AWWA-C504/ BS- 5155.

xi) Proof of design tests for valves and actuator shall be carried out as per AWWA-C504/ BS- 5155. In case the test has already been carried out on previous supplies,

the contractor may submit the test certification of same for approval of purchaser.

xii) Disc Strength test by Hydro (Forward and Backward) as per EN 12266-1

xiii) After complete assembly each valve with actuator shall be subject to the performance test by opening and closing the valve from fully closed to fully open position and the reverse, under no flow for at least 25 cycles to check the following:

a) Smooth uninterrupted movement of valve.

b) Closing and opening time.

c) Current drawn by actuator.

3. Operation of tripping switch and position indicator.

xiv) After assembly, one valve of each size with respective actuator shall be shop operated over the full range of movement in both the directions, with the body subjected to the full hydrostatic pressure conditions, to demonstrate that the unit is in working order without any leakage through the joints and torque switches/clutches, limit switches are operating satisfactorily. During the test, hand wheel operation, opening and closing time and current drawn shall also be checked. The test shall be conducted for three consecutive cycles with valve shaft both in vertical and horizontal planes.

**1.4.3 Metallic expansion bellows**

i) All raw materials used shall have co-related mill test certificate meeting mandatory checks of material specification.

ii) Hydraulic pressure test shall be carried out on each pipe and expansion bellow.

iii) Longitudinal butt weld on bellow shall be subject to MPE or DPT before forming and after forming.

iv) All welds shall be subject to 100% MPE or DPT. Butt welds shall be subject to 100% RT.

v) All the bellows subjected to vacuum service shall be vacuum tested.

vi) The bellows shall be subjected to movement test to establish suitability to perform satisfactorily in site conditions. During this test, spring rate shall also be measured.

vii) Life cycle test, meridional yield rupture test and squirm test to be carried out on a prototype/ expansion bellow as per Sec. D clause 3.2 of standards of Expansion Joint Manufacturer Association (EJMA).

**1.4.4 Hangers and Supports**

i) All raw materials used shall have co-related mill test certificate meeting mandatory checks of material specification.

ii) Completed springs shall be tested for sagging test and load versus deflection test. For diameter more than 25mm, MPE shall also be carried out.

iii) Butt welds shall be tested for UT/RT and fillet welds shall be tested for MPI/DPT.

iv) Dampers with viscous fluids shall be checked for viscosity of liquid used, damping resistance of the damper, stiffness of the damper etc.

v) Turn-buckle, pipe clamps and hangers of thickness greater than 25mm shall be checked by MPE or DPT on bent portions.

vi) Assembled hanger, one number of each type and size shall be checked for variation in deflection and travel versus load test.

**1.4.5 Thermal insulation, refractory, lagging and cladding**

i) Thermal insulation

a) Pre-formed fibrous pipe insulation and LRB mattresses/ sections of rock wool/ mineral wool from approved manufacturing sources conforming to and tested as per relevant standards shall be used.

b) For resin bonded mineral wool insulation, testing shall be carried out as per IS: 8183.

c) For resin bonded rock wool insulation, testing shall be carried out as per IS: 9842.

d) For sprayed mineral wool, testing shall be carried out as per IS: 9724.

e) For ceramic fiber blankets and block insulation, testing shall be carried out as per IS: 15402.

f) Thermal conductivity shall be regularly carried out once in three months.

g) Thermal conductivity (K value) shall be measured in line with IS: 3346.

h) Wire mesh of diameter 0.71mm (minimum) shall only be used.

ii) Castable refractory

Fire bricks or castable refractory from approved manufacturing sourcesconforming to and tested as per relevant standards shall be used. Castable refractory shall have proper identification, supplier name, customer name, batch no., date, material name and net weight in kg with proper instructions for handling.

iii) Lagging and cladding

All insulation shall be protected by means of an outer covering of aluminum sheeting conforming to ASTM B-209-1060 temper H14 from reputed manufacturer.

### 1.4.6 Low Pressure Piping, Valves and Fittings etc.

#### 1.4.6.1 Pipes, fittings and mitre bends

i) Tests shall be carried out on the materials on various components to establish their mechanical properties and chemical composition. Further, heat treatment shall be carried out for materials as required.

ii) Dye penetration test of welds of pipes and fittings (including welds of rolled and welded pipes) shall be carried out.

iii) All pipes and fittings shall be tested as per applicable codes/ standards at manufacturer's works.

#### 1.4.6.2 Valves

i) Tests shall be carried out on the materials on various components to establish their mechanical properties and chemical composition. Further, heat treatment shall be carried out for materials as required.

ii) Shaft/ spindle of size ≥ 40 mm diameter shall be subjected to ultrasonic test.

iii) Machined surfaces of casing, disc and shaft shall be subjected to 100% MPI or DPT as applicable.

iv) All valves shall be hydraulically tested for body, seat and back seat (wherever provided) at 1.5 times the maximum pressure to which respective valves can be subjected during plant operation. Check valves shall also be tested for leak tightness test at 25% of the specified seat test pressure. For rubber lined valves, hydraulic test shall be carried out before rubber lining.

v) For butterfly valves, hydraulic test, seat and disc string test and proof of design test (if not carried out earlier) shall be carried out in accordance with latest edition of AWWA-C-504/ C-516 standard. Actuators shall also meet requirements of P.O.D. test of AWWA-C-504/AWWA-C-516.

vi) Visual and dimensional check shall be carried out for all valves as per relevant code/ approved drawing.

vii) Functional/ operational checks for and check for smooth opening and closing of the valves shall be carried out.

viii) Gate, globe and swing check valves

a) Machined surfaces of castings and butt welds shall be subjected to MPE or DPT.

b) Blue matching, wear travel for gates, valves, pneumatic seat leakage, reduced pressure test for check valves shall be done as per relevant standard.

ix) Diaphragm valves

a) Seat leakage test for actuator operated valves, shall be done with by closing the valves with actuator.

b) Tests on rubber parts shall be conducted per batch of rubber mix for tensile, elongation, hardness, adhesion, spark test, bleed resistance test. In addition, type test for 50,000 cycles of each type of diaphragm shall also be conducted.

x) Cast butterfly valves

a) Machined surfaces of casing, disc and shaft shall be subjected to MPE or DPT.

b) Actuator operated valves shall be checked for seat leakage by closing the valves with actuator. Seat leakage test shall be carried out in both directions.

xi) Fabricated butterfly valves (refer 1.4.2.3)

a) UT as per ASTM A-435/IS 11630 & IS 4225 on plate material for body and disc shall be carried out for plate thickness 25mm and above.

b) Machined surfaces of casing, disc and shaft shall be subjected to MPE or DPT.

c) 100% RT and DPT as per ASTM, Section-VIII, Division-I, on butt joins of body and disc. 10% DPT on other welds shall be done. Post weld heat treatment as per ASME, Section-VIII, Division-I on butt joints of body and disc.

d) Actuator operated valves shall be checked for seat leakage by closing the valves with actuator. Seat leakage test shall be carried out in both directions.

xii) Dual plate check valves

a) Machined surfaces of casing, disc and shaft shall be subjected to MPI or DPT. Dry Cycle Test on Dual Plate Check valve spring for one lakh Cycles shall be carried out as a type test. If Dry Cycle test carried out earlier for same material & diameter, Test report shall be reviewed.

**1.4.6.3 Rubber lining of pipes and valves**

i) For rubber lining, the following tests shall be carried out as per IS-4682 part-I or acceptable equivalent standard:

a) Tensile & Elongation, Specific Gravity, Ash content

b) Adhesion test

c) Measurement of thickness

d) Shore hardness test

e) Visual examination and spark test at 5 kV/mm of thickness

f) Bleeding resistance test with keeping the sample in 33% HCl, 48% NaOH and DM water for 72 hours.

g) Ozone resistance test: (50 PPHM) / 40° C / 20 % Strain /70 Hrs

h) Water Absorption Test, After ageing test & Compression Set test.

ii) Dimensional check shall be carried out as per relevant code/ approved drawing.

**1.4.6.4 Coating and wrapping of pipes**

Spark test/ Holiday test, adhesion test and material test for primer and enameled and coal tar tapes, as applicable, shall be carried out as per AWWA-C-203-91/ IS 15337/ IS 10221 as applicable.

**1.4.6.5 Rubber expansion joints**

i) Rubber compound test slab after valcanising shall be tested for tensile strength, elongation and shore hardness. Tests on rubber compound shall also include hydro stability test as per ASTM D-3137, ozone resistance test as per ASTM D- 380 and kerosene dip test.

ii) Fabric strength of synthetic fiber for reinforcement shall be checked, and test for rubber to fabric adhesion as per IS: 3400 or ASTM D- 413, rubber to metal adhesion as per IS 3100 or ASTM D-429 shall be carried out.

iii) All expansion joints in assembled condition shall be subjected to vacuum test at 730 mm Hg under conditions to ensure its suitability to withstand deflection in each axial transverse and longitudinal direction. Duration of test shall be of minimum 10 minutes.

iv) All bare bellows shall be subjected to hydraulic pressure test in normal condition at twice the design pressure for a duration of 30 minutes. Additionally, all bare bellows shall be subjected to deflection tests under pressure, pressure being raised from zero to the design value in regular steps and deflection measured at each step.

v) All expansion joints in assembled condition along with control rod assembly shall be subjected to deflection test (axial compression & expansion test and lateral deflection) under design pressure.

vi) Either during the hydraulic test or during the vacuum test, change in circumference at the top position of the arch shall not exceed 1.5% of measured circumference at normal position.

vii) Twenty-four (24) hours after the above tests, the permanent set (variation in dimensions with respect to its original dimension) shall be measured and recorded. The permanent set shall not be more than 0.5%.

vii) Proof of Design (Life cycle test and burst test) shall be carried out on bellows of each type, design and size.

**1.4.7 Equipment Cooling Water (ECW) System**

**1.4.7.1 Primary side and secondary side pumps**

i) Tests shall be carried out on the materials on various components to establish their mechanical properties and chemical composition. Further, heat treatmentshall be carried out for materials of shaft and rotor.

ii) 100% UT shall be carried out on pump shaft.

iii) 10% RT shall be carried out for butt welds on fabricated components of thickness more than 10 mm.

iv) 100% MPE shall be carried out on pump shaft.

v) 100% DPT shall be carried out on welds on casing, suction bell, shaft, impellerand fabricated components.

vi) Hydraulic test shall be carried out on casing and pressure containing fabricated parts at 1.5 times the pump shut off pressure or 2 times the working pressure whichever is higher.

vii) Individual impellers and completed rotor assembly shall be subject to dynamic balancing test. Rotor assembly shall be subject to run out test also.

viii) Visual check and dimensional measurement shall be carried out for all the components and completely assembled pump.

ix) Final tests

a) Performance testing shall be carried out as per Hydraulic Institute Standards (HIS) on each pump to determine its characteristic curve atdesign speed and to ensure compliance with design requirements.

b) Vibration on all pumps shall be measured in transverse, horizontal and vertical direction at all measuring points.

c) Noise level on each pump shall be measured at a distance of 1.5 m above floor level in elevation and 1 m horizontally from the nearest surface of the equipment as per HIS.

d) NPSH(R) test shall be carried out on one pump at pump flows of 25%, 50%, 80%, 100% and 125% of design flow at design speed. In case, NPSH (R) test

has already been carried out by the contractor for the offered frameof a pump, the test shall not be repeated and certificates of test carried out earlier shall be furnished for review of the purchaser.

e) Complete strip down of one pump shall be done after completion of all the tests on it. The strip down shall check for the condition of bearings and problems such as internal rubbing, excessive wear.

**1.4.7.2 Plate heat exchangers**

i) The material used for cover plates, heat exchange plates and tie rods shall be subject to chemical and mechanical tests on one per heat basis. For gasket, ageing test, shrinkage test and hardness to be carried out.

ii) Each plate after pressing shall be subject to light box test or vacuum test or air chamber test as per manufacturer's practice.

iii) UT shall be done for plates with thickness 25 mm or above.

iv) DPT shall be conducted for 10% of the lot of heat exchanger plates. However, in case of any defects, entire lot shall be tested and only defect free plates shall be accepted.

v) 100% DPT shall be conducted on all welds.

vi) Each heat exchanger shall be subjected to hydraulic test.

vii) Assembly fit up and dimensional checks shall be carried out for each heat exchanger.

**1.4.7.3 Auto clean filters**

i) Tests shall be carried out on the materials on various components to establish their mechanical properties and chemical composition.

ii) In case of fabricated construction, the welds shall be examined for surface defects by 100% DPT.

iii) The body shall be subject to hydraulic test at 1.5 times the design pressure.

ii) Pressure drop, flow and particle size tests shall be carried out for the filter assembly.

**1.4.7.4 Pipes, Valves and fittings**

The QA requirements for piping, valves and fittings shall be as per clause 1.4.6 of this Section.

**1.4.8 EOT Cranes and Hoists**

**1.4.8.1 Hooks**

i) All tests including proof load test as per relevant IS shall be carried out.

ii) MPE or DPT shall be done after proof load test.

**1.4.8.2 Steels castings**

Steel castings shall be subjected to DPT on machined surface.

**1.4.8.3 Girders, end carriage, crab, gear-box and rope drum**

i) The plates of thickness 25mm and above for girders, end carriage, crab, gear-box and rope drum shall be ultrasonically tested.

ii) NDT requirements on weldments shall be as follows:

| | | |
|---|---|---|
| i) | Butt welds in tension | : 100% RT and 100% DPT |
| ii) | Butt welds in compression | : 10% RT and 100% DPT |
| iii) | Butt weld in rope drum | : 100% RT and 100% DPT |
| iv) | Fillet welds | : 10% DPT (random) |

**1.4.8.4 Forgings**

i) All forgings (wheel, gears, pinions, axles, hooks and hook trunnion) greater than or equal to 40mm diameter or thickness shall be subjected to ultrasonic testing.

ii) DPT or MPE shall be done after hard facing and machining.

**1.4.8.5 Wire rope**

Wire rope shall be tested as per relevant standard including breaking force and no. of strands.

**1.4.8.6 Reduction gear**

Reduction gears shall be tested for reduction ratio, backlash and contact pattern. Gear box shall be subjected to no- load run test to check for oil leakage, temp. rise, noise and vibration.

**1.4.8.7 Final testing**

The cranes shall be completely assembled at shop for final testing. All tests for dimension, deflection, load, overload, hoisting motion, etc. as per IS-3177 shall be carried out at shop.

**1.4.8.8 Electric hoists**

All electric hoists shall be tested as per IS-3938 and chain pulley blocks shall be testedas per IS-3832.

**1.4.9 Elevators**

i) Reduction gears shall be checked for reduction ratio, backlash and contact pattern. Run outs of wheel shafts and work shafts, tooth contact and running test shall also be carried out.

ii) Breaking load test shall be carried out along with all other tests as per relevant standard for steel wire rope.

iii) Buffer springs shall be subjected to load test as per relevant specifications.

iv) All components prior to assembly shall be checked for dimensions.

v) All rotating components shall be tested for dynamic balancing.

vi) Car sling and car body in assembled condition shall be checked for position of all major components i.e. car sling, inside depth, width, height, positions of push box, indicator box lights, fans etc.

vii) Vibration level shall be determined on work geared machine.

viii) Mechanical balance test and determination of vibration level on lift and accessories shall be carried out.

ix) In case the lift is provided with pressurized unit, the fan shall be dynamically balanced and complete unit shall be performance tested.

x) Function test of Elevator assembly shall be carried out. All electrical equipment shall be of proven quality.

### 1.4.10 Air Conditioning System

#### 1.4.10.1 Refrigerant compressor (reciprocating/ screw/ centrifugal)

i) Hydraulic/ pneumatic test of castings for cylinder block, crank case and casings etc. shall be carried out. No leakage shall be permitted

ii) DPT on connecting rod, piston, crankshaft, screw, impeller with shaft, vanes, crank case, cylinder and casing after machining shall be carried out.

iii) All rotating parts of reciprocating/ screw and centrifugal compressor shall be statically and dynamically balanced to ISO 1940 Gr. 6.3/ IS 21940.

iv) Leak tightness and vacuum check for chilling units and compressors inassembled condition shall be carried out. No leakage shall be permitted.

v) Performance test of assembled compressor shall be done to check for following:

a) Capacity test for oil pump for reciprocating compressor.

b) No load air run (free run) test of all types of compressors and chilling units to check FAD (free air delivery), noise, vibration and temperature rise of bearing and body.

c) Hydraulic/ leakage test for reciprocating compressor.

d) Functional run test and capacity control (for part load performance) check shall be carried out

**1.4.10.2 Condenser and evaporator**

i) DPT shall be carried out on finish welds.

ii) 10% RT of butt weld joints on shell shall be carried out.

iii) Dimensional check including tube hole diameter, ligament pitch etc. shall be carried out.

iv) Mock-up test for tube to tube sheet expansion shall be carried out. In case such a test is already conducted for similar tube/ tube sheet thickness and materials, record for the same shall be furnished for purchaser's review and approval.

v) Hydraulic/ pneumatic test of shell side and tube side of condenser and evaporator as applicable shall be carried out. No leakage shall be permitted.

**1.4.10.3 Vapour absorption machine (VAM)**

i) All materials used for fabrication shall be of tested quality. Mill test certificates for chemical and mechanical properties shall be furnished by the manufacturer. In absence of correlated mill test certificates, check test shall be carried out.

iii) Tubes for heat exchangers/ vessels and interconnecting pipes shall be tested as per the requirement of relevant code/standard.

iv) All welding shall be performed as per approved Welding Procedure Specification and IBR qualified procedure and welders.

v) Mock-up test for tube to tube sheet expansion shall be carried out. In case such a test is already conducted for similar tube/tube sheet thickness and materials, record for the same shall be furnished for purchaser's review.

vi) RT on butt weld joints of heat exchangers/ vessels shall be carried out as per the requirement of design code/approved drawing.

vii) DPT on Root run after back gouging and on finished welds shall be carried out.

viii) Vessels/ heat exchangers like high temperature and low temperature generator/ condenser/ high temperature and low temperature heat exchanger/ evaporator/ absorber shall be subjected to hydraulic pressure test and leakage test under vacuum with nitrogen gas and helium gas, both tube side and shell side as applicable for individual component prior to assembly. Helium leak test shall also be conducted on

complete assembly under suitable cover to detect any leakage into the system.

viii) The complete assembled unit shall be performance tested in shop for capacity (TR) and steam consumption at the rated conditions and part load conditions. Manufacturer shall furnish a detailed procedure along with calculation for conducting such test for approval and in case of any limitation same shall be clearly brought out in the bids. All the controls shall be tested for proper functioning during the above test.

**1.4.10.4 Air handling unit (AHU)**

i) 20% DPT of welding on fan hub, blades, casing and impeller as applicable shall be carried out.

ii) UT of fan shafts (diameter greater than or equal to 40mm) shall be carried out.

iii) DPT of fan shafts after machining shall be carried out.

iv) DPT of welding on shaft (in case of fabricated shaft) shall be carried out.

v) Blower fan shall be statically and dynamically balanced to ISO 1940 Gr. 6.3/ IS 21940.

vi) One fan of each type and size shall be performance tested as per AMCA / IS for air flow, static pressure, speed, efficiency, power consumption, noise and vibration.

vii) One per type of assembled AHU (AHU casing and fan assembly) shall be subject to free run test. Noise, vibration and temperature rise of bearing shall be measured during run test.

viii) All cooling coil shall be pneumatically tested and no leakage shall be permitted.

**1.4.10.5 Centrifugal pump**

The QA requirements for centrifugal pumps shall be as per clause 1.4.12.2 of this Section.

**1.4.10.6 Cooling towers**

i) UT of fan shaft and drive shaft (diameter greater than or equal to 40mm) shall be carried out.

ii) DPT of fan hub and shafts shall be carried out after machining.

iii) Colors of fills shall be as per approved data sheet.

iv) Fan assembly shall be statically balanced.

v) Cooling towers being supplied to site in assembled condition shall be subjected to run test at shop to measure FAD, noise and vibration. For cooling towers being supplied in knocked-down condition, these tests shall be done at site.

**1.4.10.7 Fans**

i) 20% DPT of welding on fan hub, blades, casing and impeller as applicable shall be carried out.

ii) DPT of fan shafts shall be carried out after machining.

iii) UT of fan shafts (diameter greater than or equal to 40mm) shall be carried out.

iv) Rotating components of all fans shall be statically and dynamically balanced to ISO-1940 Gr. 6.3.

v) All centrifugal fans shall be subjected to run test for 4 hour or till temperature stabilization is reached. Vibration, noise level, temperature rise and current drawn shall be measured during the run test.

vi) One fan of each type and size will be performance tested as per corresponding IS code for airflow, static pressure, total pressure, speed, efficiency, power consumption, noise, vibration and temperature rise.

**1.4.10.8 Low pressure air distribution system**

i) Functional test for fire damper along with solenoid shall be done.

ii) Prototype tests for fire resistance rating as per UL-555 of each type and size of damper shall be carried out. In case prototype tests have already been done, the contractor shall submit the test report for verification and approval.

iii) All ducting system shall be checked/tested for air leakages/tightness (smoke test) at site after completion.

**1.4.10.9 Insulation**

i) Insulation material shall be tested for all mandatory tests only as per relevant code or standard.

ii) Thermal conductivity tests (for thermal insulation only) shall be done once in six months for insulation material manufactured during six months period for the same density, outer diameter and thickness of material as applicable as per IS:3346 or equivalent standard.

**1.4.10.10 Air filters**

Pre and fine filters shall be tested for initial and final pressure drop versus flow and average synthetic dust weight arrestance as per the requirement of BS 6540 or ASHARE-52-76 or EN779.

**1.4.10.11 Packaged, split and window air conditioners**

i) Compressor of packaged air conditioner (PAC) shall be tested as per relevant code/standard.

ii) PAC shall be subjected to production routine test in accordance with IS: 8148 for the following.

a) General running test.

b) Pressure or leakage test of refrigerant.

c) Insulation resistance test.

d) High voltage test.

e) Performance test on one PAC of each type/size at ambient condition to check for following.

- DBT and WBT of supply and return air.
- Air flow
- Current, voltage measurement and power consumption
- Noise and vibration measurement

ix) Manufacturer's standard test certificate or guarantee certificate shall be submitted for split and window air conditioners.

**1.4.10.12 Pipes, valves and fittings**

The QA requirements for piping, valves and fittings shall be as per clause 1.4.6 of this Section.

**1.4.11 Ventilation System**

The QA requirements for ventilation system equipment shall be same as those applicable similar equipment of air conditioning system equipment described at clause 1.4.10 of this Section.

**1.4.12 Miscellaneous Items/ Equipment**

**1.4.12.1 Chemical dosing system**

i) Pumps of chemical doing system shall be performance tested as per relevant codes.

ii) In case of diaphragm type of pumps, the life cycle test shall be done on pumps.

iii) Dosing skid shall be subjected to leakage test and functional test.

**1.4.12.2 Centrifugal pumps**

i) Tests shall be carried out on the materials of the pumps to establish their properties, and chemical compositions.

ii) 100% DPT or MPE shall be carried out for the rotor and machined surfaces of casing and impellers.

iii) UT on pump shaft (diameter greater than or equal to 40mm), MPI or DPT on pump shaft and impeller after machining shall be carried out.

iv) All rotating components of the pumps shall be statically and dynamically balanced to ISO-1940 Gr. 6.3 / IS 21940.

v) Assembly fit up check, and dimensional check shall be carried out for the completed pump assembly.

vi) Pump casings shall be subject to hydraulic test at 1.5 times the shut off pressure or 2 times the working pressure whichever is higher for a minimum duration of 30 minutes.

vii) All pumps shall be tested at manufacturer's works for head, capacity, power and efficiency as per requirements of HIS, USA or equivalent standard.. Pump shall be given running test over the entire operating range covering from the shut-off head to the maximum flow. Acceptance shall be as per approved datasheet and HIS only.

viii) Pumps shall be subjected to strip down examination visually to check for mechanical damages after testing at shop in case abnormal noise level and/or excessive vibration are observed during the shop test.

**1.4.12.3 Blowers and exhausters**

i) Tests shall be carried out on the materials of the rotary blowers to establish their properties, and chemical compositions.

ii) 100% DPT or MPE shall be carried out for the rotor and machined surfaces of casing and impellers.

iii) Rotors shall be dynamically balanced as per ISO-1940 Gr. 6.3/IS 21490

iv) Assembly fit up check, and dimensional check shall be carried out for the completed blower assembly.

v) The blower casing shall be subject to hydraulic test at 1.5 times the shut off pressure or 2 times the working pressure whichever is higher.

vi) Performance test including noise and vibration tests shall be carried out as per relevant standards and codes.

**1.4.12.4 Filters and strainers**

i) Tests shall be carried out on the materials on various components to establish their mechanical properties and chemical composition.

ii) In case of fabricated construction, the welds shall be examined for surface defects by 100% DPT.

iii) The body shall be subject to hydraulic test at 1.5 times the design pressure.

iv) Pressure drop, flow and particle size tests shall be carried out for the filter assembly.

**1.4.12.5 Tanks and vessels**

i) Tests shall be carried out on the materials on various components to establish their mechanical properties and chemical composition.

ii) UT shall be carried out on plate material used for fabrication of tanks and vessels.

iv) Hydraulic test for pressurised vessels and water fill test for atmospheric tanks shall be carried out as per relevant standards/ codes.

iv) Butt welds and full penetration welds shall be checked by suitable RT or UT. Fillet welds shall be checked by MPE or DPT.

**1.4.12.6 Lube oil system/ hydraulic power pack**

Lube oil system/ hydraulic power pack shall be tested for performance.

**1.5 FGD SYSTEM**

**1.5.1 Wet lime stone FGD System:**

**1.5.1.1 Mechanical Systems**

**1.5.1.1.1 Flue Gas System**

**I. Booster fans**

i) Rotor components shall be subjected to ultrasonic test at mill and magnetic particle examination/dye penetration examination after rough machining.

ii) Butt welds in rotor components shall be subjected to 100% UT and all welds shall be subjected to MPE or DPT after stress relieving.

iii) All rotating components of fans shall be dynamically balanced to quality grade 2.5 of ISO 1940.

iv) Test for natural frequency of all fan components, including fan blades shall be carried out for the fans.

v) Full range performance test shall be carried out on one fan as per BS 848, Part-1.

vi) Hydraulic coupling of booster fan shall be checked for string test i.e., operational check of one fan assembly using hydraulic coupling to check temperature rise, smooth operation, vibration and noise level. Dry run test shall preferably be carried out during string test.

**II. Thermal insulation**

i) Pre-formed fibrous pipe insulation and LRB mattresses/ sections of rock wool/ mineral wool from approved manufacturing sources conforming to and tested as per relevant standards shall be used.

ii) For resin bonded mineral wool insulation, testing shall be carried out as per IS: 8183.

iii) For resin bonded rock wool insulation, testing shall be carried out as per IS: 9842.

iv) Type tests except thermal conductivity shall be regularly carried out once in three months.

v) Type test for thermal conductivity shall be carried out by the manufacturer minimum once in six months. Thermal conductivity (K value) shall be measured in line with IS: 3346.

**III. Dampers**

i) All the dampers shall be subjected to operational test/checks.

ii) Gas tight dampers shall be subjected to shop leakage test to demonstrate the guaranteed tightness (minimum one damper of each type and size offered). In case such type test is already done, the reports of the same shall be submitted for review.

iii) All dampers shall be checked for sealing dimensions to establish guaranteed tightness.

**IV. Structure, Ducts, Hoppers**

i) All materials shall be tested for chemical and mechanical properties as per relevant standard. All plates above 40mm shall be 100% Ultrasonically tested.

ii) Visual inspection of all welds shall be performed in accordance with AWSDI .1.

iii) NDT requirements of structural steel welds shall be as under:

a) 100% RT/UT on butt-welds of plate thickness ≥ 32mm.

b) For plates of 25mm ≤ thickness<32mm: 10%RT and 100% MPI.

c) For plates of thickness <25mm: 10% MPI/LPI.

iv) Edge for shop and field weld shall be examined by MPI for plate thickness ≥ 32mm.

Cladding material and its application on the ducts shall be tested as per applicable standard.

**1.5.1.1.2 Absorber**

**I. Metal Structures**

i) Only material which has been identified against mill sheet or test certificates shall be used for construction. All plates above 40mm shall be 100% Ultrasonically tested**.**

ii) Visual inspection of all welds shall be performed in accordance with AWSDI .1.

iii) NDT requirements of structural steel welds shall be as under:

a) 100% RT/UT on butt-welds of plate thickness>= 32mm.

b) For plates of 25mm<=thickness<32mm-10%RT and 100% MPI.

c) For plates of thickness <25mm-10% MPI/LPI.

iv) Edge for shop and field weld shall be examined by MPI for plate thickness >= 32mm.

v) Tanks shall be water fill tested up to liquid level as per construction Code.

vi) Vacuum test according to design code/standard as applicable.

vii) Cladding/Bonding material and its application shall be tested as per applicable standard.

viii) Corrosion test on Corrosion Resistant Alloy shall be performed as per ASTM G48/applicable relevant standard for C276 Gr material. For Ti Cladding, material shall be tested as per relevant applicable Indian/International standard.

ix) Absorber fabricated and erected at site shall be subjected to all tests according to design code/ standard as applicable.

II. **Spray Nozzles**

i) Spray nozzles shall be tested for physical properties.

ii) Spray nozzles also shall be subjected to performance test.

III. **Agitators**

i) Rubber lining shall be tested for hardness and spark test.

ii) Impellers shall be tested for dimensional and balancing check.

iii) Gear Boxes shall be tested for run test as per standard practice.

**IV. Other Critical Equipment**

Checks/ NDTs shall be done as per relevant Indian Standards or equivalent International Standards.

### 1.5.1.1.3 Limestone & Gypsum Handling System

**I. Crushers**

The details of the checks to be carried out for various components are to be submitted by the Contractor for Owner's approval. However, some indicative checks on different items are given below which should necessarily form part of the Quality Assurance Plan to be agreed with the Owner.

i) All plates equal to or above 25mm thickness shall be ultrasonically tested.

ii) Shaft forgings and suspension bars to be checked for ultrasonic testing in addition to check for chemical, mechanical, hardness, microstructure etc. as per applicable material specification.

iii) Following minimum NDT requirements to be ensured for welds:

a) Butt welds - 10% UT/RT and 100% MPI/DPT.

b) Fillet Welds - 10% MPI/DPT.

iv) Crusher rotor to be dynamically balanced. Procedure to be submitted for approval.

v) No-load trial run test to be carried out at shop to check for speed(RPM), temperature rise, noise level and vibration.

**II. Metal Detectors**

i) Functional test including sensitivity, Burn in test, operation of liquid spray marker, detection of smallest piece of different materials as specified.

ii) Test report for Degree of protection test to be furnished.

**III. Belt Conveyor System**

The details of the checks to be carried out in the various equipment are to be submitted by the Contractor for Owner's approval. However, some indicative checks on different items are given below which should necessarily form a part of the Quality Assurance Plan to be agreed with the Owner.

**IV. Idlers**

i) Check for run out and free movement shall be carried out on idlers. Run out shall be restricted as per IS:8598

ii) Test for dust proofness, water proofness and dynamic friction factor of the Idlers shall be conducted at shop. The detailed procedures for the same shall be submitted for review and approval.

**V. Belting**

i) Rubber cover of finished belt shall be checked for tensile strength and elongation at break before and after ageing. Rubber cover shall also be checked for abrasion, tear strength and hardness.

ii) For finished belts, checks for elongation at 10% nominal tensile strength tensile and elongation at break in longitudinal (warp) direction and tensile in transverse (weft) direction shall be carried out.

iii) Adhesion test between ply to ply and cover to ply shall be carried out.

iv) Troughability test and Test for fire resistance shall be carried out.

v) Test for procedure qualification for belt vulcanizing joint (at site) shall be done. Procedure for belt vulcanizing joint shall be discussed and finalized during FQP finalization.

vi) There will be a limitation on the no. of repairs allowed on the belts. Following will be the acceptance norm for the cover repairs.

- The maximum size of a repair shall be limited to a size equivalent to one fifth the belt width. No single dimension shall exceed one fifth (1/5) of belt width.
- Small local repair by dough filling of size 25mm x 25mm to a limited extent shall not be counted of repairs. However, in case of cluster of repairs, same shall be counted as a patch repair.
- The maximum number of patch repair shall not exceed 5 per 100 meter. However, the total number of patch and dough filling repairs shall not exceed 10 per 100 meters.

vii) In addition to above, Steel Cord belt shall be tested for following also:

- Cord dia and breaking strength
- Finished belt shall be tested for cord pull-out strength before and after ageing, peeling resistance.
- Dynamic cord pull out test
- Cord dia, pitch and number of cords

viii) In no case shall the cover thickness or the width of belt be less than that given in specification.

ix) For testing purpose, belt sample shall be taken from anywhere of the belt roll length offered.

**VI. Belt vulcanizing machine**

i) Check for tensile strength shall be carried out on a sample vulcanized belt joint for each type of belt in shop. However, if such test has been done earlier, the report for same shall be submitted for verification.

ii) Complete assembly shall be tested at shop for temp. and pressure developed.

**VII. Pulleys**

i) In addition to chemical, mechanical, hardness, microstructure as per applicable material specification, pulleys shaft forgings shall be subjected to ultrasonic testing.

ii) 100% MPI/DPT on all welds shall be conducted and 10% RT/UT on butt welds shall be conducted.

iii) Static balancing of pulleys shall be carried out after rubber lagging.

iv) Checks on rubber lagging to include abrasion loss, shore hardness test, peel-off strength test and physical properties. Peel-off strength shall be 10 kg/cm, Abrasion loss shall be less than 250 cubic mm when tested as per DIN 53516.

**VIII. Pull chord & belt sway switches**

The following tests shall be carried out:

i) Over all dimension and functional test.

ii) HV & IR test

iii) Degree of protection test report.

**IX. Zero speed switch, under belt switch and chute blockage switch**

The following tests shall be carried out:

i) Burn in test at 50 deg. C for 48 hours shall be done for electronic switches.

ii) Over all dimension and functional tests.

iii) HV & IR

iv) Degree of protection test

**X. Drive Equipment**

i) Gear Boxes

- In addition to checks for physical, chemical, hardness, microstructure as per relevant standard, the shaft and gear/pinion forgings shall be subjected to ultrasonic testing
- MPI to be carried out on Gears/Pinions after machining. Case depth, hardness and MPI after hard facing shall be checked to ensure freedom from defects.
- Gear reducer shall be checked for reduction ratio, backlash and contact pattern. No load shop trial run to be conducted on gear boxes to check for oil leakage, temperature rise, noise level and vibration.

ii) Flexible Coupling

- Ultrasonic testing shall be conducted on forgings for gear sleeve and gear hub, if gear coupling is provided.

- MPI shall be carried out after machining to ensure freedom from cracks.

iii) Fluid Coupling

- Dynamic balancing shall be carried out for the rotating parts.

- Check for leak tightness of the coupling shall be carried out.

- Functional test on fusible plug for each type of coupling shall be conducted at shop.

- All couplings to be run tested at shop on no load.

- Check for temperature rise, torque-speed, torque-slip characteristics and over speed test shall be included during performance test of one coupling of each type preferably at full load.

**XI. Belt Scales**

The details of the checks to be carried out in the various equipment are to be submitted by the Contractor for Employer's approval. However, some indicative checks are given below which should necessarily form a part of the quality assurance plan to be agreed with the Employer.

i) Mounting arrangement/Overall dimensional check shall be carried out on the Belt Scales.

ii) Belt scale shall be calibrated with test weight/test chain in static at works and with test weight for dynamic condition at site.

iii) All electronic modules shall be subjected to burn in test at 50 deg. C for 48 hours.

iv) General check for load cell shall be carried out.

v) Test report for degree of protection on enclosure shall be furnished.

vi) Accuracy/performance check shall be demonstrated at site.

**1.5.1.1.4 Dust Control System**

The tests etc. shall be carried out various components of dust extraction system offered by the bidder in line with standard industry practice. The details of the checks to be carried out on the various equipment are to be submitted by the Contractor for Purchaser’s approval.

**1.5.1.1.5 Bucket Elevator**

i) All plates equal to or above 25 mm thickness shall be ultrasonically tested.

ii) Castings and forgings, forged/rolled bar/section shall be subjected to ultrasonically test in addition to check for chemical, mechanical, hardness, microstructure etc. as per applicable material specification.

iii) Machined and hard faced surface of casting/forging and other hardened, stellited parts shall be subjected to DPT/MPI in addition to check for case depth, hardness as applicable for chain/sprocket/gear reducer/ rollers/ wheel/ pan etc.

iv) Following minimum NDT requirements shall be followed for welds:

a) Butt Welds in Tension - 100% UT/RT and 100% MPI/DPT.

b) Butt Welds in Compression - 10% UT/RT and 10% MPI/DPT.

c) Fillet Welds - 10% MPI/DPT.

v) For other items like drive system, motor, pulley, belt etc. relevant portion of specification shall be applicable.

vi) No load trial run test shall be carried out at shop on completely assembled Bucket Elevator to check for trouble free operation, temperature rise, Noise & vibration. The procedure for the No load trial run shall be submitted for approval.

**1.5.1.1.6 Silos/ Bunkers**

i) All material shall be tested for Chemical & Mechanical properties as per relevant standard. MPI/DP test on welding shall be carried out. Fit up assembly checks shall be carried out at shop for all despatchable segments.

ii) Bag Filters: Bag Leakage test shall be carried out for pressure parts. Pulsing and sequential test on bag filter shall be done.

**1.5.1.1.7 Ball Mills**

i) Raw material for shaft, coupling, gears and pinions, top and bottom races and other rotating components shall be subjected to UT. MPI/LPI shall be carried out to check surface soundness.

ii) Wear-resistant parts shall be UT/RT tested to check soundness after suitable heat treatment. Check for chemical composition, hardness and microstructure shall be carried out.

iii) Butt welds in the tube/separator/body casing of the mill shall be tested by RT and MP'. All other welds in main tube/separator shall be tested by MPI/LPI for acceptance. The tube shall be statically balanced.

iv) All gearboxes shall be run tested for adequate duration to check rise in oil temperature, noise level and vibration. Check for leak tightness of gear case also shall be performed.

No load run test of the assembly shall be demonstrated at shop/site depending upon its

design/feasibility

I. **Gravimetric Feeders**

i) Any welds in the casing/pulley fabrication shall be checked with MPI.

ii) Routine tests shall be done as per relevant Indian Standards or equivalent International Standards.

iii) All major items like plates for casing, head pulley, tail pulley, pulley shaft and major castings shall be procured with respective material test certificates.

iv) Calibration check shall be carried out on all feeders.

II. **Lubricating oil systems**

Complete lube oil system shall be checked suitably as per standard practice.

**1.5.1.1.8 Vacuum Belt Filter System**

i) Impeller, casing and shaft of vacuum pumps shall be tested for chemical and mechanical properties as per relevant standard. All plates above 40mm shall be 100% Ultrasonically tested.

ii) UT on shaft (if greater or equal to 40mm) and impeller shall be carried out.

iii) All vacuum pumps shall be tested at shop for capacity, power, pressure, efficiency, noise and vibration etc.

iv) Filter cloths and belts shall be tested for physical properties as per relevant standard

v) Hydro cyclones shall be checked by visual, dimensional etc.

**1.5.1.1.9 Monorail and Hoists**

**I. Hooks**

i) All tests including proof load test as per relevant IS/BS/DIN shall be carried out.

ii) MPE or DPT shall be done after proof load test.

**II. Steels castings**

Steel castings shall be subjected to DPT on machined surface.

**III. Forgings**

i) All forgings (wheel, gears, pinions, axles, hooks and hook trunnion) greater than or equal to 40mm diameter or thickness shall be subjected to ultrasonic testing.

ii) DPT or MPE shall be done after hard facing and machining.

**IV. Wire rope**

Wire rope shall be tested as per relevant standard.

**V. Electric hoists**

All electric hoists shall be tested as per IS-3938 and chain pulley blocks shall be tested as per IS-3832.

**1.5.1.1.10 Ventilation System**

i) Fans

a) 20% DPT of welding on fan hub, blades, casing and impeller as applicable shall be carried out.

b) DPT of fan shafts shall be carried out after machining.

c) UT of fan shafts (diameter greater than or equal to 40mm) shall be carried out.

d) Rotating components of all fans shall be statically and dynamically balanced to ISO-1940 Gr. 6.3.

e) All centrifugal fans shall be subjected to run test for 4 hour or till temperature stabilization is reached. Vibration, noise level, temperature rise and current drawn shall be measured during the run test.

f) One fan of each type and size will be performance tested as per corresponding IS code for airflow, static pressure, total pressure, speed, efficiency, power consumption, noise, vibration and temperature rise.

**1.5.1.1.11 Piping Valves and fittings- Refer clause 1.4.6**

**1.5.1.1.12 Packaged, split and window air conditioners**

i) Compressor of packaged air conditioner (PAC) shall be tested as per relevant code/standard.

ii) PAC shall be subjected to production routine test in accordance with IS: 8148 for the following.

a) General running test.

b) Pressure or leakage test of refrigerant.

c) Insulation resistance test.

d) High voltage test.

e) Performance test on one PAC of each type/size at ambient condition to check for following:

- DBT and WBT of supply and return air.
- Air flow
- Current, voltage measurement and power consumption
- Noise and vibration measurement

iii) Manufacturer's standard test certificate or guarantee certificate shall be submitted for split and window air conditioners.

**1.5.1.1.13 Elevators**

i) The details of the checks to be carried out in the various equipment are to be submitted by the contractor for owner's approval. However, some indicative checks on different items are given below which should necessarily form part of the quality assurance plan to be agreed with the owner.

ii) All forgings shall be subjected to ultrasonic test to ensure free from internal defects in addition to check for chemical and mechanical properties.

iii) 10% of the welds selected at random shall be subject to DP test.

iv) All forged components shall be subjected to DPI/MPI after machining.

v) Gear Reducer shall be checked for gear ratio, backlash, contact pattern. No load shop trial run shall be conducted on gear boxes to check for oil leakage, temperature rise, noise and vibration.

vi) Buffer springs shall be subjected to load test as per relevant specifications. Material certificates for springs shall also be furnished

vii) All components prior to assembly shall be checked for dimensions.

viii) Car sling and car body in assembled condition shall be checked for position of all major components i.e. car sling, inside depth, width, height, positions of push box, indicator box lights, fans etc.

ix) Function test of Elevator assembly shall be carried out.

x) All electrical equipment shall be of proven quality.

xi) Galvanized components/parts shall be checked for weight of Zn coating, thickness of coating, uniformity of coating and adhesion test and visual examination as per IS 2633 and IS 2629.

**1.5.1.1.14 Fire Detection & Protection System**

i) **Hydrant System: Shop Tests**

a) Hydrant Valve:

- All valves shall be hydro tested for body and seat.
- Capacity test / flow test shall be done as per relevant standard.

b) Water Monitor, Hoses, Branch Pipes, Couplings and Nozzles:

- All tests including hydraulic test shall be done as per relevant Indian/ International standard.

ii) **High/ medium velocity water spray & sprinkler system: shop tests**

a) For Pipes, Fittings, Valves and specialties, requirements are indicated separately.

b) Deluge Valves, Alarm Valves and Spray Sprinkler Nozzles

- All valves shall be hydro tested for body and seat.
- Performance test / functional test of 'Deluge Valves' and 'Spray Nozzles' shall be carried out.

iii) **Detectors**

All 'Detectors' shall be tested as per relevant Indian / International Standards. Detectors shall also meet the requirements of UL / FM / LPC/VDS etc.

iv) **Piping, valve and specialties**

Refer clause 1.4.6

v) **Portable & mobile fire extinguishers**

a. All fire extinguishers shall be tested as per relevant standard.

b. Performance / function test shall be carried out on sampling basis as per relevant code / standard.

vi) **Site tests.**

a) Fire Extinguishers: A performance demonstration test at site of five (5) percent or one (1) number, whichever is higher, of each type and capacity of the extinguisher shall be carried out by the contractor. All consumables and replaceable items require for the contractor without any extra cost to employer would supply this test would be supplied by the Contractor without any extra cost to employer.

b) Piping Protection:

- Thickness, Holiday by spark test, Adhesion test shall be carried out as per relevant standard.
- Complete piping shall be Hydro pressure tested, at 1.5 X DP or 2 X MWP whichever is higher, before protection.

c) Welding of Pipes:

- ERW Black / rolled welded:
  - 100% DPT on root of butt and finish weld of butt and fillet.
  - RT on 10% randomly selected joints shall be carried out (for underground piping).

- GI Pipes
  Welding on GI Pipes in general shall not be done. Welding of GI Pipes, if permitted by design, (butt / socket / fillet weld) shall be done strictly as per approved drawing and procedure approved by NTPC Engineering. For all such welds 100% DP test and random 1% RT shall be done.

#### 1.5.1.1.15 Miscellaneous Equipment

**I. Pressure Vessels**

i) NDT on weld joint shall be as per respective code requirements or the minimum as specified as below:

a) 100% DPT on root run of butt weld, nozzle welds and finished fillet welds.

b) 10% DPT on all finished butt welds.

c) 10% RT (covering all 'T'/cross joints) of butt welds.

ii) Butt welds of dished ends shall be stress relieved and subjected to 100% RT.

iii) Each finished vessels shall be hydraulically tested to 150% of the design pressure for a duration of 30 minutes.

**II. Tanks**

i) Tests shall be carried out on the materials of the tanks to establish their mechanical properties, and chemical compositions

ii) Plates shall be subject to 100% ultrasonic testing.

iii) Welding

a) Root run of butt welds shall be examined by 100% DPT or MPE.

b) Butt welds, full penetration joints and nozzle welds shall be checked by 100% RT and 100% MPE or DPT.

c) Fillet welds shall be checked by 100% MPE or DPT.

iv) Rubber lining shall be subject to hardness and spark test, as applicable.

v) Visual check and dimensional measurement shall be carried out on the completed equipment.

vi) The fabricated tank shall be subject to water fill test to check for the leakage.

#### 1.5.1.1.16 Low Pressure Piping, Valves and Fittings etc. Refer clause 1.4.6

### 1.5.1.1.17 Pumps & Blowers

#### I. Dosing pumps/ metering pumps

i) Tests shall be carried out on the materials of the pumps to establish their properties, and chemical compositions

ii) Pump casings shall be subject to hydraulic test at 1.5 times the shut off pressure or 2 times the working pressure whichever is higher.

iii) Pumps shall be performance tested as per HIS, USA.

#### II. Horizontal centrifugal pumps

i) Tests shall be carried out on the materials of the pumps to establish their properties, and chemical compositions.

ii) 100% DPT or MPE shall be carried out for the rotor and machined surfaces of casing and impellers.

iii) UT on pump shaft (diameter greater than or equal to 40mm), MPI or DPT on pump shaft and impeller after machining shall be carried out.

iv) All rotating components of the pumps shall be statically and dynamically balanced to ISO-1940 Gr. 6.3.

v) Assembly fit up check, and dimensional check shall be carried out for the completed pump assembly.

vii) Pump casings shall be subject to hydraulic test at 1.5 times the shut off pressure or 2 times the working pressure whichever is higher for a minimum duration of 30 minutes.

viii) All pumps shall be tested at manufacturer's works for head, capacity, power and efficiency as per requirements of HIS, USA or equivalent standard. Pump shall be given running test over the entire operating range covering from the shut-off head to the maximum flow. Acceptance shall be as per approved datasheet and HIS only.

ix) Pumps shall be subjected to strip down examination visually to check for mechanical damages after testing at shop in case abnormal noise level and/or excessive vibration are observed during the shop test.

#### III. Vertical sump pumps

i) All materials should be of tested quality and test certificates to be provided.

ii) Shaft forgings to be subjected to ultrasonic testing. iii) DPT to be done on machined shaft and impeller. iv) Impellers to be dynamically balanced to ISO 1940 Gr.6.3.

v) All pressure parts shall be hydraulically tested at 150% of the shut-off head or 200% of rated head, whichever is higher for 30 minutes. No leakage is allowed.

vi) All pumps to be performance tested as per Hydraulic Institute Standard/ Indian Standard. Performance test to include check for noise, vibration level and bearing temperature rise.

**IV. Blowers**

i) Tests shall be carried out on the materials of the rotary blowers/ compressors to establish their properties, and chemical compositions.

ii) 100% DPT or MPE shall be carried out for the rotor and machined surfaces of casing and impellers.

iii) The shaft and impellers shall be dynamically balanced.

iv) Assembly fit up check, and dimensional check shall be carried out for the completed blower assembly.

v) The blower/ compressor casing shall be subject to hydraulic test at 1.5 times the shut off pressure or 2 times the working pressure whichever is higher.

vi) The blowers/ compressor shall be performance tested as per relevant code/ standard.

**V. Air Compressors**

i) All pressure parts shall be hydraulically tested at not less than 150% of design pressure for a duration of 30 minutes prior to painting.

ii) All other parts including inter-connecting piping shall be hydraulically tested wherever possible, as per relevant codes.

iii) Ultrasonic testing shall be carried out on all forgings and rotor for dia 40mm and above. MPI/DPT shall be done on machined area of the components.

iv) During assembly all clearances and alignments shall also be checked and recorded

v) Rotor shall be statically and dynamically balanced.

vi) Performance test on the compressor shall be carried out in accordance with ISO: 1217/Eq. The test shall also include demonstration of loading and unloading mechanism (Capacity control) and operation of safety valve.

vii) Vibration and Noise level measurement shall be done during shop performance test.

viii) Air Receiver

a) Each finished vessel shall be hydraulically tested at 150% of the design pressure for a duration of 30 minutes

b) NDT on weld joints shall be as per respective code requirements or the minimum as specified below:

- 100% DPT on root run of butt welds
- 100% DPT on all finished butt welds and fillet welds
- 10% RT on butt welds which shall include all T-Joints

**1.5.1.1.17 Hangers and Supports**

i) All raw materials used shall have co-related mill test certificate meeting mandatory checks of material specification.

ii) Completed springs shall be tested for sagging test and load versus deflection test. For diameter more than 25mm, MPE shall also be carried out.

iii) Butt welds of thickness 32mm and above shall be tested for UT, and for butt welds of thickness less than 32mm MPE shall be done. Fillet welds shall be tested for MPE.

iv) Dampers with viscous fluids shall be checked for viscosity of liquid used, damping resistance of the damper, stiffness of the damper etc.

v) Turn-buckle, pipe clamps and hangers of thickness greater than 25mm shall be checked by MPE or DPT on bent portions.

vi) Assembled hanger, one number of each type and size shall be checked for variation in deflection and travel versus load test.

**1.5.2 Sea water based FGD System:**

The testing and inspection requirements of major equipment of FGD system to be followed by the bidder over and above the respective code/ standard requirements are given hereunder:

**1.5.2.1 MECHANICAL SYSTEMS**

**1.5.2.1.1 Flue Gas System**

**I. Booster fans**

i) Rotor components shall be subjected to ultrasonic test at mill and magnetic particle examination/dye penetration examination after rough machining.

ii) Butt welds in rotor components shall be subjected to 100% UT and all welds shall be subjected to MPE or DPT after stress relieving.

iii) The rotor of fans shall be dynamically balanced to quality grade 6.3 of ISO 1940.

iv) Test for natural frequency and hardness of fan blades shall be carried out as per technical specification/ relevant standard.

v) Full range performance test shall be carried out on one fan as per BS 848, Part-1/ equivalent standard.

**II. Thermal insulation**

a) Pre-formed fibrous pipe insulation and LRB mattresses/ sections of rock wool/ mineral wool from approved manufacturing sources conforming to and tested as per relevant standards shall be used.

b) For resin bonded mineral wool insulation, testing shall be carried out as per IS: 8183.

c) For resin bonded rock wool insulation, testing shall be carried out as per IS: 9842.

d) Type tests except thermal conductivity shall be regularly carried out once in three months.

e) Type test for thermal conductivity shall be carried out by the manufacturer minimum once in six months. Thermal conductivity (K value) shall be measured in line with IS: 3346.

**III. Dampers**

i) All the dampers shall be subjected to operational test/checks.

ii) Gas tight dampers shall be subjected to shop leakage test to demonstrate the guaranteed tightness (minimum one damper of each type and size offered).

iii) All dampers shall be checked for sealing dimensions to establish guaranteed tightness.

**IV. Structure, Ducts, Hoppers**

i) All materials shall be of tested quality and test certificates for chemical and mechanical properties as per relevant standard shall be provided. All plates above 40mm shall be 100% Ultrasonically tested.

ii) Visual inspection of all welds shall be performed in accordance with AWSDI .1.

iii) NDT requirements of structural steel welds shall be as under:

a) 100% RT/UT on butt-welds of plate thickness ≥ 32mm.

b) For plates of 25mm ≤ thickness<32mm: 10%RT/UT and 100% MPI.

c) For plates of thickness <25mm: 10% MPI/LPI.

iv) Edge for shop and field weld shall be examined by MPI for plate thickness ≥ 32mm.

**1.5.2.1.2 Gas to gas heater (GGH)**

i) Forged shafts for GGH like stub shaft, main rotor forging, housing hub shall be subjected to 100% UT at mill and magnetic particle examination after machining.

ii) Critical welds of rotor post shall be subjected to radiographic examination.

iii) Trial run of GGH drive assembly (gear box+pinion+electric motor+ air motor) shall be carried out at shop.

**1.5.2.1.3 Scrubber**

**I. Metal Structures**

i) Only material which has been identified against mill sheet or test certificates shall be used for construction. Check testing shall be carried out in the absence of MTC. All plates above 40mm shall be 100% Ultrasonically tested**.**

ii) Visual inspection of all welds shall be performed in accordance with AWSDI .1.

iii) NDT requirements of structural steel welds shall be as under:

a) 100% RT/UT on butt-welds of plate thickness>= 32mm.

b) For plates of 25mm<=thickness<32mm-10%RT and 100% MPI.

c) For plates of thickness <25mm-10% MPI/LPI.

iv) Edge for shop and field weld shall be examined by MPI for plate thickness >= 32mm.

II. **Spray Nozzles**

i) Spray nozzles shall be tested for physical properties.

ii) Spray nozzles also shall be subjected to performance test.

III. **Other Critical Equipment**

Checks/ NDTs shall be done as per relevant Indian Standards or other applicable International Standards.

**1.5.2.1.4 Sea water pumps**

i) All materials shall be of tested quality and test certificates for chemical and mechanical properties as per relevant standard shall be provided.

ii) Shaft forgings and thrust bearing to be subjected to ultrasonic testing.

iii) DPT/ MPI to be done on machined shaft, impeller, castings, column pipes, companion flanges and thrust bearing.

iv) RT to be done on impeller, column pipe discharge head assembly and flanges.

v) Impeller and shaft to be dynamically balanced to ISO 1940 Gr.6.3.

vi) Casing shall be hydraulically tested at 150% of the shut-off head for 30 minutes. No leakage is allowed.

vii) All pumps to be performance tested as per Hydraulic Institute Standard/ Indian Standard. The performance test shall be conducted to verify output (flow) against total head, power input, efficiency and to establish the characteristic curves of the pump. The performance test shall also include check for noise, vibration level and bearing temperature rise.

**1.5.2.1.5 Monorail and Hoists**

**I. Hooks**

i) All tests including proof load test as per relevant IS shall be carried out.

ii) MPE or DPT shall be done after proof load test.

**II. Steels castings**

Steel castings shall be subjected to DPT on machined surface.

**III. Forgings**

i) All forgings (wheel, gears, pinions, axles, hooks and hook trunnion) greater than or equal to 40mm diameter or thickness shall be subjected to ultrasonic testing.

ii) DPT or MPE shall be done after hard facing and machining.

**IV. Wire rope**

Wire rope shall be tested as per relevant standard.

**V. Electric hoists**

All electric hoists shall be tested as per IS-3938 and chain pulley blocks shall be tested as per IS-3832.

**1.5.2.1.6 Ventilation System**

i) Fans

a) 20% DPT of welding on fan hub, blades, casing and impeller as applicable shall be carried out.

b) DPT of fan shafts shall be carried out after machining.

c) UT of fan shafts (diameter greater than or equal to 40mm) shall be carried out.

d) Rotating components of all fans shall be statically and dynamically balanced to ISO-1940 Gr. 6.3.

e) All centrifugal fans shall be subjected to run test as per manufacturer's standard practice.

f) One fan of each type and size will be performance tested as per corresponding IS code for airflow, static pressure, total pressure, speed, efficiency, power consumption, noise, vibration and temperature rise.

ii) Piping, valves and fittings- Refer clause 1.4.6

**1.5.2.1.7 Packaged, split and window air conditioners**

i) Compressor of packaged air conditioner (PAC) shall be tested as per relevant code/standard.

ii) PAC shall be subjected to production routine test in accordance with IS: 8148 for the following.

a) General running test.

b) Pressure or leakage test of refrigerant.

c) Insulation resistance test.

d) High voltage test.

e) Performance test on one PAC of each type/size at ambient condition to check for following:

- DBT and WBT of supply and return air.
- Air flow
- Current, voltage measurement and power consumption
- Noise and vibration measurement

iii) Manufacturer's standard test certificate or guarantee certificate shall be submitted for split and window air conditioners.

**1.5.2.1.8 Elevators**

i) The details of the checks to be carried out in the various equipment are to be submitted by the contractor for owner's approval. However, some indicative checks on different items are given below which should necessarily form part of the quality assurance plan to be agreed with the owner.

ii) All critical forgings shall be subjected to ultrasonic test to ensure free from internal defects in addition to check for chemical and mechanical properties.

iii) 10% of the welds selected at random shall be subject to DP test.

iv) All forged components shall be subjected to DPI/MPI after machining.

v) Gear Reducer shall be checked for gear ratio, backlash, contact pattern. No load shop trial run shall be conducted on gear boxes to check for oil leakage, temperature rise, noise and vibration.

vi) Buffer springs shall be subjected to load test as per relevant specifications. Material certificates for springs shall also be furnished

vii) All components prior to assembly shall be checked for dimensions.

viii) Car sling and car body in assembled condition shall be checked for position of all major components i.e. car sling, inside depth, width, height, positions of push box, indicator box lights, fans etc.

ix) Function test of Elevator assembly shall be carried out.

x) All electrical equipment shall be of proven quality.

xi) Galvanized components/parts shall be checked for weight of Zn coating, thickness of coating, uniformity of coating and adhesion test and visual examination as per IS 2633 and IS 2629.

**1.5.2.1.9 Fire Detection & Protection System**

i) **Hydrant System: Shop Tests**

a) Hydrant Valve:

- All valves shall be hydro tested for body and seat.
- Capacity test / flow check shall be done as per relevant standard.

b) Water Monitor, Hoses, Branch Pipes, Couplings and Nozzles:

- All tests including hydraulic test shall be done as per relevant Indian/ International standard.

ii) **High/ medium velocity water spray & sprinkler system: shop tests**

a) For Pipes, Fittings, Valves and specialties, requirements are indicated separately.

b) Deluge Valves, Alarm Valves and Spray Sprinkler Nozzles

- All valves shall be hydro tested for body and seat.
- Performance test / functional test of 'Deluge Valves' and 'Spray Nozzles' shall be carried out.

iii) **Detectors:** All 'Detectors' shall be tested as per relevant Indian / International Standards. Detectors shall also meet the requirements of UL / FM / LPC/VDS etc.

iv) **Piping, valve and specialties**

Refer clause 1.4.6.

v) **Portable & mobile fire extinguishers**

a. All fire extinguishers shall be tested as per relevant standard.

b. Performance / function test shall be carried out on sampling basis as per relevant code / standard.

vi) **Site tests.**

a) Fire Extinguishers: A performance demonstration test at site of five (5) percent or one (1) number, whichever is higher, of each type and capacity of the extinguisher shall be carried out by the contractor. All consumables and replaceable items require for the contractor without any extra cost to employer would supply this test would be supplied by the Contractor without any extra cost to employer.

b) Piping Protection:

- Thickness, Holiday by spark test, Adhesion test shall be carried out as per relevant standard.
- Complete piping shall be Hydro pressure tested, at 1.5 X DP or 2 X MWP whichever is higher, before protection.

c) Welding of Pipes:

- ERW Black / rolled welded:

  - 100% DPT on root of butt and finish weld of butt and fillet.
  - RT on 10% randomly selected joints shall be carried out (for underground piping).

d) GI Pipe: Welding on GI Pipes in general shall not be done. Welding of GI Pipes, if permitted by design, (butt / socket / fillet weld) shall be done strictly as per approved drawing and procedure approved by Owner. For all such welds 100% DP test and random 1% RT shall be done.

**1.5.2.1.10 Miscellaneous Equipment**

**I. Pressure Vessels**

i) NDT on weld joint shall be as per respective code requirements or the minimum as specified below:

a) 100% DPT on root run of butt weld, nozzle welds and finished fillet welds.

b) 10% DPT on all finished butt welds.

c) 10% RT (covering all 'T'/cross joints) of butt welds.

ii) Butt welds of dished ends shall be stress relieved and subjected to 100% RT.

iii) Each finished vessels shall be hydraulically tested to 150% of the design pressure for a duration of 30 minutes.

**II. Tanks**

i) All materials shall be of tested quality and test certificates for chemical and mechanical properties as per relevant standard shall be provided.

ii) Plates above 40 mm thickness shall be subject to 100% ultrasonic testing.

iii) Welding

a) Root run of butt welds shall be examined by 100% DPT or MPE.

b) Butt welds, full penetration joints and nozzle welds shall be checked by 100% RT and 100% MPE or DPT.

c) Fillet welds shall be checked by 100% MPE or DPT.

iv) Rubber lining shall be subject to hardness and spark test, as applicable.

v) Visual check and dimensional measurement shall be carried out on the completed equipment.

vi) The fabricated tank shall be subject to water fill test to check for the leakage.

**III. GRP/GRE Piping for Sea Water**

i) The testing and quality inspection for GRP/ GRE pipe and piping materials shall be carried at manufacturer's works as per the approved quality assurance plan. The tests to be carried out, as a minimum, shall cover the following:

a) Raw materials

Raw materials for use in pipes covered in this specification shall be sampled and tested by the manufacturer prior to their use to ensure that they comply with the requirement of ASTM D 3517. The glass content in the GRP/GRE material used shall be determined in accordance with ASTM D2584 using ignition loss method.

b) Pipe stiffness

Samples of pipe shall be tested for compliance with the pipe stiffness in accordance with ASTM D2412, with the stiffness value rated at 3% deflection.

c) Load capacity (hoop and axial)

Tests will be performed in accordance with AWWA C950 and ASTM D3517 to check the load capacity (or strength) in both the hoop and axial directions.

d) Barcol hardness test

Barcol hardness tests will be conducted in accordance with ASTM D 2583. Pipes failing to reach the required level of cure will be rejected.

e) Critical dimensions

The pipes shall be measured for compliance with critical dimensions as specified in ASTM standards including diameter, thickness, end squareness and length. Measurements shall be made in accordance with ASTM D3567. Wall thickness should be measured as per ASTM D3567 once per every production lot.

f) *Visual acceptance*

Visual Inspection and classification of defects shall be carried out according to ASTM D2563 level III. The pipe should be free from all defects, including delamination, bubbles, pinholes, cracks, pits, blisters, foreign inclusions, and resin-starved areas. The pipe should be as uniform as commercially practicable in color, opacity, density and other physical properties.

ii) Field Hydro Testing

a) Hydrostatic test of the GRP/ GRE pipe for the entire length or on a segment of it shall be carried out to verify the hydraulic sealing of the system at the testing pressure and its structural integrity.

b) The hydro testing of the piping system shall be carried out before encasing or closing the trench covers. Permanent flanged spool pieces should be provided at the start and end point of the pipe to facilitate blinding of the line for hydro testing. The joints should be visible in order to allow for the inspection, unless otherwise stated by Owner & their representative.

c) Hydrostatic testing shall be carried out at 1.5 times the design pressure for a duration of minimum 2 hours after stabilization of the test pressure. The contractor shall submit the detailed plan indicating the methodology for hydro testing, blinding the ends, air venting, supply of sea water, pressurizing and draining. The test procedure shall be subject to purchase's approval.

d) The hydraulic testing shall be considered acceptable, if at the end of the 2 hours of testing, the following parameters are met:

- During the period of the hydraulic test, the pressure stays stable.
- No leakages are noticed in any point of the pipeline, or in the joints, or in the testing equipment.

e) In case of failure of the test, the reason for leakage shall be examined. Any pipes found defective or leaking (except at the butt joints) shall be replaced with a new one. Repair or patch work on pipes shall not be acceptable. The pipeline shall then be tested again according to the approved test procedure.

**IV. Low Pressure Piping, Valves and Fittings etc. Refer Cl 1.4.6**

**V. Horizontal centrifugal pumps**

i) Tests shall be carried out on the materials of the pumps to establish their properties, and chemical compositions.

ii) 100% DPT or MPE shall be carried out for the rotor and machined surfaces of casing and impellers.

iii) UT on pump shaft (diameter greater than or equal to 40mm), MPI or DPT on pump shaft and impeller after machining shall be carried out.

iv) All rotating components of the pumps shall be statically and dynamically balanced to ISO-1940 Gr. 6.3.

v) Assembly fit up check, and dimensional check shall be carried out for the completed pump assembly.

vi) Pump casings shall be subject to hydraulic test at 1.5 times the shut off pressure for a minimum duration of 30 minutes.

vii) All pumps to be performance tested as per Hydraulic Institute Standard/ Indian Standard. The performance test shall be conducted to verify output (flow) against total head, power input, efficiency and to establish the characteristic curves of the pump. The performance test shall also include check for noise, vibration level and bearing temperature rise.

viii) Pumps shall be subjected to strip down examination visually to check for mechanical damages after testing at shop in case abnormal noise level and/or excessive vibration are observed during the shop test.

**VI. Vertical pumps**

i) All materials should be of tested quality and test certificates to be provided.

ii) Shaft forgings to be subjected to ultrasonic testing.

iii) DPT to be done on machined shaft and impeller.

iv) Impellers to be dynamically balanced to ISO 1940 Gr.6.3.

v) All pressure parts shall be hydraulically tested at 150% of the shut-off head for 30 minutes. No leakage is allowed.

vi) All pumps to be performance tested as per Hydraulic Institute Standard/ Indian Standard. The performance test shall be conducted to verify output (flow) against total head, power input, efficiency and to establish the characteristic curves of the pump. The performance test shall also include check for noise, vibration level and bearing temperature rise.

**VII. Blowers**

i) Tests shall be carried out on the materials of the rotary blowers/ compressors to establish their properties, and chemical compositions.

ii) 100% DPT or MPE shall be carried out for the rotor and machined surfaces of casing and impellers.

iii) The shaft and impellers shall be dynamically balanced.

iv) Assembly fit up check, and dimensional check shall be carried out for the completed blower assembly.

v) The casing shall be subject to hydraulic test at 1.5 times the shut off design pressure.

vi) The blowers shall be performance tested as per relevant code/ standard.

**VIII. Air Compressors**

i) All pressure parts shall be hydraulically tested at not less than 150% of design pressure for a duration of 30 minutes prior to painting.

ii) All other parts including inter-connecting piping shall be hydraulically tested wherever possible, as per relevant codes.

iii) Ultrasonic testing shall be carried out on all forgings and rotor for dia 40mm and above. MPI/DPT shall be done on machined area of the components.

iv) During assembly all clearances and alignments shall also be checked and recorded.

v) Rotor shall be statically and dynamically balanced.

vi) Performance test on the compressor shall be carried out in accordance with ISO: 1217/Eq. The test shall also include demonstration of loading and unloading mechanism (Capacity control) and operation of safety valve. Power consumption at motor input terminal at rated capacity as well as at fully unloaded condition of all the compressor shall be measured.

vii) Vibration and Noise level measurement shall be done during shop performance test.

viii) Air Receiver

a) Each finished vessel shall be hydraulically tested at 150% of the design pressure for a duration of 30 minutes

b) NDT on weld joints shall be as per respective code requirements or the minimum as specified below:
- 100% DPT on root run of butt welds
- 100% DPT on all finished butt welds and fillet welds
- 10% RT on butt welds which shall include all T-Joints

**IX. Hangers and Supports**

i) All raw materials used shall have co-related mill test certificate meeting mandatory checks of material specification.

ii) Completed springs shall be tested for sagging test and load versus deflection test. For diameter more than 25mm, MPE shall also be carried out.

iii) Butt welds of thickness 32mm and above shall be tested for UT, and for butt welds of thickness less than 32mm MPE shall be done. Fillet welds shall be tested for MPE.

iii) Dampers with viscous fluids shall be checked for viscosity of liquid used, damping resistance of the damper, stiffness of the damper etc.

iv) Turn-buckle, pipe clamps and hangers of thickness greater than 25mm shall be checked by MPE or DPT on bent portions.

v) One assembled hanger of each type and size in each lot shall be checked for variation in deflection and travel versus load test.

X. **EOT Crane, Semi Gantry Crane and Hoists**

i) **Hooks**

a) All tests including proof load test as per relevant IS/BS/DIN shall be carried out.
b) MPI/DPT shall be carried out after proof load test.

ii) **Steel casting**

DPT on machined surface shall be carried out.

iii) **Girders, end carriage, crab, gear box and rope drum**

a) The plates of thickness 25mm and above shall be ultrasonically tested.
b) NDT requirements on weldments shall be as follows:

- Butt welds in tension:-100% RT and 100% DPT
- Butt welds in compression:-10% RT and 100% DPT
- Butt welds in rope drum:-100% RT an 100% DPT
- Fillet welds:- 10% DPT

**iv) Forging (wheel, gears, pinions, axle, hooks & hook trunnion)**

a) All forgings greater than or equal to 40 mm diameter or thickness shall be subjected to ultrasonic testing.

b) DPT/MPI shall be done after hard facing and machined surfaces.

v) Wire rope shall be tested as per relevant standard.

vi) Reduction gears shall be tested for reduction ratio, backlash & contact pattern. Gear box shall be subjected to no-load run test to check for oil leakage, temperature rise, noise and vibration.

vii) The cranes shall be completely assembled at shop for final testing. All tests for dimension, deflection, load, overload, hoisting motion, cross travel etc. As per IS-3177 shall be carried out at shop.

viii) All electric hoists shall be tested as per IS-3938 and chain pulley blocks shall be tested as per IS-3832.

## 1.5A GENERAL REQUIREMENTS FOR FIELD ERECTION CHECKS AND TESTS

The QA requirements for raw materials, in-process tests and NDTs indicated for shop manufacture shall be applicable for site fabrication/erection of the respective item.

**(a) Hydraulic Test of Pressure Parts**

On completion of erection of pressure parts of each steam generator, the unit with its fittings and mountings in position shall be subjected to hydraulic test pressure in accordance with requirement of Indian Boiler Regulations. Water used for hydraulic test shall be made alkaline by addition of suitable chemical. After the test, all parts shall be drained and suitably preserved.

**(b) Turbine Assembly**

Bidder shall clearly indicate the extent of assembly to be carried out at site for steam turbine and BFP drive turbine(s). Accordingly, bidder shall submit elaborate erection and assembly inspection programme of turbines for purchaser's approval.

**(c) Condenser Assembly**

i) If the condenser sections calls for site assembly, care shall be taken in assembly of sections and correctness of alignment and fit up shall be checked. Site welding shall be carried out as per the procedure approved by the purchaser.

ii) All weld seams shall be subjected to magnetic particle examination. At least 10% of butt welds shall be subjected to radiographic examination.

iii) All welds between condenser neck and LP turbine shall be subjected to 100% radiographic and magnetic particle examination.

iv) Condenser tubes shall be visually examined for dents, mechanical damages or any other defects prior to insertion. Both tube ends shall be thoroughly cleaned to a length of 100mm to remove oil, grease etc. and shall be checked for freedom from burrs prior to insertion.

v) Tube expansion shall be carried out by electronic automatic torque control expanding unit, which shall be calibrated before use. Tube wall thinning and length of expansion shall be controlled and recorded.

vi) Hydrostatic testing of condenser steam space shall be carried out after connecting all the pipes with the condenser along with condenser vacuum systems by filling the steam space with water up to the tip of the last stages of blades of LP cylinder.

vi) Condenser water boxes shall be tested hydraulically at a minimum test pressure of 1.5 times the design pressure.

**(d) General**

i) All rotating equipment shall be checked for their direction of rotation and free

movement after placing on the respective foundations.

ii) Piping system shall be tested hydraulically or pneumatically as per application requirement.

iii) All valves shall be checked for their direction of flow.

iv) Insulation shall be carried out only after satisfactory inspection of leak test.

v) After complete installation of air conditioning and ventilation systems, all ducting system shall be tested for air leakage test or smoke tightness test.

| Sl. No. | Component & Operation | Characteristics | Class | Type of Check | Quantum of Check | | Reference Document / Acceptance Norms | Format of Record | D | Agency | | | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | M | C/U | | | | M | C | U | |
| LEGEND: **M:** MANUFACTURER/SUB-SUPPLIER, **C:** MAIN SUPPLIER, **U:** CUSTOMER, **P:** PERFORM, **W:** WITNESS, **V:** VERIFICATION, **IR**-INSPECTION REPORT, **D:** DOCUMENT REQUIRED<br>Note:<br>1) '**W**' UNDER AGENCY COLUMN INDICATES THE CUSTOMER HOLD POINT (CHP), WHICH SHALL BE IDENTIFIED BY CUSTOMER.<br>2) RECORDS, INDENTIFIED WITH "TICK'' ( √ ) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER UNDER COLUMN 'D' | | | | | | | | | | | | |
| **MODEL QUALITY ASSURANCE PLAN (MQAP)** | | | | | | | | | | | | | |
| **1 STEAM GENERATOR** | | | | | | | | | | | | | |
| **1.1 PRESSURE PARTS** | | | | | | | | | | | | | |
| **1.0 Raw Material Inspection** | | | | | | | | | | | | | |
| 1.1 | Drums Plates, pipes, bar and forging | Chemical properties | Critical | Chemical Test | 100 % | | Minimum requirements of BS: 5996 grade LC3/ ASTM or equivalent standards, Approved Drawing/ Datasheet | MTC | √ | P | V | V | See Note 3 |
| | | Mechanical properties | Critical | Mech. Tests | 100 % | | | MTC | √ | P | V | V | |
| | | Elevated temp. tensile test on plate material | Critical | Tests | 100 % | | Approved Drawing/ Datasheet | MTC | √ | P | V | V | |
| | | UT (normal UT at Mill) | Critical | UT | 100 % | | SA 577/ SA 578 level B | MTC | √ | P | V | V | |
| 1.2 | Headers (Plates & seamless pipes, bar, forging, Tubes) | Chemical properties, Mechanical Properties., Heat Treatment, Ultrasonic testing, Hardness test | Critical | Review of TC | 100% | | i) Ultrasonic Test<br>ii)Transverse test on headers (greater than 8")<br>iii) Flattening test on pipe from one end | MTC | √ | P | V | V | |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Grade 22 and above | | | | As per applicable material standard/code<br><br>As per IBR or ASME E 213 or equivalent with the longitudinal calibration notch of depth 5% of wall thickness (0.3mm min. and 1.5mm max.) | | | | | | |
| 1.3 | Tubes & Tube Elements | Chemical properties, Mechanical Properties., Heat Treatment, Ultrasonic testing, Hardness test Grade 22 and above | Critical | Tests | 100% | As per applicable material standard/code<br>As per IBR or ASME E 213 or equivalent with the longitudinal calibration notch of depth 5% of wall thickness (0.3mm min. and 1.5mm max.) | MTC | √ | P | V | V | See Note 4 |
| 1.4 | Piping | Chemical, Mechanical Properties, NDT | Critical | HT & UT | 100% | Approved Drawing/Datasheet | MTC | √ | P | V | V | |
| 1.4.1 | Fittings | Chemical, Mechanical Properties, NDT | Critical | Ultrasonic Test | 100% | Approved Drawing/Datasheet | Test Report | √ | P | V | V | |
| 1.5 | Valves | Chemical, Mechanical Properties, NDT | Critical | HT & UT | 100% | Approved Drawing/Datasheet | MTC | √ | P | V | V | NDT as per clause 1.2.1.6 |
| 1.6 | Compensating Pads | Chemical, Mechanical properties | Critical | Tests | 100% | Approved Drawing/Datasheet | | √ | P | V | V | |
| 2.0 | **In Process Inspection** | | | | | | | | | | | |
| 2.1 | Drum | Dimensional | Major | Measurement | 100% | Approved Drawing/Datasheet | IR | | P | - | - | |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Dished end pressing, Dished end HT after forming, Thickness, | | | | | | √ | P | V | V | |
| | | Tensile test on cut out piece, WPS, PQR, Welder qualification records | | | | | | √ | P | V | V | |
| | | Forming of Drum suspension Rod | | | | | | √ | P | V | V | |
| 2.1.1 | | Visual | Major | Visual | 100% | MANUFACTURING DRAWING | | √ | P | - | - | |
| 2.1.2 | a) Butt welds | NDT | Critical | UT/RT/PAUT+TOFD | 100% | Approved Drawing/Datasheet | RT | √ | P | V | V | UT/RT/PAUT+TOFD after stress relief. RT Film review |
| | b) Butt welds | NDT | Critical | UT/RT/PAUT+TOFD & MPE | 100% | Approved Drawing/Datasheet | UT REPORT | √ | P | W | W | Before stress relieving in the furnace of the entire drum |
| 2.1.3 | Full penetration Welds & Lifting lug | NDT | Critical | Ultrasonic testing | 100% | Approved Drawing/Datasheet | UT REPORT | √ | P | V | V | Before stress relief |
| 2.1.4 | Mechanical testing of long seam & C-seam weld joint test coupon | Mechanical Test | Critical | Tensile test | 100% | Approved Drawing/Datasheet | TC | √ | P | W | W | |
| 2.1.5 | Suspension rod weld joint UT | NDT | Critical | UT | 100% | Approved Drawing/Datasheet | TC | √ | P | W | W | |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2.1.6 | Heat treatment of Drum inside furnace | Heat Treatment | Critical | HT Chart | 100% | Approved Drawing/Datasheet | HT Chart | √ | P | V | V | |
| 2.1.7 | Dimension of drum, suspension rod, assembly of internal, nozzles | Visual & Dimensional | Critical | Measure ment | 100% | Approved Drawing/Datasheet | TC | √ | P | W | W | |
| 2.2 | **Headers** | | | | | | | | | | | |
| 2.2.1 | Forming, Heat Treatment | Manufacturing | | Visual, HT Chart | 100% | Approved Drawing/Datasheet | | √ | P | V | V | |
| 2.2.2 | Butt welds (Carbon steel and low alloy except for P91/92 and X20) | NDT | Critica l | a)Radiogr aphic test (RT)<br><br>b) TOFD | 100% | Approved Drawing/Datasheet | RT REPORT | √ | P | V | V | Before stress relief. Review of RT film |
| 2.2.3 | Butt welds (P91/92 and X20) | NDT | Critica l | a) MPE<br><br>b)Radiogr aphic test (RT)<br><br>c) TOFD | 100% | Approved Drawing/Datasheet | | √ | P | V | V | After stress relief. |
| 2.2.4 | Full penetration Nozzle (carbon and low alloy steels ) | NDT | Critical | Ultrasonic testing & MPE/DPT | 100% | Approved Drawing/Datasheet | UT REPORT | √ | P | W | W | UT before PWHT |
| 2.2.5 | Full penetration welds (Gr91/92) & attachment welds | NDT | Critical | Ultrasonic testing & MPE | 100% | Approved Drawing/Datasheet | UT REPORT | √ | P | W | W | UT after PWHT |
| 2.2.6 | Production weld test for L seam if welded | Tensile test | Critical | Measure ment | 100% | Approved Drawing/Datasheet | TC | √ | P | W | W | |
| 2.2.7 | WPS, PQR & welder qualification test | WPS,PQR & WTQ | Critical | Review | 100% | ASME Sec.IX, IBR | WPS/PQ R | √ | P | V | V | |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2.2.8 | Hydro test | Hydraulic Test | Critical | Measure ment | 100% | Approved Drawing/Datasheet | TC | √ | P | W | W | |
| 2.3 | Tubes and Tube Elements | NDT | Critical | MPI/DPT | 100% | Approved Drawing/Datasheet | TC | √ | P | V | V | |
| | | | | | | | | | | | | |
| | | Bending, sizing, swaging | Major | Visual | | | TC | √ | P | V | V | |
| | | Heat treatment | Major | HT | | | TC | √ | P | V | V | |
| | | Bend- First off inspection | Major | Visual | | | TC | √ | P | W | W | |
| | | WPS, PQR, Welder qualification | Major | WPS/PQ R/WTQ | | | TC | √ | P | V | V | |
| | | Hardness test | Critical | Hardness | | | TC | √ | P | W | W | |
| | | Hydro Test | Critical | Measure ment | | | TC | √ | P | W | W | |
| | | Steel ball and sponge ball test | Critical | Measure ment | | | TC | √ | P | W | W | |
| 2.3.1 | Butt Welds | NDT | Critical | RT / UT | 100% (in case of random sampling – min. 20%) | Approved Drawing/Datasheet | TC | √ | P | W | W | Review of RT Films |
| 2.3.2 | Fillet welds (including fins if any) | NDT | Critical | MPE or dye penetratio n test (DPT) | 100% | Approved Drawing/Datasheet | TC | √ | P | W | W | |
| 2.4 | Piping and Fitting | NDT | Critical | MPI/ PT | 100% | Approved Drawing/Datasheet | TC | √ | P | V | V | |
| 2.4.1 | Valves | NDT | Critical | MPI/DPT | 100% | Approved Drawing/Datasheet | TC | √ | P | V | V | |
| 2.4.2 | Butt Welds | NDT<br>All butt welds in alloy steel piping of P91, X20 and X 22 after stress relieving (SR). | Critical | RT or UT & MPE | 100% | Approved Drawing/Datasheet | TC | √ | P | V | V | Review of RT Films |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | UT shall be of digital recordable type | | | | | | | | | | |
| 2.4.3 | All Weld joints | NDT 100% (Alloy steel piping of P91, X20 and X 22) (3% hardness on welds of other alloy steel piping.) | Critical | Hardness | 100% | | | √ | P | V | V | For preheating and post weld heat treatment (PWHT) induction heating shall be deployed. However, PWHT can be done in furnace also. |
| 2.4.4 | HP Piping | NDT | Critical | Examination of welds | 100% | Approved Drawing/Datasheet | TC | √ | P | V | V | See Note 5 |
| 2.4.5 | Any other pipe not covered | NDT | Critical | MPE/ DPT/ RT | 100% / 10% | Approved Drawing/Datasheet | Test Reports | √ | P | V | V | See Note 6 |
| 2.5 | Valves | NDT | Critical | MPI / DPT | 100% | | | √ | P | V | V | |
| 2.5.1 | Pressure retaining parts | NDT | Critical | MPE/ RT | 100%/ 105 | | | | | | | See Note 7 |
| 2.5.2 | Stem | NDT | Critical | UT | 100% | Dia 500mm or more | | √ | P | V | V | |
| 2.5.3 | Body & Bonnet | NDT | Critical | a) UT/RT<br>b) MPE/ DPT | 100%<br>100% | a) 1500 class or above<br>b) 600 class or above | | √ | P | V | V | |
| 2.6 | Compensating Pads | | | | | | | | | | | |
| 3.0 | **Final Inspection** | | | | | | | | | | | |
| 3.1 | Drum | Hydraulic Pressure Test, Dimension | Major | Measurement | 100% | Approved Drawing/Datasheet | TC | √ | P | W | W | See Note 8 |
| 3.1.1 | Compensating Pads | Pneumatic test | Major | Measurement | | | | √ | P | W | W | See Note 9 |
| 3.2 | Complete closed end headers | Hydraulic Pressure Test, dimension | Major | Measurement | | | | √ | P | W | W | See Note 8 |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3.2a | Drum Suspension Rod | Profile check, Thread matching, Length Measure | Major | Measure ment | 100% | Drawing/Datasheet | IR | √ | P | W | W | |
| 3.3 | Tubes and Fabricated, panels, coils | Hydraulic Pressure Test, Steel Ball and sponge ball test, dimension, trail assembly of spiral wall assembly | Major | Measure ment | | | | √ | P | W | W | See Note 8 |
| 3.4 | Valves | a) Hydraulic Pressure Test<br>b) Seat leak test<br>c) Back Seat test | Critical | Measure ment | 100% | a) ASME/ ANSI 16.34 or IBR<br>b) As per applicable standards or codes<br>c) Approved drawing/ datasheet | TC | √ | P | W | W | See Note 8 |
| | | Visual & Dimension | Critical | Measure ment | 100% | Approved drawing/datasheet | TC | √ | P | W | W | |
| | | Functional Test | Critical | Measure ment | 100% | | | | | | | |
| 3.5 | Non pressure bearing attachments | NDT, UT and MPE for Load bearing welds after stress relieving.<br><br>MPE for Non load bearing welds after stress relief. | Major | UT & MPE/DPT<br><br>MPE/ DPT | 100% | Approved drawing/datasheet | TC | √ | P | W | W | The toes of the welds adjoining the drum shall be ground smooth prior to stress relieving before carrying out this examination. |

**NOTE -**

| | |
|---|---|
| 1 | INSPECTION / NDT / TEST CERTIFICATE / REPORT FOR UT, MPI, BALANCING, PRESSURE TEST SHALL INDICATE REFERENCE OF ITEM SERIAL NUMBER & MODEL FOR CO-RELATION. |
| 2 | MATERIAL TEST CERTIFICATE / REPORT FOR TEST SUCH AS CHEMICAL & MECHANICAL TEST ETC. SHALL INDICATE REFERENCE OF ITEM SERIAL NUMBER & ENGINE MODEL FOR CO-RELATION AS PER SAMPLING NORMS. |
| 3 | ONLY THOSE MATERIALS SHALL BE USED IN THE MANUFACTURE OF PRESSURE PARTS WHICH CAN BE IDENTIFIED AGAINST MILL SHEET OR MANUFACTURER TEST CERTIFICATES. MATERIAL SHALL MEET ALL THE MANDATORY REQUIREMENTS (AND SUPPLEMENTARY CHECKS, IF ASKED FOR) OF SPECIFIED SPECIFICATION, INDIAN BOILER REGULATIONS (IBR), AND RELEVANT CODE/STANDARD. ALL NON-DESTRUCTIVE TESTING AS DETAILED AGAINST RELEVANT EQUIPMENT SHALL MEET THE REQUIREMENT OF ASTM SECTION 3 VOL. 3.03 OR EQUIVALENT BIS STANDARD |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 4 | RAW MATERIAL FOR TUBES FOR WATER WALL, SUPERHEATER, REHEATER, ECONOMIZER, RISER, SUPPLY AND CONNECTING TUBES INCLUDING NOZZLE/STUBS, CONNECTIONS FOR DRUM, HEADERS, PIPE WORK ETC., SHALL BE SUBJECTED TO 100% UT PRIOR TO FABRICATION | | | | | | | | | | | |
| 5 | a) Temperature > 400$^0$C and/ or pressure exceeding 71 bar<br>' 100% RT or UT on butt welds and full penetration branch welds.<br>' 100% MPE.<br>b) Temperature > 175$^0$C up to 400$^0$C and/or pressure exceeding 17 bar adopt 71 bar<br>' 100% RT or UT on butt welds and full penetration branch welds for pipe diameter more than 100NB.<br>' 10% RT or UT on butt welds and full penetration branch welds for pipe diameter up to 100NB.<br>' 100% MPE. | | | | | | | | | | | |
| 6. | 100% MPE or DPT for underground pipes and 10% MPE or DPT for above ground piping. RT for 10% of butt welds of underground piping.` | | | | | | | | | | | |
| 7. | a. The drum and all components which are to be subjected to fluid pressure shall be tested to minimum of 150% of the design pressure. The duration of the pressure tests shall be sufficient, as approved by the purchaser, to show any leakage paths and to permit a thorough examination of the component whilst under pressure.<br>b. The temperature of the fluid used for the pressure test shall be such as to avoid any possibility of brittle fracture at a low temperature and the same shall be modified and submitted to the purchaser for approval, before commencing the test.<br>c. The fluid used shall be of a sufficient purity and where relevant, suitable inhibits shall be used to avoid excessive corrosion and /or damage to temporary parts either during the test or prior to drying and cleaning. | | | | | | | | | | | |
| 8. | All compensating pads shall be provided with two-threaded weep holes to test welds at 0.5kg/cm$^2$ (g) with soap solution and no leakage shall be ensured. | | | | | | | | | | | |
| 9. | Chemical requirements: As per ASME Sec II A | | | | | | | | | | | |
| 10. | For supercritical unit<br>The design of all pressure parts (tubes, headers, separators, vessels etc.) shall meet the requirements of Indian Boiler Regulations (IBR). | | | | | | | | | | | |
| **1.2** | **BOILER WATER CIRCULATION PUMPS** | | | | | | | | | | | |
| **1.0** | **Raw Material Inspection** | | | | | | | | | | | |
| 1.1 | Casing Pump , Discharge nozzle, Heat Barrier, Motor frame (casing), pipes, Thrust bearing case, | Chemical, Mechanical, Heat treatment, Hardness, High temperate physical properties, UT | Critical | Review of TC | 100% | Apart from mandatory and supplementary check of material specification.<br><br>Approved Drawing/Datasheet | MTC | √ | P | V | V | |
| 1.2 | Shaft, Stud bolt | Mechanical Properties, Chemical, Heat | Critical | Review of TC | 100% | Apart from mandatory and | MTC | √ | P | V | V | |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | treatment, Impact, High temp physical, Run out, Dimension, DPT, RT, Hardness | | | | Supplementary check of material specification.<br><br>Approved Drawing/Datasheet | | | | | | |
| 1.3 | Impeller | Mechanical Properties, Chemical, Heat treatment, Impact, High temp physical, Dimension, DPT, Dynamic balancing | Critical | Review of TC | 100% | Apart from mandatory and supplementary check of material specification.<br><br>Approved Drawing/Datasheet | MTC | √ | P | V | V | |
| 1.4 | Spherical Casing | PT Bevel edge surface for site joint and sealing surface | Major | NDT | 100% | ASME SEC V / ASME SEC VIII DIV 1 | TC | Y | P/V | V | V | |
| 2.0 | **In Process Inspection** | | | | | | | | | | | |
| 2.1 | Welding Documents | WPS, PQR, Welder qualification | Major | Review | 100% | ASME SECIX,IBR | WPS/PQR | √ | P | V | V | |
| 2.2 | Butt welds on pressure parts for these pumps | NDT, Heat Treatment as applicable | Critical | UT or RT and MPE or DPT | 100% | Approved Drawing/Datasheet | MTC | √ | P | V | V | |
| 3.0 | **Final Inspection** | | | | | | | | | | | |
| 3.1 | Boiler water circulation pumps | a) Hydraulic Test<br><br>b) Dimension | Critical | Measurement | 100% | Approved Drawing/Datasheet | TC | √ | P | W | W | The pump casing to be tested to minimum of 150% of the design pressure |
| | | Performance | Critical | Measurement | 100% | Approved Drawing/Datasheet | TC | √ | P | W | W | |
| | | Electrical checks like Winding Resistance, HV,IR, | Critical | Measurement | 100% | Approved Drawing/Datasheet | TC | √ | P | W | W | |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Endurance test of motor windings, joints and terminal seals | | | | | | | | | | |
| | | NPSH test, Temp. rise test, under voltage test, function of pump at operating temp. & pressure and hot standstill & start test, ,No-load test, lock rotor test, performance test , proof test, noise, vibration, over speed test | Critical | Measure ment | One no. | Approved Drawing/Datasheet | TC | √ | P | W | W | Documents will be submitted for review and approval of the purchaser |
| **1.3 AIR PREHEATERS, STEAM COIL AIR PRE-HEATER AND FUEL OIL HEATERS** | | | | | | | | | | | | |
| **Refer Appendix-B - Page No.: C-264** | | | | | | | | | | | | |
| **1.4 SOOT BLOWERS** | | | | | | | | | | | | |
| 1.0 | **Raw Material Inspection** | | | | | | | | | | | |
| 1.1 | Casing, Tubes | Chemical & Mechanical, NDT | Major | UT | 100% | Approved Drawing/Datasheet | MTC | √ | P | V | V | |
| 1.2 | Welding Documents | WPS, PQR, Welder qualification | Major | Review | 100% | ASME SECIX,IBR | WPS/PQ R | √ | P | V | V | |
| 2.0 | **In-Process Inspection** | | | | | | | | | | | |
| 2.1 | Soot blowers : Butt weld | NDT | Critical | MPI/LPI | 20% | Approved Drawing/Datasheet | TC | √ | P | V | V | |
| 2.2 | Leakage Test | Hydraulic test | Critical | Measure ment | 100% | Approved Drawing/Datasheet | TC | √ | P | W | W | |
| 3.0 | **Final Inspection** | | | | | | | | | | | |
| 3.1 | Soot blowers, total travel, Deflection, direction of rotation | Operational checks & Dimension | Critical | Measure ment | 100% | Approved Drawing/Datasheet | TC | √ | P | W | W | For Long tube travel, closing and opening time and current drawn |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **1.5 ID, FD AND PA FANS: ROTATING PARTS & STATIONARY PARTS** | | | | | | | | | | | | |
| 1.0 | **Raw Material Inspection** | | | | | | | | | | | |
| 1.1 | Shaft, Hub, Impeller, Blades, Disc, Servo motor, Bearing Housing, Static Parts | Chemical & Mechanical Properties, Hardness, HT & NDT(UT), MPI | Major | Review of TC | 100% | Approved Drawing/Datasheet | TC | √ | P | V | V | |
| 2.0 | **In-Process Inspection** | | | | | | | | | | | |
| 2.1 | Rotor components | NDT | Critical | MPI/PT | 100% | Approved Drawing/Datasheet | TC | √ | P | W | W | |
| 2.2 | WPS, PQR, welder qualification PWHT Shaft dimension, Impeller assembly & bearing housing dimensions, Balancing, Blades moment sorting, blade natural frequency test | Visual, Dimensional, Balancing | Critical | Review/ Measure ment | 100% | Approved Drawing/Datasheet | TC | √ | P | V | V | |
| 2.3 | Function test – for shaft with bearing assembly for temp rise, Impeller assembly with servomotors for blade shaft movement, assembly of blades- no fouling at fully close condition, Static parts assembly- dimensions | Functional Test | Critical | Measure ment | 100% | Approved Drawing/Datasheet | TC | √ | P | W | W | |
| 2.4 | Butt welds in Rotor components | NDT | Major | UT/ MPE | 100% | UT for Butt welds<br>All welds MPE after stress relief. | | √ | P | W | W | |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2.5 | Main Shaft | Check of dimension R/O & F/O | Major | Dimensional | 100% | Drawing | Test Report | √ | - | P | W | # Bore dimension |
| 2.6 | Impeller Hub | Check of dimensions incl radial and axial run at machines conditions, checking of bore dimension | Major | Dimensional | 100% | Drawing | Test Report | √ | P | - | #W | |
| | | Dynamic balancing of Impeller without internal and without blades | Major | Dimensional | 100% | Gr 2.5 of ISO 1940/1 | Test Report | - | - | P | V | |
| 3.0 | **Final Inspection** | | | | | | | | | | | |
| 3.1 | Hydraulic coupling of ID fan | Operational checks<br>String test for coupling to check temperature rise, smooth operation, vibration and noise level | Critical | Measurement | One fan assembly | Approved Drawing/Datasheet | TC | √ | P | W | W | Dry run test to be carried out during string test. |
| 3.2 | Performance test of assembled fan | Functional Test | Critical | Measurement | 1/type | Approved Drawing/Datasheet | TC | √ | P | W | W | |
| **1.5.1 HYDRAULIC BLADE ADJUSTING UNIT** | | | | | | | | | | | | |
| **1.0 Manufacturing of Hydraulic Blade Adjusting Unit** | | | | | | | | | | | | |
| 1.1 | Hydraulic Unit | Material Grade | Critical | Mechanical | 100% | DIN EN 10204 | TC | | P | V | - | |
| 1.2 | Hydraulic Unit | Test run on testing stand duration of test<br>-Pressure Equalizing<br>-Leakage oil volume at testing pressure | Critical | Mechanical | 100% | Manufacturing Standard | TC | √ | P | V | V | |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | -Temperature at Hydraulic housing<br>-Testing of function | | | | | | | | | | |
| 1.3 | Hydraulic Unit | Dynamic balancing of cylinder Piston | Critical | Mechanical | 100% | Grade 2.5 of ISO-1940 (as min) | TC | √ | P | V | V | |

**1.5.2 STATIC PARTS**

| | |
|---|---|
| 1.0 | **Welders & Procedures are qualified as per AWS D1.1 for static parts.** |
| 2.0 | **Raw Materials** |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2.1 | Plates | Chemical & mechanical properties | Major | Inspection of documents test/review | Melt wide | IS 2062/ENGG DRG/SPECIFICATION | Test report | | P | V * | - | *Verification of compliance TC. Round>50mm & plates more than 40 mm shall be UT tested. |
| 2.2 | Welder | Check of welder certificates | Major | Inspection of documents test/review | 100% | AWSD1.1 | Welder certificate | | P | - | - | |
| 2.3 | Welding procedure specification | Check of welding procedures before manufacturing start up | Major | Inspection of documents test/review | 100% | AWSD1.1 | WPS | | P | V | - | |
| 2.4 | Welding procedure qualification record | Check of PQR before manufacturing start up | Major | Inspection of documents test/review | 100% | AWSD1.1 | PQR | | P | V | - | |
| 2.5 | Qualification of NDT operators | Check of NDT certificates | Major | Inspection of documents test/review | 100% | ASNT SNT TC | NDT certificate | | P | V | - | |
| **3.0** | **In Process Inspection** | | | | | | | | | | | |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **3.1** | Fan Housing Assembly | | | | | | | | | | | |
| 3.1.1 | Fan Housing | Check of dimensions after machining | Major | Dimensional Measurement | 100% | Drawing | Test report | √ | P | W | W | |
| 3.1.2 | Fan Housing | Visual inspection of welds seams and test of gas tight weld seams by DPT | Major | Visual & dye penetrant test (DPT) | 100% | for visual inspection, Drawing & Manufacturer Standard | Test report | √ | P | W | **W** ** | **10% witness by Owner |
| **3.2** | Suction Chamber Assembly | | | | | | | | | | | |
| 3.2.1 | Suction chamber | Check of dimensions | Major | Dimensional Measurement | 100% | Drawing | Test report | √ | P | W | W | Part processing from BHEL approved sub-contractor (refer note – 4) |
| 3.2.2 | Suction chamber | Visual inspection of welds seams and test of gas tight weld seams by DPT | Major | Visual & dye penetrant test (DPT) | 100% | for visual inspection, Drawing & Manufacturer Standard | Test report | √ | P | W | **W** ** | **10% witness by Owner |
| **3.3** | Diffuser Assembly | | | | | | | | | | | |
| 3.3.1 | Diffuser | Check of dimensions | Major | Dimensional Measurement | 100% | Drawing | Test report | √ | P | W | W | |
| 3.3.2 | Diffuser | Visual inspection of welds seams and test of gas tight weld seams by DPT | Major | Visual & dye penetrant test (DPT) | 100% | for visual inspection, Drawing & Manufacturer Standard | Test report | √ | P | W | **W** ** | **10% witness by Owner |
| **3.4** | Silencer Assembly | | | | | | | | | | | |
| 3.4.1 | Silencer | Visual inspection of welds | Major | Visual | 100% | for visual inspection, Drawing & Manufacturer Standard | Test report | √ | P | W | W | |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3.4.2 | Silencer | Measurement of surface protection coating thickness | Major | Visual & paint coating thickness | 100% | AS per Owner approved painting scheme | Test report | √ | P | W | V | |
| **4.0** | **Final Inspection** | | | | | | | | | | | |
| 4.1 | Painting & Preservation | Painting & Preservation | Major | Visual and paint coating thickness | 100% | As per Owner approved painting scheme | Test report | √ | P | W | V | |

**Notes:**

1. Manufacturer Standard internal NDT norm and the acceptance norm is in line with AWS.
2. Manufacturer Standard internal procedure for visual inspection of non-pressure parts.
3. GA Drawing approved by Owner Engineering. Actual material shall be as per owner approved GA Drawing. If material is not indicated in owner approved GA drawing the same shall be as per manufacturer drawing.

**1.6 COAL MILLS**

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **1.0** | **Raw Material Inspection** | | | | | | | | | | | |
| 1.1 | Shaft, coupling, gears and pinions, top and bottom races and other rotating components<br><br>Plates, casting like bearing housing, forgings, gear box | Chemical & Mechanical, HT, NDT(UT), Impact test | Critical | | 100% | Approved Drawing/Datasheet | MTC | √ | P | V | V | |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1.2 | Journal Pressure Spring | Chemical | Major | Lab Test | Test piece per Heat | Manufacturing Standard | MTC | √ | P | V | V | 1) Testing at raw material manufacturer/supplier works<br>2) Verification of MTC & correlation with material at manufacturer/ Owners approved works |
| | | Hardness Check | Major | Hardness | 10% | Manufacturing Standard | MTC | √ | P | V | V | |
| | | Load Test | Major | Lab Test | 10% | Manufacturing Standard | MTC | √ | P | V | V | |
| | | Compression Test | Major | Lab Test | As per manufacturer specification | Manufacturing Standard | MTC | √ | P | V | V | |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Dimensional Exam | Major | Measurement | 10 % | Manufacturing Standard | MTC | √ | P | V | V | | |
| 2.0 | **In Process Inspection** | | | | | | | | | | | | |
| 2.1 | Butt welds in tube/ body casing and separator of mill | NDT | Major | RT/ UT and MPE/ LPI | 100% | RT/ UT for Butt welds<br>All welds MPE or LPI | | √ | P | W | W | | |
| 2.2 | WPs, PQR, Welder qualification Dimensions, NDT-RT on butt weld. | Visual, Dimensional, NDT, heat treatment | Critical | Review/ Measure ment | 100% | Approved Drawing/Datasheet | TC | √ | P | V | V | | |
| 2.3 | Gear box body | Kerosene Leakage test | Critical | Measure ment | 100% | OEM/Manufacturer's standard | TC/IR | √ | P | V | V | | |
| 3.0 | **Final Inspection** | | | | | | | | | | | | |
| 3.1 | Gearboxes | Operational checks Check rise in oil temperature, noise level and vibration. | Critical | Measure ment | 100% | Approved Drawing/Datasheet | TC | √ | P | W | W | Check for leak tightness of gear case also to be done. | |
| 3.2 | Burner Assembly | Assembly | Critical | Measure ment | 100% | Approved Drawing/Datasheet | TC | √ | P | W | W | | |
| 3.3 | Trial assembly of mill & No load trial run | No Load Trial | Critical | Measure ment | At least one no. | Approved Drawing/Datasheet | TC | √ | P | W | W | | |

**1.6.1 ROLLS**

| SL NO | COMPONENT / OPERATIONS & DESCRIPTION OF TEST | TYPE OF CHECK | **Quantum of Check / Sampling with basis** | REFERENCE DOCUMENT | ACCEPTANCE NORMS | FORMAT OF RECORD | AGENCY | | | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | M | C | N | |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | D * | 8 | | 9 |
| **1.0** | **Raw Materials** | | | | | | | | | | |
| 1.1 | Moulding sand | Physical | Each batch | Manufacturer's standard/ Customer Tech. Specification | Lab record | - | P | - | - | | |
| 1.2 | Ferro alloys | Chemical | Each batch | Manufacturer's standard/ Customer Tech. Specification | Lab record | - | P | - | - | | |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 1.3 | Scrap | Chemical | Each batch | Manufacturer's standard/ Customer Tech. Specification | Lab record | - | P | - | - | |
| **2** | **Inprocess Inspection – Inserts for Sintercast Grinding Rolls** | | | | | | | | | |
| 2.1 | Melting | Temp. control | Each melt | Manufacturer's standard/ Customer Tech. Specification | Log sheet | - | P | - | - | |
| | | Chemical test | Each melt | Manufacturer's standard/ Customer Tech. Specification | Test report | ✓ | P | V | V | |
| | | Pouring | Each melt | Manufacturer's standard/ Customer Tech. Specification | Log sheet | - | P | - | - | |
| 2.2 | Insert casting | Visual | Each insert | Manufacturer's standard/ Customer Tech. Specification | Test report | - | P | - | - | |
| 3.0 | **Inprocess Inspection – Sintercast Inserted Roll Castings** | | | | | | | | | |
| 3.1 | Melting | Temp. control | Each melt | Manufacturer's standard/ Customer Tech. Specification | Log sheet | - | P | - | - | |
| | | Chemical test | Each melt | Manufacturer's standard/ Customer Tech. Specification | Test report | ✓ | P | V | V | |
| | | Pouring | Each melt | Manufacturer's standard/ Customer Tech. Specification | Log sheet | - | P | - | - | |
| 3.2 | Roll casting | Heat treatment | Each batch | Manufacturer's standard/ Customer Tech. Specification | H/T charts | ✓ | P | V | V | |
| | | Visual | Each Roll | Manufacturer's standard/ Customer Tech. Specification | Test report | - | P | - | - | |
| | | Microstructure | Manufacturer's standard | Manufacturer's standard/ Customer Tech. Specification | Test report | - | P | V | V | |
| | | Hardness | Each H/T Batch | Manufacturer's standard/ Customer Tech. Specification | Test report | - | P | - | - | |
| 4.0 | **Final Inspection - Finished Sintercast Inserted Roll** | | | | | | | | | |
| 4.1 | Finished rolls | Visual | Each roll | Manufacturer's standard/ Customer Tech. Specification | Inspection report | ✓ | P | W | W | |
| | | Dimensions | Each roll | Manufacturer's standard/ Customer Tech. Specification | Inspection report | ✓ | P | W | W | |
| | | Hardness test | Each roll-(One | Manufacturer's standard/ Customer Tech. Specification | Inspection | ✓ | P | W | W | To be checked with Equotip |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | insert/roll) | | report | | | | | hardness tester |
| | | Bore surface contact | Each roll | Min. 85% of area | Inspection report | ✓ | P | W | W | Not applicable for straight bore rollers |
| | | Identification & Painting | Each roll | Manufacturer's standard/ Customer Tech. Specification | Inspection report | - | P | V | - | |

Note : 1. For reference: Heat treatment: Rolls are air quenched from 980 to 1060°c after holding for 9 to 12 hours (Please refer Manufacturer's standard).
Note : 2. Roll serial number to be punched on the non wearing surface of the roll.
Note : 3. The sub vendor must provide and comply with the performance guarantee for operation life of these rollers as described in the contract.
Note 4: M- Manufacturer, C- Main Contractor, N- Customer

**1.6.2 TABLE LINERS**

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **1** | **Raw Materials** | | | | | | | | | |
| 1.1 | Moulding sand | Physical | Each batch | Manufacturer's standard/ Customer Tech. Specification | Lab record | - | P | - | - | |
| 1.2 | Ferro alloys | Chemical | Each batch | Manufacturer's standard/ Customer Tech. Specification | Lab record | - | P | - | - | |
| 1.3 | Scrap | Chemical | Each batch | Manufacturer's standard/ Customer Tech. Specification | Lab record | - | P | - | - | |
| 2 | **Inprocess Inspection** | | | | | | | | | |
| 2.1 | Melting | Temp. control | Each melt | Manufacturer's standard/ Customer Tech. Specification | Log sheet | - | P | - | - | |
| | | Chemical test | Each melt | Manufacturer's standard/ Customer Tech. Specification | Test report | ✓ | P | V | V | |
| | | Pouring | Each melt | Manufacturer's standard/ Customer Tech. Specification | Log sheet | - | P | - | - | |
| 2.2 | Liner casting | Heat treatment | Each H/T batch | Manufacturer's standard/ Customer Tech. Specification | HT Chart | ✓ | P | V | V | |
| | | Microstructure | Each H/T batch | Manufacturer's standard/ Customer Tech. Specification | Report | ✓ | P | V | V | |
| 3.0 | **Final Inspection And Testing** | | | | | | | | | |
| 3.1 | Liner casting | Visual | 100% | Manufacturer's standard/ Customer Tech. Specification | Inspection report | ✓ | P | W | W | |
| | | Dimensions and trial assembly | Assy. On test bowl- | Manufacturer's standard/ Customer Tech. Specification | Inspection report | ✓ | P | W | W | |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | 100% | | | | | | | |
| | | Hardness test | 100% | Manufacturer's standard/ Customer Tech. Specification | Inspection report | ✓ | P | W | W | Quantum per set to be given |
| 3.2 | Liner casting | Identification | Each Set | See notes | Test Certificate | ✓ | P | V | - | |

Note : 1. For reference: Heat treatment: 980 to 1060°c after holding for 4 to 6 hours and air quench (Please refer Manufacturer's standard).
Note : 2. Serial number and set number will be painted on working face of each casting.
Note : 3. The sub vendor must provide and comply with the performance guarantee for operation life of these rollers as described in the contract.
Note 4: M- Manufacturer, C- Main Contractor, N- Customer

**1.7 COAL FEEDERS**

| Sl. No. | Component & Operation | Characteristics | Class | Type of Check | Quantum of Check | | Reference Document / Acceptance Norms | Format of Record | D | Agency | | | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | M | C/U | | | | M | C | U | |
| 1.0 | **Raw Material** | | | | | | | | | | | | |
| 1.1 | Plates, Pipes, Forging etc. | Chemical & Mechanical, NDT, Properties | Major | Review of TC | 100% | | Approved Drawing/Datasheet | TC | √ | P | V | V | |
| 1.2 | Welding Documents | WPS, PQR, Welder qualification | Major | Review | 100% | | ASME SEC IX | WPS/PQR | √ | P | V | V | |
| 1.3 | Gear box assembly including motor, Feeder main & clean out conveyor drives | Run test, Type and Routine test for motors | Critical | Review of documents | 100% | | Purchase Specification & IS :325 | TC | | P | V | V | Procured with TC from manufacturer approved sources |
| 1.4 | Remote and Local Cabinets | Overall dimension Functional Test H. V Test | Minor | Review of documents | 100% | | Owner Approved QP & CHP clearance reports | CHP | | P | V | V | |
| 2.0 | **In-Process Inspection** | | | | | | | | | | | | |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2.1 | Welds in the casing and pulley fabrication | NDT | Major | MPE/PT & RT on Butt Joints | 100% | Approved Drawing/Datasheet | TC | √ | P | V | V | Review of RT Films |
| 3.0 | **Final Inspection** | | | | | | | | | | | |
| 3.1 | Feeder casing Leak tightness check, endurance test for Load,, Dimension, Feeder body hydro test, gear box run test, dimension, function performance & calibration test | Visual, Dimensional, Functional | Major | Measure ment | 100% | Approved Drawing/Datasheet | TC | √ | P | W | W | |

**1.8 BOILER STRUCTURE, DUCTS, HOPPERS, DAMPERS ETC.**

**Refer Appendix-A -Page No. – C-248**

**1.9 ELECTRO- STATIC PRECIPITATORS (ESPs)**

| SL. NO | COMPONENT & OPERATIONS | CHARACTERISTICS | CLASS | TYPE OF CHECK | QUANTUM OF CHECK | | REFERENCE DOCUMENT | ACCEPTANCE NORMS | FORMAT OF RECORD | AGENCY | | | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | M | C/N | | | | M | C | N | |
| **1.0** | **Raw Material:** Raw material to be procured from OWNER-approved sources. | | | | | | | | | | | | |
| 1.1 | Plates & Rolled Sections | a. Visual & Dimensional | Major | Visual & Measurement | 100 % | 100 % | Material spec./ OWNER Approved GA Drawings. / Mfg. Drawings | | Inward Inspection Report | -- | P | V | -- | Refer Note 2 & 3 |
| | | b. Chemical Composition | Critical | Document Review | 1 per Heat / Lot | 1 per Heat / Lot | | | MTC | √ | P | V | V | |
| | | c. Mechanical Properties | Critical | Document Review | 1 per Heat / Lot | 1 per Heat / Lot | | | MTC | √ | P | V | V | |
| | | d. UT (Bars > 50 mm) | Critical | Document Review | 100 % | 100% | ASTM 388 | | MTC | √ | P | V | V | |
| | | e. UT (Plates Thk. > 40 mm) | | | 100 % | 100 % | ASTM A 578 Level B S2 | | | √ | P | V | V | |
| **2.0** | **Welding / Fit-Up** | | | | | | | | | | | | |

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2.1 | Welding | Welding Procedure – WPS & PQR | Major | Document Review | 100 % | 100 % | AWS D1.1 / ASME Sec. IX | | WPS | √ | P | V | V | - WPS & PQR. |
| | | Welder Performance Qualification – WPQ | Major | | 100 % | 100 % | | | WPQ | √ | P | V | V | - |
| 2.2 | Welding consumable | Verification of Make, Type & Batch No. | Major | Visual | 100 % | 100 % | ASME Sec II Part C | | BTC | √ | P | V | - | As per the MAIN SUPPLIER-approved list |
| 2.3 | Straightening Marking, Cutting, Edge Preparation, Drilling and Splicing | a. Shape<br>b. Size<br>c. Diagonal<br>d. Straightness | Major | Visual & Measurement | 100% | ----- | Drawings / spec. | | Job History Card | -- | P | -- | -- | |
| 2.4 | Fit Up, Welding, Dimensional Control, | Orientation, Weld Visual, Dimensions, Offset, Straightness, Shape, Diagonal & etc. | Major | Visual & Measurement | 100 % | -- | Drawings / spec. | | Job History Card | -- | P | -- | -- | |
| 2.5 | Pre-heating (as applicable) | Preheating Temperature Control | Major | Measurement | 100 % | 100 % | As per WPS & Tech. Spec. | | Register | -- | P | V | V | |
| **3.0** | **Non-Destructive Examination** | | | | | | | | | | | | | |
| 3.1 | Edge Preparation for Plates THK ≥ 32mm | Lamination/ Flaws | Major | MPT/LPT | 100 % | 100 %/ 10% | AWS D1.1 | AWS D1.1 | MPT / LPT Report | √ | P | V | V | |
| 3.2 | Butt weld Joints for Plates THK ≥ 32mm | Weld Soundness | Critical | *RT / UT | 100 % | 100 % / 10 % | AWS D1.1 | AWS D1.1 | RT / UT Report | √ | P | W | W | *RT films review |

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3.3 | Butt Weld Joints for Plates 25mm≥THK < 32mm | Weld Soundness | Critical | MPT / LPT | 100 % | 100 % / 10 % | AWS D1.1 | AWS D1.1 | MPT / LPT Report | √ | P | W | W | |
| | | | | *RT / UT | 10 % | 10 % | AWS D1.1 | AWS D1.1 | RT / UT Report | √ | P | W | W | *RT films review |
| 3.4 | All Butt Weld Joints of Plates THK < 25mm | Weld Soundness | Critical | MPT / LPT | 10 % | 10 % | AWS D1.1 | AWS D1.1 | MPT / LPT Report | √ | P | W | W | |
| 3.5 | All fillet Weld Joints | Weld Soundness | Major | MPT / LPT | 10 % | 10 % | AWS D1.1 | AWS D1.1 | MPT / LPT Report | √ | P | W | W | |
| 3.6 | All fillet weld of Built-up Girders, including the Bracket | Weld Soundness | Major | MPT / LPT | 100 % | 100 % / 10 % | AWS D1.1 | AWS D1.1 | MPT / LPT Report | √ | P | W | W | |
| 3.7 | Fillet weld at Base and Top Plate Welding in Columns | Weld Soundness | Major | MPT / LPT | 100 % | 100 % / 10 % | AWS D1.1 | AWS D1.1 | MPT / LPT Report | √ | P | W | W | |
| 3.8 | Weld Visual | Completeness of welding, Surface Defects, Weld Size | Major | Visual | 100 % | 100 % / 10 % | Mfg. Drawings | AWS D1.1 | Inspection Report | √ | P | W | W | |
| 3.9 | Bend line – Hopper, Funnel & etc. | Bending area | Major | MPI / LPT | 100 % | 10 % | AWS D1.1 | AWS D1.1 | MPT / LPT Report | √ | P | W | W | |
| **4.0** | **Final Inspection** | | | | | | | | | | | | | |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 4.1 | Orientation and Dimensional Inspection | Verification of Orientation, Dimensions, hole & position. Straightness, Twist, Web verticality, web shift - as applicable | Major | Visual and Measurement | 100 % | 100 % / 10 % | Drawings / Applicable Standard | Inspection Report | √ | P | W | W | If columns are to be dispatched in two or more parts, a mock-up assembly of the columns must be conducted at the shop. Ground Mock-up assembly of 1st Hopper shall be performed at each Manufacturer. |
| 4.2 | Match Marking & Identification | Material Identification Mark No. with DU No | Major | Visual | 100 % | 100 % | | Inspection Report | √ | P | W | R | All Components except Loose materials shall be identified by a Hard Punch. The same shall be highlighted by silver Paint and stencilled by Weatherproof Paint. |
| **5.0** | **Surface Preparation And Painting** | | | | | | | | | | | | |
| 5.1 | Surface Preparation & Painting | Removal of Scale, Rust, Foreign Materials, etc. | Major | Visual | 100% | 100% | Approved Painting Scheme/ Approved Drawing / Tech. Spec. | Inspection Report | √ | P | R | - | |
| | | Review of Paint Certificate | Major | Visual | Per Batch | Per Batch | | Paint Mfr. TC | √ | P | R | **V** | |
| | | Complete Coverage of Paint | Major | Visual | 100 % | Random | | Inspection Report | √ | P | W | **V** | |
| | | DFT | Major | Measurement | 100 % | Random | | Inspection Report | √ | P | W | **V** | |
| 5.2 | Completeness of Supply | Verification of Scope of Supply & Correctness of QA Documents | Major | Verification | 100 % | 100 % | Purchase Order / Quality Plan / Drawing | Inspection reports | -- | P | V | -- | |

**Notes:**

1. M/s OWNER and M/s MAIN SUPPLIER inspectors shall have full access to take photos of the respective jobs without seeking prior permission from the manufacturer.
2. Raw materials must be sourced from OWNER-approved suppliers, and the MTC must be submitted.
3. The manufacturer shall provide appropriate storage for raw materials, ensuring colour coding and traceability.
4. The Heat Number or Internal Allocation Number (IAN) shall be provided on the main parts (Flange & Web), excluding attachments.

Qualified and continuously employed welders may be deployed without requalification. Records of their qualification and continuity must be available for verification. A newly qualified welder by the Main Contractor shall be deployed for welding.

## 1.9.1 COLLECTING ELECTRODES

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **1.0** | **Raw Material** | | | | | | | | | | | | |
| 1.1 | COIL | CHEMISTRY | MAJOR | CHEMICAL | EACH HEAT | EACH HEAT | AS PER DRAWING / GMS | TC | √ | P | V | V | |
| | | HARDNESS AND ERICHSEN CUPPING VALUE | MAJOR | HARDNESS AND ERICHSEN CUPPING TEST | EACH HEAT | EACH HEAT | MATL. AS PER SPECN. | TC | | P | V | V | |
| **2.0** | **In Process Control** | | | | | | | | | | | | |
| 2.1 | ROLLING AND DIMENSIONAL CONTROL | PROFILE, CAMBER, BEND (LONG), LENGTH & PROFILE WIDTH, TRANSVERSE BEND, TWIST & WAVINESS | MAJOR | MEASUREMENT | Daily Once | ONCE IN A MONTH ON SURVEILLANCE BY OWNER | DRAWING | R | | P | W | W | |
| **3.0** | **FINAL INSPECTION** | FINISH, PRESERVATION AND STURDINESS OF PACKING | CRITICAL | VISUAL | ALL BUNDLES | RANDOM | RUST PREVENTIVE FLUID APPLICATION AND AS PER PACKING DRAWING | R | √ | P | W | V | |

## 1.9.2 EMITTING ELECTRODES

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **1.0** | **Raw Material** | | | | | | | | | | | | |
| | | CHEMISTRY | MAJOR | ANALYSIS | EACH HEAT | EACH HEAT | AS PER DRG / GMS | MILL TC | √ | P | V | V | MATE-RIALS TO BE, |
| | | MECHANICAL (UTS) | MAJOR | TENSILE TEST | ALL COILS | ALL COILS | AS PER DRG / GMS | MILL TC | | P | V | V | |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1.1 | WIRE | MICRO STRUCTURE (Longitudinal & transverse (250X)) | MAJOR | MICRO EXAMINATION | ONE SAMPLE /BATCH OF 1000 KGS | ONE SAMPLE /BATCH OF 1000 KGS | AS PER DRG / GMS | MILL TC | √ | P | V | V | PROCURED WITH MILL TC |
| | | *SURFACE PURITY* | | | | | | | | | | | |
| | | FREEDOM FROM CHLORIDE IONS | MAJOR | CHLORIDE ION CHECK | EACH COIL | EACH COIL | AS PER DRG / GMS | MILL TC | | P | V | V | |
| | | FREEDOM FROM SURFACE DEFECTS | MAJOR | MICRO EXAM | EACH COIL | EACH COIL | AS PER DRG / GMS | MILL TC | | P | V | V | |
| | | COILING TEST | MAJOR | UNIFORMITY OF COIL | SAMPLE COILS | SAMPLE COILS | AS PER DRG / GMS | MILL TC | | P | V | V | |
| 1.2 | SHROUD TUBE FOR EMITTING ELECTRODE | CHEMISTRY & MECHANICAL | MAJOR | ANALYSIS | EACH HEAT | EACH HEAT | AS PER DRG / GMS | TC | | P | V | V | REFERENCE TC WILL BE FURNISHED AS THESE ARE STOCK ITEMS |
| **2.0** | **In Process Control** | | | | | | | | | | | | |
| | **NOTE:** DURING STORAGE AND HANDLING THE CONTACT OF EMITTING ELECTRODE WIRE WITH STEEL SURFACE SHALL BE AVOIDED. IF REQUIRED SURFACE LIKELY TO COME IN CONTACT MAY BE LINED WITH RUBBER. | | | | | | | | | | | | |
| 2.1 | DIMENSION | NO OF TURNS & END CONTSRUCTION ETC | MAJOR | MEASUREMENT AND CHECKING WITH TEMPLATE | 100% BY SUB-VENDOR | SINGLE SAMPLING BY BHEL AQL 1.0% IL -III, IS: 2500 PART – I | DRAWING | R | | P | V | V | |
| 2.2 | SURFACE CONDITION | FREE FROM SURFACE DEFECTS AND NO JOINTS | MAJOR | VISUAL & MAGNIFYING GLASS | 100% | 10% | DRAWING / BHEL ACCEPTANCE STANDARD (Scratches not accepted) | R | | P | V | V | |
| **3.0** | **Final Inspection** | | | | | | | | | | | | |
| 3.1 | SPRING BACK, RETENTION FORCE & INITIAL TENSION | SPRING BACK TEST, RETENTION FORCE, INITIAL TENSION | MAJOR | MEASUREMENT | ONE ELECTRODE PER HEAT | ONE ELECTRODE PER HEAT | DRAWING / BHEL ACCEPTANCE STANDARD | R | | P | W | V/ W @ | @once in three months |
| 3.2 | DIMENSIONS & SURFACE CONDITION | DIMESIONS & SURFACE CONDITIONS | MAJOR | MEASUREMENT & VISUAL | 20 piece per lot | 20 piece per lot | DRAWING/BHEL ACCEPTANCE STANDARD | | | P | W | V/ W @ | @once in three months |

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3.3 | FINISH & PACKING | FINISH AND PACKING | MAJOR | VISUAL | 100% | | DRAWING/BHEL ACCEPTANCE STANDARD | R | | P | W | V | | |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **NOTE -** | | | | | | | | | | | | | |
| 1 | INSPECTION / NDT / TEST CERTIFICATE / REPORT FOR UT, MPI, BALANCING, PRESSURE TEST SHALL INDICATE REFERENCE OF ITEM SERIAL NUMBER & MODEL FOR CO-RELATION. | | | | | | | | | | | | |
| 2 | MATERIAL TEST CERTIFICATE / REPORT FOR TEST SUCH AS CHEMICAL & MECHANICAL TEST ETC. SHALL INDICATE REFERENCE OF ITEM SERIAL NUMBER & ENGINE MODEL FOR CO-RELATION AS PER SAMPLING NORMS. | | | | | | | | | | | | |
| 3 | For Critical items of APH like Rotor post, module, bearings, lub oil system etc. Oil heater & SCAPH, separate MQPs shall be prepared with mutual agreement between manufacturer and purchaser. | | | | | | | | | | | | |
| 4 | **For coal mills, MQP for mill shell, grinding rolls, planetary gear box, bullring segment, Bowl assembly separator MQP s**hall be prepared with mutual agreement between manufacturer and purchaser. | | | | | | | | | | | | |
| **2. STEAM TURBINE GENERATOR AND AUXILIARIES** | | | | | | | | | | | | | |
| **2.1 STEAM TURBINE - HIGH PRESSURE (HP) AND INTERMEDIATE PRESSURE (IP) ENCLOSURES** | | | | | | | | | | | | | |
| **1.0 Raw Material Inspection** | | | | | | | | | | | | | |
| 1.1 | Casting material | Chemical properties, Heat Treatment. | Critical | Chemical composition, Review of HT charts, Defectogram etc. | 100% | OEM Standard | MTC | √ | P | V | V | Creep data in case of New or Non-established vendor |
| 1.2 | Test pieces of the material and condition of the casting | Chemical & Mechanical properties, Micro structure | Critical | Chemical & Mechanical testing | 100% | OEM Standard | MTC | √ | P | W | W | |
| 2.0 | **In Process Inspection** | | | | | | | | | | | | |
| 2.1 | Casting material | Final NDT after HT | Critical | MPE | 100% | OEM Standard & NDE plan | MTC | √ | P | W | W | Both inside & outside surface |
| | | | Critical | UT or RT | 100% | | MTC | √ | P | W | W | |
| 2.2 | Welds of stub pipes and transition pieces to the main body of an enclosure | NDT | Critical | RT and MPE or DPT | 100% | OEM Standard & NDE plan | MTC | √ | P | V | V | After stress relieving |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | RT/UT/MPE of finished welds | | | | | | | | |
| 2.3 | Casting material | Dimensional control, Hardness survey | Critical | Dimension check, UT, Hardness check | 100% | OEM Standard | MTC | √ | P | W | W | |
| 2.4 | Casting material-machining | Machining of Horizontal Joint surface, Groves & other parts | Critical | Dimension check | 100% | OEM Standard | MTC | √ | P | W | W | Random for Customer |
| 3.0 | **Final Inspection** | | | | | | | | | | | |
| 3.1 | Cast enclosure | Hydraulic Test | Critical | Measurement | 100% | OEM Standard | TC | √ | P | W | W | |
| 3.2 | Cast enclosure | Box up of upper & lower half(Contact check) | Critical | Measurement | 100% | OEM Standard | TC | √ | P | W | W | |
| **2.2 STEAM TURBINE - LOW PRESSURE (LP) ENCLOSURES (FABRICATED)** | | | | | | | | | | | | |
| 1.0 | **Raw Material Inspection** | | | | | | | | | | | |
| 1.1 | Plates, Piping & Fittings,<br><br>Casing Casting (if applicable) | Chemical, Mechanical & NDT | Major | TC Review | 100% | Approved Drawing/Datasheet | MTC | √ | P | V | V | Co-related MTC from approved sources, UT more than 25mm for Plates |
| 2.0 | **In Process Inspection** | | | | | | | | | | | |
| 2.1 | Welds of an enclosure | Stress Relieving after completion of all welding | Major | Heat Treatment | 100% | OEM Standard | IR | √ | P | V | V | |
| | | Welding & NDT | Critical | RT and MPE or DPT<br><br>RT/UT/MPE of finished welds | 100% | OEM Standard | IR | √ | P | V | V | See Note 3 for NDT, Welding as per approved WPS/PQR/WTQ |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3.0 | **Final Inspection** | | | | | | | | | | | |
| 3.1 | Fabricated enclosure | Hydraulic Test | Major | Mech. Tests /Measure ment | 100% | OEM Standard | IR/TC | √ | P | W | W | After stress relieving |
| | | Box up of upper & lower half (Contact check) | Critical | Measure ment | 100% | OEM Standard | IR/TC | √ | P | W | W | |
| | | Visual & Dimensional | Critical | Visual, Measure ment | 100% | Approved drawing/datasheet | IR/TC | √ | P | W | W | |
| **2.3 TURBINE ROTORS - FORGING AND COMPLETE ROTOR** | | | | | | | | | | | | |
| 1.0 | **Raw Material Inspection** | | | | | | | | | | | |
| 1.1 | Forging material | Chemical properties, Heat Treatment, | Major | Chemical compositi on, Review of HT charts etc. | 100% | OEM Standard | MTC | √ | P | V | V | Creep data in case of New or Non-established vendor |
| 1.2 | Test pieces of the material | Chemical & Mechanical Properties, Microstructure | Critical | Chemical & Mechanic al testing | 100% | OEM Standard | MTC | √ | P | W | W | |
| 1.3 | Forging material | Overlay Welding & its NDT | Critical | WPS/PQ R review | 100% | OEM Standard | MTC | √ | P | V | V | |
| 1.4 | Forging material | NDT | Critical | UT | 100% | OEM Standard & NDE Plan | MTC | √ | P | W | W | |
| 2.0 | **In Process Inspection** | | | | | | | | | | | |
| 2.1 | Rotor Welds, if applicable | NDT | Critical | RT and MPE or DPT | 100% | OEM Standard & NDE Plan | MTC | √ | P | W | W | Ultrasonic examination with normal and angular probes of the weld<br>• Run out of rotor before and after welding |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | • MPE on finish welds<br>• Hardness survey on the welds<br>• Stress relieve annealing |
| | | | | RT/UT/MPE of finished welds | | | | √ | P | W | W | |
| 2.2 | Forging material | Residual Stress Measurement | Major | Residual Stress | 100% | OEM Standard | TC/IR | √ | P | W | W | |
| 2.3 | Forging material | Machining of Shaft | Critical | Measurement | 100% | Approved drawing/datasheet | TC/IR | √ | P | W | W | Witness of Critical dimensions |
| 3.0 | **Final Inspection** | | | | | | | | | | | |
| 3.1 | HP and IP rotor forgings | Thermal stability tests | Critical | Measurement | 100% | OEM Standard | TC/IR | √ | P | W | W | Thermal stability of the rotors in service and at over speed |
| 3.2 | Each Rotor | NDT on Journal areas | Critical | MPE | 100% | OEM Standard | TC/IR | √ | P | W | W | After final machining and before gashing on other areas |
| 3.3 | Each Rotor | Blades Assembly (Feeler check b/w blade to blade at shroud & root) | Critical | Measurement | 100% | Approved drawing/datasheet | TC/IR | √ | P | W | W | Random check by Customer |
| 3.4 | Complete Rotor | i) Axial & radial run-outs before and after blading and after over speed tests. | Critical | Measurement | 100% | OEM Standard/Technical Specification | | √ | P | W | W | See Note 4 |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | ii) dynamically balancing at rated speed<br>iii) An over speed test to withstand over speed of 120% for five continuous minutes or 125% for two continuous minutes.<br>iv) Vibration tests to determine natural frequencies in various vibration modes to ensure that the ranges are outside operating frequencies<br>v) Lock Blade Lift check | | | | | | | | | | |
| **2.4 TURBINE ROTORS – STATOR AND ROTOR BLADES AND SHROUD BANDS** | | | | | | | | | | | | | |
| 1.0 | **Raw Material Inspection** | | | | | | | | | | | | |
| 1.1 | Blades Material Each bar stock | Chemical & Mechanical Properties, Heat Treatment, Hardness | Critical | Measurement | 100% | OEM Standard/Technical Specification | MTC | √ | P | V | V | Creep data in case of New or Non-established vendor |
| | | Mechanical properties, chemical composition, and microstructure | Critical | Measurement | Per Heat/Batch | OEM Standard | MTC | √ | P | W | W | On softest & Hardest Bar |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1.2 | Each bar stock | NDT | Critical | UT | 100% | OEM Standard | MTC | √ | P | V | V | Random check by Customer |
| 2.0 | **In Process Inspection** | | | | | | | | | | | |
| 2.1 | Erosion shield and blade joint | NDT | Critical | Radiography, Visual check PT | 100% | OEM Standard | IR/TC | √ | P | W | W | Shall be done prior to fitting to the wheel and after over speed tests |
| 2.2 | Shroud bands after punching and after riveting | NDT | Critical | DPT | 100% | OEM Standard | IR/TC | √ | P | W | W | Random check by Customer |
| 3.0 | **Final Inspection** | | | | | | | | | | | |
| 3.1 | Dimensional Inspection after machining & polishing | Dimensions check (Total Length, Throat, Min. & Max. Thickness etc.) | Critical | Measurement | 100% | OEM Standard | IR/TC | √ | P | W | W | Random check by Customer |
| 3.2 | Machined Blades | NDT | Critical | MPI | 100% | OEM Standard | IR/TC | √ | P | W | W | Random check by Customer |
| 3.3 | Moving blades of over 225mm active length | Moment weighed | Critical | Measurement | 100% | OEM Standard | IR/TC | √ | P | W | W | Random check by Customer |
| 3.4 | LP turbine blades | Natural Frequency Test | Critical | Measurement | 100% | OEM Standard | IR/TC | √ | P | W | W | Random check by Customer |
| 3.5 | Cast blades (if provided) | Chemical analysis and mechanical properties, Heat Treatment, NDT | Critical | (RT/UT) | 100% | OEM Standard | IR/TC | √ | P | W | W | Random check by Customer, Note-5 |
| **2.5 DIAPHRAGMS** | | | | | | | | | | | | |
| 1.0 | **Raw Material** | | | | | | | | | | | |
| 1.1 | Blade material | Chemical & Mechanical Properties, Heat Treatment, UT, Hardness, PMI | Major | Review of CHP/TC & IR | As per separate blade bar QAP | Approved Drawing/Datasheet | CHP/MTC & IR | √ | P | V | V | |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1.2 | Diaphragm Outer ring | Chemical, Mechanical Properties & UT | Major | Review of TC | Per Heat/Batch | Approved Drawing/Datasheet | MTC | √ | P | V | V | | |
| 1.3 | Diaphragm Flange (Inner Ring) | Chemical, Mechanical & NDT | Major | Review of TC, NDT | Per Heat/Batch & 100% | Approved Drawing/Datasheet | MTC & IR | √ | P | V | V | | |
| 2.0 | **In-Process Inspection** | | | | | | | | | | | | |
| 2.1 | Welded and Fabricated diaphragms | NDT | Critical | UT/ MPE | 100% | OEM Standard | MTC | √ | P | V | V | | |
| 3.0 | **Final Inspection** | | | | | | | | | | | | |
| 3.1 | Guide blade, moving blades and port wall | Concentricity, flatness | Critical | Measurement | 100% | OEM Standard | IR/TC | √ | P | V | V | | |
| 3.2 | Colour Matching | Surface contact of mating parts | Major | Visual | 100% | Manufacturer Standard | TC/IR | √ | P | V | V | Min.80 % contact & no through passage | |
| 3.3 | Visual & Dimensional | | Major | Measurement | 100% | | TC/IR | √ | P | V | V | | |
| **2.6 EXHAUST HOOD** | | | | | | | | | | | | | |
| 1.0 | **Raw Material Inspection** | | | | | | | | | | | | |
| 1.1 | Castings, Plates (if fabricated construction) | Chemical analysis and mechanical properties | Major | Review of TC | 100% | As per drawing/datasheet | MTC | √ | P | V | V | | |
| 2.0 | **In-Process Inspection** | | | | | | | | | | | | |
| 2.1 | Butt welds of Fabricated construction (if provided) | NDT | Critical | RT/ DPT | 10%/ 100% | OEM Standard | TC/IR | √ | P | V | V | | |
| 3.0 | **Final Inspection** | | | | | | | | | | | | |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3.1 | Finished hood | Pressure test | Critical | Measure ment | 100% | As per drawing/datasheet | | √ | P | W | W | |
| 3.2 | Exhaust hood parting planes | Blue matching & Dimensional check | Critical | Measure ment | 100% | As per applicable standard | | √ | P | W | W | |
| **2.7 STOP, CONTROL AND BYPASS VALVES, ACTUATORS/ SERVO-MOTORS AND STEAM STRAINERS** | | | | | | | | | | | | |
| 1.0 | **Raw Material Inspection** | | | | | | | | | | | |
| 1.1 | Raw material of valve body, bonnet, valve disc, seat & spindle | Chemical & Mechanical properties, Heat Treatment, NDT,IBR Forms | Major | Review of TC | 100% | Approved drawing/ datasheet, OEM Standard | MTC | √ | P | V | V | Creep data in case of New or Non-established vendor |
| 2.0 | **In Process Inspection** | | | | | | | | | | | |
| 2.1 | Stellited and nitrided areas of components and on stellite components in the finish ground or honed condition | NDT | Major | Visual check/ DPT | 100% | OEM Standard | TC/IR | √ | P | V | V | Random check for Customer |
| 2.2 | Valve body and bonnet castings or forgings | NDT | Critical | RT/ UT MPE | 100% | Body and bonnet shall also be subjected to 100% MPE on entire surface/ OEM Standard | | √ | P | W | W | |
| 2.3 | All pressure containing welds in body and bonnet | NDT | Critical | RT/ UT, MPE | 100% | OEM Standard | TC/IR | √ | P | V | V | Random check for Customer |
| 2.4 | Bar stock of 40 mm and above size for valve stem | NDT | Critical | UT, MPE/ DPT | 100% | OEM Standard | TC/IR | √ | P | V | V | Random check for Customer |
| 3.0 | **Final Inspection** | | | | | | | | | | | |
| 3.1 | Each valve body and bonnet | Pressure test, Seat Leakage Test | Critical | Measure ment | 100% | As per drawing/ datasheet/ IBR requirements (if applicable) | TC/IR | √ | P | W | W | At min.1.5 times the max. working pressure after applying temp. |

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| | | | | | | | | | | | | corrections for min. 30 minutes |
| 3.2 | All the actuating cylinders and servomotors | Operational checks | Critical | Measure ment | 100% | Approved drawing/ datasheet, Manufacturer Standard | TC/IR | √ | P | W | W | |
| 3.3 | Functional Testing with Actuator | Operational checks | Critical | Measure ment | 100% | Approved drawing/ datasheet, Manufacturer Standard | TC/IR | √ | P | W | W | |
| **2.8** | **CAST AND FORGED STEEL COMPONENTS** | | | | | | | | | | | |
| 1.0 | **Final Inspection** | | | | | | | | | | | |
| 1.1 | LP casing- in case of cast design, inlet, extraction and exhaust connections, shaft seal covers and rings, governor shaft, breach nut, threaded ring, angle ring, U- ring, servomotor parts such as body, piston, cover, yokes; turning gear casing | Chemical analysis and mechanical | Major | Measure ment | 100% | Approved drawing/ datasheet, Manufacturer Standard | MTC | √ | P | V | V | Including other items |
| **2.9** | **BOLTS AND NUTS FOR PRESSURE RETAINING ENCLOSURES AND ROTOR COUPLINGS** | | | | | | | | | | | |
| 1.0 | **Raw Material** | | | | | | | | | | | |
| 1.1 | Bar stock for bolts | Chemical & Mechanical, NDT | Major | Review of TC | 100% | Approved drawing/ datasheet, Manufacturer Standard | MTC | √ | P | V | V | |
| 2.0 | **Final Inspection** | | | | | | | | | | | |
| 2.1 | Finish machined bolts | NDT | Major | MPE or DPT | 100% | | TC/IR | √ | P | V | V | |

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| | | Visual & Dimensional | Major | Measure ment | 100% | | TC/IR | √ | P | V | V | |
| **2.10** | **GOVERNING AND PROTECTION SYSTEM EQUIPMENT** | | | | | | | | | | | |
| 1.0 | **Final Inspection - Electro-hydraulic controller, hydraulic amplifier, hydraulic controller, electro hydraulic convertors, hydraulic convertors, hydraulic speed governor, trip devices etc.** | | | | | | | | | | | |
| 1.1 | Pressure retaining parts | Hydraulic testing | Critical | Measure ment | 100% | Approved drawing/ datasheet, Manufacturer Standard | TC/IR | √ | P | W | W | |
| 1.2 | All the main assemblies and sub-assemblies | Functional test | Critical | Measure ment | 100% | | TC/IR | √ | P | W | W | |
| 1.3 | All control equipment | Rig testing | Critical | Measure ment | 100% | | TC/IR | √ | P | W | W | |
| 1.4 | Nitrided, stellite components in the finish ground | NDT, Hardness properties | Critical | DPT, Hardness | 100% | | TC/IR | √ | P | W | W | |
| **2.11** | **INSPECTION OF COMPLETED TURBINE** | | | | | | | | | | | |
| **2.11.1** | **HP, IP & LP TURBINE** | | | | | | | | | | | |
| 1.0 | **Final Inspection** | | | | | | | | | | | |
| 1.1 | Complete turbine | Various checks and measurement:<br>• Clearance between shaft seal casing and shaft seal ring<br>• Clearance in anti- rotational device in shaft seal casing joint<br>• Axial and radial alignments of inner and outer casings | Critical | Measure ment | 100% | OEM Standard/ Technical Specification/approved drawing & datasheet | TC/IR | √ | P | W | W | |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | ▪ For radial and axial blade clearances in blading section<br>▪ For axial and radial clearances in shaft seal<br>▪ Min. axial clearances and min. radial clearances in completely assembled steam turbine<br>▪ Alignment of over speed governor<br>▪ Axial distances for shroud bands for casings | | | | | | | | | | |
| 1.2 | Steam turbine control and emergency control equipment | No load running test | Critical | Measurement | 100% | OEM Standard/ Technical Specification | TC/IR | √ | P | W | W | |
| 1.3 | Pre- dispatch inspections | Visual including clearance check for transportation device | Major | Measurement | 100% | OEM Standard/ Technical Specification | TC/IR | √ | P | V | V | |
| **2.11 INSPECTION OF COMPLETED TURBINE** | | | | | | | | | | | | |
| **2.11.1 HP, IP AND LP TURBINES** | | | | | | | | | | | | |
| 1.0 | **Final Inspection** | | | | | | | | | | | |
| 1.1 | Complete turbine | Various checks and measurement:<br>▪ radial and axial blade clearance in blading section | Critical | Measurement | 100% | OEM Standard/ Technical Specification/approved drawing & datasheet | TC/IR | √ | P | W | W | |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | ▪ min. axial clearances and min. radial clearances in completely assembled steam turbine<br>▪ alignment of stationary blade carriers | | | | | | | | | | |
| 1.2 | Steam turbine control and emergency control equipment | No load running test | Critical | Measure ment | 100% | OEM Standard/ Technical Specification | TC/IR | √ | P | W | W | |
| 1.3 | Pre- dispatch inspections | Visual including clearance check for transportation device | Major | Measure ment | 100% | OEM Standard/ Technical Specification | TC/IR | √ | P | V | V | |
| **2.12** | **INTEGRAL AUXILIARIES OF STEAM TURBINE** | | | | | | | | | | | |
| 1.0 | **Raw Material - Bearing Pedestals, Housings And Bearings** | | | | | | | | | | | |
| 1.1 | Bearing Pedestal, Housings & Bearings | Chemical & Mechanical properties, NDT | Major | Review of TC | 100% | Approved Drawing/Datasheet | MTC | √ | P | V | V | |
| 2.0 | **In-Process Inspection** | | | | | | | | | | | |
| 2.1 | Pedestals | Leakage test | Critical | Measure ment | 100% | OEM/Manufacturer's standard | TC/IR | √ | P | V | V | |
| 2.2 | Butt Welds (for fabricated pedestals and housing) | NDT | Critical | RT or UT | 10% | OEM/Manufacturer's standard | TC/IR | √ | P | V | V | after stress relieving |
| 2.3 | Bearing shell | NDT | Critical | RT or UT | 100% | OEM/Manufacturer's standard | TC/IR | √ | P | V | V | |
| 3.0 | **Final Inspection** | | | | | | | | | | | |
| 3.1 | Bearing oil inlet | Hydraulic Test | Major | Measure ment | 100% | OEM/Manufacturer's standard | TC/IR | √ | P | V | V | |

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| | piping and jacking oil piping | | | | | | | | | | | |
| 3.2 | UT & DPT of bonding of lining to Shell/Liner & Thrust Bearing Pads | NDT | Critical | UT & DPT | 100% | OEM/Manufacturer's standard | TC/IR | √ | P | W | W | |
| 3.3 | Parting Plane tightness check | Feeler Gauge tightness of parting planes of bearing shell | Major | Measure ment | 100% | OEM/Manufacturer's standard | TC/IR | √ | P | V | V | |
| 3.4 | Colour Contact | Colour contact of joint plane for Journal bearing/combined Thrust & Journal bearing | Major | Measure ment | 100% | OEM/Manufacturer's standard | TC/IR | √ | P | V | V | |
| 3.5 | Visual & Dimensional | Verification of Dimension & Visual inspection | Major | Measure ment | 100% | OEM/Manufacturer's standard | TC/IR | √ | P | V | V | |
| **2.12.1 LUBRICATING OIL, JACKING OIL AND CONTROL OIL SYSTEMS** | | | | | | | | | | | | |
| **2.12.1.1 PUMPS** | | | | | | | | | | | | |
| 1.0 | **Raw Materials** | | | | | | | | | | | |
| 1.1 | Pumps Impeller, Shaft, Casing | Chemical & Mechanical Properties, NDT | Major | Review of TC | 100% | Approved drawing/datasheet | MTC | √ | P | V | V | |
| 2.0 | **In-process Inspection** | | | | | | | | | | | |
| 2.1 | Oil pump shaft | NDT | Critical | UT | 100% | OEM/Manufacturer's Std. | TC/IR | √ | P | V | V | |
| 2.2 | Pump impeller | NDT | Critical | MPE or DPT | 100% | OEM/Manufacturer's Std. | TC/IR | √ | P | V | V | |
| | | Over speed test, if applicable for Main Oil Pump | Critical | | 100% | OEM/Manufacturer's Std. | TC/IR | √ | P | V | V | |
| | | Impeller Balancing | Critical | Balancing | 100% | OEM/Manufacturer's Std. | TC/IR | √ | P | V | V | |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2.3 | Pump casing | Hydraulic pressure test | Major | Measure ment | 100% | Approved drawing/datasheet | TC/IR | √ | P | V | V | |
| 3.0 | **Final Inspection** | | | | | | | | | | | |
| 3.1 | Pumps | Performance Test | Critical | Measure ment | 100% | Approved drawing/ datasheet, OEM/ Manufacturer's Std. | TC/IR | √ | P | V | V | |
| 3.2 | Coolers and lubricating oil tanks | Pressure test(Tube & Shell side) | Critical | Measure ment | 100% | Approved drawing/datasheet, | TC/IR | √ | P | W | W | |
| 3.3 | Atmospheric tanks | Performance (leakage test) By water fill test for at least 12 hrs. | Critical | Measure ment | 100% | Approved drawing/datasheet, | TC/IR | √ | P | W | W | |
| 3.4 | Functional Test of Lube Oil Skid | Skid Functional Test for Pump discharge, Pressure, Noise, Vibration & current | Critical | Measure ment | 100% | Approved drawing/datasheet, OEM/Manufacturer's Std. | TC/IR | √ | P | W | W | |
| **2.12.1.2 OIL PURIFIERS (CENTRIFUGAL TYPE)** | | | | | | | | | | | | |
| 1.0 | **Raw Materials** | | | | | | | | | | | |
| 1.1 | Major components like Bowl Body, Bowl Hood, Top Disc, Distributor, Shafts, Impeller etc. | Chemical & Mechanical properties | Major | Review of TC | Per Heat/Batch | Manufacturer 'Standard | TC/IR | √ | P | V | V | |
| 2.0 | **Final Inspection** | | | | | | | | | | | |
| 2.1 | All pressure parts | Hydraulic Pressure test | Critical | Measure ment | 100% | Approved drawing /datasheet, OEM/ Manufacturer's Std. | TC/IR | √ | P | V | V | |
| 2.2 | Bowl Complete | Unbalance | Major | Balancing | 100% | Manufacturer's Standard | TC/IR | √ | P | V | V | |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2.3 | Complete purifier | Performance Test at manufacturer's works for capacity, mechanical running, sequential operation and interlocks, moisture content, vapour tightness, vibration, noise level, quality improvements etc. | Critical | Measure ment | 100% | Approved drawing/ datasheet, OEM/ Manufacturer's Std. | TC/IR | √ | P | W | W | See Note 6 |
| 2.4 | | Particle Size at Inlet & Outlet of Centrifuge | Critical | Measure ment | 01/Type | Approved drawing/ datasheet, OEM/ Manufacturer's Std. | TC/IR | √ | P | W | W | |

**2.12.1.3 OIL PURIFIERS (COALESCER TYPE)**

| Sl.No. | Component/Operation | Characteristics | Class | Type of Check | Quantum of Check | Reference document/Acceptance Norms Norms | Format | D | Agency M | Agency C | Agency U | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1.0 | **Raw Materials & Bought Out Items** | | | | | | | | | | | |
| 1.1 | Major components like Filter Housing,Piping Assembly etc. | Chemical & Mecanical properties,NDT | Major | Review of TC | Per Heat/Batch | Manufacturer'Standard | TC/IR | √ | P | V | V | |
| 1.2 | Pump,Motor, Catridges, Intrumentation (DP Gauge, Pressure Gauge etc.) | Receiving Inspection | Major | Review of TC | 100% | Manufacturer'Standard | TC/IR | √ | P | V | V | |

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| 2.0 | **In-Process Inspection** | | | | | | | | | | | |
| 2.1 | WPS/PQR Check | Welding | Major | Documentation | 100% | ASME Sec.IX | WPS/PQR | √ | P | V | V | |
| 2.2 | Visual & NDT after Welding | Visual,DPT | Major | Visual,DPT | 100% | As per relevant Std. | TC/IR | √ | P | V | V | |
| 3.0 | **Final Inspection of Final SKID Assembly** | | | | | | | | | | | |
| 3.1 | Hydrostatic Test with Oil | Hydraulic Pressure test | Critical | Measure | 100% | Approved drawing/datasheet, OEM/Manufacturer's Std. | TC/IR | √ | P | W | V | |
| 3.2 | Visual & Dimensional | Visual, Measurement | Major | Visual, Measurement | 100% | Approved drawing/datasheet | TC/IR | √ | P | W | V | |
| 3.3 | Functionality Test(Flow,Discharge Pressure,Noise, | Function Test | Critical | Measure | 100% | Approved drawing/datasheet, OEM/Manufacturer's Std. | TC/IR | √ | P | W | W | |
| 3.4 | Water & Particle Removal Test | Type Test | Critical | Measure | 01/Type | Approved drawing/datasheet, OEM/Manufacturer's Std./Technical Specification | TC/IR | √ | P | W | W | |
| 3.5 | Painting, Packing & Preservation | Visual,Measurement | Major | Visual,Measurement | 100% | Approved Drawing/Datasheet | IR/TC | √ | P | V | V | |

**2.12.2 STEAM CONDENSER**

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|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1.0 | **Raw Material** | | | | | | | | | | | |
| 1.1 | Plate,Pipe, Forgings,Tubes | Chemical & Mechanical Properties,Heat Treatment, NDT | Major | Review of TC | 100% | Approved drawing/datasheet | MTC | √ | P | V | V | |
| 2.0 | **In-Process Inspection:-** | | | | | | | | | | | |
| 2.1 | Welding Document | WPS/PQR/WTQ | Major | Verification | 100% | ASME Sec.VIII/IX,Technical Specification | WPS & POR | √ | P | V | V | |
| 2.2 | Weld Visual | Surface Defects | Major | Visual | 100% | Approved Drawing,ASME | IR | √ | P | V | V | |

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| 2.3 | Forgings of the nozzles | NDT | Critical | UT & MPE | 100% | Manufacturer's Std./Technical Specification | MTC | √ | P | V | V | |
| 2.4 | Butt welds (including T- joints) | NDT For vacuum containing welds, RT on atleast 10% of each butt weld shall be carried out. | Critical | RT & MPE/ DPT,Review of RT Films | 10%/ 100% | Manufacturer's Std./Technical Specification | TC/IR | √ | P | V | V | Nozzle welds shall be subject to 100% MPE or DPT |
| 2.5 | Welds (of fabricate d | NDT | Critical | RT/ UT & MPE | 100% | Manufacturer's Std./Technical Specification | TC/IR | √ | P | V | V | |
| 2.6 | Tube to tube sheet weld joints | NDT | Critical | DPT | 100% | Manufacturer's Std./Technical Specification | TC/IR | √ | P | V | V | |
| 2.7 | Tube sheet Visual & Dimensional | Hole Size,Pitch, Ligament etc. | Critical | Measure | 100% | Approved drawing/datasheet | TC/IR | √ | P | V | W | Random inspection by Customer |
| 2.8 | Condenser Tubes | 1.Hydro Test<br>2. Eddy Current Test<br>3. Visual & Dimensional check(Length,OD,Thickness,Ovality etc.)<br>In place of hydraulic test, air under water or Helium leak detection test can be carried out | Critical | Visual/ Measurement | 100% | Approved drawing/datasheet, Mfg.Std. | TC/IR | √ | P | V | W | Random inspection by Customer |
| 3.0 | **Final Inspection (After assembly at site)** | | | | | | | | | | | |
| 3.1 | Mock-Up for Tube Expansion | Dimensional Check | Major | Measure | 100% | Approved Drawing,ASME,Mfg.Std. | IR/TC | √ | P | V | V | Random check by Customer |
| 3.2 | Tube side of condenser | Hydraulic Pressure test | Critical | Measure | 100% | Approved drawing/datasheet,Mfg.Std. | TC/IR | √ | P | W | W | |
| 3.3 | Shell side of condenser | Water fill test | | | | | | | | | | |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3.4 | Standpipe, Flash tank etc. | Water fill test | | | | | | | | | | |
| 3.5 | Compensating pads (RF pads) | Pneumatical test | | | | | | | | | | |
| 3.6 | Painting, Packing & | Visual,Measurement | Major | Visual,Measurement | 100% | Approved Drawing/Datasheet | IR/TC | √ | P | V | V | |

**2.12.3 CONDENSER AIR EVACUATION SYSTEM**

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1.0 | **Raw material(Bought Out Items)** | | | | | | | | | | | |
| 1.1 | Pump Casing,Head, Impeller,Shaft, Cooler, Separator Tank | Chemical & Mechanical Properties,Heat Treatment,NDT | Major | Review of TC | 100% | Approved drawing/datasheet | MTC | √ | P | V | V | UT for shaft dia.more than 40mm |
| 2.0 | **In-Process Inspection** | | | | | | | | | | | |
| 2.1 | Rotor Assembly (Impeller & Shaft Assembly) | Static & Dynamic Balancing | Major | Balancing | 100% | Approved drawing/datasheet | MTC | √ | P | V | V | |
| 3.0 | **Final Inspection** | | | | | | | | | | | |
| 3.1 | Pump Casing | Hydraulic testing | Critical | Measure | 100% | Approved drawing/datasheet | TC/IR | √ | P | W | W | |
| 3.2 | Heat exchangers | Hydro test On both tube side and shell side | Critical | Measure | 100% | Approved drawing/datasheet | TC/IR | √ | P | W | W | After, the heat exchangers shall be suitably dried |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3.3 | Complete unit | Operation and performance testing including Noise & Vibration | Critical | Measure | 100% | Approved drawing/datasheet, Mfg. Std. | TC/IR | √ | P | W | W | The test shall be conducted with the respectiv e motors to be supplied |
| 3.4 | Painting, Packing & Preservation | Saturated Air(Humid Air Test) & Cavitation Test | Critical | Type Test | 1/Type | Approved drawing/datasheet, Mfg. Std. | TC/IR | √ | P | W | W | |
| | | Visual,Measurement | Major | Visual,Measu rement | 100% | Approved Drawing/Datasheet | IR/TC | √ | P | V | V | |

**2.12.4 (A) DEAERATOR & FEED WATER STORAGE TANK**

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1.0 | **Raw Materials** | | | | | | | | | | | |
| 1.1 | Plate,Pipe, Fittings,Spray Nozzles, Dished End & Manhole Cover (as applicable) | Chemical & Mechanical Properties,Heat Treatment, NDT | Major | Review of TC | 100% | Approved drawing/datasheet | MTC | √ | P | V | V | |
| 2.0 | **In-process Inspection** | | | | | | | | | | | |
| 2.1 | Welding Document | WPS/PQR/WTQ | Major | Verification | 100% | ASME Sec.VIII/IX,Technical Specification,IBR as | WPS & POR | √ | P | V | V | |
| 2.2 | Welding | Surface Defects/NDT | Major | Visual & PT/MT & RT/TOFD/ PAUT | 100% | Approved Drawing, ASME,Mfg.Std., IBR as appliacble | IR/TC | √ | P | V | V | Random Check by Customer, Review of RT Films |
| 2.3 | PWHT(as applicable) | Heat Treatment | Major | Visual | 100% | Mfg.Std. | IR/TC | √ | P | V | V | |
| 3.0 | **Final Inspection** | | | | | | | | | | | |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3.1 | Deaerator & Storage Tank | Hydraulic Test | Critical | Measurement | 100% | Drawing/Datasheet | IR/TC | √ | P | W | W | |
| 3.2 | Visual & Dimensional | Visual,Dimensional | Critical | Measure | 100% | Approved Drawing/Datasheet, IBR documents as applicable | TC/IR | √ | P | W | W | |
| 3.3 | Painting, Packing & Preservation | Visual,Measurement | Major | Visual,Measurement | 100% | Approved Drawing/Datasheet | IR/TC | √ | P | V | V | |

**2.12.4 (B) FEED WATER HEATERS, DRAIN COOLERS, GLAND STEAM CONDENSER**

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|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1.0 | **Raw Materials** | | | | | | | | | | | |
| 1.1 | Plate,Pipe, Forgings,Tubes, Tubesheet,Nozzles, Hemihead,Dished End & Manhole Cover (as applicable) | Chemical & Mechanical Properties,Heat Treatment, NDT | Major | Review of TC | 100% | Approved drawing/datasheet | MTC | √ | P | V | V | |
| 2.0 | **In-process Inspection** | | | | | | | | | | | |
| 2.1 | Welding Document | WPS/PQR/WTQ | Major | Verification | 100% | ASME Sec.VIII/IX,Technical Specification,IBR as | WPS & POR | √ | P | V | V | |
| 2.2 | Welding | Surface/Volumetric Defects/NDT | Major | Visual & PT/MT & RT/TOFD/ PAUT(as applicable) | 100% | Approved Drawing,ASME,Mfg.Std. | IR/TC | √ | P | V | V | Random Check by Customer, Review of RT Films |
| 2.3 | Dishend Forming | Visual,Dimensional,NDT,Heat | Major | Verification of TC | 100% | Approved Drawing,ASME,Mfg.Std. | IR/TC | √ | P | V | V | |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2.4 | Tube Sheet Fabrication | Weld Overlay & its NDT,Visual & Dimensional | Major | Verification of TC | 100% | Approved Drawing,ASME,Mfg.Std. | IR/TC | √ | P | V | V | Random check by Customer |
| 2.5 | Tubes | 1.Hydro Test<br>2. Eddy Current Test<br>3. UT Test(as applicable)<br>4. Visual & Dimensional | Critical | Visual, Measurement | 100% | Approved drawing/datasheet, Mfg.Std. | TC/IR | √ | P | V | V | |
| 2.6 | Mock-Up for Tube Expansion | Dimensional Check | Major | Measure | 100% | Approved Drawing,ASME,Mfg.Std. | IR/TC | √ | P | V | V | |
| 2.7 | Tube Bundle Assembly | Dimensional & NDT | Major | Measure,PT | 100% | Approved Drawing,ASME,Mfg.Std. | IR/TC | √ | P | V | V | |
| 2.8 | Tube to tube sheet weld joints | NDT | Critical | DP | 100% | Mfg.Std. | IR/TC | √ | P | V | V | |
| 2.9 | PWHT(as applicable) | Heat Treatment | Major | Visual | 100% | Mfg.Std. | IR/TC | √ | P | V | V | |
| 3.0 | Production Test Coupon testing(as applicable) | Visual & Dimensional | Major | Visual | 100% | Drawing,Mfg.Std., IBR as applicable | IR/TC | √ | P | V | V | |
| 3.0 | **Final Inspection** | | | | | | | | | | | |
| 3.1 | Heat exchangers | Hydro test (On both tube side and shell side) | Critical | Measure | 100% | Drawing/Datasheet, IBR as applicable | IR/TC | √ | P | W | W | After, the heat exchangers shall be suitably dried and Nitrogen capped |
| 3.2 | Complete Unit | Visual,Dimensional | Critical | Measure | 100% | Approved Drawing/Datasheet, IBR as applicable | TC/IR | √ | P | W | W | |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3.3 | Painting, Packing & Preservation | Visual,Measurement | Major | Visual,Measurement | 100% | Approved Drawing/Datasheet | IR/TC | √ | P | V | V | |

**2.13.4 BOILER FEED PUMPS**

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1.0 | **Raw Material** | | | | | | | | | | | |
| 1.1 | Barrel casing, casing cover, suction & discharge branches, shaft, Impeller, Diffusers ring sections, and wearing rings | Chemical & Mechanical Properties, Heat Treatment & NDT | Major | Review of TC | 100% | Approved Drawing/ Datasheet | MTC | √ | P | V | V | |
| **2.0** | **In-Process Inspection** | | | | | | | | | | | |
| 2.1 | On machined components | NDT | Critical | DPT | 100% | Manufacturer Standard | MTC | √ | P | V | V | |
| 2.2 | Rotor Assembly | Runout Checking<br>Dynamic Balancing | Critical | Measurement | 100% | Manufacturer Standard, Relevant Std. | TC/IR | √ | P | W | W | |
| 2.3 | Pump Assembly | Radial & Axial Running Clearances | Critical | Measurement | 100% | Drawing, Manufacturer Standard. | TC/IR | √ | P | W | W | |
| 3.0 | **Final Inspection** | | | | | | | | | | | |
| 3.1 | On barrel casing, discharge cover, and suction and discharge branches | Hydraulic testing | Critical | Measurement | 100% | Drawing/Datasheet | TC/IR | √ | P | W | W | |
| 3.2 | Overall Visual & Dimensional Check | Visual & Dimensional | Critical | Measurement | 100% | Drawing/Datasheet | TC/IR | √ | P | W | W | |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3.3 | Complete unit | Operation and performance testing<br><br>-Performance testing as per Hydraulic Institute Standards (HIS) to determine its characteristic curve at design speed and to ensure compliance with design requirement.<br>- Vibration to be Measured in transverse, horizontal and vertical direction at all measuring points<br>· Noise Level as per HIS.<br>-Strip down test | Critical | Measure ment | 100% | Drawing/Datasheet/Technical Specification, Manufacturer Standard, HIS/ASME | TC/IR | √ | P | W | W | Tests shall be carried out with loop water at specifie d design temper ature. Soften quality water shall be used for the perfor mance testing |
| **2.13.4.2 BOOSTER PUMP** | | | | | | | | | | | | |
| 1.0 | **Raw Materials** | | | | | | | | | | | |
| 1.1 | Casing, Casing cover, Shaft, Impeller, and wearing rings | Chemical & Mechanical Properties, Heat Treatment & NDT | Major | Review of TC | 100% | Approved Drawing/Datasheet | MTC | √ | P | V | V | |
| 2.0 | **In-process Inspections** | | | | | | | | | | | |
| 2.1 | On machined components | NDT | Critical | DPT | 100% | Manufacturer Standard | MTC | √ | P | V | V | |
| 2.2 | Rotor Assembly | Runout Checking | Critical | Measure ment | 100% | Manufacturer Standard, Relevant Std. | TC/IR | √ | P | W | W | |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2.3 | Pump Assembly | Radial & Axial Running Clearances, Dimensional | Critical | Measure ment | 100% | Drawing, Manufacturer Standard, | TC/IR | √ | P | W | W | |
| 3.0 | **Final Inspection** | | | | | | | | | | | |
| 3.1 | On pump casing | Hydraulic testing | Critical | Measure ment | 100% | Drawing, Manufacturer Standard, | | √ | P | W | W | |
| 3.2 | Impeller and completed rotor assembly | dynamic balancing test | Critical | Measure ment | 100% | Manufacturer Standard, Relevant Std. | | √ | P | W | W | |
| 3.3 | Complete unit | Operation and performance testing<br><br>Performance testing as per (HIS) to determine its characteristic curve at design speed and to ensure compliance with design requirement.<br><br>Vibration to be Measured in transverse, horizontal and vertical direction at all measuring points<br>Noise Level as perHIS.<br><br>Strip down test | Critical | Measure ment | 100% | Drawing/Datasheet/Technical Specification, Mfg. Std., HIS/ASME | TC/IR | √ | P | W | W | Tests shall be carried out with loop water at specified design temperature. Soften quality water shall be used for the performance testing |
| **2.13.4.3 GEAR BOX AND HYDRAULIC COUPLING** | | | | | | | | | | | | |
| 1.0 | **Raw Materials** | | | | | | | | | | | |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1.1 | Gears, pinions, wheels and shafts | Chemical & Mechanical Properties, NDT, Hardenability Test | Major | Review of TC | 100% | Drawing, Manufacturer Standard | MTC | √ | P | V | V | |
| 2.0 | **In-process Inspection** | | | | | | | | | | | |
| 2.1 | Gears, pinions, wheels and shafts | NDT on machined components | Major | PT/MPT | 100% | Manufacturer Standard | TC/IR | √ | P | V | V | |
| 2.2 | Assembled rotating component | Dynamic balancing test | Critical | Measure ment | 100% | Manufacturer Standard | TC/IR | √ | P | V | V | |
| 3.0 | **Final Inspection** | | | | | | | | | | | |
| 3.1 | Gear box Assembly | Full load speed and back to back locked rotor torque test | Critical | Measure ment | 01 Gear Box/ Model | Manufacturer Standard | TC/IR | √ | P | W | W | |
| | | Visual & Dimensional Static Tooth Contact, Backlash | Critical | Measure ment | 100% | Manufacturer Standard | TC/IR | √ | P | W | W | |
| | | Mechanical Run Test | Critical | Measure ment | 100% | Manufacturer Standard, AGMA Std. | TC/IR | √ | P | W | W | |
| 3.2 | Hydraulic Coupling Assembly | Visual & Dimensional | Critical | Measure ment | 100% | Approved Drawing | TC/IR | √ | P | W | W | |
| | | Performance test at No-Load | Critical | Measure ment | 100% | Manufacturer Standard | TC/IR | √ | P | W | W | |
| **2.13.5 CONDENSATE EXTRACTION PUMPS (CEPS)** | | | | | | | | | | | | |
| **2.13.5.1 PUMP** | | | | | | | | | | | | |
| 1.0 | **Raw Materials** | | | | | | | | | | | |
| 1.0 | Casings, Diffuser, Shafts, Impeller | Chemical & Mechanical Properties, Heat Treatment, NDT | Major | Review of TC | 100% | Approved Drawing/Datasheet | MTC | √ | P | V | V | |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2.0 | **In-Process Components** | | | | | | | | | | | |
| 2.1 | Machined components | NDT | Major | PT/MPI | 100% | Manufacturer Standard | TC/IR | √ | P | V | V | |
| 2.2 | Pump shaft | NDT<br>Runout | Major | UT<br>Measure ment | 100% | Manufacturer Standard | TC/IR | √ | P | V | V | |
| 2.3 | Pump Impeller | NDT | Major | RT | 100% | Manufacturer Standard | TC/IR | √ | P | V | V | Review of RT Films |
| 2.4 | Butt welds on fabricated components of thickness more than 10 mm | NDT | Major | RT | 10% | Manufacturer Standard | TC/IR | √ | P | V | V | Review of RT Films |
| 2.5 | Welds on Casing, suction bell, shaft, impeller and fabricated components | NDT | Major | DPT | 100% | Manufacturer Standard | TC/IR | √ | P | V | V | |
| 3.0 | **Final Inspection** | | | | | | | | | | | |
| 3.1 | On pump casing and pressure containing fabricated parts | Hydraulic testing | Critical | Measure ment | 100% | Drawing/Datasheet, Manufacturer Standard | TC/IR | √ | P | W | W | |
| 3.2 | Individual Impeller and completed rotor assembly | Dynamic balancing Test, Runout | Critical | Measure ment | 100% | Manufacturer Standard, Relevant Std. | TC/IR | √ | P | W | W | |
| 3.3 | Complete unit | Operation and performance testing<br>• Performance testing as per Hydraulic Institute Standards (HIS) to determine its characteristic | Critical | Measure ment | 100% | Drawing/Datasheet/Technical Specification, Manufacturer Standard, HIS | TC/IR | √ | P | W | W | Tests shall be carried out using cold soften quality water. |

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| | | curve at design speed and to ensure compliance with design requirements<br>• Vibration to be Measured in transverse, horizontal and vertical direction at all measuring points<br><br>Noise Level as per HIS.<br><br>Strip down test | | | | | | | | | | |
| **2.13.6 CONDENSATE POLISHING UNIT (CPU)** | | | | | | | | | | | | |
| **2.13.6.1 CPU SERVICE VESSELS** | | | | | | | | | | | | |
| 1.0 | **Raw Material** | | | | | | | | | | | |
| 1.1 | Plates for Shell & Dish Ends, Pipes | Chemical & Mechanical, HT & NDT | Major | Review of TC | 100% | Approved drawing/datasheet | MTC | √ | P | V | V | UT for plates thickness more than 25mm |
| 1.2 | Rubber | Chemical & Mechanical | Major | Review of TC | 100% | Approved drawing/datasheet, Mfg. Std. | MTC | √ | P | V | V | |
| 2.0 | **In-Process Inspection** | | | | | | | | | | | |
| 2.1 | Finished and formed dished ends and hemi heads | NDT Knuckle portion shall be checked by 100% MPE or DP test | Critical | DP/ MPE | 100% | Manufacturer Standard | MTC | √ | P | V | V | |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2.2 | Butt welds full penetration joints and nozzle welds | NDT | Critical | RT & MPE or DPT | 100% | Manufacturer Standard | MTC | √ | P | V | V | Review of RT Films |
| 2.3 | Rubber lining | Mechanical Properties (Tests as per IS-4682 part-I)<br>• Tensile & Elongation, Specific Gravity, Ash content<br>• Adhesion test<br>• Shore hardness test<br>• Ozone resistance test: (50 PPHM) / 40° C / 20 % Strain /70 hrs.<br>• Water Absorption Test<br>.Spark Test | Critical | Measure ment | 100% | Technical Specification, Relevant std. | TC/IR | √ | P | V | V | Water Absorp tion Test, After ageing test & Compr ession Set test |
| 3.0 | **Final Inspection** | | | | | | | | | | | |
| 3.1 | Fabricated vessel | Hydraulic testing | Critical | Measure ment | 100% | Drawing/datasheet, Manufacturer Standard | TC/IR | √ | P | W | W | |
| 3.2 | Visual & Dimensional | Dimensional Conformity | Critical | Measure ment | 100% | Drawing/datasheet | TC/IR | √ | P | W | W | |
| **2.13.6.2 ACID/ ALKALI HANDLING TANKS** | | | | | | | | | | | | |
| 1.0 | **Raw Materials** | | | | | | | | | | | |
| 1.1 | Plates for Shell & Dish Ends, Pipes | Chemical & Mechanical, HT & NDT | Major | Review of TC | 100% | Approved drawing/datasheet | MTC | √ | P | V | V | UT for plates thickne ss more |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | than 25mm |
| 1.2 | Rubber | Chemical & Mechanical | Major | Review of TC | 100% | Approved drawing/datasheet, Mfg. Std. | MTC | √ | P | V | V | |
| 2.0 | **In-process Inspection** | | | | | | | | | | | |
| 2.1 | Butt welds full penetration joints and nozzle welds | NDT | Critical | RT & MPE or DPT | 100% | Manufacturer Standard | TC/IR | √ | P | V | V | |
| 2.2 | Rubber lining | Mechanical Properties (Tests as per IS-4682 part-I) | Critical | Measure ment | 100% | Technical Specification, Relevant std. | TC/IR | √ | P | V | V | Tests are same as applica ble for CPU |
| 3.0 | **Final Inspection** | | | | | | | | | | | |
| 3.1 | Fabricated tank | Leakage testing | Critical | Measure ment | 100% | Drawing/Datasheet | TC/IR | √ | P | V | V | Rando m check by Custom er |
| **2.13.6.3 DOSING PUMPS/ METERING PUMPS** | | | | | | | | | | | | |
| 1.0 | **Raw Materials** | | | | | | | | | | | |
| 1.1 | Casing, Shaft, Impeller, valve seat, diaphragms | Chemical & Mechanical Properties, NDT | Major | Review of TC | 100% | Drawing/Datasheet | MTC | √ | P | V | V | |
| 2.0 | **In-process Inspection** | | | | | | | | | | | |
| 2.1 | Machined parts | Dimension LPI | Major | Dimensio n | 100% | ASTM E-165 | IR | √ | P | V | V | |
| 3.0 | **Final Inspection** | | | | | | | | | | | |
| 3.1 | Pump casing | Hydraulic testing (at 1.5 times the shut off pressure or 2 times the working pressure | Critical | Measure ment | 100% | Drawing/Datasheet | TC/IR | √ | P | V | V | Rando m check by Custom er |

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| | | whichever is higher) | | | | | | | | | | |
| 3.2 | Complete unit | Operation and performance testing | Critical | Measure ment | 100% | Relevant HIS, Mfg. Std. | TC/IR | √ | P | V | V | Rando m check by Custom er |
| **2.13.7 CONDENSER ON-LINE TUBE CLEANING SYSTEM** | | | | | | | | | | | | |
| **2.13.7.1 BALL RECIRCULATION PUMP** | | | | | | | | | | | | |
| 1.0 | **Raw Material** | | | | | | | | | | | |
| 1.1 | Casing, Impeller & Shaft | Chemical & Mechanical Properties, NDT | Major | Review of TC | 100% | Drawing/Datasheet | MTC | √ | P | V | V | |
| 2.0 | **Final Inspection** | | | | | | | | | | | |
| 2.1 | Pump casing | Hydraulic testing | Critical | Measure ment | 100% | Drawing/Datasheet, Mfg. Std. | TC/IR | √ | P | V | V | |
| 2.2 | Complete pump | Performance test | Critical | Measure ment | 100% | Drawing/Datasheet, Mfg. Std. | TC/IR | √ | P | V | V | |
| **2.13.7.2 BALL SORTER/ FABRICATED BODY (HOUSING)** | | | | | | | | | | | | |
| 1.0 | **Raw Materials** | | | | | | | | | | | |
| 1.1 | Housing Shell, Nozzle Flanges, Pipes, Screen Shaft, Gear Boxes | Chemical & Mechanical Properties, NDT | Major | Review of TC | 100% | Drawing/Datasheet | MTC | √ | P | V | V | |
| 2.0 | **Final Inspection** | | | | | | | | | | | |
| 2.1 | Body | Hydraulic testing | Critical | Measure ment | 100% | Drawing/Datasheet | TC/IR | √ | P | W | W | |
| 2.2 | Ball sorter assembly | Performance test | Critical | Measure ment | 100% | Drawing/Datasheet, Manufacturer Standard | TC/IR | √ | P | W | W | |
| **2.13.7.3 COATING/ LINING** | | | | | | | | | | | | |
| 1.0 | **Final Inspection** | | | | | | | | | | | |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1.1 | Rubber lining | Mechanical properties | Critical | Tests as per IS-4682 part-I | 100% | • Tensile & Elongation, Specific Gravity, Ash content<br>• Adhesion test<br>• Shore hardness test<br>• Ozone resistance test: (50 PPHM) / 40° C / 20 % Strain /70 Hrs<br>• Water Absorption Test. | | √ | P | V | V | Water Absorption Test, After ageing test & Compression Set test |
| **2.13.7.4 DEBRIS FILTER** | | | | | | | | | | | | |
| 1.0 | **Raw Material** | | | | | | | | | | | |
| 1.1 | Body, strainer mesh and other components | Chemical & Mechanical Properties | Major | Review of TC | 100% | Drawing/Datasheet, Manufacturer Standard | MTC | √ | P | V | V | |
| 2.0 | **Final Inspection** | | | | | | | | | | | |
| 2.1 | Body | Hydraulic testing | Critical | Measurement | 100% | Drawing/Datasheet, Manufacturer Standard | TC/IR | √ | P | W | W | |
| 2.2 | Filter assembly | Performance test | Critical | Measurement | 100% | Drawing/Datasheet, Mfg.Std. | TC/IR | √ | P | W | W | |
| **2.13.8 DRIP PUMP** | | | | | | | | | | | | |
| 1.0 | **Raw Material** | | | | | | | | | | | |
| 1.0 | Casings,Diffuser, Shafts,Impeller | Chemical & Mechnical Properties, Heat Treatment,NDT | Major | Review of TC | 100% | Approved Drawing/Datasheet | MTC | √ | P | V | V | |
| 2.0 | **In-Process Components** | | | | | | | | | | | |
| 2.1 | Machined components | NDT | Major | PT/MPI | 100% | Mfg.Std. | TC/IR | √ | P | V | V | |
| 2.2 | Pump shaft | NDT<br>Runout | Major | UT<br>Measure | 100% | Mfg.Std. | TC/IR | √ | P | V | V | |
| 2.3 | Pump Impeller | NDT | Major | RT | 100% | Mfg.Std. | TC/IR | √ | P | V | V | Review of RT Films |

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| 2.4 | Butt welds on fabricated components of thickness more than 10 mm | NDT | Major | RT | 10% | Mfg.Std. | TC/IR | √ | P | V | V | Review of RT Films |
| 2.5 | Welds on Casing, suction bell, shaft, impeller and fabricated components | NDT | Major | DPT | 100% | Mfg.Std. | TC/IR | √ | P | V | V | |
| 3.0 | **Final Inspection** | | | | | | | | | | | |
| 3.1 | On pump casing and pressure containing fabricated | Hydraulic testing | Critical | Measure | 100% | Drawing/Datasheet,Mfg.Std. | TC/IR | √ | P | W | W | |
| 3.2 | Individual Impeller and completed rotor assembly | Dynamic balancing Test, Runout | Critical | Measure | 100% | Mfg.Std.,Relevant Std. | TC/IR | √ | P | W | W | |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3.3 | Complete unit | Operation and performance testing<br>Performance testing as per Hydraulic Institute Standards (HIS) to determine its characteristic curve at design speed and to ensure compliance with design requirements<br>Vibration to be measured in transverse, horizontal and vertical direction at all measuring points<br>Noise Level as per | Critical | Measure | 100% | Drawing/Datasheet/Technical Specification,Mfg.Std., HIS | TC/IR | √ | P | W | W | Tests shall be carried out using cold soften quality water |
| 3.4 | Painting, Packing & Preservation | Visual,Measurement | Major | Visual,Measurement | 100% | Approved Drawing/Datasheet | IR/TC | √ | P | V | V | |

**NOTE -**

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|---|---|
| 1 | INSPECTION / NDT / TEST CERTIFICATE / REPORT FOR UT, MPI, BALANCING, PRESSURE TEST SHALL INDICATE REFERENCE OF ITEM SERIAL NUMBER & MODEL FOR CO-RELATION. |
| 2 | MATERIAL TEST CERTIFICATE / REPORT FOR TEST SUCH AS CHEMICAL & MECHANICAL TEST ETC. SHALL INDICATE REFERENCE OF ITEM SERIAL NUMBER & ENGINE MODEL FOR CO-RELATION AS PER SAMPLING NORMS. |
| 3 | a) Butt welds & full penetration welds : 10% RT or UT and 10% MPE or DPT 00%)<br>b) Fillet welds : 10% MPE or DPT (100%)<br>c) Nozzle welds : 10% MPE or DPT (100%)<br>d) Lifting lug and other load bearing : 100% MPE or DPT |

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| | fillet welds<br>e) Site weld edge preparations : 10% MPE or DPT | | | | | | | | | | | |
| 4 | ' Run out examination shall be carried out at blade shrouds also<br>' In case, bidder's practice is different, the same shall be furnished for purchaser's approval. During over speed test, vibration measurement and analysis shall also be carried out.<br>' In case impulse stage and or blade discs are fitted on the rotor, fit up between such disc and rotor shall be checked up beforere and after over speed test<br>' Lock blade lift after the over speed test shall be checked and record for same shall be maintained. | | | | | | | | | | | |
| 5. | Before starting mass productions, following technological tests shall be carried out on the first lot of 10 to 15 blades:<br>' 100% RT and 100% MPE on blades<br>' 100% hardness testing.<br>' Mechanical testing and metallurgical testing.<br>' Weld repair shall not be permitted | | | | | | | | | | | |
| 6. | ' Sample shall be drawn from inlet and outlet of purifier after works test and tested for moisture content, chemical tests and particle size of impurities | | | | | | | | | | | |
| **3. HIGH PRESSURE PIPING, VALVES, THERMAL NSULATION AND MISCELLANEOUS SYSTEMS/ EQUIPMENT** | | | | | | | | | | | | |
| **3.1 HIGH PRESSURE PIPING AND FITTING** | | | | | | | | | | | | |
| 1.0 | **Raw Material** | | | | | | | | | | | |
| 1.1 | All pipe lengths, Fittings | Chemical & Mechanical Properties, Heat Treatment, NDT | Major | Review of TC | 100% | Drawing/Datasheet, Technical Specification, IBR requirement | MTC | √ | P | V | V | |
| 1.2 | Review of WPS,PQR & WTQ | Verification, Validity | Major | Review of documents | 100% | Drawing, ASME Sec IX,IBR | WPS,PQR, IBR Cert./ WTQ | √ | P | V | V | |
| 2.0 | **In-Process Inspection** | | | | | | | | | | | |
| 2.1 | All mother pipes used for fittings | Hydro/NDT | Critical | hydraulic test or ultrasonic test | 100% | Drawing, Technical Specification, | IR/TC | √ | P | V | V | |
| 2.2 | All alloy and carbon steel pipes | NDT | Critical | UT | 100% | Drawing, Technical Specification, | IR/TC | √ | P | V | V | Random Check by Customer |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2.3 | Longitudinal welds | Hydro/NDT | Critical | UT or hydraulic tests | 100% | Drawing, Technical Specification, | IR/TC | √ | P | V | V | Random Check by Customer |
| 2.4 | Pipe bends (cold/ hot formed) | Bend Angle, Radius, Thinning, ,Surface Defect, Hardness | Critical | Visual, Measurement, Hardness, PT/MT | 100% | Drawing, Technical Specification, Mfg. Std. | IR/TC | √ | P | V | V | Random Check by Customer |
| 2.5 | Welds | NDT, Visual (after HT, if applicable) | Critical | RT/UT & PT/MPI, | 100% | Drawing, Technical Specification, Mfg. Std. | IR/TC, Review of RT Films | √ | P | V | V | Random Check by Customer, See Note 3 |
| 2.6 | Finished welding for alloy steel, BFP discharge, MS, HRH, CRH piping and associated piping | NDT, Visual (after HT, if applicable) | Critical | RT/UT & PT/MPI | 100% | Drawing, Technical Specification, Mfg. Std. | IR/TC, Review of RT Films | √ | P | V | V | Random Check by Customer, See Note 4 |
| 2.7 | Finished welding for Carbon Steel Class- I piping | NDT, Visual (after HT, if applicable) | Critical | RT/UT & PT/MPI | 100% | Drawing, Technical Specification, Mfg. Std. | IR/TC, Review of RT Films | √ | P | V | V | Random Check by Customer, See Note 5,6 &7 |
| 2.8 | Oil piping | NDT, Visual (after HT, if applicable) | Critical | RT/UT & PT/MPI | 100% | Drawing, Technical Specification, Mfg. Std. | IR/TC, Review of RT Films | √ | P | V | V | Random Check by Custom |

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| 2.9 | Hardness of Alloy Steel Butt Joint (Weld & HAZ) | Metal properties | Critical | Hardness | 100% for P91 material only, 3% for Other Alloy steel | Drawing, Technical Specification, Manufacturer Standard | IR/TC, | √ | P | V | V | Random Check by Customer |
| 3.0 | **Final Inspection** | | | | | | | | | | | |
| 3.1 | Final Dimensional & Visual Inspection | Weld Visual, Dimensional, PMI | Critical | Visual, Measurement, Chemical | 100% | Drawing, Technical Specification, Manufacturer Standard | IR/TC | √ | P | V | V | Random Check by Customer |
| **3.2** | **POWER CYCLE VALVES** | | | | | | | | | | | |
| **3.2.1** | **VALVES INCLUDING EXTRACTION LINE VALVES** | | | | | | | | | | | |
| 1.0 | **Raw Materials** | | | | | | | | | | | |
| 1.1 | Body, Bonnet, Disc, Seat | Chemical & Mechanical Properties, Heat Treatment, NDT | Major | Review of TC | 100% | Drawing/Datasheet, IBR if applicable | MTC | √ | P | V | V | |
| 1.2 | Actuators (if applicable) | Compliance with Specification | Major | Review of TC | 100% | Drawing/Datasheet | TC/IR | √ | P | V | V | |
| 1.3 | Gear Box | MTC, Run Test | Major | Review of TC | 100% | Drawing/Datasheet | TC/IR | √ | P | V | V | Run Test- Noise, Vibration, Gear Ratio, DOR |
| 2.0 | **In-Process Inspection** | | | | | | | | | | | |
| 2.1 | Weld Overlay Inspection | Surface Defect Overlay Hardness | Major | PT, Hardness | 100% | Drawing/Datasheet, Manufacturer Standard | TC/IR | √ | P | V | V | Performed on |

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| | | | | | | | | | | | | Test coupon |
| 2.2 | Pressure retaining parts of valves | NDT | Critical | RT/UT & MPI/PT | 100% | Drawing/Datasheet, Technical Specification, Manufacturer Standard | TC/IR | √ | P | V | V | Random Check by Customer , See Note 9 |
| 2.3 | Colour Matching of Disc/Plug/Seat | Surface contact of mating parts | Major | Visual | 100% | Manufacturer Standard | TC/IR | √ | P | V | V | Min.80 % contact & no through passage |
| 3.0 | **Final Inspection** | | | | | | | | | | | |
| 3.1 | Assembled Valves | Hydraulic testing- Shell<br>Seat leak test- Hydro<br>Seat leak test-Air | Critical | Visual & Measurement | 100% | Drawing/Datasheet, Technical Specification, Applicable. Std., IBR if applicable | TC/IR | √ | V | V | V | Random check by Customer |
| 3.2 | Fully assembled valve | Functional testing with actuator<br>• Valve travel, closing and opening time<br>• Current drawn by actuators | Critical | Measurement | 100% | Drawing/Datasheet | TC/IR | √ | V | V | V | Random check by Customer |
| **3.2.2** | **BUTTERFLY VALVE** | | | | | | | | | | | |
| **1.0** | **Raw Material Inspection** | | | | | | | | | | | |
| 1.1 | Plates for body, disc and flanges ( for fabricated valves), | Chemical & Mechanical Properties, Heat Treatment, NDT | Major | Review of TC | 100% | Drawing/Datasheet | MTC | √ | P | V | V | |

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| | Body & Disc Castings for Casted Valve, Drive & Stub Shafts | | | | | | | | | | | |
| 1.2 | Actuators (if applicable) | Compliance with Specification | Major | Review of TC | 100% | Drawing/Datasheet | TC/IR | √ | P | V | V | |
| 1.3 | Gear Box | MTC, Run Test | Major | Review of TC | 100% | Drawing/Datasheet | TC/IR | √ | P | V | V | Run Test- Noise, Vibration, Gear Ratio, DOR |
| 2.0 | **In-Process Inspection** | | | | | | | | | | | |
| 2.1 | Austenitic stainless steel welds | Material property for sea water application valves | Critical | IGC (inter-Granular corrosion )test | 100% | Manufacturer Standard | TC/IR | √ | P | V | V | |
| 2.2 | Shafts, seat rings etc. | NDT | Critical | Dye Penetration test | 100% | Manufacturer Standard | TC/IR | √ | P | V | V | |
| 2.3 | Rubber seal | Mechanical Properties, Hardness, Hydraulic stability test (Bleed Resistance) and ozone crack resistance tests | Critical | tensile, elongation and hardness test for vulcanising | Sample from lot | Relevant Std., Technical Specification | MTC | √ | P | V | V | |
| 3.0 | **Final Inspection** | | | | | | | | | | | |
| 3.1 | On each valve | Hydraulic testing ' To check body and bonnet strength | Critical | Measurement | 100% | As per AWWA- C504/C516/ BS-5155 | TC/IR | √ | P | W | W | |

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| | | ▪ Air seat leakage test | | | | | | | | | | |
| 3.2 | Disc Strength test | Hydro (Forward and Backward) | Critical | Measure ment | 100% | as per EN12266-1/ AWWA-C516 | TC/IR | √ | P | W | W | |
| 3.3 | Proof of Design (POD) Test | Type Test | Critical | Review | 01 per design/rating | AWWA C-516 | POD Report | √ | P | V | V | |
| 3.4 | On each valve with actuator | Performance test Opening and closing the valve from fully closed to fully open position and the reverse, under no flow for at least 25 cycles to check the following :<br>▪ Closing and opening time<br>▪ Operation of tripping switch and position indicator | Critical | Measure ment | 100% | Approved drawing/datasheet | TC/IR | √ | P | W | W | See Note 10 |
| **3.2.3 METALLIC EXPANSION BELLOW** | | | | | | | | | | | | |
| 1.0 | **Raw Material** | | | | | | | | | | | |
| 1.1 | Bellows/Pipe Ends/Plates | Chemical & Mechanical properties | Major | Review of TC | 100% | Approved drawing/datasheet | MTC | √ | P | V | V | |
| 2.0 | **In-Process Inspection** | | | | | | | | | | | |
| 2.1 | Longitudinal butt weld on bellow | NDT Before forming and after forming | Critical | MPE or DPT | 100% | Manufacturer Standard | TC/IR | √ | P | V | V | |
| 2.2 | Butt/Groove Welds | NDT | Critical | RT, MPE or DPT | 100% | Technical Specification, Manufacturer Standard | TC/IR | √ | P | V | V | Review of RT Films |
| 3.0 | **Final Inspection** | | | | | | | | | | | |

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| 3.1 | Visual & Dimensional | Dimensions | Critical | Measure ment | 100% | Approved drawing/datasheet | TC/IR | √ | P | W | W | |
| 3.2 | On each pipe and expansion bellow | Hydraulic testing & Vacuum Test (for vacuum applications) | Critical | Measure ment | 100% | Approved drawing/datasheet | TC/IR | √ | P | W | W | |
| 3.3 | On prototype/ expansion bellow | Type Test | Critical | Life cycle test, Squirm Test, Yield & Rupture | 01/Type | Approved drawing/datasheet | TC/IR | √ | P | W | W | |
| 3.4 | Routine Test | Deflection Test, Spring Rate(Only Axial) | Critical | Measure ment | 01/Type | Mfg. Std. | TC/IR | √ | P | W | W | |
| **3.2.4 HANGERS AND SUPPORT** | | | | | | | | | | | | |
| 1.0 | **Raw Materials** | | | | | | | | | | | |
| 1.1 | Round Bar, Plate, Coil Spring | Chemical & Mechanical Load Deflection, HT, Hardness, scragging test for Spring | Major | Review of TC | 100% | Drawing/Datasheet, Technical Specification | MTC | √ | P | V | V | |
| 2.0 | **In-Process Inspection** | | | | | | | | | | | |
| 2.1 | Welds | NDT<br>• Butt welds of thickness 32mm and above<br>• Butt welds of thickness less than 32mm & Fillet welds | Critical | UT/RT & MPE/DPT | 100% | Mfg. Std. | TC/IR | √ | P | V | V | |
| 2.2 | Turn-buckle, pipe clamps and hangers of thickness greater than 25mm | NDT | Critical | MPE/ DPT | 100% | Manufacturer Standard | TC/IR | √ | P | V | V | On bent portions |

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| 3.0 | **Final Inspection** | | | | | | | | | | | |
| 3.1 | Completed Springs, & Assembled hangers | Performance test (Sagging test and load versus deflection test) | Critical | MEASUREMENT | 100% | Drawing/Datasheet, Manufacturer Standard | TC/IR | √ | P | V | V | Random check by Customer |
| **3.2.5 THERMAL INSULATION, REFRACTORY, LAGGING AND CLADDING** | | | | | | | | | | | | |
| **3.2.5.1 THERMAL INSULATION** | | | | | | | | | | | | |
| 1.0 | **Final Inspection** | | | | | | | | | | | |
| 1.1 | Resin bonded mineral wool insulation | Performance test | Critical | Measurement | 100% | As per IS: 8183,Technical Specification | MTC | √ | P | V | V | Random check by Customer |
| 1.2 | Resin bonded rock wool insulation | Performance test | Critical | Measurement | 100% | As per IS: 9842, Technical Specification | MTC | √ | P | V | V | |
| 1.3 | Sprayed mineral wool | Performance test | Critical | Measurement | 100% | As per IS: 9724, Technical Specification | MTC | √ | P | V | V | |
| 1.4 | Ceramic fiber blankets and block insulation | Performance test | Critical | Measurement | 100% | as per IS: 15402, Technical Specification | MTC | √ | P | V | V | |
| **3.2.5.2 REFRACTORY** | | | | | | | | | | | | |
| 1.0 | **Final Inspection** | | | | | | | | | | | |
| 1.1 | Fire bricks or castable refractory | Performance test Castable refractory shall have proper identification, supplier name, customer name, batch no., date, material name and net weight in kg with proper instructions for handling | Critical | Measurement | 100% | Manufacturer Standard, Technical Specification | TC/IR | √ | P | W | W | |

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| **3.2.5.3 L AGGING AND CLADDING** | | | | | | | | | | | | |
| 1.0 | **Final Inspection** | | | | | | | | | | | |
| 1.1 | Aluminum sheeting | Chemical & Mechanical Properties | Major | Review of TC | 100% | Manufacturer Standard, Technical Specification | MTC | √ | P | V | V | |
| | | | | | | | | | | | | |
| **3.3 LOW PRESSURE PIPING, VALVES AND FITTINGS ETC.** | | | | | | | | | | | | |
| **3.3.1 PIPES, FITTINGS AND MITRE BENDS** | | | | | | | | | | | | |
| **3.3.1.1 MS PIPES ( BLACK & GALVANISED)** | | | | | | | | | | | | |
| 1.0 | **Raw Material Inspection** | | | | | | | | | | | |
| 1.1 | Steel strip/sheet | Mechanical & Chemical Properties | Major | Review of TC | 1 sample/heat | Approved Drg/ Data sheet/Tech Spec/ IS 1239/IS 3589 | MTC | √ | P | V | V | |
| 2.0 | **In-Process Inspection** | | | | | | | | | | | |
| 2.1 | Welds of pipes and fittings Including welds of rolled and welded pipes | NDT | Critical | Dye penetration test | 100% | ASTM E 165 | TC/IR | √ | P | V | V | |
| 3.0 | **Final Inspection** | | | | | | | | | | | |
| 3.1 | Pipe (Black) | Surface defect, Finish & End connection<br><br>Dimensions, Straightness, Ovality, Bend removal<br><br>Tensile, Elongation, Bend & Flattening | Critical | Visual<br><br>Measurement<br><br>Physical | Sampling as per IS 4711 | Approved Drg/Data sheet/Tech Spec/ IS 1239/IS 3589 | Inspection report | √ | P | W | W | |
| 3.2 | Galvanizing (If applicable) | Surface defect, Finish | Critical | Visual | Sample as Per IS 4736 | IS:2633 | Inspection report | √ | P | W | W | |

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| | | Uniformity of Zinc coating | Critical | Dip test | Sample as Per IS 4736 | IS 4736 | Inspection report | √ | P | W | W | |
| | | Thickness of coating, Thickness of Zn coating, Adhesion of Zn coating, Free Bore test | Critical | Measure ment | | | Inspection report | √ | P | W | W | |

**3.3.1.2 ROLLED & WELDED PIPES / MITRE BENDS >600 NB TO 2200 NB**

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| **1.0** | **Raw Material Inspection** | | | | | | | | | | | |
| 1.1 | PLATES | MECHANICAL & CHEMICAL PROPERTIES | MAJOR | MECHANICAL & CHEMICAL | 1 SAMPLE/HEAT | | APPROVED DRAWING/DATA SHEET / RELEFVANT MATERIAL SPEC AS PER DATA SHEET | TC | √ | P | V | V | CORRELATED MILL TCs ARE REQUIRED |
| | | SURFACE DEFECTS | MAJOR | VISUAL | 100% | - | RELEFVANT MATERIAL SPEC AS PER DATA SHEET / NO PITTING/CORRO SION | IR | | P | - | - | |
| | | DIMENSIONS | MAJOR | MEASURE | 100% | - | MFG.DRG. | IR | | P | - | - | |
| **2.0** | **In Process Inspection** | | | | | | | | | | | |

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| 2.1 | Welding | WPS/PQR/WQR | Major | Qualification/Verification | 100% | - | ASME Sec-IX / ASME Sec-IX | WPS, PQR | | P | - | - | Refer Note #1 |
| | | Marking, cutting, rolling,, joint set-up | Major | Visual & Measure | 100% | - | MFG DRG / MFG DRG | IR | | P | - | - | |
| | Welding | NDT on root run | Critical | DPT | 100% | - | ASTM E 165 / No Indications | IR | √ | P | V | V | Refer Note #2 |
| | | NDT on finished weld | Critical | DPT | 100% | - | ASTM E 165 / No Indications | IR | √ | P | W | W | During Final Inspection |
| | | NDT on 'T' joints (if any) | Critical | RT | 100% | - | ASME Sec-VIII / ASME Sec-VIII | IR | √ | P | V | V | Review of radiographs in CHP |
| **3.0** | **Final Inspection** | | | | | | | | | | | | |
| 3.1 | Complete Pipe / Mitre Bend | Dimensional (thickness, diameter, ovality, straightness) | Critical | Measure | 100% | 2% | IS 3589 / BS 534 / Tech sec | IR | √ | P | W | W | CHP |
| | | Flattenning test | Critical | Mechanical | 1 Sample / Lot | | IS:3589 | IR | √ | P | W | W | CHP |
| | | Hydraulic test | Critical | Hydro test | 100% | 10% | IS:3589 / No leakage | IR | √ | P | W | W | Refer Note 3 |
| NOTE 1: ONLY QUALIFIED WELDER / WPS SHALL BE USED.<br>NOTE 2: DPT AFTER BACKGAUGING SHALL BE DONE, INSTEAD OF DPT ON ROOT RUN, IN CASE BACK GAUGING IS POSSIBLE.<br>NOTE 3: IN CASE HYDRO TEST IS NOT POSSIBLE, 100 % RT OF WELD JOINTS IS REQUIRED TO BE DONE. | | | | | | | | | | | | | |
| **3.3.2 VALVES AND CAST & FABRICATED BUTTERFLY VALVE** | | | | | | | | | | | | | |
| **3.3.2.1 VALVES** | | | | | | | | | | | | | |
| **1.0** | **Raw Material Inspection** | | | | | | | | | | | | |
| 1.1 | Shaft/ spindle of size ≥ 40 mm diameter | Mechanical properties | Critical | ▪ UT<br>▪ MPE or DPT | 100% | | Machined surfaces of casing, disc and shaft for MPE or DPT to check surface soundness. | MTC | √ | P | V | V | |
| 2.0 | **Final Inspection** | | | | | | | | | | | | |

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| 2.1 | All valves | Hydraulic testing | Critical | Measurement | 100% | | Body, seat and back seat (wherever provided) at 1.5 times the maximum pressure to which respective valves can be subjected during plant operation. | | √ | P | W | W | Check valves shall also be tested for leak tightness test at 25% of the specified seat test pressure. For rubber lined valves, hydraulic test shall be carried out before rubber lining |
| 2.2 | Butterfly valves | Hydraulic testing, seat and disc string test | Critical | AWWA-C-504 standard | 100% | | | | √ | P | W | W | |
| **3.3.2.2 CAST & FABRICATED BUTTERFLY VALVE** | | | | | | | | | | | | | |
| 1.0 | Raw Material Inspection | | | | | | | | | | | | |
| 1.1 A | BODY & DISC CASTING, BAR STOCK FOR DRIVE & STUB SHAFTS, SEAT RING, CLAMPIN G RING | CHEMICAL & MECHANICAL PROPERTIES | Major | CHEMICAL & MECHANICAL | 1 SAMPLE/ HEAT | | RELEVANT MATERIAL SPECIFICATION AS PER APPROVED DATA SHEET/ APPROVED DRAWING | MTC | √ | P | V | V | REFER NOTE-1 |
| 1.1 B | | SURFACE DEFECT | Major | VISUAL | 100 % | -- | MSS SP-55 | √ | | P | V | - | |
| 1.1 C | | HEAT TREATMENT (WHEREVER APPLICABLE) | Major | REVIEW OF H.T CHARTS | 100 % | 100% | -DO- | √ | □ | P | V | V | |
| 1.1 D | | IGC TEST(WHEREVER APPLICABLE) | Major | CHEMICAL | 1 SAMPLE / HT BATCH | | ASTM A 262 / Practice – "E" | | √ | P | V | V | |
| 1.1 E | | INTERNAL DEFECTS | Major | UT | 100% | | ASTM A 388 | REFER NOTE- 2 | √ | P | V | V | ON BAR DIAMETER ≥ 40 MM |
| 1.1 F | MS PLATES FOR BODY & DISC | CHEMICAL & MECHANICAL PROPERTIES | Major | CHEMICAL | 1 SAMPLE/ HEAT | | RELEVANT MATERIAL SPECIFICATION AS PER | MTC | √ | P | V | V | REFER NOTE-1 |

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| | | | | & MECHANIC AL | | APPROVED DATA SHEET/ APPROVED DRAWING | | | | | | |
| 1.2 A | Rubber Seals, Seat liners | DIMENSIONS | Major | MEASURE | 100% | MANUFACTURING DRAWING | IR | √ | P | V | - | Type of Rubber as per approved drawing / data sheet<br>Acceptance norms shall be as per APPRVD DRG / DATA sheet if not mentioned in that value given in QP is to be followed |
| 1.2 B | | SURFACE DEFECT | Major | VISUAL | 100% | NO CUT MARKS | IR | √ | P | V | V | |
| 1.2 C | | SHORE HARDNESS | Major | MEASURE | 100% | IS 3400-II / SHORE A 75+/- 5 For Nitrile & 70+/-5 for EPDM | IR | √ | P | V | V | |
| 1.2 D | | Tensile & Elongation | Major | Measure | 1 Sample / Batch | IS 3400-II/ASTM D 412 150KG/CM2 Min &250% MIN | TC | √ | P | V | V | |
| 1.2 E | | Ageing test | Major | Physical | 1 sample/ batch | ASTM D 573 / Refer Note -3 | IR | √ | P | V | V | |
| 1.2 F | | Bleed resistance test | Major | Hydraulic Stability | 1 sample/ batch | IS 3400 part 6 / ASTM D 471 Refer note-4 | IR | √ | P | V | V | |
| 1.2 G | | Ozone resistance test | Major | Chemical | 1 sample/ batch | ASTM D 1149 / No crack at 50 PPM ozone for 72 hrs at 40deg C | IR | √ | P | V | V | |
| 1.3 | Gear box, bearing hardware | Dimensions & Make | Major | Measure & verification | 100% | Manufacturer catalogue / drawing | TC/COC | √ | P | V | V | Refer note-5 |
| 1.4 | ELECTRICAL ACTUATOR (IF APPLICABLE) - REFER SEPARATE MQP/ RQP OF ACTUATOR MANUFACTURER FOR INSPECTION. THE CHP REPORT OF ACTUATOR MANUFACTURER WILL BE SHOWN FOR CORRELATION & VERIFICATION | | | | | | | | | | | |
| 1.5 A | PNEUMATIC ACTUATOR (AS APPLICABLE) | APPEARANCE | Major | VISUAL | 100% | 100% | APPROVED DRAWING/ DATA SHEET/ MFG STD /CATALOGUE/ AWWA C504 | IR /TC | √ | P | V | V | |
| 1.5 B | | PERFORMANCE | Major | OPERATION | 100% | 100% | | IR | √ | P | V | V | |
| 1.5 C | | LEAK TIGHTNESS | Major | PNEUMATIC TEST | 100% | 100% | APPROVED DRAWING/ DATA SHEET/ MFG STD/ CATALOGUE NO LEAKAGE | IR | √ | P | V | V | |
| 2.0 | In process inspection | | | | | | | | | | | |
| 2.1 A | CAST BODY & DISC AFTER MACHINING | DIMENSION | Major | MEASURE | 100% | - | MANUFACTURER DRAWING | IR | - | P | - | - | |

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| 2.1 B | | BODY SHELL STRENGTH TEST | Major | HYDRO TEST | 100% | | APPLICABLE DESIGN STANDARD / APPROVED DRAWING | IR | √ | P | V | V | |
| 2.1 C | | NDT on change of sections & machined surfaces | Major | MPI | 100% | | ASTM E 709 REFER NOTE – 6 | NDT REPORT | √ | P | V | V | |
| 2.1 D | | NDT ON MACHINED SURFACES FOR STAINLESS STEEL CASTINGS | Major | DPT | 100% | | ASTM E 165 NO LINEAR INDICATIONS | NDT REPORT | √ | P | V | V | |
| 2.2 A | DRIVE & STUB SHAFTS | DIMENSIONS | Major | MEASURE | 100 % | -- | MANUFACTURER DRAWING | IR | - | P | - | | |
| 2.2 B | | SURFACE FINISH | Major | VISUAL & MEASURE | 100 % | -- | MANUFACTURER'S DRAWING | - | - | P | - | - | |
| 2.2 C | | SURFACE DEFECTS | Major | DPT | 100% | | ASTM E 165 NO LINEAR INDICATIONS | NDT REPORT | √ | P | V | V | |
| 2.3 A | PLATES FOR FABRICATION(FOR FABRICATED VALVE ONLY) | CUTTING OF PLATES | Major | VISUAL & MEASURE | 100% | - | CUTTING PLAN/MANUFAVTURING DRAWING | REGISTER | | P | - | - | |
| 2.4 A | BODY AND DISC FABRICATION(FOR FABRICAT | EDGE PREPARATION AND FIT UP | Major | VISUAL & MEASURE | 100% | - | APPROVED WPS/ FABRICATION DRG | REGISTER | | P | - | - | |
| 2.4 B | | WPS, PQR / WELDER QUALIFICATION | Major | VISUAL & MECHANICAL TEST /NDT | 100% | | ASME SEC IX | QW 482, 483, 484 | √ | P | V | V | Note-9 |
| 2.5 A | ED VALVE ONLY) | NDT ON BUTT WELD OF BODY & DISC AFTER BACK GAUGING | Major | DPT AFTER BACK GAUGING | 100% | | ASME SEC V / ASME SEC VIII DIV- 1 APPENDIX 8 | NDT REPORT | √ | P | V | V | |

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| 2.5 B | | & FINAL WELDING | Major | RT FINAL WELDING | 100% | | ASME SEC V / ASME SEC VIII DIV- 1 UCS 56 | | RT REPORT | √ | P | V | V | RT FILM SHALL BE REVIEWED BY CUSTOME R/OWNER |
| 2.5 C | | STRESS RELIEVING (AS APPLICABLE) | Major | TIME-TEM MEASURE | 100% | | ASME SEC VIII DIV-1 UW-51 | | SR CHART | √ | P | V | V | |
| 2.5 D | | NDT ON BUTT WELD AND FILLET WELD OF BODY & DISC ON FINISHED WELD | Major | DPT | 100% | 10% | ASME SEC V | √ | NDT REPORT | □ | P | W | W | CUSTOME R/OWNER WITNESS DURING FINAL INSPECTIO N |
| 2.5 E | | BODY SHELL STRENGTH CHECK | Major | HYDRO TEST | 100% | | APPLICABLE DESIGN STANDARD/APPROVED DRAWING/DATA SHEET | | IR | √ | P | V | V | |
| 3.0 | Final Inspection | | | | | | | | | | | | | |
| 3.1 A | COMPLETE VALVE WITH JOB ACTUATOR | PROOF OF DESIGN TEST | Major | TYPE TEST | 1 NO PER DESIGN / RATING | | APPLICABLE DESIGN STANDARD / /POD PRECEDURE | | POD REPORT | √ | P | V / W | V / W | REFER NOTE-7 |
| 3.1 B | | VISUAL & DIMENSION | Major | MEASURE | 100% | 10% OR MIN 02 NOS | APPLICABLE DESIGN STANDARD / APPROVED DRAWING / DATA SHEET | | √ | √ | P | W | W | |
| 3.1 C | | SHELL TIGHTNESS TEST | Critical | HYDRO TEST | 100 % | OF EACH SIZE WHICH EVER IS HIGHE R | APPLICABLE DESIGN STANDARD /APPROVED DRAWING/DATA SHEET No leakage | | √ | √ | P | W | W | |
| 3.1 D | | SEAT TIGHTNESS TEST | Critical | HYDRO TEST | 100 % | | APPLICABLE DESIGN STANDARD /APPROVED DRAWING/DATA SHEET No leakage | | √ | √ | P | W | W | |
| 3.1 E | | DISC STRENGTH TEST | Critical | HYDRO TEST | 01 NO. OF EACH SIZE & RATING | | APPLICABLE DESIGN STANDARD | | IR | √ | P | W | W | |

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| | | | | | | | /APPROVED DRAWING/DATA SHEET<br><br>NO PERMANENT DEFORMATION & LEAKAGE PERMITTED. | | | | | | |
| 3.2 | FUNCTIONAL TEST OF COMPLETE VALVE WITH JOB ACTUATOR/ OPERATOR | SMOOTH OPERATION<br><br>CURRENT<br><br>DRAWN LIMIT<br><br>SETTING<br><br>INTERLOCKS, OPEN & CLOSING TIME CHECK (IF APPLICABLE) | Critical | Operation | 100% | 10% | APPROVED DATA SHEET / DRAWING | IR | √ | P | W | W | |
| 3.3 | PAINTING | PAINTING APPEARANCE, THICKNESS & ADHESION | Major | VISUAL & MEASURE | 100% | 100% | TECHNICAL SPECIFICATION/ APPROVED DRAWING / PAINTING SCHEDULE | IR | √ | P | V | V | |
| 3.4 | MARKING | NAME PLATE/ FLOW DIRECTION INDICATION | Minor | VISUAL | 100% | -- | APPROVED DRAWING | LOG SHEET | - | P | - | - | |

| NOTES | |
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| 1 | NO WELD REPAIR IS ALLOWED ON CASTINGS OF CAST IRON. ONLY MECHANICAL PROPERTIES REQUIRED FOR CI/SGI CASTINGS. AS CAST HEAT NO. MARKS FOR SIZE ABOVE 500 NB AND PUNCHED HEAT NO. MARKS FOR SIZE BELOW 500 NB IS REQUIRED FOR CORRELATION OF CASTINGS.<br>MS PLATES SHALL BE OF CUSTOMER/OWNER ACCEPTABLE SOURCE WITH CORRELATED TC. #-IN CASE CASTING OF BODY IS OUTSORCED V/V MFR TO WITNESS TESTS ONE PER HEAT AS PER RELEVANT STD. |
| 2 | NORMAL PROBE OF 2MHZ FREQUENCY AND 20MM DIAMETER SHALL BE USED. WITH THIS PROBE THE BACK WALL ECHO (BWE) IN SOUND AREA SHALL BE SET AT 100% FSH (FULL SCREEN HEIGHT). AT THIS GAIN SETTING, ANY DEFECT ECHO ≥ 20% FSH IS NOT ACCEPTABLE. ALSO, LOSS OF BWE > 20% FSH IS NOT ACCEPTABLE. |
| 3 | AGEING TEST SAMPLE SHALL BE KEPT AT 100º C(FOR NITRILE RUBBER) & AT 70º C(FOR EPDM RUBBER) FOR 72 HOURS. ACCEPTANCE CRITERIA SHALL BE AS PER APPVD DRG/DATA SHEET OR AS BELOW IF NOT MENTIONED IN APPVD DRG/DATA SHEET:<br><br>A) PERMISSIBLE VARIATION IN HARDNESS ±5 % OF ORIGINAL VALUE. |

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| | B) PERMISSIBLE VARIATION IN TENSILE STRENGTH ±30% OF ORIGINAL VALUE.<br>C) PERMISSIBLE VARIATION IN % ELONGATION ±50 % OF ORIGINAL VALUE. | | | | | | | | | | | |
| 4 | FOR BLEED RESISTANCE TEST, ONE SAMPLE EACH SHALL BE KEPT IN 33% HCL, 48% NA OH AND DM WATER SEPARATELY FOR 72 HOURS AT 27 DEG. ACCEPTANCE CRITERIA WILL BE; | | | | | | | | | | | |
| | a. NO DISCOLORATION | | | | b. PERMISSIBLE CHANGE IN MASS SHALL BE 0% TO +2% | | | | | | | |
| 5 | GEAR BOX MANUFACTURERS TEST CERTIFICATE WITH GEAR RATIO, TORQUE RATING AND RUN TEST. FOR BEARINGS AND OTHER HARDWARE COC TO BE SUBMITTED. | | | | | | | | | | | |
| 6 | ACCEPTANCE NORMS FOR MPI TEST (AS PER ASTM E 125). | | | | | | | | | | | |
| | TYPE | DISCONTINUITY | ACCEPTABLE LEVEL | TYPE | DISCONTINUITY | ACCEPTABLE LEVEL | | | | | | |
| | I | HOT TEARS & CRACKS | NOT ACCEPTABLE | IV | INTERNAL CHILLS & UN FUSED CHAPLETS | 1 | | | | | | |
| | II | SHRINKAGE | 3 | V | POROSITY | 1 | | | | | | |
| | III | INCLUSION | 3 | | | | | | | | | |
| 7 | POD CLEARANCE SHALL BE TAKEN FROM CUSTOMER/OWNER-ENGG (WHEREVER APPLICABLE AS PER CONTRACTUAL REQUIREMENT). IN CASE POD TEST HAS BEEN CARRIED OUT ALREADY<br><br>FOR VALVE OF THE SAME SEAT DESIGN WITH THE SAME MOC & SIZE GROUP AND WITNESSED BY CUSTOMER, REPORT FOR THE SAME NEED TO BE REVIEWED ONLY.<br>IF POD IS ENVISAGED IN TECHNICAL SPECIFICATION AND NOT CARRIED OUT EARLIER AS ABOVE, THE SAME SHALL BE OFFRED FOR WITNESS OF CUSTOMER/OWNER. | | | | | | | | | | | |
| 8 | POSITIVE MATERIAL IDENTIFICATION FOR ALLOY/SS MATERIALS LIKE BODY, SEAT, FASTENERS ETC TO BE CARRIED OUT. THE QUANTUM OF CHECK SHALL BE 10 % OF THE OFFERED QUANTITY (EACH SIZE) OR MIN 2 NUMBERS OF VALVE OF EACH SIZE WHICHEVER IS HIGHER | | | | | | | | | | | |
| 9 | MAIN CONTTRACTOR/CUSTOMER/OWNER APPROVED WPS & PQR TO BE USED. ONLY QUALIFIED WELDERS TO BE ENGAGED FOR WELDING. | | | | | | | | | | | |
| **3.3.3** | **RUBBER LINING OF PIPES AND VALVES** | | | | | | | | | | | |
| 1.0 | **Final Inspection** | | | | | | | | | | | |
| 1.1 | Rubber lining of pipes and valves | Mechanical properties | Critical | Tests as per IS-4682 part-I | 100% | • Tensile & Elongation, Specific Gravity, Ash content<br>• Adhesion test<br>• Shore hardness test | | √ | P | V | V | Water Absorption Test, After ageing test & Compression Set test |

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| | | | | | | ▪ Ozone resistance test: (50 PPHM) / 40° C / 20 % Strain /70 hrs.<br>▪ Water Absorption Test<br>▪ Resistance to bleeding<br>▪ Dimensions<br>▪ Cleanliness & Uniformity<br>▪ Spark Test<br>▪ Control of Pr./Temp/ & Time<br>▪ Thickness<br>▪ Adhesion<br>▪ Surface Defects<br>▪ Completeness | | | | | | |
| **3.3.4 COATING AND WRAPPING MATERIAL** | | | | | | | | | | | | |
| 1.0 | **Raw Material** | | | | | | | | | | | |
| 1.1 | Coal tar based synthetic Primer | Viscosity<br>Drying time<br>Flash Point<br>Volatile matter | Major | Chemical & Physical test | IS 15337/AWWA C203 | Approved Data sheet/ IS 15337/AWWA C203 | TC | √ | P | V | V | |
| 1.2 | Fabric | Pliability<br>Heat Resistance<br>Breaking load in longitudinal direction<br>Porosity | Major | Physical test | IS 15337/AWWA C203/ASTM D 146 | Approved Data sheet/ IS 15337/AWWA C203/ASTM D 146 | TC | √ | P | V | V | |
| 2.0 | **In process Inspection** | | | | | | | | | | | |
| 2.1 | COAL TAR TAPE | A) UNIFORMITY OF COATING (ON BOTH SIDES) | MAJOR | VISUAL | AS PER IS:15337/ AWWA C203 | APPD DATA SHEET/AWWA C203/IS:15337 | IR | √ | P | V | V | |

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| | | B) PLIABILITY | | | | | | | | | | | |
| 3.0 | **Final Inspection** | | | | | | | | | | | | |
| 3.1 | Coal tar tape | Thickness<br>Width<br>Softening point<br>Penetration<br>Filler content<br>Service temperature<br>Breaking load in longitudinal direction<br>Adhesion test<br>Holiday test<br>Direct Impact test<br>Petrol solubility test | Critical | Measurement & Physical test | IS 15337/AWWA C203 | Approved Data sheet/ IS 15337/AWWA C203 | Inspection report | √ | P | W | V | Note: Cathodic disbondment test to be carried out by Mfrs as per IS 15337 and report to be submitted for review. |
| **3.3.5 RUBBER EXPANSION JOINTS** | | | | | | | | | | | | | |
| 1.0 | **Raw Materials** | | | | | | | | | | | | |
| 1.1 | Neoprene Rubber | Chemical & Mechanical, Shore Hardness, Ozone resistance test, Hydro stability test, Flame resistance test, Kerosene Dip Test | Major | Review of TC | 01 Sample/Batch | As per relevant IS | MTC | √ | P | V | V | |
| 1.2 | Rubber compound test slab after valcunising | Tensile strength, elongation, shore hardness | Major | Review of TC | 01 Sample/Batch | As per relevant IS | MTC | √ | P | V | V | |
| 1.3 | Fabric strength of synthetic fiber for reinforcement | Rubber to fabric adhesion<br>Rubber to metal adhesion | Major | Review of TC | 01 Sample/Batch | As per relevant IS | MTC | √ | P | V | V | |

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| 2.0 | **Final Inspection** | | | | | | | | | | | |
| 2.1 | Bare Bellows/ Expansion joints in assembled condition | 1.Visual & Dimensional<br>2. Hydro Test<br>3.Vacuum Test<br>4.Combined Movement Test<br>5.Deformation Check | Critical | Measure ment | 100% | Drawing/Datasheet, Technical Specification | TC/IR | √ | P | V | V | Random check by Customer<br>Proof of design (POD) test documents verification. |
| **3.4** | **EQUIPMENT COOLING WATER (ECW) SYSTEM** | | | | | | | | | | | |
| **3.4.1** | **PRIMARY SIDE AND SECONDARY SIDE PUMPS** | | | | | | | | | | | |
| 1.0 | **Final Inspection** | | | | | | | | | | | |
| 1.1 | Pump casing and pressure containing fabricated parts | Hydraulic testing | Critical | Measure ment | 100% | At 1.5 times the shut off head or 2 times the working pressure whichever is higher | | √ | P | W | W | |
| 1.2 | Complete unit | Operation and Performance testing as per Hydraulic Institute Standards (HIS) to determine its characteristic curve at design speed and to ensure compliance with design requirements<br>Vibration to be measured in transverse, horizontal and vertical direction | Critical | Measure ment | 100% | Drawing/Datasheet | | √ | P | W | W | Other tests shall also be conducted in line with details given above for other pumps |

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| | | at all measuring points.<br><br>Noise Level as per HIS.<br><br>Strip down test | | | | | | | | | | |

## 3.4.2 PLATE HEAT EXCHANGERS

| SL. NO | COMPONENT & OPERATIONS | CHARACTERISTICS | CLASS | TYPE OF CHECK | QUANTUM OF CHECK | | REFERENCE DOCUMENT | ACCEPTANCE NORMS/ | FORMAT OF RECORD/ | | AGENCY | | | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | M | C/ O | | | | | M | C | O | |
| 1. | 2. | 3. | 4. | 5. | 6. | | 7. | 8. | 9. | D* | ** 10 | | | 11 |
| 1 | **Raw Material Inspection** | | | | | | | | | | | | | |
| 1.1 | FRAME PLATE & PRESSURE PLATE, CONNECTION LINING MATERIAL. TOP AND BOTTOM CARRYING BAR, COUNTER FLANGE | CHEMICAL & MECHANICAL | MAJOR | CHEMICAL & MECH | 1SAMPLE / HEAT | | APPROVED DRAWING / DATA SHEET | | MTC | √ | P | V | V | REFER NOTE-1 |
| 1.2 | | HEAT TREATMENT (AS APPLICABLE) | MAJOR | MEASURE | 100% | | | | HT Chart | □□ | P | V | V | |
| 1.3 | | INTERNAL SOUNDNESS OF PLATES (≥ 25 MM THICK) | MAJOR | UT | 100% | | ASME SEC VIII DIV 1 SA 578 LEVEL B /ASTM A 435 (NOTE-2) | | MTC/ IR | √ | P | V | V | (APPLICABLE FOR FRAME AND PRESSURE PLATE ONLY) |
| 1.4 | | INTERNAL SOUNDNESS BARS (≥ 40 MM Dia) | MAJOR | UT | 100% | | ASTM A 388 (NOTE-2) | | MTC/ IR | √ | P | V | V | REFER NOTE-2 |
| 1.5 | HEAT TRANSFER PLATES | CHEMICAL PROPERTIES | MAJOR | CHEMICAL TEST. | 1SAMPLE / HEAT | | APPROVED DRAWING / DATA SHEET | | MTC | √ | P | V | V | REFER NOTE- 53 |
| 1.6 | | MECHANICAL PROPERTIES | MAJOR | MECHANICAL TEST. | 1SAMPLE / HEAT | | | | MTC | √ | P | V | V | |
| 1.7 | PIPES/NOZZLES | REVIEW OF MILL TC | MAJOR | CHEM, MECH & HYDRO | 1/LOT | | APPROVED DRAWING / DATA SHEET | | TC | √ | P | V | V | REFER NOTE-4 |
| 1.8 | GASKET | DIMENSIONS | MAJOR | MEASUREMENT | 100 % | 100 % | APPROVED DRAWING | | I.R. | √ | P | V | V | REFER NOTE-5 |
| 1.9 | | WORKMANSHIP AND FINISH | MAJOR | VISUAL. | 100 % | 100 % | NO DAMAGE. NO SURFACE DEFECTS | | I.R. | √ | P | V | V | |
| 1.10 | | CONTOUR | MAJOR | VISUAL | 100 % | 100 % | MFG DRGS/ SPECIFICATION | | I.R. | √ | P | V | V | |

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| 1.11 | | HARDNESS | CRITICAL | MEASUREMENT | 100 % | 100 % | APPROVED DRAWING | I.R. | √ | P | V | V | |
| 1.12 | TIGHTENING BOLT / STUD & NUT/TIE ROD | CHEMICAL & MECHANICAL | MAJOR | CHEMICAL & MECH | 1SAMPLE / HEAT | | APPROVED DRAWING / DATA SHEET | MTC | √ | P | V | V | |
| 1.13 | | WORKMANSHIP AND FINISH. | MAJOR | VISUAL. | 100 % | 100 % | APPROVED DRAWING | I.R. | √ | P | V | V | |
| 1.14 | | INTERNAL SOUNDNESS (FOR DIA >= 40 MM | CRITICAL | UT | 100 % | 100% | ASTM A 388 (NOTE-2) | MTC/IR | √ | P | V | V | |
| **2.0** | **Inprocess Inspection** | | | | | | | | | | | | |

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| 2.1 | WELDING (AS APPLICABLE) | WPS, PQR, WPQ | CRITICAL | VERIFICATION | 100% | | ASME-SEC.IX | | QW-482, 483, 484 | √ | P | V | V | REFER NOTE-6 |
| 2.2 | HEAT TRANSFER PLATES | PLATES PRESSED IN SINGLE OPERATION | MAJOR | VERIFICATION | 100 % | 100 % | MANUFACTURERS STANDARD PROCEDURE | UNIFORM CORRUGATION THROUGHOUT PLATE PRESSING CAPACITY | COMPLIANCE REPORT | √ | P | V | V | REFER NOTE-7 |
| 2.3 | | HT AREA<br><br>MEASUREMENT | MAJOR | WHITE<br><br>LIGHT SCANNING | 1/<br><br>MODEL TYPE | 1/<br><br>MODEL TYPE | MANUFACTURERS STANDARD PROCEDURE | APPROVED<br><br>DRAWING / DATASHEET | I.R. | √ | P | V | V | REFER NOTE-8 |
| 2.4 | | GASKET GROOVE DEPTH ON EACH PLATE | MAJOR | VISUAL & MEASUREMENT | 100 % | 100 % | MFG DRGS/ DATA SHEET | GASKET SHOULD NOT PROTRUDE OUTSIDE THE GASKET GROOVE FOR MORE THAN | IR | √ | P | V | V | GASKET GROOVE IN EACH PLATE SHOULD BE ABLE TO SUPPORT THE GASKET |

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| | | | | | | | | 20 % OF GASKET THICKNESS | | | | | | FROM THREE SIDES. |
| 2.5 | | WORKMANSHIP AND FINISH | MAJOR | VISUAL | 100 % | 100 % | NO SCRATCHES, CRACKS ETC. | | IR | | P | V | V | |
| 2.6 | | SURFACE DEFECTS AND CRACKS | CRITICAL | LIGHT BOX /VACUUM/ AIR CHAMBER TEST | 100 % | 10 % | MANUFACTURER'S LIGHT BOX TEST PROCEDURE NO | | IR | √ | P | W | W | REFER NOTE-9 |
| 2.7 | | | | DP TEST | 10 % | 2% / 1% | MANUFACTURER'S DP TEST PROCEDURE/ ASTM E 165 | | IR | √ \| P | | W | W | REFER NOTE-10 |
| 2.8 | WELDING OF PIPE AND PIPE TO INNER & OUTER RINGS(NOZZLE CONNECTION). | WELDING JOINT SOUNDNESS | MAJOR | DP TEST | 100 % | 100 % | MANUFACTURER'S DP TEST PROCEDURE/ ASTM E 165 | | IR | √ | P | W | V | |
| 2.9 | | VISUAL INSPECTION OF WELD | MAJOR | VISUAL | 100 % | 100 % | APPROVED DRAWING | | IR | √ | P | V | V | |
| 2.10 | PHE STRUCTURE | WORKMANSHIP AND FINISH | MAJOR | MEASURE & VISUAL | 100 % | 100 % | APPROVED DRAWING | | IR | √ | P | V | V | |
| 2.11 | PLATE GASKETS | PRESENCE OF GASKET | MAJOR | VISUAL | 100 % | 100 % | MANUFACTURES SPECIFICATION | | IR | √ | P | V | V | |
| 2.12 | PLATE ARRANGEMENT TO FLOW DIAGRAM | CORRECTNESS | MAJOR | VISUAL AS PER FLOW DIAGRAM | 100 % | 100 % | APPROVED DRAWING | | IR | √ | P | V | V | |
| 2.13 | ASSEMBLY OF TIGHTENING BOLTS | SQUEEZING OF | MAJOR | VISUAL | 100 % | 100 % | APPROVED DRAWING / DATA SHEET | | IR | | P | V | - | |

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| | AND NUTS | THREADS ON TIGHTENING BOLTS. | | | | | | | | | | | |
| 2.14 | PLATE PACK | DIMENSION | MAJOR | MEASURE | 100 % | 100 % | APPROVED DRAWING | IR | | P | V | - | |
| 2.15 | PHE ASSEMBLY | LEAKAGE/ STRENGTH OF THE STRUCTURE | MAJOR | HYDRO TEST | 100 % | 100 % | MANUFACTURER'S HYDRO TEST PROCEDURE NO. | IR | √ | P | V | V | |
| **3.0** | **Final Inspection & Testing** | | | | | | | | | | | | |
| 3.1 | COMPLETE ASSEMBLY | DIMENSION, NO OF HEAT TRANSFER PLATES, WORKMANSHIP & FINISH. | MAJOR | MEASURE & VISUAL | 100 % | 100 % | APPROVED DRAWING/DATA SHEET | IR | √ | P | W | W | |
| 3.2 | | LEAKAGE/ STRENGTH OF THE STRUCTURE | MAJOR | HYDRO TEST | 100 % | 100 % | MANUFACTURER'S HYDRO TEST PROCEDURE NO. | IR | √ | P | W | W | UNBALANCED HYDROSTATIC PRESSURE (BOTH PRIMARY & SECONDARY SIDE) |
| 3.3 | HT PLATE MATERIAL GRADE VERIFICATION | PMI WITH XRF ANALYZER | MAJOR | PMI | 100 % | 10 % | MATERIAL SPECIFICATION AS PER APPROVED DRAWING / APPROVED DATA SHEET | IR | √ | P | W | W | NOTE-11 |
| 3.4 | SURFACE PREPARATION & PAINTING | SHADE, DFT | MAJOR | VISUAL / MEASURE | 100 % | 100 % | APPROVED DRAWING/ APPROVED PAINTING PROCEDURE | IR | √ | P | W | V | |
| 4.0 | **Preservation & Packing** | | | | | | | | | | | | |
| 4.0 | PACKING & PRESERVATION | SOUNDNESS AND COMPLETENESS | MAJOR | VISUAL | 100 % | 100 % | TECH SPEC/ APPROVED QAP/ APPROVED DRAWING | COC | - | P | V | - | |

**Notes:**

NOTE-1 – IN ABSENCE OF CO-RELATED MILL TCS, MANUFACTURER SHALL ARRANGE CHECK TESTING AND TC SHALL BE SUBMITTED FOR CUTOMER'S REVIEW.

NOTE-2 – ULTRASONIC TEST SHALL BE CARRIED OUT USING 10 MM/20 MM SIZE NORMAL BEAM PROBE OF FREQUENCY 2 MHZ. UT ACCEPTANCE: BACK WALL ECHO (BWE) IN SOUND AREA SHALL BE SET AT 100% OF FULL-SCALE HEIGHT (FSH). THE WHOLE BAR SHALL BE SCANNED UNDER THIS SENSITIVITY SETTING. AT THIS SENSITIVITY SETTING ANY DEFECT ECHO EXCEEDING 20% OF FSH IS NOT ACCEPTABLE. ALSO, AT ANY PLACE LOSS IN BACK WALL ECHO MORE THAN 20% OF FSH IS NOT ACCEPTABLE.

NOTE-3 ALL THE SOURCE OF RAW MATERIAL FOR COIL / CUT TO SHEET SHOULD BE FROM CUTOMER'S APPROVED VENDORS (e.g. JINDAL / SAIL/ARCELLORMITAL / OUTOKUMPU). MILL TCS FOR HT PLATES FROM CUTOMER'S APPROVED VENDORS SHALL BE SUBMITTED TO CUTOMER'S FOR REVIEW WITH PROPER CORRELATION AS PER MFRS HEAT NUMBER.

NOTE-4 – TC REVIEW FOR CHEMICAL, MECHANICAL PROPERTIES. & HYDRO TEST.

NOTE-5 TCS FOR GASKETS FROM CUTOMER'S ACCEPTED VENDORS WILL BE SUBMITTED TO CUTOMER'S FOR REVIEW WITH PROPER CORRELATION AS PER, MFRS BATCH NUMBER.

NOTE-6 MAIN CONTRACTOR/ LLOYDS/TUV/BV/CUTOMER'S APPROVED WPS & PQR SHALL BE ACCEPTABLE. IF WELDERS ARE ALREADY QUALIFIED BY LLOYDS/TUV/BV/CUTOMER'S & DOING SIMILAR JOB REGULARLY, REQUALIFICATION IS NOT REQUIRED.
NOTE-7: SINGLE STEP PRESSING OPERATION - ONLY SINGLE STROKE (UNLESS UNTILL ALLOWED IN CONTRACT) SHALL BE USED TO FORM WHOLE CORRUGATIONS ON EACH WHOLE PLATE BY USING A SINGLE PRESS AND NOT IN MULTIPLE STROKE OR IN INCREMENTAL MANNER. CERTIFICATE OF COMPLIANCE FOR HT PLATE WITH WITNESS OF TPI AGENCY LIKE TUV/LLOYDS/BV WILL BE SUBMITTED FOR MAIN CONTRACTOR AND CUTOMER'S REVIEW.

NOTE-8: INSPECTION OF HT PLATE AREA MEASUREMENT SHALL BE BY WHITE SCANNING METHOD FROM THIRD PARTY LIKE TUV/ LLOYD/BV & SHALL BE WITNESS BY MAIN CONTRACTOR & CUTOMER'S. HOWEVER, IN CASE SAME HAS ALREADY BEEN WITNESSED BY CUTOMER'S IN SOME EARLIER PROJECTS, THE INSPECTION REPORT FOR THE SAME SHALL BE FURNISHED FOR CUTOMER'S REVIEW.

NOTE-9: 10% LIGHT BOX / VACUUM / AIR CHAMBER TEST SHALL BE RANDOMLY WITNESS BY MAIN CONTRACTOR & CUTOMER'S AT VENDORS WORKS, IN CASE ANY DEFECT IS FOUND IN ANY OF THESE 10% PLATES, THE WHOLE LOT SHALL BE TESTED IN PRESENCE OF MAIN CONTRACTOR & CUTOMER'S. H.T. PLATES WITHOUT DEFECT ONLY SHALL BE ACCEPTED.

NOTE-10: DPT 1% OR MINIMUM 50 NOS. OF PLATES WHICHEVER IS MAXIMUM SHALL BE RANDOMLY WITNESS BY CUTOMER'S AT VENDORS WORKS. MAIN CONTRACTOR TO WITNESS DP TEST ON 2 % OR MINIMUM 100 NOS. OF PLATES. IN CASE ANY DEFECT IS FOUND IN ANY OF THESE PLATES DURING ABOVE D.P. TEST , MANUFACTURER SHALL CONDUCT D.P.TEST ON ENTIRE LOT OF PLATES. CUTOMER'S SHALL WITNESS TWICE THE SAMPLE AS EARLIER VIZ. 2% OF TOTAL NOS. OF PLATES RANDOMLY SELECTED FROM THE ENTIRE LOT.
MAIN CONTRACTOR TO WITNESS D.P. TEST ON 4 % TO TOTAL NOS. OF PLATES RANDOMLY SELECTED FROM THE ENTIRE LOT. VENDOR SHALL FIRST CARRYOUT DPT AS STATED ABOVE THEMSELVES AND ONLY AFTER SATISFACTORY TESTING, SHALL OFFER THE DPT FOR CUTOMER'S WITNESS.

NOTE-11: 100% PMI INSPECTION FOR MATERIAL GRADE VERIFICATION OF HT PLATES OF PHE SHALL BE WITNESSED BY REPUTED TPIA LIKE TUV/ LLYOD/BV AND CERTIFICATE SHALL BE SUBMITTED FOR REVIEW OF MAIN CONTRACTOR & CUTOMER'S. RANDOM 10% PMI INSPECTION FOR MATERIAL GRADE VERIFICATION OF HT PLATES OF PHE SHALL BE WITNESSED BY MAIN CONTRACTOR & CUTOMER'S.

| 3.5 | EOT CRANES AND HOISTS |
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| SL. No. | COMPONENT & OPERATIONS | CHARACTERISTICS | CLASS | TYPE OF CHECK | QUANTUM OF CHECK | | REFERENCE DOCUMENT | ACCEPTANCE NORMS | FORMAT OF RECORD | AGENCY | | | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **A.** | **Raw Material Inspection** | | | | | | | | | | | | |
| A.1 | MS PLATES FOR BRIDGE GIRDER, END CARRIAGES, CRAB FRAME, ROPE DRUM & PULLEYS (FABRICATED) | VISUAL& DIMENSIONAL | MAJOR | VISUAL& MEASUREMENT | 100% | 100% | RELEVANT MATERIAL SPECIFICATION AS PER APPROVED DATA SHEETS /DRAWINGS. | | IR | | P | V | - | |
| | | CHEMICAL COMPOSITION | MAJOR | CHEMICAL ANALYSIS | 1 SAMPLE / HEAT | | | | MTC | √ | P | V | V | In the absence of correlated TC check testing shall be done. |
| | | MECHANICAL PROPERTIES | MAJOR | TENSILE,% ELONGATION & YIELD STRESS | 1 SAMPLE / HEAT | | | | | √ | P | V | V | |
| | | ULTRASONIC TEST OF PLATES (THICKNESS ≥ 25 MM) | MAJOR | NDT | 100% | 100% | ASTM A 435 | ASTM A 435 | IR | √ | P | V | V | |
| | | CHEMICAL COMPOSITION | MAJOR | CHEMICAL ANALYSIS | 1 SAMPLE / HEAT/SIZE | | RELEVANT | | | √ | P | V | V | |

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| A.2 | ROPE DRUM (IF SEAM LESS PIPE USED).. | MECHANICAL PROPERTIES | MAJOR | TENSILE,% ELONGATION , YIELD STRESS, FLATTENING & MACRO ETCHING TEST | 1 SAMPLE / HEAT/SIZE | | MATERIAL SPECIFICATION AS PER APPROVED DATA SHEETS /DRAWINGS. | | IR | √ | P | V | V | | |
| | | ULTRASONIC TEST FOR SEAMLESS Pipe | MAJOR | UT | 100 % | 100 % | ASTM E-213 | ASTM E-213 | UT REPORT | √ | P | V | V | | |

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| A.3 | FORGINGS / ROLLED BARS FOR GEARS, PINIONS WHEELS AXLES, SHAFTS AND BRAKE | CHEMICAL PROPERTIES | MAJOR | CHEMICAL ANALYSIS | 1 SAMPLE / HEAT/SIZE | | RELEVANT MATERIAL SPECIFICATION AS PER APPROVED DATA SHEETS /DRAWINGS. | | IR | √ | P | V | V | in the absence of correlated TC check testing shall be done |
| | DRUM OF OUTER DIAMETER 200 MM | MECHANICAL PROPERTIES | MAJOR | TENSILE, % ELONGATION , YIELD STRESS | 1 SAMPLE / HEAT/SIZE | | | | IR | √ | P | V | V | |
| | | ULTRASONIC TEST | MAJOR | NDT | 100% | 100 % | ASTM A 388 | REFER NOTE-9 | UT REPORT | √ | P | V | V | |
| A.4 | STEEL CASTING FOR PULLEY BREAK DRUM OF OUTER DIAMETER ≥200 MM | CHEMICAL COMPOSITION | MAJOR | CHEMICAL ANALYSIS | 1 SAMPLE / HEAT/HT BATCH | | RELEVANT MATERIAL SPECIFICATION AS PER APPROVED DATA SHEETS /DRAWINGS. | | IR | √ | P | V | V | |
| | | MECHANICAL PROPERTIES | MAJOR | TENSILE, % ELONGATION , YIELD STRESS | 1 SAMPLE/ HEAT/HT BATCH | | | | | √ | P | V | V | |
| | | ULTRASONIC TEST | MAJOR | NDT | 100% | 100% | ASTM A 609 | ASTM A 609 | UT REPORT | √ | P | V | V | On accessible Area |
| A.5 | CI CASTING FOR GEAR BOX HOUSING | CHEMICAL & MECHANICAL PROPERTIE | MAJOR | CHEMICAL, TENSILE, % ELONGATION , YIELD | 1 SAMPLE/ HEAT/HT BATCH | | SPECIFICATION/ DATA SHEETS /DRAWINGS | | MTC | √ | P | V | V | in the absence of correlated TC check testing shall be done |

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| | | S | | STRESS | | | | | | | | | |
| B. | Bought out items | | | | | | | | | | | | |
| B.1 | RAILS (IF APPLICABLE) | CHEMICAL & MECHANICAL PROPERTIES | MAJOR | CHEMICAL ANALYSIS, MECHANICAL PROPERTIES | 1 SAMPLE / HEAT | | IS 3443 / SAIL PRODUCT/ APPROVED DATA SHEETS /DRAWINGS. | MTC / CHECK TEST REPORT | √ | P | V | V | Test to be carried out in absence of Mill T.C |
| | | VISUAL & DIMENSIONAL | MAJOR | VISUAL & MEASURE | RANDOM 25% (EACH SIZE) | | | IR | √ | P | V | V | |
| B.2 | HOOKS | CHEMICAL & MECHANICAL PROPERTIES | MAJOR | CHEMICAL ANALYSIS, TENSILE STRENGTH, % ELONGATION | 1 SAMPLE/ HEAT/HT BATCH | | MATERIAL AS PER APPROVED DATA SHEETS /DRA`WINGS | MTC | √ | P | V | V | |
| | | PROOF LOAD TEST | MAJOR | MECHANICAL | 100% | 100% | IS 15560/IS:57 49 | IS 15560/IS:57 49 | TEST Report | √ | P | V | V | | |

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| | | UT BEFORE & AFTER PROOF LOAD TEST | CRITICAL | NDT | 100 % | 100 % | ASTM A 388 | REFER NOTE-9 | UT REPORT | √ | P | V | V | | | |
| | | DPT TEST BEFORE & AFTER PROOF LOAD TEST | CRITICAL | NDT ON MACHINED SURFACE | 100% | 100 % | ASTM E 165 | ASTM E 165 | PT REPORT | √ | P | v | V | | | |
| | | DIMENSIONS | MAJOR | MEASUREMENT | 100% | 100 % | MANUFACTURE'S DRAWING | | IR | √ | P | V | V | | | |
| B.3 | WIRE ROPES | IDENTIFICATION DIMENSIONAL CONFORMITY& BREAKING STRENGTH | MAJOR | CONSTRUCTI ON ,DIAMETER,T ENSILE,DESIGNATION, BREAKING LOAD | 100% (EACH BATCH) | | IS-2266 / APPROVED DATA SHEET | | MTC | √ | P | V | V | | | |
| B.4 | GEAR COUPLINGS | CHEMICAL COMPOSITION | MAJOR | CHEMICAL ANALYSIS, | 1 SAMPLE / HEAT | | IS-3177 / APPROVED DRAWING / APPROVED DATA SHEET | | MTC / CHECK TEST REPORT | √ | P | V | V | | | |
| | | MECHANICAL PROPERTIES | MAJOR | MECHANICAL TESTS | 1 SAMPLE / HEAT | | | | | √ | P | V | V | | | |

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| | | VISUAL & DIMENSIONAL | MAJOR | VISUAL & MEASURE | 100% | 100% | PRODUCT CATALOGUE / COMPONENT DRAWING | IR | √ | P | V | V | | | |
| B.5 | BEARINGS | MAKE, & TYPE, | MAJOR | VERIFICATION | 100% | 100 % | APPROVED DATA SHEET / BEARING CATALOGUE | IR | | P | V | V | | | |
| B.6 | MOTOR | MAKE / TYPE / RATING | MAJOR | VISUAL, | 100% | 100% | CUSTOMER/OWNER APPROVED DRAWING / DATA SHEET / CUSTOMER/OWNER SPECIFICATION / IS 325 | IR, | | P | V | V | | | |
| | | ROUTINE TESTS | MAJOR | REVIEW | 100% | 100% | | MTC / COC | √ | V | V | V | | | |
| B.7 | SHROUDED DSL (DOWN SHOP LEAD) & CURRENT COLLECTOR | MAKE / TYPE / RATING HV & IR Test | MAJOR | VISUAL | 100% | 100% | CUSTOMER/OWNER APPROVED DRAWING / CUSTOMER/OWNER SPECIFICATION / IS 3177 | IR / MTC | √ | P | V | V | | | |
| B.8 | BRAKES –EM / EHT | MAKE / TYPE / RATING | MAJOR | VERIFICATIO N | 100% | 100% | CUSTOMER/OWNER APPROVED DRAWING / CUSTOMER/OWNER SPECIFICATION / IS 3177 | IR | √ | P | V | V | | | |
| | | FUNCTIONAL CHECK INCLUDING | MAJOR | REVIEW | 100% | 100% | | MTC | √ | V | V | V | | | |

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| | | IR-HV | | | | | | | | | | | | | |
| B.9 | LIMIT SWITCH | MAKE / TYPE / RATING, OPERATION | MAJOR | VISUAL | 100% | 100% | CUSTOMER/OWNER APPROVED DRAWING / CUSTOMER/OWNER SPECIFICATION / IS 3177 | IR | √ | P | V | V | | | |
| B.10 | DBR (DYNAMIC BRAKING RESISTOR), LINE CHOKE | RATING, IR / HV, | MAJOR | VISUAL /REVIEW | 100% | 100% | CUSTOMER/OWNER APPROVED DRAWING / CUSTOMER/OWNER SPECIFICATION / IS 3177 / MANUFACTURER STANDARD | IR / MTC | | P | V | - | | | |
| B.11 | CABLES - LT POWER / CONTROL / EPR FLEXIBLE TRAILING | MAKE / TYPE / RATING | MAJOR | VERIFICATION | 100% | 100% | CUSTOMER/OWNER APPROVED DRAWING / CUSTOMER/OWNER SPECIFICATION / IS 1554 /IS 694/ IS 9968 / IS 4289 / IS 7098 | IR | | P | V | V | | | |
| | | ROUTINE & ACCEPTANCE TESTS | MAJOR | REVIEW | 100% | 100% | | MTC | √ | V | V | V | | | |
| B.12 | LOAD CELL (AS APPLICABLE) | MAKE / TYPE / RATING/FUNCTIONAL CHECK | MAJOR | REVIEW | 100% | 100% | CUSTOMER/OWNER APPROVED DRAWING / CUSTOMER/OWNER SPECIFICATION / IS 3177 | IR | | P | V | V | | | |
| B.13 | MCCB / MCB / MPCB/ OVERLOAD RELAY/ SFU / CONTACTOR / TIME DELAY RELAY / AUX(CONTROL) RELAY/INDICATING METER, CONTROL | MAKE / TYPE / RATING IR & FUNCTIONAL CHECK | MAJOR | VERIFICATION | 100% | 100% | CUSTOMER/OWNER APPROVED DRAWING / CUSTOMER/OWNER SPECIFICATION | IR | | P | V | V | SEE NOTE – 8 | | |

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| | TRANSFORMER/CURRENT TRANSFORMER | | | | | | | | | | | | | |
| B.14 | PUSH BUTTON/INDICATING LAMP/SELETOR SWITCH/TERMINAL BLOCK | MAKE / TYPE / RATING | MAJOR | VISUAL & MEASURE | 100% | 100% | CUSTOMER/OWNER APPROVED DRAWING / CUSTOMER/OWNER SPECIFICATION /IS 3177 | IR | | P | V | V | SEE NOTE – 8 | |
| B.15. 1 | PANEL & PENDENT STATION HOUSING / BOX. | SHEET/GLAND PLATE THICKNESS/MATERIAL PAINT SHADE/THICKNESS (MIN 70 MICRONES)/ADHESION ,DOP BY PAPER INSERTION | MAJOR | -VISUAL & REVIEW | 100% | 100% | CUSTOMER/OWNER APPROVED DRAWING / CUSTOMER/OWNER SPECIFICATION | IR | | P | V | V | SEE NOTE – 8 | |
| B.15.2 | ASSEMBLED PANEL AND PENDENT STATION (EXCLUDING VVVF DRIVE) | -MAKE / TYPE / RATING OF BOIs ACCESSIBLE MOUNTING & LABELING OF COMPONENTS, WIRE DRESSING & FRRULING , CRIMPING CHECK BY GENTLE PULLING , EARTHING OF | MAJOR | -VISUAL & MEASURE | 100% | 100% | CUSTOMER/OWNER APPROVED DRAWING / CUSTOMER/OWNER SPECIFICATION / IS-8623, LIST OF MAKES FOR BOI | IR | | P | V | V | | |

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| | | DOOR & PANEL ,IR-HV TEST | | | | | | | | | | | | | |
| B.15.3 | VVVF DRIVE (AS APPLICABLE) | MAKE, TYPE, RATINGS & ROUTINE TEST. | MAJOR | VISUAL | 100% | 100% | BOI LIST & CUSTOMER/OWNER APPROVED DRAWING/DATA SHEET | | IR | | P | V | V | | |
| C | IN PROCESS INSPECTION | | | | | | | | | | | | | | |
| C.1 | GEARS, PINIONS & WHEELS | DP TEST ON TOOTH AREA OF GEAR & PINION & TREAD OD OF WHEELS | MAJOR | NDT – DP TEST | 100% | 100% | ASTM E 165 | NO RELEVANT INDICATION | IR | √ | P | V | V | | |
| | | HARDNESS TEST | MAJOR | HARDNESS TEST | 100% | 10% RANDOM | IS-3177 / APPROVED DATA SHEET / APPROVED DRAWING. | | IR | √ | P | V | V | | |
| | | VISUAL & DIMENSIONAL | MAJOR | VISUAL & MEASURE | 100% | 100% | MANUFACTURER'S DRAWINGS | | IR | | P | V | - | | |
| C.2 | BRAKE DRUM, PULLEYS | VISUAL & DIMENSIONAL | MAJOR | VISUAL & MEASURE | 100% | 100% | MANUFACTURER'S DRAWINGS | | IR | | P | V | - | | |
| | | DP TEST ON MACHINED AREA | MAJOR | NDT | 100% | 100% | ASTM E 165 | NO RELEVANT INDICATION | DPT REPORT | √ | P | V | V | | |

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| C.3 | WELDING OF BOX GIRDER, CRAB, END CARRIAGES, ROPE DRUM (IF | WPS, PQR &WPQ | MAJOR | VISUAL & MECHANICAL TESTS | 100% | 100% | APPROVED WPS, ASME SEC-IX | ASME SEC-IX | QW-481-484 | √ | P | V | V | | |

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| | FABRICATED) GEAR BOX CASINGS, ETC | MARKING & CUTTING OF MS PLATES | MAJOR | VISUAL & MEASURE | 100% | 100% | MANUFACTURING DRAWING | | IR | | P | V | - | | |
| | | EDGE PREPARATION | MAJOR | VISUAL & MEASURE | 100% | 100% | MANUFACTURING DRAWING / APPROVED WPS | | IR | | P | V | – | | |
| | | WELD JOINT SIZE / LOCATION / WELDER NO. CO-RELATION | MAJOR | MARKING, VERIFICATION | 100% | 100% | MANUFACTURING DRAWING | | IR | | P | V | V | | |
| | | DP TEST ON WELD | MAJOR | NDT | 100% FOR BW JOINTS & CRITICAL FILLET WELD JTS | 100% FOR BW JOINTS & 10% FOR FW | ASTM E 165 | NO RELEVANT INDICATION | DPT REPORT | √ | P | V | V | | |
| | | RADIOGRAPHY OF BUTT WELD JOINTS | CRITICAL | NDT TEST | 100% IN TENSION ZONE & 25% IN | | ASME – SEC-V | ASME –SEC-VIII DIVISION – I, UW 51 | RT FILMS & REPORT | √ | P | V | V | | |

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| | | | | | COMPRESSION ZONE 100% FOR ROPE DRUM JOINT | & UW-52 | | | | | | | | |
| | | DIMENSIONAL CHECK AFTER FINAL FABRICATION / MACHINING | MAJOR | MEASURE | 100% 100% | MANUFACTURING DRAWING | IR | √ | P | V | _ | | | |
| C.4 | GEAR BOXES | BACK LASH, TOOTH CONTACT REDUCTION RATIO | MAJOR | MEASUREMENT | 1 PER STAGE | IS:4460 , APPROVED DRAWING / APPROVED / DATA SHEET | IR | √ | P | V | V | | | |
| | | NO LOAD RUN OF GEAR BOXES ( Duration -4 hours) | MAJOR | SOUND LEVEL,TEMP Rise & Oil Leakage | 100% EACH | APPROVED DRAWING / | IR | √ | P | V | V | | | |
| D | FINAL INSPECTION | | | | | | | | | | | | | |

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| D.1 | COMPLETE ASSEMBLED CRANE AT SHOP FLOOR FOR NO LOAD / FULL LOAD/125% OVER LOAD TEST ALONG WITH ACTUAL CONTROL PANEL, VVFD, PUSH BUTTON PENDENT/RADIO REMOTE CONTROL CONNECTED(AS APPLICABLE) | OVERALL DIMENSIONS, SPEED,CURRENT, DURING NO LOAD TEST & FULL LOAD, DEFLECTION, OPERATION OF BRAKES ON FULL LOAD TEST, LIMIT SWITCH OPERATION OF ALL MOTIONS WITH PENDENT AS WELL AS RRC. CHECKING OF SAFETY INTERLOCKS, FUNCTIONAL TEST, DOP CHK BY PAPER INSERTION | MAJOR | VISUAL & MEASURE (SEE NOTE – 6) | 100% | 100% | IS-3177/APPROVED DRAWING /APPROVED DATA SHEET/ APPROVED SIZING CALCULATION | IR | √ | P | W | W | | |
| D.2 | PAINTING OF CRANE | ADHESION ,VISUAL & DFT MEASUREMENT | MAJOR | VISUAL,SHADE VERIFICATION ,DFT & MEASUREME NT | 100% | 100% | AS PER CUSTOMER/OWNER SPECIFICATION | IR | √ | P | V | V | | |
| | NOTES:- | | | | | | | | | | | | | |

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| 1. | MOTOR POWER RATING LESS THAN 30KW:<br>ACCEPTANCE OF MOTOR LESS THAN 30KW IS BASED ON COC OF THE MANUFACTURER & THE CONTRACTOR CONFIRMING AS FOLLOWS: “IT IS HEREBY CONFIRMED THAT THE ABOVE MENTIONED MOTOR /MOTORS WAS/ WERE MANUFACTURED TAKING CARE OF CUSTOMER/OWNER SPECIFIC REQUIREMENTS REGARDING AMBIENT TEMP., VOLTAGE & FREQUENCY VARIATION, HOT STARTS, PULL OUT TORQUE, STARTING KVA/KW, TEMP. RISE, DISTANCE BETWEEN CENTRE OF STUD & GLAND PLATE AND TESTED IN ACCORDANCE WITH APPROVED DRAWING /DATA SHEETS.” MOTOR POWER RATING MORE ≥ 30 KW BUT 50 KW<br>ACCEPTANCE OF MOTOR RATING BETWEEN 30 KW & 50 KW IS BASED ON CUSTOMER/OWNER REVIEW OF ROUTINE TEST INSPECTION REPORT AS PER IS 325 WITNESSED BY MAIN<br>CONTRACTOR ALONG WITH COC OF THE MANUFACTURER & THE CONTRACTOR CONFIRMING AS FOLLOWS: “IT IS HEREBY CONFIRMED THAT THE ABOVE MENTIONED MOTOR<br>/MOTORS WAS/ WERE MANUFACTURED TAKING CARE OF CUSTOMER/OWNER SPECIFIC REQUIREMENTS REGARDING AMBIENT TEMP., VOLTAGE & FREQUENCY VARIATION, HOT STARTS, PULL OUT TORQUE, STARTING KVA/KW, TEMP. RISE, DISTANCE BETWEEN CENTRE OF STUD & GLAND PLATE, SPACE HEATER AND TESTED IN ACCORDANCE WITH APPROVED DRAWING /DATA SHEETS.”<br>MOTOR POWER RATING MORE ≥ 50 KW<br>SEPARATE RQP / MQP SHALL BE SUBMITTED FOR MOTOR > 50KW WHERE CUSTOMER/OWNER SHELL WITNESS THE TESTS. |
| 2 | CUSTOMER/OWNER/BHEL/LLOYD/BVQI/TPL/NPCIL WPS SHELL BE USED FOR FABRICATION. ONLY CUSTOMER/OWNER/BHEL/LLOYD/BVQI/TPL/NPCIL APPROVED WELDERS SHALL BE ENGAGED FOR WELDING. (NO WELDING IS ALLOWED FOR CI MATERIAL) |
| 3. | THE HEAT NUMBER / PLATE IDENTIFICATION NUMBER SHALL BE TRANSFERRED ON ALL MAJOR CUT PIECES OF THE MS PLATE FOR PROPER CORRELATION. CUTTING PLAN OF EACH<br>PLATE SHALL BE MAINTAINED FOR PROPER TRACEABILITY. |

4. WELDER’S NUMBER SHALL BE PUNCHED NEAR BUTT WELD JOINTS. THE WELDING PLAN OF EACH FABRICATED ITEM SHALL BE MAINTAINED.
5. HV TEST ON CONTROL PANELS WILL BE DONE ISOLATING VVVF DRIVE AND OTHER ELECTRONIC PARTS. HV TEST AT 2 KV FOR POWER & 1.5 KV FOR CONTROL CIRCUIT.

ALL CRITICAL DIMENSIONS SHALL BE MEASURED. DEFLECTION SHALL BE MEASURED AT SAFE WORKING LOAD TEST THE CURRENT AND SPEED FOR HOISTING MOTION AND CROSS TRAVEL

6. MOTION SHALL BE MEASURED DURING NO LOAD TEST AND SAFE WORKING LOAD (SWL) TEST. THE SPEED AND CURRENT FOR LONG TRAVEL MOTION SHALL BE MEASURED DURING FREE RUNING TEST. ALL INTERLOCKS, BRAKES CONTROL PANEL/PUSH BUTTON PENDANT, RADIO REMOTE CONTROL AND SAFETY MEASURES SHALL BE CHECKED DURING FINAL INSPECTION.
7. SAFE WORKING LOAD TEST & 125% OVERLOAD TEST SHALL BE CONDUCTED AT SHOP WITH ACTUAL VVFD PANELS, SHOP WIRE ROPES & TEMPORARY CABLES.
8. LIST OF ALL MAJOR BOUGHT OUT ITEMS AND THEIR ACCEPTABLE MAKE IS ATTACHED.
9. I) ASTM A -388/A-388M, APPENDIX 12.12.3

II) ANT DEFECT ECHO HEIGHT MORE THAN 20% OF FULL SCREEN HEIGHT (WHEN SENSITIVITY LEVEL IS AT PRIMARY REFERENCE LEVEL) IS NOT ACCEPTABLE

III) AT ANY LOCATION, IF LOSS IN FIRST BACK WALL ECHO IS OBSERVED TO BE MORE THAN 20% (I.E FIRST BACK WALL ECHO HEIGHT IS LESS THAN 80% OF FULL SCREEN HEIGHT) WHEN SENSITIVITY SETTING IS AT PRIMARY REFERENCE LEVEL THE SAME IS ALSO NOT ACCEPTABLE.

| Sl. No. | Component & Operation | Characteristics | Class | Type of Check | Quantum of Check | | Reference Document / Acceptance Norms | Format of Record | D | Agency | | | Remarks |
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| **3.6** | **AIR CONDITIONING SYSTEM** | | | | | | | | | | | | |
| **3.6.1** | **REFRIGERANT COMPRESSOR (RECIPROCATING/ SCREW/ CENTRIFUGAL)** | | | | | | | | | | | | |
| 1.0 | **Raw Material** | | | | | | | | | | | | |
| 1.1 | Raw Materials | Chemical & Mechanical | Major | Chemical & Mechanical | 1/heat | | Approved Drg/ Data sheet | TC | √ | P | V | V | |
| 2.0 | **Final Inspection** | | | | | | | | | | | | |
| 2.1 | Castings for cylinder block, crank case and casings | Operation and performance testing | Critical | Hydraulic / pneumatic test | 100% | | Approved Drg/ Data sheet | Inspection Report | √ | P | V | V | |
| 2.2 | Oil pump for reciprocating compressor | | | Capacity test | 100% | | Approved Drg/ Data sheet | Inspection Report | √ | P | V | V | |
| | Assembled compressor : | | | | | | | | | | | | |
| 2.3 | Compressors and chilling units | Performance testing to check FAD (free air delivery), noise, vibration and temperature rise of bearing and body | Critical | No load air run (free run) test | 100% | | Approved Drg/ Data sheet | Inspection Report | √ | P | V | V | |
| 2.4 | Reciprocating compressor | Performance testing | Critical | Hydraulic/ | 100% | | Approved Drg/ Data sheet | Inspection Report | √ | P | V | V | |

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| | | | | leakage test | | | | | | | | |
| 2.5 | Compressors | Performance testing | Critical | Functional run test | 100% | Approved Drg/ Data sheet | Inspection Report | √ | P | V | V | Also capacity control (for part load performance) check |
| **3.6.2** | **CONDENSER AND EVAPORATOR** | | | | | | | | | | | |
| 1.0 | **Final Inspection** | | | | | | | | | | | |
| 1.1 | Shell side and tube side of condenser and evaporator | Operation and performance testing | Critical | Hydraulic / pneumatic test | 100% | No leakage shall be permitted | | √ | P | V | V | |
| **3.6.3** | **VAPOUR ABSORPTION MACHINE (VAM)** | | | | | | | | | | | |
| 1.0 | **Final Inspection** | | | | | | | | | | | |
| 1.1 | Complete assembled unit | Operation and performance testing | Critical | Capacity (TR) and steam consumption | 100% | Approved Drg / Data Sheet | Inspection report | √ | P | W | W | All the controls shall be tested for proper functioning during the above test |
| 1.2 | N2 testing | leakage | Critical | Leakage | 100% | Mfrs std | Inspection report | √ | P | W | V | |
| 1.3 | Helium spray test | leakage | Critical | Leakage | 100% | Mfrs std | Inspection report | √ | P | W | V | |
| 1.4 | Helium shroud test | leakage | Critical | Leakage | 100% | Mfrs std | Inspection report | √ | P | W | W | |
| 1.5 | Hydro testing | leakage | Critical | Leakage | 100% | Mfrs std/ Approved Drg / Data Sheet | Inspection report | √ | P | W | V | |
| **3.6.4** | **AIR HANDLING UNIT (AHU)** | | | | | | | | | | | |
| 1.0 | **Final Inspection** | | | | | | | | | | | |
| 1.1 | Fan | Operation and performance testing | Critical | As per AMCA / IS | One of each type and size | for air flow, static pressure, speed, efficiency, | | √ | P | V | V | |

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| | | | | | | power consumption, noise and vibration | | | | | | |
| 1.2 | Assembled AHU (AHU casing and fan assembly) | Operation and performance testing | Critical | As per IS | One per type | free run test. Noise, vibration and temperature rise of bearing | | √ | P | V | V | |
| **3.6.5 COOLING TOWER (AIR CONDITIONING)** | | | | | | | | | | | | |
| 1.0 | **Raw Material** | | | | | | | | | | | |
| 1.1 | Hub Plates, Gear Boxes, Fan Shaft | Chemical & Mechanical Properties, NDT | Major | Review of TC | 100% | Approved drawing/datasheet | MTC | √ | P | V | V | |
| 2.0 | In-Process Inspection | | | | | | | | | | | |
| 2.1 | Fan Static Balancing,<br><br>Drive Shaft Dynamic Balancing<br><br>Gear Assembly Run Test | Balancing<br><br>Run Test | Critical | Visual/ Measure ment | 100% | Approved drawing/datasheet, Manufacturer Standard | TC/IR | √ | P | V | V | |
| 3.0 | **Final Inspection** | | | | | | | | | | | |
| 3.1 | Assembled Cooling towers | Operation and performance testing<br><br>Free run test at shop to measure FAD, noise and vibration<br><br>Visual & Dimensional | Critical | Measure ment | 100% | Approved drawing/datasheet, Manufacturer Standard | TC/IR | √ | P | W | W | For cooling towers being supplied in knocked- down condition, these tests shall be done at site |
| **3.6.6 LOW PRESSURE AIR DISTRIBUTION SYSTEM** | | | | | | | | | | | | |
| **1.0 Final Inspection** | | | | | | | | | | | | |
| 1.1 | Ducting system | Leakage | Major | Visual | 100% | Smoke Test | | √ | P | W | W | |

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| 1.2 | Air conditioning | Temperature and humidity | Major | Measure ment | 100% | Approved drawing/datasheet, Manufacturer Standard | | √ | P | W | W | |
| **3.7** | **VACUUM PUMP** | | | | | | | | | | | |
| 1.0 | **Raw Material Inspection** | | | | | | | | | | | |
| 1.1 | Pump components | Chemical, Physical properties & Hardness | Major | Chemical, Physical & Hardness | 1/heat | Approved Drg/Data sheet | TC | √ | P | V | V | |
| 1.2 | Separator | UT of forgings like shaft, couplers etc. | Major | UT | 100% | ASTM A 388 | UT Report | √ | P | V | V | Note-1 |
| 1.3 | Heat Exchanger | Chemical, Physical properties | Critical | Chemical, Physical | 1/heat | Approved Drg/Data sheet | TC | √ | P | V | V | |
| | | Hydraulic test | Critical | Leakage test | 100% | Approved Drg/Data sheet | TC | √ | P | V | V | |
| 1.4 | Gear Box | Chemical, Physical properties | Critical | Chemical, Physical | 1/heat | Approved Drg/Data sheet | TC | √ | P | V | V | |
| 1.5 | Valves | Hydraulic test of tube side & shell side | Critical | Leakage test | 100% | Approved Drg/Data sheet | TC | √ | P | V | V | |
| 1.6 | Instruments | Performance test | Critical | Performa nce test | 100% | Approved Drg/Data sheet | TC | √ | P | V | V | No load condition, backlash, no. of gear train etc. |
| 2.0 | **In Process Inspection** | | | | | | | | | | | |
| 2.1 | Rotor | NDT Of machined portion | Critical | DPT | 100% | ASTM E 165/no relevant indication | Inspection report | √ | P | V | V | |
| | | Dynamic Balancing, Run out check | Critical | | 100% | ISO 1940 Gr.6.3 or better | Inspection report | √ | P | V | V | |

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| 3.0 | **Final Inspection** | | | | | | | | | | | |
| 3.1 | Pump Assembly | Major dimensions | Critical | Measure ment | 100% | Approved Drg/Data sheet | Inspection report | √ | P | W | W | |
| | | Hydrostatic test | Critical | Leakage Test | 100% | Approved Drg/Data sheet | Inspection report | √ | P | W | W | |
| | | Performance test | Critical | Measure ment | 100% | Approved Drg/Data sheet | Inspection report | √ | P | W | W | |
| | | Noise level check, Vibration check, Bearing temp. rise check | Critical | Measure ment | 100% | Approved Drg/Data sheet | Inspection report | √ | P | W | W | |
| **3.8** | **OXIDATION BLOWER** | | | | | | | | | | | |
| 1.0 | **Raw Material Inspection** | | | | | | | | | | | |
| 1.1 | Body/ casing, End plate/ Cover, Rotor | Chemical, Physical properties & Hardness | Major | Review of TC | 100% | Approved Drawing/datasheet | MTC | √ | P | V | V | |
| 1.2 | Shaft | Chemical, Physical properties | Major | Review of TC | 100% | Approved Drawing/datasheet | MTC | √ | P | V | V | |
| | | NDT | Major | UT | | | | √ | P | V | V | |
| 1.3 | Timing gears | Chemical, Physical properties | Major | Review of TC | | | | √ | P | V | V | |
| | | Hardness | Major | | | | | √ | P | V | V | |
| | | Mechanical properties | Major | UT after proof machinin g | | | | √ | P | V | V | |
| 1.4 | Base frame, Pipe & fitting, Foundation bolts | Chemical, Physical properties | Major | Review of TC | | | | √ | P | V | V | |

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| 1.5 | Coupling/ Gear box, Valves, Filter, Silencer, Bearings etc. | Functional & Performance check | Major | Review of TC | | | | √ | P | V | V | |
| 1.6 | Actuators & Motor | Functional & Performance check | Major | Review of TC | | | | √ | P | V | V | |
| 2.0 | **In-Process Inspection** | | | | | | | | | | | |
| 2.1 | Body/ Casing | Hydro test | Critical | Measure ment | 100% | Approved Drawing/datasheet | TC | √ | P | V | V | |
| 2.2 | Shaft, Gears, End plate after machining | NDT | Critical | DPT | 100% | Mfg.Std, | TC | √ | P | V | V | |
| 2.3 | Rotor assembly (shaft with lobe) | Balancing | Critical | Visual | 100% | Mfg.Std, | TC | √ | P | V | V | |
| 3.0 | **Final Inspection** | | | | | | | | | | | |
| 3.1 | Complete blower assembly with motor | Performance Run<br>• Overall major dimensions<br>• Free air delivery<br>• Head Power<br>• Efficiency, speed<br>• Discharge Pressure & temp.<br>• Noise & Vibration<br>• Oil temp. rise test | Critical | Measure ment | 100% | Approved Drawing/datasheet | TC | √ | P | W | W | |
| | | | | | | | | | | | | |
| **NOTE -** | | | | | | | | | | | | |
| 1 | INSPECTION / NDT / TEST CERTIFICATE / REPORT FOR UT, MPI, BALANCING, PRESSURE TEST SHALL INDICATE REFERENCE OF ITEM SERIAL<br>NUMBER & MODEL FOR CO-RELATION. | | | | | | | | | | | |

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| 2 | MATERIAL TEST CERTIFICATE / REPORT FOR TEST SUCH AS CHEMICAL & MECHANICAL TEST ETC. SHALL INDICATE REFERENCE OF ITEM SERIAL<br>NUMBER & ENGINE MODEL FOR CO-RELATION AS PER SAMPLING NORMS. |
| 3 | However, as a minimum, the following requirements shall be met (except for oil piping) :<br>• For temperature > 400 $^0$C and/or pressure exceeding 71 bar, the butt welds and full penetration branch welds shall be subject to 100% RT or UT and 100% MPE<br>• For temperature > 1750C up to 400 0C and/or pressure exceeding 17 bar and up to 71 bar, the butt welds & full penetration branch welds shall be subject to NDTs as below:<br>  • pipe diameter > 100 NB100% RT or UT and 100% MPE<br>  • pipe diameter ≤ 100 NB10% RT or UT and 100 % MPE<br>• In addition to above, statutory requirement, wherever applicable, shall also be complied with |
| 4 | • Butt welds 100% RT and 100% MT or DPT<br>• Welds for nozzle, branch 100% RT and 100% MT or DPT connections of size > 100NB<br>• Welds for all other attachments 100% MT or DPT<br>• Removal of weld defects 100% MT or DPT |
| 5. | i) Butt welds:<br>pipe size > 100 NB 100% RT and 100% MPE or DPT<br>pipe size ≤ 100 NB 10% RT and 10% MPE or DPT<br>ii) Welds for nozzle, branch and thickness > 19 mm 100% RT and 100% MPE or DPT connections of size > 100NB<br>iii) Welds for all other attachments 10% MPE or DPT<br>iv) Removal of weld defects/weld repair 100% MPE or DPT |
| 6. | a) Butt welds:<br>pipe size > 100 NB 100% RT and 10% MPE or DPT<br>pipe size ≤ 100 NB 10% MPE or DPT<br>b) Welds for nozzle, branch 10% MPE or DPT connections/ attachments<br>c) Removal of weld defects 100% MPE or DPT |
| 7. | All other pipes not covered above (except oil piping) shall be subjected 100% MPE or DPT in case of underground piping and 10% MPE or DPT in case of over ground<br>piping. 10% of butt welds of underground piping shall be subjected to RT |
| 8. | a) Butt welds of Oil piping shall be subjected to 10% RT and 10% DP Test. For Jacking oil lines 100% RT and 100% DPT shall be carried out on butt welds.<br>b) Fillet welds with load transfer shall be subjected to 100% MPE or DPT and fillet welds without load transfer shall be subjected PE |
| 9. | a) Valve size < 50 NB<br>• Visual examination for rating below ANSI Class 900<br>• MPE for rating above ANSI Class above 900 |

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| | b) Valve size ≥ 50 NB and < 100 NB<br>• Visual examination for rating up to ANSI Class 600<br>• MPE for rating above ANSI Class above 600 and below 900<br>• 100% MPE and 100% RT on 10% of valves for rating above ANSI Class above 900 and below 4500<br>c) Valve size ≥ 100 NB and < 300 NB<br>• Visual examination for rating up to ANSI Class 300<br>• MPE for rating above ANSI Class above 300 and below 600<br>• 100% MPE and 100% RT on 10% of valves on change of section and weld ends for rating above ANSI Class above 600 and below 900<br>• 100% MPE and 100% RT on valves for rating above ANSI Class 900 and below 4500<br>d) Valve size ≥ 300 NB<br>• MPE for rating up to ANSI Class 600<br>• 100% MPE and 100% RT on all valves in the areas of change of section and weld ends for rating above ANSI Class 600 and below Class 900<br>• 100% MPE and 100% RT on valves for rating above ANSI Class 900 and below Class 4500<br>Note : In the above NDTs, MPE may be replaced by DPT for austenitic steels | | | | | | | | | | | |
| 10. | After assembly, one valve of each size with respective actuator shall be shop operated over the full range of movement in both the directions, with the body subjected to the full hydrostatic pressure conditions. During the test, hand wheel operation, opening and closing time and current drawn shall also be checked. The test shall be conducted for three consecutive cycles with valve shaft both in vertical and horizontal planes | | | | | | | | | | | |
| **3.9** | **COOLING WATER PUMP** | | | | | | | | | | | |
| **1** | **Raw Material** | | | | | | | | | | | |
| 1.1 | Bell Mouth | Chemical Properties | Major | Chem. Analysis | 1 Sample/Heat | Relevant Material Specification as per Approved Drawing and Approved Data sheet | MTC | √ | P | V | V | |
| | | Mech. Properties | Major | Mech. | 1 Sample/Heat | | MTC | √ | P | V | V | |
| | | Visual Inspection | Major | Visual | 100% | Manufacturer's Practice | IR | √ | P | V | V | |
| 1.2 | Diffuser Casing, Impeller casing and Casing Cap (Bowl) | Chemical Properties | Major | Chem. | 1 Sample/Heat | Relevant Material Specification as per Approved Drawing and Approved Data sheet | MTC | √ | P | V | V | As Cast Heat Nos required for Co-Relation. Also Refer Note – 1. |
| | | Mech. Properties | Major | Mech. | Each melt & HT batch | | MTC | √ | P | V | V | |
| | | Visual Inspection | Major | Visual | 100% | Manufacturer's Practice | IR | √ | P | V | V | |
| 1.3 | Impeller (Casting), Impeller Nut | Chemical Properties | Major | Chem. Analysis | 1 Sample/Heat | Relevant Material Specification as per | MTC | √ | P | V | V | As Hard Punch Heat Nos required for Co-relation. |
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| | | Mech. Properties | | Mech. test | 1 Sample/Heat | Approved Drawing and Approved Data sheet | MTC | √ | P | V | V | Mech check carried out after HT. Also Refer Note – 1. |
| | | Visual Inspection | | Visual | 100% | Manufacturer's Practice | IR | √ | P | V | V | |
| 1.4 | Forging for Muff coupling | Chemical Properties | Major | Chem. Analysis | 1 Sample/Heat | Relevant Material Specification as per Approved Drawing and Approved Data sheet | MTC | √ | P | V | V | Refer Note-2 |
| | | Mech. Properties | | Mech. test | 1 Sample/Heat | | MTC | √ | P | V | V | |
| | | Internal Defects | | UT (on rough Machined) | 100% | App. Drg/ Data sheet/ specification | UT Certificate | √ | P | W | V | |
| 1.5 | Forging for Rigid coupling | Chemical Properties | Major | Chem. Analysis | 1 Sample/Heat | Relevant Material Specification as per Approved Drawing and Approved Data sheet | MTC | √ | P | V | V | |
| | | Mech. Properties | | Mech. test | 1 Sample/Heat/ HT Batch | | MTC | √ | P | V | V | |
| | | Internal Defects | | NDT-UT | 100% | App. Drg/ Data sheet/ Relevant Standard /Manufacturer's Standard | UT Certificate | √ | P | W | V | |
| 1.6 | PUMP SHAFT | Chemical Properties | Major | Chem. Analysis | 1 Sample/Heat | Relevant Material Specification as per Approved Drawing and Approved Data sheet | MTC | √ | P | W | V | Refer Note-2 |
| | | Mech. Properties | Major | Mech. test | 1 Sample/Heat/ Heat batch | | MTC | √ | P | W | V | |
| | | Heat Treatment | Major | Measure (Time-Temp chart) | 100% | | HT Chart | √ | P | V | V | |
| | | Sub Surface Defects | Major | MPI | 100% | Relevant Standard | MTC | √ | P | W | V | |

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| | | Internal Defects | Major | NDT-UT | 100% | | App. Drg/ Data sheet/ Relevant Standard /Manufacturer's Standard | | UT Certificate | √ | P | W | V | |
| 1.7 | Forging for shaft sleeves | Chemical Properties | Major | Chem. Analysis | 1 Sample/Heat | | Relevant Material Specification as per Approved Drawing and Approved Data sheet | | MTC | √ | P | V | V | |
| | | Mech. Properties | Major | Mech. test | 1 Sample/Heat/ Heat batch | | | | MTC | √ | P | V | V | |
| | | Internal Defects | | NDT-UT | 100% | | App. Drg/ Data sheet/ Relevant Standard /Manufacturer's Standard | | UT Certificate | √ | P | W | V | |
| 1.8 | Taper Column & Discharge Head, Sole plate, Motor Stool & Flanges | Chemical & Mech. Properties | Critical | Chemical & Mech Check | 1 Sample/Lot | | Relevant Material Specification as per Approved Drawing and Approved Data sheet | | MTC | √ | P | V | V | |
| | | Internal Defects | Major | UT*` | 100% | | ASTM A 435 | | UT Certificate | √ | P | W | V | *For plate t >=25 mm |
| **2** | **In Process Inspection** | | | | | | | | | | | | | |
| 2.1 | Diffuser Casing, Impeller casing (Bowl) | Dimensions | Major | Measure | 100% | - | Manufacturing Drawing | | IR | | P | V | | |
| | | DPT on Machined Area | | NDT-DPT | 100% | | ASME Sec V article 6 | ASME Sec VIII DIV I, App 7 | TC | √ | P | V | V | |
| | | Hydraulic Test of Bowl | Major | Leak tightness Test | 100% | 100% | App. Drg/ Data sheet | NO LEAKAGE | TC | √ | P | V | V | Test duration 30min |
| 2.2 | Impeller | Dimensions | Major | Measure | 100% | - | Manufacturing Drawing | | IR | | P | V | | |
| | | RT | Critical | NDT | 100% | | ASME Sec V | ASTM E-446 | | √ | P | V | V | Review of RT film reports by Owner |

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| | | | | | | article 2 | | RT FILM & REPORT | | | | | |
| | Impeller (after clearance of RT) | Solution Annealing (SS – CF8M Material) | Major | Measure (Time-Temp chart) | 100% | App. Drg/ Data sheet | App. Drg/ Data sheet | HT Chart | √ | P | V | V | |
| | | IGC Test | Major | IGC Test | 1 Sample/Heat/ Heat batch | ASTM 262 Practice E | | TC | √ | P | V | V | |
| | | Dimensions | Major | Measurement | 100% | Manufacturing Drawing | | IR | √ | P | W | V | |
| | | DPT on Machined Area | Major | NDT/DPT | 100% | ASME Sec V article 6 | ASME Sec VIII DIV I, App 7 | TC | √ | P | W | V | |
| | | Grinding/ Finishing | Major | Visual | 100% - | Manufacturing Drawing | | - | | P | - | - | |
| | | Dynamic Balancing | Major | Balancing | 100% | ISO 21940, GR, 6.3 | | IR | √ | P | W | V | |
| 2.3 | Bell Mouth | DPT on Machined Area | Major | NDT - DPT | 100% | ASTM 165 | | TC | √ | P | W | V | |
| | | Dimensions | Major | Measurement | 100% - | Manufacturing Drawing | | IR | | P | V | | |
| 2.4 | Shaft & Sleeves, Muff Coupling After Machining | Dimensions | Major | Measurement | 100% - | Manufacturing Drawing | | IR | | P | | | |
| | | Surface Finish | Major | Visual | 100% - | Manufacturing Drawing | | - | | P | - | - | |
| | | DPT on Machined Area | Major | NDT - DPT | 100% | ASTM 165 | | TC | √ | P | W | V | |
| 2.5 | Pump & Motor Coupling | Dimensions | Major | Measurement | 100% - | Manufacturing Drawing | | IR | | P | V | | |
| | | Dynamic Balancing | Major | Balancing | 100% | ISO 21940, GR 6.3 | | IR | √ | P | W | V | |

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| 2.6 | Fabricated Parts | | | | | | | | | | | | | |
| 2.6.1 | Fabricated Items mentioned above & Segmental Flanges (If made for components Mentioned in 1.7) | WPS, PQR / Welder Qualification | Major | Visual &Mech test | 100% | | ASME SEC- IX/Approved WPS | | QW 483 484 | √ | P | V | V | See Note-3 |
| | | Joint Fit-up | Major | Measure | 100% | - | Manufacturing Drawing | | - | | P | - | - | |
| | | Root run welding | Major | Visual | 100% | - | Manufacturing Drawing | | - | | P | - | - | |
| | | DPT after Back gauging (In Case of Butt Weld) | Major | NDT | 100% | | ASME Sec VIII DIV I, App 8 | | IR | √ | P | V | V | |
| | | Spot RT on Full Penetration Butt Weld Joint for thickness > 10mm | Critical | NDT | 10% of Butt Weld Length | | ASME SEC-V | ASME SEC-VIII DIV-I | RT REPORT & RT FILM | √ | P | V | V | Review of RT film reports by owner |
| | | RT Test on Weld Joint for flange thickness <=56mm | Critical | RT | 100% | | ASME SEC-V | ASME SEC-VIII DIV-I | RT REPORT & RT FILM | √ | P | V | V | Review of RT film reports by owner |
| | | UT Test on Weld Joint for Plate thickness > 56mm | Critical | UT | 100% | 100/ 20% | ASME SEC-V | ASME SEC-VIII DIV-I, APP 12 | UT REPORT | √ | P | W | W | |
| | | DPT on finished weld | Major | DPT Test | 10% of Butt And 10% on Fillet weld | | ASME SEC-V Art 6 | ASME SEC-VIII DIV-I, App 8 | IR | √ | P | W | V | |
| | | Stress Relieving (segmental flanges if made for these parts and thickness >= | Major | Measure | 100% | | ASME SEC-VIII | ASME SEC-VIII | HT Chart | √ | P | V | V | |

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| | | 37.5mm | | | | | | | | | | | | |
| 2.6.2 | Finished Column Pipe & Discharge Head | Dimensions | Major | Measure | 100% | - | Manufacturing Drawing | | IR | - | P | - | - | |
| | | Hydraulic test of column pipe & | | Leak Tightness Test | 100% | 100% | App. Drg/ Data sheet | NO LEAKAGE | IR | √ | P | W | V | Test duration 30min |
| | | Discharge Head | | | 100% | 100% | | | | | | | | |
| **3.0** | **Final Inspection** | | | | | | | | | | | | | |
| 3.1 | Pump Assembly/ Bowl Assembly | Assembly Checks, Free rotation of assembly | Major | Measurement | 100% | | App. Drg | App. Drg | Log Sheet | √ | P | W | W | |
| | | Performance Testing, Noise Level, Vibration, Bearing Temp | Critical | Testing | 100% | | Approved Test Procedure | Approved Test Procedure | Test Repot | √ | P | W | W | |
| | | Post test inspection(Up to Journal & Thrust bearings only) | Major | Visual | 100% | | App. Drg | No Damages | Inspection Report | √ | P | W | W | |
| 3.2 | Painting & Packing | Verification of completeness & Packing | Major | Visual | 100% | | App. Drg/ Data sheet | App. Drg/ Data sheet | Inspection Report | √ | P | W | W | |
| 3.3 | QA Documentation | All Reports | Major | Review | 100% | | Approved QAP | Approved QAP | Report | √ | P | V | V | |

NOTE-

1. NO WELDING IS PERMISSIBLE ON CAST IRON CASTINGS. FOR CI MATERIAL – "S" & "P" CONTENT SHALL BE S = 0.1 % MAX & P = 0.15 % MAXIMUM, NI % AS PER APPROVED DATA SHEET.
2. IN CASE, CORRELATED MTC ARE NOT AVAILABLE, THEN QUANTUM OF CHECK SHALL BE ONE SAMPLE FROM EACH BAR.
3. FABRICATION SHALL BE CARRIED OUT IN MANUFACTURER'S OR ITS APPROVED SOURCES ONLY.

**3.10 ASH HANDLING PLANT**

**3.10.1 BAG FILTER FOR BUFFER HOPPER & VENT FILTER OF FA SILO**

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| **1** | **Raw Material** |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1.1 | Dish end, Plenum casing flanges & Tube, MS Sheets/plates and Std section | Visual & Dimension | Major | Visual/ measurement | 20% random | IS:2062 & IS 1079/ Approved Drg/ DS | Mfg. TC/QCR | √ | P | V | V | |
| | | Chemical & Mechanical | Major | Chemical & Mechanical | Sample/Lot | IS:2062 & IS 1079/ Approved Drg/DS | Mfg. TC/QCR | √ | P | V | V | |
| 1.2 | Pipe for air manifold and pulsing pipe | Chemical & Mechanical | Major | Chemical & Mechanical | Sample/Lot | IS:1239 & IS 3589/ Approved Drg/DS | Mfg. TC/QCR | √ | P | V | V | |
| 1.3 | Wire cages | Visual & Dimension | Major | Visual/ measurement | 5% | Approved Drg/DS | Mfg. TC/QCR | √ | P | V | V | |
| 1.4 | Venture | Visual & Dimension Tensile & Hardness | Major | Visual/ Measurement & Mechanical Test | 10% random | Approved Drg/DS | Inspection report | √ | P | V | V | |
| 1.5 | Sequential controller, gauges as applicable | Visual & review of MTC, review of calibration certificate & Functional test | Major | Verification | 100% | Approved Drg/DS | Test & guarantee certificate from mfc | √ | P | V | V | |
| 1.6 | Pulse valve & solenoid Valves | Visual & review of MTC and Functional Test | Major | Visual/ Measurement & Testing | 100% | Approved Drg/DS | Test & guarantee certificate from mfc | √ | P | V | V | |
| 1.7 | Filter bags | Visual review of MTC | Major | Visual/ measurement | 5% | Approved Drg/DS | Test & guarantee | √ | P | V | V | |

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| | | | | | | | certificate from mfc | | | | | |
| **2** | **In Process Control** | | | | | | | | | | | |
| 2.1 | Marking and Cutting | Visual & Dimension | Major | Visual/ measurement | 100% | Approved Drg./DS | IR | √ | P | V | V | |
| 2.2 | Set up & truck welding | Visual & Dimension | Major | Visual/ measurement | 100% | Approved Drg./DS | IR | | P | V | V | |
| 2.3 | Welding Qualification | WPS & PQR | Major | Verification | 100% | ASME SEC IX | WPS/PQR | | P | V | V | |
| 2.4 | Welding (by approved welder) | Weld quality | Major | Visual & DP | 100% | Approved Drg/ASTM E-165 | IR | √ | P | V | V | |
| 2.5 | Air Manifold/ reservoir | Leak tightness | Major | Hydro | 100% | Approved Drg./DS | IR | √ | P | V | V | |
| **3** | **Final Inspection** | | | | | | | | | | | |
| 3.1 | Assembly surface, Cleaning & painting | Visual | Major | Visual | 100% | Approved GA DRG | IR | √ | P | W | W | |
| 3.2 | | Dimensional, quality | Major | Measurement | 100% 10% | Approved GA DRG | IR | √ | P | W | W | |
| 3.3 | | Leakage of Casing | Major | Pneumatic Test | 100% | Approved GA DRG / Data Sheet / No leakage | IR | √ | P | V | V | |
| 3.4 | | Functional test | Major | Pulsating test | 100% | Approved GA DRG/Data sheet/approved test procedure | IR | √ | P | V | V | |
| 3.5 | | Painting | Minor | Visual | random | Approved painting Schedule/ Mfd Std. | IR | √ | P | V | V | |
| 3.2 | QA Documentation | Visual | Major | Review | 100% | Approved QAP | Report | √ | P | V | V | |
| 3.10.2 **BAH FEED GATE** | | | | | | | | | | | | |
| 1 | **Raw Material** | | | | | | | | | | | |

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| 1.1 | Housing | Chemical Composition | Major | Chemical | 1 /heat | Approved DRG/Approved Specification | MTC/Lab TC | √ | P | V | V | |
| | | Mechanical Test | Major | Mechanical | 1 /heat | Approved DRC/Approved Specification | MTC/Lab TC | √ | P | V | V | |
| | | Visual and Dimension | Major | Visual & Measurement | 100% | Approved DRG/Approved Specification | IR | √ | P | V | V | |
| 1.2 | Wear Strip/Liner | Chemical Composition | Major | Chemical | 1 /heat | Approved DRG/Approved Specification | MTC/Lab TC | √ | P | V | V | |
| | | Mechanical Test | Major | Mechanical | 1 /heat | Approved DRG/Approved Specification | MTC/Lab TC | √ | P | V | V | |
| | | Visual and Dimension | Major | Visual & Measurement | 100% | Approved DRG/Approved Specification | IR | √ | P | V | V | |
| 1.3.1 | Rollers | Mechanical Test/HT Chart | Major | Mechanical | 1 /heat | Approved DRG/Approved Specification | MTC/Lab TC | √ | P | V | V | |
| | | Chemical Composition | Major | Chemical | 1 /heat | Approved DRG/Approved Specification | MTC/Lab TC | √ | P | V | V | |
| | | Hardness | Major | Mechanical | 1 /heat | Approved DRG/Approved Specification | MTC/Lab TC | √ | P | V | V | |
| | | Visual and Dimension | Major | Visual & Measurement | 100% | Approved DRG/Approved Specification | IR | √ | P | V | V | |
| 1.3.2 | Roller wedges | Chemical Composition | Major | Chemical | 1 /heat | Approved DRG/Approved Specification | MTC/Lab TC | √ | P | V | V | |
| | | Mechanical Test | Major | Mechanical | 1 /heat | Approved DRG/Approved Specification | MTC/Lab TC | √ | P | V | V | |
| | | Visual and Dimension | Major | Visual & Measurement | 100% | Approved DRG/Approved Specification | IR | √ | P | V | V | |

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| 1.4 | Door and Door Frame | Chemical | Major | Chemical | 1 /heat | Approved DRG/Approved Specification | MTC/Lab TC | √ | P | V | V | |
| | | Mechanical Test | Major | Mechanical | 1 /heat | Approved DRG/Approved Specification | MTC/Lab TC | √ | P | V | V | All bolts and nuts are Galvanized |
| | | Visual and Dimension | Major | Visual & Measurement | 100% | Approved DRG/Approved Specification | IR | √ | P | V | V | |
| 1.5 | Pneumatic Cylinder | Visual and Dimension & Operation Test | Major | Documents Review | 100% | As per Approved Drg./ DS | MTC/Lab TC | √ | P | V | V | |
| 1.6 | Shafts | Chemical Composition | Major | Chemical | 1 /heat | Approved DRG./ Specification | MTC/Lab TC | √ | P | V | V | |
| | | Visual and Dimension | Minor | Visual & Measurement | 100% | Approved DRG./ Specification | IR | √ | P | V | V | |
| | | Mechanical Properties | Major | Mechanical | One sample/lot | Approved DRG./ Specification | MTC/Lab TC | √ | P | V | V | |
| | | Sub surface Defect (above 40min dia) | Major | UT | 100% | Approved DRG./ Specification/ ASTM A 388 | IR | √ | P | V | V | NOTE-1 |
| | | Surface Defect after machining | Major | OPT | 100% on final weld | ASME SEC V | IR | √ | P | V | V | |
| 2.0 | **In Process Inspection** | | | | | | | | | | | |
| 2.1 | Gate & Flame, Cylinder Mounting pedestal, Follower, Wear Plates, Body for access door & inspection window | Casting Defects | Major | Visual | 100% | Approved DRG/ Specification | IR | √ | P | V | V | |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Visual & Dimensional | Major | Visual & Measurement | 100% | Approved DRG./ Specification | IR | √ | P | V | V | |
| 2.2 | Marking, Cutting, Edge Preparation, tacking, Drilling, Assembly of liner plates for Fabrication of Housing | Visual & Dimensional | Major | Visual & Measurement | 100% | Approved DRG/ Specification | Shop Record | √ | P | V | V | |
| | | DP Test | Major | DPT | 100% | ASME SEC V | IR | √ | P | V | V | |
| | Welding Documents for Fabrication of Housing. | WPS & PQR, WPQ | Major | Review | 100% | ASME Sec. IX / ASME SEC. VIII | WPS & PQR, WPQ | √ | P | V | V | |
| | Welding (Final) Housing Joints only for Fabrication of Housing. | Weld Quality | Major | Visual & DPT | 100% | ASME SEC V | IR | √ | P | V | V | |
| 2.3 | Wear Strip, Roller Wedge, Rollers & Roller Axial | Visual & Dimensional | Major | Visual & Measurement | 100% | Manufacturing Drg. | IR | √ | P | V | V | |
| 2.4 | Assy. With Pneumatic Cylinder | Matching of Door 7 Frame movement of door clearance | Major | Operation, Measurement, Hydro test | 100% | Approved DRG. Approved Specification | IR | √ | P | V | V | |
| **3.0** | **Final Inspection** | | | | | | | | | | | |
| 3.1 | Gate way along with Pneumatic Cylinder | Fitment Dimensions Completeness | Major | Visual & Measurement | 100% | As per Approved Drg. | IR | √ | P | W | W | PMI test to be done for alloy materials. |
| 3.2 | | Leakage test of Sealing area of feed gate | Major | Water Fill test | 100% | As per Approved Drg./DS | IR | √ | P | W | W | |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3.3 | | Functional test | Major | Open and close operations for free movement | 100% | As per Approved Drg./DS | IR | √ | P | W | W | | |
| 3.4 | Painting | Final Finish & DFT | Minor | Visual & Measurement | 100% | Approved Painting Schedule/Data sheet. | IR | √ | P | V | V | | |
| 3.5 | QA Documentation | Visual | Minor | Review | 100% | Approved QAP | IR | √ | P | V | V | | |
| NOTE-1 : UT SHALL BE CARRIED OUT BY USING SUITABLE FREQUENCY PROBE. USING THIS PROBE, THE BACK WALL ECHO SHALL BE SET AT 100% OF FULL SCALE HEIGHT (FSH) IN SOUND AREA. AT THIS SENSITIVITY LEVEL, ANY DEFECT ECHO EXCEEDING 20% OF FSH IS NOT ACCEPTABLE. ALSO LOSS OF BACK WALL ECHO MORE THAN 20% AT ANY LOCATION IS NOT ACCEPTABLE | | | | | | | | | | | | | |
| 3.10.3 **CLINKER GRINDER** | | | | | | | | | | | | | |
| 1.0 | **Raw Material Inspection** | | | | | | | | | | | | |
| 1.1 | Housing | Chemical Composition | Major | Chemical | 1 Sample /heat | Approved DRG. Specification | MTC/Lab TC | √ | P | V | V | NOTE-1 | |
| | | Physical properties | Major | Mechanical | 1 Sample /heat | Approved DRC/ Specification | MTC/Lab TC | √ | P | V | V | | |
| | | UT OF PLATES >25 MM THK | Major | Mechanical | 1 Sample /heat | ASME SEC VIII DIV 1 SA 578 LEVEL B /ASTM A 435 | MTC/UT REPORT | √ | P | V | V | | |
| | | Dimensional conformity | Major | Measurement | 100% | Approved DRG. Specification | IR | √ | P | V | V | | |
| 1.2 | Driving Gear | Chemical Composition | Major | Chemical | As per Approved DRG/Specification | Approved DRG/ Specification | MTC/Lab TC | √ | P | V | V | | |
| | | Mechanical Test | Major | Mechanical | Approved DRG/ Specification | Approved DRG/ Specification | MTC/Lab TC | √ | P | V | V | | |
| 1.3 | Grinder Rolls | Chemical Composition & Mechanical properties | Major | Chemical & Mechanical | 1 Sample/heat | Approved DRG/ Specification | MTC/Lab TC | √ | P | V | V | | |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Dimensional conformity | Major | Measurement | 100% | Approved DRG/ Specification | IR | √ | P | V | V | |
| | | Heat Treatment | Major | Review of HT chart | 100% | Approved DRG/ Specification | IR | √ | P | V | V | |
| | | Bend Test | Major | Mechanical | 1 Sample/heat | Approved DRG/ Specification | MTC/Lab TC | √ | P | V | V | |
| | | Hardness | Major | Measurement | 1 Sample/heat | Approved DRG/ Specification | MTC/Lab TC | √ | P | V | V | |
| | | Casting Defects | Major | Visual | 100% | Approved DRG/ Specification | MTC/Lab TC | √ | P | V | V | |
| 1.4 | Shaft | Chemical Composition | Major | Chemical | 1 Sample /heat | Approved DRG/ Specification | MTC/Lab TC | √ | P | V | V | |
| | | Dimensional conformity | Minor | Measurement | 100% | Approved DRG/ Specification | IR | √ | P | V | V | |
| | | Mechanical Properties | Major | Mechanical | 1 Sample /heat | Approved DRG/ Specification | MTC/Lab TC | √ | P | V | V | |
| | | Sub surface Defect (above 40mm dia) | Major | UT | 100% | Approved DRG/ Specification/ASTM A 388 | IR | √ | P | v | v | NOTE-1 |
| | | Surface Defect after Ma | Major | DPT | 100% on final weld | ASME SEC V | IR | √ | p | V | V | |
| 1.5 | Shaft Sleeve | Chemical Composition & Mechanical properties | Major | Chemical & Mechanical | On 10% sample | Approved DRG/ Specification | MTC/Lab TC | √ | P | V | V | |
| | | Hardness | Minor | Measurement | 100% | Approved DRG/ Specification | MTC/Lab TC | √ | P | V | V | |
| | | Dimensional conformity | Minor | Measurement | 100% | Approved DRG/ Specification | IR | - | P | V | V | |
| 1.6 | Wear Plate | Chemical Composition | Major | Chemical | 1 Sample /heat | Approved DRG/ Specification | MTC/Lab TC | √ | P | V | V | |

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| | | Hardness | Major | Measurement | 1 Sample /heat | Approved DRG/ Specification | IR | √ | P | V | V | |
| 1.7 | Bearing, Screws, Flexible hose pipes and other items | Verification of Make/Model no. | Major | Visual | 100% | Approved DRG/ Specification | MTC/Lab TC | √ | P | V | V | |
| **2.0** | **In Process Inspection** | | | | | | | | | | | |
| 2.1 | Big Support | Casting Defect | Major | Visual | 100% | Approved DRG/ Specification | IR | √ | P | V | V | |
| | | | Major | DPT | 100% on final weld | ASME SEC V | IR | √ | P | V | V | |
| | | Dimensional Conformity | Major | Measurement | Critical dimensions | Approved Drg. | IR | √ | P | V | V | |
| 2.2 | Fabrication of Housing | Dimensional conformity | Major | Measurement | Critical dimensions | Approved Drg. | IR | √ | P | V | V | |
| 2.3 | Welding Qualification | WPS, PQR, WQR | Major | Verification | 100% | ASME SEC IX | IR | √ | P | V | V | |
| 2.4 | Welding of Housing, Shaft & Rolls | DPT on final weld | Major | DPT | 100% on final weld | ASME SEC V | IR | √ | P | V | V | |
| 2.5 | Alignment of Clinker grinder | Alignment of fire movement | Major | Visual & by manual operation | 100% | Approved Drg. | IR | √ | P | V | V | |
| 3.0 | **Final Inspection** | | | | | | | | | | | |
| 3.1 | Check for Completeness, appearance, drilled holes, straightness, diameter, no. of holes verification, | Fitment Dimension | Major | Measurement/Visual | 100% | Approved Drg./Data sheet | IR | √ | P | W | W | |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Cleanliness & dimension | | | | | | | | | | | |
| 3.2 | No Load running test at least for 2hours with shop drive | Free Rotation | Critical | Visual | 100% | Approved Drg | IR | √ | P | W | W | |
| | | Bearing Temp rise & Vibration | Major | Measurement | 100% | Approved Drg ./DATA SHEET | IR | √ | P | W | W | Temp rise ambient +30° Vibration below B5 Micron |
| 3.3 | Painting | Paint shade, DFT | Minor | Visual & Measurement | 100% | Approved painting Schedule | IR | √ | P | V | V | |
| 3.4 | QA Documentation | Visual | Major | Review | 100% | Approved QAP | Report | √ | P | V | V | |
| NOTE-1: UT SHALL BE CARRIED OUT BY USING SUITABLE FREQUENCY PROBE. USING THIS PROBE, THE BACK WALL ECHO SHALL BE SET AT 100% OF FULL SCALE HEIGHT (FSH) IN SOUND AREA. AT THIS SENSITIVITY LEVEL, ANY DEFECT ECHO EXCEEDING 20% OF FSH IS NOT ACCEPTABLE. ALSO LOSS OF BACK WALL ECHO MORE THAN 20% AT ANY LOCATION IS NOT ACCEPTABLE | | | | | | | | | | | | |
| **3.10.4 AIR OIL CONVERTER TANK** | | | | | | | | | | | | |
| 1.0 | **Raw Material Inspection** | | | | | | | | | | | |
| 1.1 | Body & Baffle plate, Structural supports | Chemical Composition | Major | Chemical | 1 Sample/heat | Approved DRG/Specification | MTC/Lab TC | √ | P | V | V | |
| | | Mechanical Test | Major | Mechanical | 1 Sample/heat | Approved DRG/Specification | MTC/Lab TC | √ | P | V | V | |
| | | Surface Defect | Major | Visual & DP T | 100% | Approved DRG/Specification | IR | √ | P | V | V | |
| 2.0 | **In Process Inspection** | | | | | | | | | | | |
| 2.1 | Body & Structural, Dish end | | | | | | | | | | | |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | a) Marking, cutting edge preparation, Cleaning, tacking, straightening etc. | a) Fit up check (ovality / misalignment) | Major | Dimensional/ Visual | 100% | Approved DRG/Specification | IR | √ | P | V | V | |
| | b) Welder Qualification and welding procedure | Welding Documents | Major | Review | 100% | ASME SEC IX | IR | √ | P | V | V | |
| | c) NDT | Surface Defect | Major | Visual of DP Test | 100% | Approved DRG/Specification | IR | √ | p | V | V | |
| | | Weld Quality | Major | DP Test | 100% Butt<br>10% Fillet | ASME SEC V / ASME SEC VIII Appendix-B | IR | √ | P | V | V | |
| 3.0 | **Final Inspection** | | | | | | | | | | | |
| 3.1 | Check for critical dimensions, straightness, Distortion, alignments etc. | Completeness and visual/ dimensional examination | Major | Measurement/Visual | Overall Dimensions 100% | Approved DRG/Specification | IR | √ | P | W | W | Witness 100% of offered lot |
| 3.2 | Hydrostatic Pr. Testing of shell | Hydraulic pressure for 5 min. | Major | Pressure Test | 100% | Test Pressure as per Approved Drg/DS/Relevant code & standard /<br>No leakage/Pressure Drop | IR | √ | P | W | W | |
| 3.3 | Painting | Paint shade, DFT | Major | Visual & Measurement | 100% | Approved painting Schedule | IR | √ | P | V | V | |
| 3.4 | QA Documentation | Visual | Major | Review | 100% | Approved QAP- | Report | √ | P | V | V | |
| 3.10.5 **CAST IRON PIPE** | | | | | | | | | | | | |
| 1.0 | **Raw Material Inspection** | | | | | | | | | | | |
| 1.1 | Raw Material Pig Iron & Scrap | Material Compliance | Major | Chemical Check | One Sample / Lot | AS per Mfg. Std | MTC | √ | P | V | V | |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1.2 | RUBBER GASKETS FOR SOCKET & SPIGOT ENDS PIPES** | CONFORMANC E TO IS 1536 REQUIREMENT S | MINO R | VISUAL | ONE/ LOT | IS 5382 & IS 12820 | IR | | P | V | | ** IF APPLICABLE |
| 2.0 | **In Process Inspection** | | | | | | | | | | | |
| 2.1 | Pipe Spinning | Surface Condition | Major | Verificatio n of Lot Sheet | 100% | IS:1536/BS:1211 | IR | √ | P | V | V | |
| | | Thickness | Major | Visual | 100% | IS:1536/BS:1211 | IR | √ | P | V | V | |
| 2.2 | Heat Treatment | Verification of Heat Treatment | Critical | Review | 100% | IS 1536/APPVD DRG & DS/MFRS STD | IR | √ | P | V | V | |
| 2.3 | Pipe after heat Treatment | Major Dimensions | Major | By Vernier Calliper | Every Hour | IS 1536/APPVD DRG & DS/MFRS STD | IR | √ | P | V | V | |
| **3.0** | **Final Inspection** | | | | | | | | | | | |
| 3.1 | Physical Testing | Mechanical Test | Critical | Modulus of rupture/ tensile test | One sample / Batch | IS:1536/BS:1211 | IR | √ | P | W | W | |
| | | Brinell Hardness | Critical | Hardness Test | One sample / Batch | IS:1536/BS:1211 | IR | √ | P | W | W | |
| 3.2 | Dimension | OD, THICKNESS, OVALITY & LENGTH, QUALITY, STRAIGHTNES S, LENGTH AND SOCKET | Major | BY GO GAUGES, VERNIER CALIPER, MEASURI NG TAPE | 100% | IS:1536/BS:1211 | IR | √ | P | W | W | 10% from the offer lot (Rev 01) |

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| | | & SPIGOT DIMENSIONS | | | | | | | | | | | |
| 3.3 | Hydrostatic Test | Leak Test | Major | Hydrostatic Test | 100% | IS:1536/BS:1211 | IR | √ | P | W | W | 10% from the offer lot | |
| 3.4 | Bitumeneous Black Paint / Tar | Coating Adherence | Major | Adherence Test | 100% | IS:1536/BS:1211 | IR | √ | P | V | V | | |
| 3.5 | Marking | Compliance | Major | Verification | 100% | IS:1536/BS:1211 | IR | √ | P | V | V | | |
| **3.10.6 EXPANSION BELLOW, BELLOW APH, DUCT & SCR HOPPER** | | | | | | | | | | | | | |
| **1.0** | **Raw Material Inspection** | | | | | | | | | | | | |
| 1.1 | Sheet for Bellows | Mechanical & Chemical Properties | Major | Mechanical & Chemical | Sample Test Report or Mill TC | Approved Drawing/ Specification | TC | √ | P | V | V | | |
| 1.2 | CS Flange and plate for socket/centre pipe | Mechanical & Chemical Properties | Major | Mechanical & Chemical | Sample Test Report or Mill TC | Approved Drawing/ Specification | TC | √ | P | V | V | | |
| 2.0 | **In Process Inspection** | | | | | | | | | | | | |
| 2.1 | Marking, Cutting & machining | Measurement | Major | Dimension | 100% | Approved Drawing | IR | √ | P | V | V | | |
| 2.2 | Fabrication before welding | Edge preparation & Fit up checking | Major | Visual & Dimension | 100% | Approved Drawing | IR | √ | P | V | V | | |
| 2.3 | After welding of bellows Long scam (plies) | Soundness of weld joints | Major | Visual & DP Test | 100% | ASTM E 165 / As per std. Practice | IR | √ | P | V | V | | |
| **3.0** | **Final Inspection** | | | | | | | | | | | | |
| 3.1 | After welding of bellows with socket & Flange with socket full assembly | Surface defect, Dimension | Major | Visual, Measurement | 100% | Approved Drawing | IR | √ | P | W | W | | |

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| 3.2 | Deflection Test (Routine Test) | Deflection Test | Critical | Axial & Lateral Movement Measurement | 100% | Approved Drawing | IR | √ | P | W | W | |
| 3.3 | Pneumatic Test (Routine Test) | Leakage Test at Specified Test Pressure with air and soap solution | Major | Pneumatic Leakage Test | 100% | Approved Drawing/ Specification | IR | √ | P | W | W | |
| 3.4 | Painting on all MS Paints | Surface cleaning and painting | Minor | Visual Checking | 100% | As per approved paint specification | IR | √ | P | V | W | |
| 3.5 | QA Documentation | Visual | Major | Review | 100% | Approved Drawing & QAP | IR | √ | -P | V | V | |
| **3.10.7 FLUIDISING BLOWER** | | | | | | | | | | | | |
| **1.0** | **Raw Material Inspection** | | | | | | | | | | | |
| 1.1 | Casing, Rotary Lobi (Rotor), end cover/end plate/side plate | Physical & Chemical | Major | Physical & Chemical | 1/Heat | IS:210/ Approved Drg/ DS | MTC | √ | P | V | V | |
| 1.2 | Shaft | Physical & Chemical | Major | Physical & Chemical | 1/Heat | approved Drg/Data sheet | MTC | √ | P | V | V | |
| | | NDT | Major | UT | 100% | ASTM – A 388 | IR | | | | | For Dia > 40MM, NOTE-1 |
| 1.3 | Gears | Chemical | Major | Chemical | 1/Heat | approved Drg/Data sheet | MTC | √ | P | V | V | |
| | | Internal Defects | Major | UT | 100% | ASTM – A 388 | IR | √ | P | V | V | For Dia > 40MM, , NOTE-1 |
| | | Hardness 54 to 60 HRC | Major | Mechanical | 100% | Approved Drg/DS | Test Report | √ | P | V | V | |
| **2.0** | **In Process Inspection** | | | | | | | | | | | |
| 2.1 | Impeller (Lobe with shaft assembly) after machining | Surface Defects in machining area | Major | DPT | 100% | ASTM – 165 / No Linear Indication | IR | √ | P | V | V | |

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| | | Dynamic Balancing | Major | Balancing | 100% | ISO:1940 GR 6.3 | IR | √ | P | V | V | |
| 2.2 | Casing and end cover assembly | Pressure Test | Major | Hydro Test | 100% | 1.5 Times of Design pressure or 2 times of working pressure whichever is higher for 30 minutes / No leakage | IR | √ | P | V | V | |
| **3.0** | **Final Inspection** | | | | | | | | | | | |
| 3.1 | Complete Blower Assembly | Overall Dimensions, completeness | Major | Visual & Measure | 100% | Approved DRG | IR | √ | P | W | W | |
| 3.2 | | Performance Test with Shop/JOB motor | Critical | Capacity, Head, speed Power, efficiency | 100% | BS-1571 Part II/Approved Drg/Data Sheet | IR | √ | P | W | W | |
| 3.3 | | Noise & Vibration | Critical | Measurement | 100% | Approved Drg/Data Sheet | IR | √ | P | V | W | |
| 3.4 | | Brg Temp Rise | Critical | Measure | 100% | Approved Drg/Data Sheet/Mfrs std | IR | √ | P | V | V | |
| 3.5 | | Painting | Minor | Visual & Measurement | 100% | As per Approved Painting Specification | IR | √ | P | V | V | |
| 3.6 | QA Documentation | Visual | Major | Review | 100% | Approved QAP | Report | √ | P | V | V | |
| NOTE-1: UT shall be carried out by using suitable frequency PROBE. Using this probe, the Back Wall Echo shall be set at 100% of Full Scale Height (FSH) in sound area. At this sensitivity level, any defect echo exceeding 20% of FSH is not acceptable. Also loss of back wall echo more than 20% at any location is not acceptable | | | | | | | | | | | | |
| **3.10.8 FLY ASH FEED VALVE** | | | | | | | | | | | | |
| 1.0 | **Raw Material Inspection** | | | | | | | | | | | |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1.1 | Body Intake,<br><br>Tee Intake | Mechanical Properties | Major | Hardness | 1/Heat | Approved Drg./TDS | MTC | √ | P | V | V | |
| | | Chemical | | Chem. Compo. | 1/Heat | | MTC | √ | P | V | V | |
| | | Dimensions | | Measurement | 100% | | IR | √ | P | V | V | |
| | | Surface Defects | | Visual | 100% | | IR | √ | P | V | V | |
| 1.2 | Disc & Seat | Mechanical Properties | Major | Hardness | 1/Heat | Approved Drg./TDS | MTC | √ | P | V | V | |
| | | Chemical | | Chem. Compo. | 1/Heat | | MTC | √ | P | V | V | |
| | | Dimensions | | Measurement | 100% | | IR | √ | P | V | V | |
| | | Surface Defects | | Visual | 100% | | IR | √ | P | V | V | |
| 1.3 | Shafts | Chemical & Mech. Properties | Major | Chem. Analysis & Mech. Prop | 1/Batch/Lot | Approved Drg./T DS | MTC | √ | P | V | V | |
| | | Internal soundness | Major | UT (DIA ≥40 MM) | 100% | ASTM A 388 / Note-1 | UT Report | √ | P | V | V | |
| 1.4 | Hopper Inlet | Physical Properties | Major | UTs & Hardness | 1/Heat | Approved Drg./TDS | MTC | √ | P | V | V | |

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| | | Surface Defects | | Visual | 100% | | IR | √ | P | V | V | |
| | | Dimensions | | Measurement | 100% | | IR | √ | P | V | V | |
| 1.5 | Spring (Spring Steel) | Chemical Properties | Major | Chem. Analysis stiffness measurement | 1/Batch | Approved Drg./TDS | MTC | √ | P | V | V | |
| | | Physical Properties | | | 25% | | IR | √ | P | V | V | |
| | | Dimensions | | | 100% | | IR | √ | P | V | V | |
| 1.6 | Diffuser Mounting plenum | Review Document & Operation | Major | Verification | 100% | Approved Drg./TDS | IR & TC | √ | P | V | V | |
| | | | | | | | | √ | P | V | V | |
| | | | | | | | | √ | P | V | V | |
| | | | | | | | | √ | P | V | V | |
| 1.7 | Porus Tile | Review Document & Operation | Major | Verification | 100% | Approved Drg./TDS | IR & TC | √ | P | V | V | |
| 1.8 | Pneumatic Cylinder | Review Document & operation | Major | Verification | 100% | Approved Drg./TDS | IR & TC | √ | P | V | V | |
| **2.0** | **In Process Inspection** | | | | | | | | | | | |
| 2.1 | Machining of components | Dimensions<br>Surface Defects | Major | Measurement<br>Visual | 100% | Approved/Mfg. Drg | IR<br>IR | √ | P | V | V | |
| | | | | | | | | √ | P | V | V | |

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| 2.2 | Machining of valve seat & Disc. | Machining<br>Grinding<br>Lapping | Minor | Measurement<br>Blue Matching of Disc & Seat | 100% | Mfr. Drg / Full circle matching<br>(at least 80%of area) | IR<br>IR<br>IR | √ | P | V | V | |
| | | | | | | | | √ | P | V | V | |
| | | | | | | | | √ | P | V | V | |
| 2.3 | Pressure testing of Hopper Inlet & Tee Intake | Leak Tightness | Major | Hydro Test | 100% | Approved Drg./TDS | IR | √ | P | V | V | |
| **3.0** | **Final Inspection** | | | | | | | | | | | |
| 3.1 | Complete Fly ash Feed Valve Assembly along with Air Cylinder | Dimensions & Completeness<br>Operational Test(No Load) 10 cycles<br>Seat vacuum Test | Major<br>Major<br>Major | Measurement Visual<br>By Comp. Air<br>-Do- | 100%<br>100%<br>100% | Approved Drg./TDS<br>Smooth operation | IR<br>IR<br>IR | √ | P | W | W | |
| 3.2 | Painting | Appearance & Cleanliness | Major | Visual | 100% | Approved painting schedule | IR | √ | P | V | V | |
| 3.3 | QA Documentation | Visual | Major | Review | 100% | Approved QAP | Report | √ | P | V | V | |
| **3.10.9 AIR WASHER** | | | | | | | | | | | | |
| 1.0 | **Raw Material Inspection** | | | | | | | | | | | |
| 1.1 | Body Steel plates, structural steel members | Chemical Composition | Major | Chemical | 100% | Approved DRG/DATA SHEET | MTC/IR | √ | P | V | V | UT of plate thickness more than 25mm |
| | | Mechanical Test | Major | Mechanical | 100% | Approved DRG/ DATA SHEET | IR | √ | P | V | V | |

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| **2** | **In Process Inspection** | | | | | | | | | | | |
| 2.1 | Body a) Marking, Cutting, edge preparation, Cleaning, tacking, straightness | Dimensional conformity | Major | Measurement/Visual | 100% | AS per shop Drg | IR | √ | P | V | V | |
| | Weld joint & Welding | Welder Qualification and procedure welding | Major | Mechanical | 100% | ASME Sec IX | PQR/WPS Certificate | √ | P | V | V | |
| | | Weld Quality | Major | DPT | 100% | ASTME-165 | IR | √ | P | V | V | |
| 2.2 | Pipe connection and fittings | Dimensional conformity Alignment | Major | Measurement/Visual | 100% | AS per shop Drg | IR | √ | P | V | V | |
| 2.3 | Structural Welding | Weld Quality | Major | DPT on root run | 100% | ASTME-165 | IR | √ | P | V | V | |
| | | | | DPT on final & fillet weld | 100% | ASTME-165 | IR | √ | P | V | V | |
| **3** | **Final Inspection** | | | | | | | | | | | |
| 3.1 | Check for critical dimensions, completeness | Dimensional conformity | Major | Measurement/Visual | 100% | As per Approved DRG | IR | √ | P | W | W | |
| 3.2 | Leak Test | Water Fill Test for 1 hour duration | Major | Fill Test | 100% | As per Approved DRG | IR | √ | P | W | W | |
| 3.3 | Painting | Paint shade, DFT | Major | Visual & Measurement | 100% | Approved painting Schedule | IR | √ | P | V | V | |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3.4 | QA Documentation | Visual | Major | Review | 100% | Approved QAP- | Report | √ | P | V | V | |
| **3.10.10 ASH SLURRY PUMPS** | | | | | | | | | | | | |
| 1.0 | **Raw Material Inspection** | | | | | | | | | | | |
| 1.1 | Casing, impeller, Wear Ring/Wear Plate | Visual, Physical & Chemical | Major | Visual Measurement | 1/Heat | App. Drg/ Data sheet | MTC | √ | P | V | V | |
| 1.2 | Shaft | Physical, Chemical | Major | Visual Measurement | 1/Lot | App. Drg/ Data sheet | MTC | √ | P | V | V | |
| 1.3 | | Internal Soundness | Major | UT(DIA ≥40 MM) | 100% | ASTM A 388 / Note-1 | UT Report | √ | P | V | V | |
| **2** | **In Process Inspection** | | | | | | | | | | | |
| 2.1 | Machining of shaft, Bearing Housing Sleeve, Impeller Casing etc., | Compliance Report | Major | Visual Measurement | 100% | Mfr. Drawing | Inspection Report | √ | P | V | V | |
| 2.2 | Casing Hydrostatic Test | Hydrostatic | Critical | Hydrostatic | As per Std | App. Drg/ Data sheet/ / As per IS 5120 | Inspection Report | √ | P | V | V | |
| 2.3 | Impeller Dynamic Balancing | Dynamic Balancing | Critical | Measurement | AS per Std | As per Std / ISO 1940-1973 Gr.6.3 | Inspection Report | √ | P | V | V | |
| **3** | **Final Inspection** | | | | | | | | | | | |
| 3.1 | Dimensional | Overall Dimensional Conformity | Major | Visual Measurement | One/Type/Size | Approved Drawing/Data Sheet | Inspection Report | √ | P | W | W | |
| 3.2 | Performance Test with Calibrated test lab motor | Q Vs H, P & Noise, Vibration | Critical | Performance | One/Type/Size | Approved Drawing/Data Sheet/IS 5120/BIS | Inspection Report | √ | P | W | W | |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3.3 | Painting | Visual & DFT | Major | Visual & measure | Random | Approved Painting Schedule | Inspection Report | √ | P | V | V | |
| **3.10.11 WETTING HEAD** | | | | | | | | | | | | |
| 1.0 | **Raw Material Inspection** | | | | | | | | | | | |
| 1.1 | Casting (ejector head) | Chemical Composition | Major | Chemical | 1 Sample /heat | Approved DRG/ Specification/DS | MTC/Lab TC | √ | P | V | V | |
| | | Mechanical Properties | Major | Mechanical | 1 Sample /heat | Approved DRG/ Specification/DS | MTC/Lab TC | √ | P | V | V | |
| | | Casting Defects | Major | Visual Checking | 100% | Approved DRG/ Specification/DS | IR | √ | P | V | V | |
| | | Hydro Test (Water jacket only) for 5 Min. | Major | Hydro Test | 100% | Approved DRG/ Specification/DS / No Leakage/Sewage & Drop | IR | √ | P | V | V | Hydro Test to be done before drilling of Nozzle hole. |
| | | Hardness | Major | Measurement | 100% | Approved DRG/ Specification/DS | IR | √ | P | V | V | |
| 1.2 | Nozzle Tip | Chemical Composition | Major | Chemical | 1 Sample /heat | Approved DRG/ Specification/DS | MTC/Lab TC | √ | P | V | V | |
| | | Mechanical Properties | Minor | Mechanical | 1 Sample /heat | Approved DRG/ Specification/DS | MTC/Lab TC | √ | P | V | V | |
| | | Dimensional conformity | Major | Measurement | 100% | Plant Drg. | IR | √ | P | V | V | |
| | | Hardness | Major | Measurement | 100% | Approved DRG/ Specification/DS | IR | √ | P | V | V | |
| 2.0 | **In Process Inspection** | | | | | | | | | | | |
| 2.1 | Drilling Machining, Visual & Dimensions | Accuracy/ Appearance & conformity to the | Major | Visual & Measurement | 100% | Approval/Details Drg. | IR | √ | P | V | V | |

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| | | drawing shape, size, orientation. | | | | | | | | | | |
| | | All machined area DPT to be done before & after machining | Major | DP Test | 100% | ASME SEC V / ASME SEC VIII Appendix & (cl 8-4) | IR | √ | P | V | V | |
| 3.0 | **Final Inspection** | | | | | | | | | | | |
| 3.1 | Assembly | Dimension | Major | Measurement | 100% | Approved DRG/ Specification/DS | IR | √ | P | W | W | |
| | | Completeness | Major | Visual Checking | 100% | Approved DRG/ Specification/DS | IR | √ | P | W | W | |
| 3.2 | Leakage Test | Water fill Test (2hr) | Major | Water fill Test | 100% | Approved DRG/ Specification/DS / No Leakage/ Sewage & Drop | IR | √ | P | W | W | |
| 3.3 | Painting | Paint shade, DFT | Minor | Measurement/Visual | 100% | Approved painting Schedule | IR | √ | P | V | V | |
| 3.4 | QA Documentation | Visual | Major | Review | 100% | Approved QAP | Report | √ | P | V | V | |
| **3.11 COAL HANDLING PLANT** | | | | | | | | | | | | |
| **3.11.1 FEED EJECTOR** | | | | | | | | | | | | |
| 1.0 | **Raw Material Inspection** | | | | | | | | | | | |
| 1.1 | Inlet liner, discharge throat, Tall pipe, Elbow, Plate, Flange | Chemical | Major | Chemical | 1 Sample /heat | Approved /Mfg. DRG/ Specification | MTC/Lab TC | √ | P | V | V | |
| | | Mechanical Test | Major | Hardness Measurement | 1 Sample /heat | Approved /Mfg. Drg/ Specification | MTC/Lab TC | √ | P | V | V | |
| 1.2 | Ejector head, Nozzle, Nozzle Tip | Chemical | Major | Chemical | 1 Sample /heat | Approved /Mfg. DRG | MTC/Lab TC | √ | P | V | V | |

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| | | Mechanical Test | Major | Mechanical | 1 Sample /heat | Approved /Mfg. DRG | MTC/Lab TC | √ | P | V | V | |
| 1.3 | NDT for Forged Flanges | NDT | Major | UT | 1 Sample/heat | Approved /Mfg. DRG/REL STD | MTC/Lab TC | √ | P | V | V | |
| 2.0 | **In Process Inspection** | | | | | | | | | | | |
| 2.1 | Inlet liner, Discharge throat, Tall pipe | Visual & Dimensional conformity | Major | Measurement/Visual | 100% | Mfg. Drg/ Specification | IR | - | P | W | V | |
| 2.2 | Ejector Head | Visual & Dimensional conformity | Major | Measurement/Visual | 100% | Mfg. Drg/ Specification | IR | √ | P | W | V | |
| | | Hydro Test (30 min) | Major | Hydro Test | 100% | Approved Drg./ Specification/ No Leakage/ Seepage | IR | √ | P | V | V | |
| 2.3 | Nozzle | Hardness | Major | Measurement | 100% | Mfg. Drg/ Specification | IR | - | P | V | V | |
| 3.0 | **Final Inspection** | | | | | | | | | | | |
| 3.1 | Completeness and final dimensional examination for overall assembly | Fitment Dimension | Major | Measurement/Visual | 100% | Approved Drg./ Specification | IR | √ | P | W | W | |
| 3.2 | Leak Test | Water fill Test (1hr) | Major | Water fill Test | 100% | Approved Drg./ Specification No Leakage/ Seepage / | IR | √ | P | W | V | |
| 3.3 | Painting | Paint shade, DFT | Minor | Measurement/Visual | 100% | Approved painting Schedule | IR | √ | P | V | V | |
| 3.4 | QA Documentation | Visual | Major | Review | 100% | Approved QAP | Report | √ | P | V | V | |
| **3.11.2 BELT WEIGHER** | | | | | | | | | | | | |

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| 1.0 | **Raw Material Inspection** | | | | | | | | | | | | |
| 1.1 | Steel | i) Dimension<br>ii) Chemical analysis<br>iii) Mechanical Properties | Major | Visual<br>Chemical<br>Mechanical | 100% | 100% | As per ISO/BIS | As per ISO/BIS/ MTC | √ | P | V | V | |
| 1.2 | Load cell Blank | i) Visual dimension<br>ii) Chemical test<br>iii) Ultrasonic test<br>iv) Hardness Test<br>v) Planting DFT | Major | Visual, Chemical, Measurement | 100% | | Manufacturer Standard | Manufacturer Standard/ Test report/Lab report | √ | P<br>P | V<br>W | V<br>V | Witness of final plating DFT during Final Inspection |
| 1.3 | Speed Sensor | Visual & Functional | Major | Visual, Functional | 100% | | Relevant Standard/ Specification | Relevant Standard/ Specification/ Internal/ External Test Report | √ | P | V | V | |
| 1.4 | Cable | i) Visual, Dimensional<br>ii) Insulation, high voltage test | Major | Visual, Measurement | 100% | | Relevant Standard/ Specification | Relevant Standard/ Specification/ Internal/ External Test Report | √ | P | V | V | |
| 1.5 | Junction Box | i) Visual, Dimensional<br>ii) ingress test | Major | Visual | 100% | | Relevant Standard/ Specification | Relevant Standard/ | √ | P | V | V | |

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| | | | | | | | Specification/ Internal/ External Test Report | | | | | |
| 1.6 | Enclosure | i) Visual, Dimensional<br>ii) Paints & Shade | Major | Visual Dimensional<br>DFT | 100% | Relevant Standard/ Specification | Relevant Standard/ Specification/ Internal/ External Test Report | √ | P | V | V | |
| 2.0 | **In Process Inspection** | | | | | | | | | | | |
| 2.1 | Indicated/ Controller assembly and testing | i) Calibration<br>ii) Functional check<br>iii) Surface finish<br>iv) NDT | Major | Visual, Dimensional | 100% | Approved Specification | Approved Specification/ Internal/ External Test Report | √ | P | V | V | |
| 2.2 | Fabricated & machined item | i) Visual, Dimension | Major | Visual, Dimensional, DP | 100% | Approved DRG/DS/MFRS DRG | Mfr. Procedure Internal/ External Test Report / | √ | P | V | V | |
| 3.0 | **Final Inspection** | | | | | | | | | | | |
| 3.1 | Load Cell | i) Visual, Dimensional<br>ii) Linearly, Accuracy | Major | Visual, Dimensional, Functional | 100% | Design Documents, test procedure, standard operating procedure(SOP) | IPA Procedure Internal/ | √ | P<br>P<br>P | W<br>V<br>V | W<br>W<br>W | |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | iii) Ingress & temp test<br>iv) capacity, make & model | | | | | | External Test Report | | P | V | - | |
| 3.2 | Electronic testing under simulated conditions | i) Visual, Dimensional<br>ii) Linearly, Repeatability, Calibration, functional, accuracy<br>iii) Vibration, Ingress protection, temperature, sock test. | Major | Visual, Dimensional, Functional | 100% Sampling 100% | | Design Documents, test procedure, standard operating procedure(SOP) | Mfr. Procedure Internal/ External Test Report | √ | P<br>P<br>P | W<br>W<br>V | W<br>W<br>W | |
| 3.3 | Overall Assembly | i) Visual, Dimensional<br>ii) Paint & Shade | Major | Visual, Dimensional, DFT | 100% | 10% | Design Documents, standard operating procedure(SOP) | Mfr. Procedure Internal/ External Test Report | √ | P | W | W | Witness of final paint, DFT during Final Inspection. |
| 3.4 | | Painting | Major | Visual & Measurement | 100% | 100% | Approved Painting Schedule / Data Sheet | IR | √ | P | V | V | |
| **3.11.3 FR GRADE CONVEYOR BELT** | | | | | | | | | | | | | |
| 1.0 | **Raw Material Inspection** | | | | | | | | | | | | |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1.1 | Raw Rubber | A) Volatile Matter<br>B) Ash Content<br>C)Mooney Viscosity<br>D)Dirt Content<br>E) Plasticity<br>F) Retention Index | Major | Physical<br>Chemical<br>Physical<br>Physical<br>Physical<br>Chemical | Random One Sample Per Lot | - | IS:4588 & Is:3660/ Mfr. Std. | Raw Material Analysis Sheet | | V | - | - | |
| 1.2 | Zinc Oxide | A) Moisture Content<br>B) Ignition Test<br>C) Purity<br>D)Particle Size<br>E)Bulk Density<br>F) Acid Insolubility | Major | Physical<br>Chemical | Random One Sample Per Lot | - | IS:3399/ Mfr. Std. | Raw Material Analysis Sheet | | V | - | - | |
| 1.3 | Stearic Acid | A) Ash Content<br>B) Melting Point<br>C) Acid Value | Major | Chemical<br>Physical | Random One Sample Per Lot | - | IS:1675 / Mfr. Std. | Raw Material Analysis Sheet | | V | - | - | |
| 1.4 | Carbon Black | A) Moisture Content<br>B) Ash Content<br>C)Iodine Absorption No.<br>D)BDP Absorption No.<br>E) pH | Major | Physical<br>Chemical | Random One Sample Per Lot | - | IS:7497 & Is:7498/ Mfr. Std. | Raw Material Analysis Sheet | - | V | - | - | |
| 1.5 | White Filter | A)Moisture Content<br>B)Ignition Test | Major | Physical<br>Chemical<br>Chemical | Random One | - | IS:1685/ Mfr. Std. | Raw Material | - | V | - | - | |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | C)Insolubility in HCl<br>D) Particle Size | | Physical | Sample Per Lot | | | Analysis Sheet | | | | | |
| 1.6 | Protective Agent | A)Moisture Content<br>B)Ash Content<br>C)Softening Point/Melting Point | Major | Physical<br>Chemical<br>Physical | Random One Sample Per Lot | - | Mfr. Standard | Raw Material Analysis Sheet | - | V | - | - | |
| 1.7 | Rubber/Chemicals/ Accelerators | A)Moisture Content<br>B)Ash Content<br>C)Meeting Point<br>D)Solubility | Major | Physical<br>Chemical<br>Physical<br>Physical | Random One Sample Per Lot | - | Mfr. Standard | Raw Material Analysis Sheet | - | V | - | - | |
| 1.8 | Sulphur | A)Moisture Content<br>B)Ash Content<br>C)Purity | Major | Physical<br>Chemical<br>Chemical | Random One Sample Per Lot | - | IS:8851/Mfr. Std. | Raw Material Analysis Sheet | - | V | - | - | |
| 1.9 | Plasticizer | A)Relative Density<br>B)Aniline Point<br>C)Viscosity | Major | Physical | Random One Sample Per Lot | - | Mfr. Standard | Raw Material Analysis Sheet | - | V | - | - | |
| 1.10 | Textile Fabric | A)Thickness<br>B)Width<br>C)Weight (GSM) | Major | Physical | Random One Sample Per Roll | Random One Sample Per Roll | Mfr. Standard | Textile Laboratory Testing Report | √ | V | V | V | |
| 1.11 | Dipped Textile Fabric | A) Breaking Strength (Warp & Weft)<br>B) Elongation At Break (Warp & Weft) | Major | Physical | Random One Sample Per Batch | Random One Sample Per Batch | Mfr. Standard | Textile Laboratory | √ | V | V | V | |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | C)Elongation T Ref. Load (Warp & Weft)<br>D) Rubber Adhesio Cover To Ply And Ply To Ply<br>E) Shrinkage (Warp & Weft)<br>F) % Cramp (Warp & Weft) | | | | | | Testing Report | | | | | |
| 1.12 | Rubber Compound | A) Rheometric Analysis<br>B) Specific Gravity<br>C)Hardness<br>D)Tensile Strength<br>E) Elongation At Break<br>F) Adhesion | Major | Physical | Random One Sample Per Batch | Random One Sample Per Batch | Mfr. Standard | √Lab Report | √ | P | V | V | |
| 2.0 | **In Process Inspection** | | | | | | | | | | | | |
| 2.1 | Rubber Coating Of Fabrics | A)Ply Thickness<br>B)Ply Width<br>C)Ply Length<br>D)Fabric Roll No. And Type<br>E)Compound Code And Batch No. | Major | Physical | Each Ply | Each Ply | Mfr. Standard | Production Log Sheet/Internal Record | √ | P | V | V | |
| 2.2 | Rubber Cover Sheeting/Calenderin g | A)Thickness<br>B)Width<br>C)Length<br>D)Compound Code And Batch No. | Major | Physical | Each Sheet | Each Sheet | Mfr. Standard | Production Log Sheet/Internal Record | √ | P | V | V | |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2.3 | Belt Building | A)Thickness<br>B)Width<br>C)Length<br>D)Cover And Ply Position | Major | Physical | Each Belt | Each Belt | Mfr. Standard | Production Log Sheet/Internal Record√ | √ | P | V | V | |
| 2.4 | Moulding (Curing) | A)Curing Temperature<br>B)Curing Time<br>C) Hydraulic Pressure<br>C) Cured Belt Width, Length And Thickness | Major | Physical | Each Belt | Each Belt | Mfr. Standard | Production Log Sheet/ Internal Record | √ | P | V | V | |
| 2.5 | Dressing & Sizing | A)Finish<br>B)Edge (Mould Cut) | Major | Visual | 100% | 100% | Approved Drg/Ds/ Tech. Specs | Production Log sheet/ Internal Record | | P | V | - | |
| 2.6 | Cured Belt Inspection | Mapping Of Surface Defects Their Type And Repairs | Major | Visual | Each Belt | Each Belt | IS:1891/ Specification | Production Log sheet/ Internal Record | √ | P | V | V | Refer Not-01 |
| **3.0** | **Final Inspection** | | | | | | | | | | | | |
| 3.1 | Dimensional and Visual | A) Visual Exam For Surface Finish<br>B) Mapping Of Surface Defects Their Type And Repairs<br>C)Length<br>D)Edge (Mould/Cut) | Critical | Physical | 100%<br>100%<br>100%<br>100%<br>Random | Sample As Per Is:1891-1 | Approved Drg/DS/ Tech. Specs. | IR | √ | P | W | W | Refer Note-01 & 02 & 05 |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | E) Width<br><br>F) Shore Hardness<br><br>G) Thickness Of Full Belt<br><br>H) No. Of Plies<br><br>I)Top & Bottom Cover Thickness | | | Location In Each Roll Random Spots In Each Roll<br><br>Each Roll<br><br>Each Roll | | | | | | | | |
| 3.2 | Tensile Strength Of Full Belt Thickness | A) Breaking Strength (Warp & Weft)<br>B) Elongation At Ref. Load (Warp)<br>C)Elongation At Break (Warp) | Critical | Physical | Each Roll | Sample As Per Is:1891-I | IS:1891 Part-I / Specification/ Approved Data Sheet | Laboratory Test Report | √ | P | W | W | |
| 3.3 | Adhesion | A) Top Cover To Ply<br>B )Ply To Ply<br>C)Ply To Bottom Cover | Critical | Physical | Each Roll | Sample As Per Is:1891-I | IS:1891 Part-I / Specification / Approved Data Sheet | Laboratory Test Report | √ | P | W | W | |
| 3.4 | Troughability | Troughability | Critical | Physical | Each Roll | Sample As Per Is:1891-I | IS:1891 Part-I | Laboratory Test Report | √ | P | W | W | Refer Note -02 |
| 3.5 | Cover Rubber Properties | A) Cover Tensile Strength (Before & After Ageing)<br>B) Elongationa At Break (Before & After Ageing), thickness | Critical | Physical | Each Roll | Sample As Per Is:1891-I | IS:1891 (Part-I & V) / Specification / Approved Data Sheet | Laboratory Test Report | √ | P | W | W | |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | C)Angular Tear Strength | Critical | Physical | Each Roll | Sample As Per Is:1891-I | ASTM D 624 Type-C / Specification/ Approved Data Sheet | | √ | P | W | W | |
| | | D)Abrasion Loss | Critical | Physical | Each Roll | Sample As Per Is:1891-I | Din:53516 / Specification/ Approved Data Sheet | Laboratory Test Report | √ | P | W | W | |
| 3.6 | Fire Resistivity Test | A) Drum Friction Test | Critical | Physical | Each Roll | Sample As Per Is:1891-I | CAN/CSA/M422-M87 Type C | Laboratory Test Report | √ | P | W | W | |
| | | B) Flame Test | Critical | Physical | Each Roll | Sample As Per Is:1891-I | ISO 340 | Laboratory Test Report | √ | P | W | W | |
| | | C)Electrical Surface Resistance Test | Critical | Physical | Each Roll | Sample As Per Is:1891-I | CAN/CSA /M422-M87 Type C | Laboratory Test Report | √ | P | W | W | |
| 4.0 | Identification & Marking | Belt number, manufacture's name, logo, belt ratting, grade, fabric type, and year of manufacture etc. shall be embossed by the manufacture on every valcanized length of belt or as per PO condition. Belts nos. Offered for inspection & belt nos. From which samples are drawn for testing shall be indicated in the CHP. Accepted belt nos. Shall be identified with signature and date using permanent marker as well as hard punch in white paint. The identification marks shall be preserved by the manufacturer. | | | | | | | | | | | |
| 5.0 | Dispatch | Packing And Marking | Major | Visual | Each Roll | Each Roll | Mfr. Standard Specs. | Finished Product Department Record | | P | V | - | |

NOTE-01: Defectogram shall be prepared by the belt manufacturer and shall be submitted for verification by NTPC representative/Inspection Engineer during Final Inspection. Following repair norms shall be applicable –

i) Patch repair: Localized rectification of surface blemishes/defect in cured belt by using rubber compound similar to the mother compound up to top carcass may be done followed by local vulcanization.

ii) Buffing/dough: Entrapment of foreign matters may be buffed. Depth of buffing should not exceed the difference in thickness of the rubber (as measured in test sample for the purpose of acceptance of cover rubber thickness) and the specified minimum cover thickness. Where the indentation depth is more, the same may be filled with rubber compound followed by vulcanization locally. The repairs of size up to and including (25X25 mm) (625 sq mm) shall not be considered as patch repair.

iii) a) Maximum number of repairs as per (i) as indicated above shall be limited to 5 per 100 sq . meters of belt area (rounded up to higher unit).

b) Total number of repairs as per (i) and (ii) indicated above shall not exceed more than 10 per 100 sq. meter of belt.

c) In case of patch repair as indicated in i above, the maximum size/area of each repair shall be limited to 1/5 W x1/5 W, with one-dimension Max, 1/5W, where 'W' is width of the belt.
Note-02: Sample shall be taken randomly from anywhere of belt roll/length offered for inspection. Belt to be supplied in 02 pieces and the lengths shall be indicated on packing drum.
Note-03: Latest edition of all the standards mentioned in the quality plan is to be used.
Note- 04 : Two Copies of MTC (material test certificate ) and IR (Inspection report ) to be submitted in hard form or soft form.
Note-05: Visual Inspection (including random check of belt width, hardness and total belt thickness) on both sides shall be done on the complete belts from which sample shall be taken as per IS-1891 part-I.

**3.11.4 FABRICATED GEAR CASE:**

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| **1.0** | **Raw Material inspection** | | | | | | | | | | | | |
| A1 | | Chemical Composition | Critical | Check Test | 1 per heat | 1 Per Heat | Relevant Material Specification as per Approved Drawing / DS. | TC | √ | P | V | V | |
| A2 | | Mechanical Properties | Critical | Tensile Test | 1 per heat | 1 Per Heat | Relevant Material Specification as per Approved Drawing / DS. | TC | √ | P | V | V | |
| A3 | | Internal Defect | Major | UT | 100% | 100% | ASTM-A-435 | TC | √ | P | V | V | For Thickness >= 20 MM |
| **II** | **Pinions, Wheels & Shafts** | | | | | | | | | | | | |
| **(A)** | **Raw Material (as per drawing)** | | | | | | | | | | | | |
| A1 | (Forgings & Round Bars of Carbon Steel / Alloy Steel) | Surface Condition | Major | Visual | 100% | 100% | Drawing/Relevant Standard | I.R./TC | √ | P | V | V | |
| A2 | | Internal Defect | Critical | Ultrasonic | 100% | 100% | Relevant Standard | I.R./TC | √ | P | V | V | |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A3 | | Chemical Composition | Critical | Check testing | 1/heat | 1/heat | Relevant Material Specification as per Approved Drawing / DS. | TC | √ | P | V | V | |
| A4 | | Mechanical Properties | Critical | Tensile test | 1/heat | 1/heat | Relevant Material Specification as per Approved Drawing / DS. | TC | √ | P | V | V | |
| A5 | | Microstructure | Critical | Visual under microscope | 1/heat | 1/heat | Relevant Material Specification as per Approved Drawing / DS. | TC | √ | P | V | V | |
| | **In Process Inspection** | | | | | | | | | | | | |
| **III.A** | | | | | | | | | | | | | |
| 1) | Gear Casing (Fabricated) | WPS/PQR/WPQ | Major | Verification | 100% | 100% | ASME Sec-IX | WPS/PQR/ WPQ | √ | P | V | V | Refer Not-05 |
| 2) | | Stress Relieving | Major | Visual | 100% | 100% | Mfr. S.R. Procedure | H.T. Chart | √ | P | V | V | |
| 3) | | Surface Defect (Welding) | Major | DP Test on Weld | 100% | 100% | ASTM E 165 / No Linear Indication | IR | √ | P | V | V | |
| **III.B** | | | | | | | | | | | | | |
| 1) | Pinion and Gear (After Machining & Case Hardening ) | Case Depth | Major | Measurement | 1/HT Batch | 1/HT Batch | Mfr. Standard | IR | √ | P | V | V | |
| 2) | | Hardness | Major | Measurement | 1/HT Batch | 1/HT Batch | NTPC Approved Drawing / DS | IR | √ | P | V | V | |
| 3) | | Surface Defect | Major | DP Test | 100% | 100% | ASTM E 165 / No linear Indication | IR | √ | P | V | V | |
| 4) | | Dimension | Major | Measurement | 100% | - | Mfr. Drawing | IR | | P | - | - | |
| **III.C** | | | | | | | | | | | | | |
| 1) | Input and Out Put Shaft after Machining | Dimension | Major | Measurement | 100% | - | Mfr. Standard | IR | √ | P | -- | - | |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2) | | Surface Defect | Major | DP Test | 100% | 100% | ASTM E 165 / No linear Indication | IR | √ | P | V | V | |
| 3) | | Hardness | Major | Measurement | 1/HT Batch | 1/HT Batch | NTPC Approved Drawing / DS | IR | √ | P | V | V | |
| **IV** | **Final Inspection of assembled gear box** | | | | | | | | | | | | |
| 1) | | Arrangement Verification | Major | Visual | 100% | 10% | Approved Drawing. | IR | √ | P | W | W | |
| 2) | | Overall Dimensions & Completeness | Major | Measurement | 100% | 10% | Approved Drawing. | IR | √ | P | W | W | |
| 3) | | Backlash | Critical | Measurement | 100% | 10% | Mfr. Standard / Approved Drawing | IR/TC | √ | P | W | W | |
| 4) | | Contact Pattern | Critical | Blue matching | 100% | 10% | Mfr. Standard / Approved Drawing | IR/TC | √ | P | W | W | |
| **II** | **No-Load Running Trial Test** | | | | | | | | | | | | |
| 1) | | Reduction Ratio | Critical | Visual/ Measurement | 100% | 10% | Approved Drawing / Datasheet | IR | √ | P | W V | W | |
| 2) | | Oil Leakage | Critical | Visual | 100% | 10% | Relevant Standard / No Leakage | IR | √ | P | W V | W | |
| 3) | | Temp rise of Oil | Critical | Measurement | 100% | 10% | Relevant / Standard | IR | √ | P | W V | W | |
| 4) | | Noise Level | Critical | Measurement | 100% | 10% | Max 85 DBA at 1 Mtr in horizontal direction and 1.5 M in elevation. | IR | √ | P | W | W | |

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| 5) | | Vibration | Critical | Measurement | 100% | 10% | ISO 10816 / 5mm/sec RMS MAX (Group B based on the class) | IR | √ | P | W | W | |
| **II)** | **Painting, packing & identification** | | | | | | | | | | | | |
| 1) | | Uniformity of Coating & Finishing, DFT Measurement | Major | Visual | 100% | 100% | As per Approved Data Sheet. | IR | √ | P | V | V | |
| **3.11.5** | **IN LINE MAGNETIC SEPARATOR** | | | | | | | | | | | | |
| **1.0** | **Raw Material inspection** | | | | | | | | | | | | |
| 1.1 | Top & Side plates | Visual/ dimensional/ Chemical | Minor | Visual/ physical measurement | 100% | 100% | 100% | G.A. Drg/ Approved Drawing | MTC | √ | P | V | V | |
| 1.2 | Nonmagnetic Sheet (S.S) | Visual/ Dimensional /Chemical | Minor | Visual/ physical/ chemical | 100% | 100% | 100% | G.A. Drg/ Approved Drawing | MTC | √ | P | V | V | |
| 1.3 | Coil material – Anodized Annealed Aluminum strips | MTC | Critical | MTC | 100% | 100% | 100% | Relevant Standard/ Specification. Approved Drawing | MTC | √ | P | V | V | |
| 1.4 | Switch gear/Geared Motor, Belting Pulley, Rectifier Transformer | Visual/Electrical/Type/Rating Verify/ Continuity Check | Major | Visual | 100% | 100% | 100% | G.A. Drg/ App. B.O.M | IR | √ | P | V | V | |
| 1.5 | In Process Fabrication Marking, Cutting, Drill | Workmanship, Dimensions & DP Test of Welding leakage test on tank | Major | Visual/ physical measurement | 100% | 100% | 100% | G.A. Drg/ Approved Drawing | IR | √ | P | V | V | |
| 1.6 | Silicon Oil | Electrical & Chemical | Major | Visual, Measure | 1/Lot | 1/Lot | 1/Lot | G.A. Drg/Relevant Std./ Approved Drawing | IR | √ | P | V | V | |
| **2.0** | **In process inspection** | | | | | | | | | | | | | |
| 2.1 | Magnet housing fabricator | Visual/ dimensional | Major | Visual/ physical measurement | 100% | 100% | 100% | App.G.A. Drg | ITC | √ | P | V | V | Degree of protection (DOP) certificate to verification shall be produced. |

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| 2.2 | Control Panel manufacturing | BOM/make ferruling/wire size/terminal/ marking interlock/ functional Check/H.V. Test /Insulation Resistance Test/Painting shade thickness | Major | Visual/ dimensional / electrical/ Megger test/HV test | 100% | 100% | 100% | App.G.A. Drg | ITC | √ | P | W | W | |
| **3.0** | **Final Inspection** | | | | | | | | | | | | | |
| 3.1 | In Line Magnetic Separator (Electric Magnetic Type) | Visual/ Dimensional/ operational check with control panel | Critical | Visual physical measurement/HV test & Insulation Resistance test current & voltage measurement/Temp rise test, load test in hot & cold condition, force index, calculation at hot steady state, Noise level. | 100% | 100% | 100% | App.G.A. Drg | ITC | √ | P | W | W | |
| 3.2 | Random lifting of tramp iron pieces as per App. Drg & Lifting force | performance | Major | Functional | 100% | 100% | 100% | App.G.A. Drg | ITC | √ | P | W | W | |
| 3.3 | Gauss Valve | Electrical | Major | Gauss valve | 100% | 100% | 100% | App.G.A. Drg | ITC | √ | P | W | W | |

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| 3.4 | Painting | Painting shade/DFT | Major | Visual/ Thickness of paint | 100% | 100% | 100% | As per Approved Painting Specs. | ITC | √ | P | V | V | |

Note**:**
1. Statutory requirement will be complied.
2. Instruments used for test shall have valid calibration certificate with tractability to national level.
3. Bought out items shall be from approved vendor by Customer.
4. All inspection/verification/NDT report along with material certificate shall be reviewed at the time of witness point.
5. W at customer column shall be considered as hold point/Witness.

**3.11.10 TOOTHED RING HAMMERS**

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| **1.0** | **Raw Material Inspection** | | | | | | | | | | | | |
| 1.1 | Casting Hammers and Test bar Elements of C, Si, Mn, P, S, Cr | Chemical Properties | Major | Chemical analysis | One Sample/Heat | As per Approved Drawing & IS 276 Grade 3/ Clause 8, Table-1 | MTC | √ | P | V | V | |
| **2.0** | **In Process Inspection** | | | | | | | | | | | | |
| 2.1 | Heat treatment | Mechanical | Major | Heat Treatment | 100% | As Per IS 276 Grade 3 | HT Chart | √ | P | V | V | |
| 2.2 | Brinells Hardness Test | Mechanical | Major | Harness check Physical | Min 10% Heat & HT Batch | As Per IS 276 Grade 3 | TC | √ | P | V | V | Max Hardness HB 229 BHN Class II |
| 2.3 | Bend Test | Mechanical | Major | Mechanical Test Physical | IS 6907 | As Per IS 276 Grade 3/ Clause 14.3 | TC | √ | P | V | V | |
| 2.4 | Liquid penetrant Test | Mechanical | Major | NDE | Min 10% of offer Qty | IS 3658/ IS 11732 | TC | √ | P | - | V | |
| **3.0** | **Final Inspection** | | | | | | | | | | | | |
| 3.1 | Finished Hammer for Coal Crushers | Surface Defects, Marking and Dimensional (OD, ID, Height, Width, | Major | Measurement | 100% / Random 5% | As per Approved Drawing | IR | √ | P | W | W | See Note 1&2 |

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| | | Thickness, Edge Preparation) | | | | | | | | | | |
| 3.2 | | Chemical Composition | Major | Chemical Analysis | One Sample/Heat | Approved Drawing/DS / IS 276 Grade 3, Clause 8, Table-1 | IR | √ | P | W | W | Testing with PMI |
| 3.3 | | Bend Test on Test bar | Critical | Bend Test | One Sample/Heat | Approved drawing/datasheet | IR | √ | P | W | W | Max Hardness HB229BHR: and see Note 2 & 3 |
| 3.4 | | Hardness | Major | Mechanical | Random 10% of offer Qty/<br>1 per Heat per Batch | Approved drawing/datasheet | IR | √ | P | W | W | Approximate weighment of each hammer 39.5 kg Tolerance +/-0.50kg |
| 3.5 | | Weight | Critical | Measurement | 100% offer Qty / Random 5% offer Qty | As per Approved Drawing/Data Sheet | IR | √ | P | W | W | |
| 3.6 | | Drop Test | Major | Mechanical | Random 1% offer Qty | See Note 4 | IR | | P | W | W | |
| 3.7 | Finished Hammer for Coal Crushers | Painting | Major | Visual | 100% | IS 276 Clause 18 | IR | √ | P | W | W | Painting with Red oxide and weighment marking on each hammer with yellow paint |

Note:-

1. Casting should be properly fitted and dressed before inspection. Risers/Runners shall not be removed by gas cutting. Surface cracks and pitting visible to naked eyes, are not acceptable.
2. Dimensions and weights shall be as per approved drawing/data sheet/technical specifications with a max. Variation of +/-1mm in dimensions and +/-0.5 Kgs in Weights.
3. Weight of hammer casting should be punched on each casting and embossing of plant name, Heat batch number and firm name.
4. Drop test: The hammer casting shall be keep with its axis in horizontal position, over a steel plate. A dead weight of not less than 100Kgs shall be dropped on the casting, from not less than 03 Mtrs height. Any crack or chip off is not acceptable. Further any significant variation in dimensions after drop test is not acceptable. In case of failure of the first sample, two more samples, for each failed sample, from the same lot, shall be subjected to the drop test. In case of failure in retest, the entire lot shall be rejected and hammer castings used in drop test are not to be supplied and are to be destroyed in presence of purchaser.
5. Hardness shall be measured by digital hardness tester.
6. Weld repair on the hammer castings is not acceptable.
7. Manufacturer shall ensure proper surface protection on the castings, prior to dispatch.

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| **3.11.11 VIBRATING FEEDERS** | | | | | | | | | | | | | | |
| **1.0** | **Raw Material Inspection** | | | | | | | | | | | | | |
| 1.1 | Plates for Feeder/Screen body | Chemical & Mechanical Properties | Major | MTC | 1/Heat | 1/Heat | 1/Heat | Approved Drawings/ Relevant STD | Mill TC | √ | P | V | V | |
| | | NDE (UT) for plate material soundness for 40mm thickness and above. | Major | Testing | 100% | 100% | 100% | ASTM A 435 | NDE Report | √ | P | V | V | |
| 1.2 | Stiffness Angles/Flat/Channel /Rectangular Section/Pipe Beams/Exciter Shaft | Chemical & Mechanical Properties | Major | MTC | 1/Heat | 1/Heat | 1/Heat | Approved Drawings/Relevant STD | Mill TC | √ | P | V | V | |
| 1.3 | Liner Plates | Chemical & Mechanical Properties | Major | MTC | 100% | 100% | 100% | Approved Drawing/ Relevant Standard | MTC | √ | P | V | V | |
| 2.0 | **Bought Out Items** | | | | | | | | | | | | | |
| 2.1 | Bearings | Visual, Identification & Review of warranty certificate | Major | Warranty Cert. | 100% | 100% | 100% | Tech. Specification | Warranty Certificate | √ | P | V | V | Bearings shall be procured from origina manufacturer |
| 2.2. | Coil spring | Visual, Dimensions & Review of MTC | Major | MTC | 100% | 100% | 100% | Approved Drawings/ Tech. Specification | MTC | √ | P | V | V | |
| 2.3 | Fasteners of vibrating Parts | Chemical & Mechanical Properties, Visual and Grade | Major | Visual, Measurement & Verification | Random | Random | Random | Tech. Specification/ Mfg Drgs | MTC | √ | P | V | V | |

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| 3.0 | WELDING CONTROL | | | | | | | | | | | | | |
| 3.1 | Procedure & performance Qualification | Review of established WPS, PQR & WPQ | Major | Verification | 100% | 100% | 100% | ASME Sec-IX | WPS, PQR & WPQ | √ | P | V | V | |
| 3.2 | Welding electrodes | Baking & Holding of electrodes for low hydrogen electrodes (if applicable) | Major | Visual & Measurement | 100% | 100% | 100% | Mfg .Recommendation /Standard Procedure | Register | | P | V | V | |
| 4.0 | In Process Inspection | | | | | | | | | | | | | |
| 4.1 | Material Preparation | Edge preparation (Bevel angle and Root face) | Major | Visual & Measurement | 100% | 100% | 100% | As per /Drawings | I/R | √ | P | V | V | Verification at Final Inspection |
| | Weld Joints | Fitment and alignment (Root gap & bevel angle) | Major | Visual & Measurement | 100% | 100% | 100% | As per /Drawings | I/R | √ | P | V | V | Verification at Final Inspection |
| 4.2 | Weld soundness | NDE for filler welds | Major | DPT | 10% | 10% | 10% | ASME Sec-VIII Div-1 app.8/ASTM SE 165 | NDE Report | √ | P | V | V | |
| **5.0** | **Final Inspection** | | | | | | | | | | | | | |
| 5.1 | Sub assembly of Feeder/Screen other accessories | Completeness & Dimensions | Major | Visual & Measurement | 100% | 100% | 100% | Approved Drawings/ Tech. Specifications | IR | √ | P | W | W | |
| 5.2 | UB Motor Exciter Assembly | Completeness & Dimensions of final assembly, Motor Data (Resistance Value, HV Test & Reduce voltage) | Major | RTC | 100% | 100% | 100% | Manufacturing Drawing/ Tech. Specification | RTC | √ | P | W | W | |

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| 5.3 | Final Assembly | Completeness & Dimensions of final assembly, no load running test speed (RPM), amplitude (stroke), Temperature rise & Noise Level | Major | Visual & Measurement | 100% | 100% | 100% | Mfg. Drawing & Standard Procedures | IR | √ | P | W | W | No Load running test shall be conducted for 4-hours at available test bed in works. Amplitude of vibration, Bearing temperature rise and Noise Level is measured. Vibration will be recorded in vibograph , Noise Level shall be 85 dBA at 1.0m in horizontal and 1.5m in vertical. |
| 5.4 | Surface preparation & Painting | Roughness | Major | Visual & Measurement | 100% | Random | Random | Approved Drawing/ Painting Specification | IR | √ | P | V | V | |
| | | Visual, Shade, DFT | Major | Visual & Measurement | 100% | Random | Random | Approved Drawing/ Painting Specification | | √ | P | W | W | |
| 5.5 | Final Documentation | Complete Inspection Documents | Major | Verification | 100% | 100% | 100% | AS per approved MQP | IR | √ | P | V | V | |
| Note: No load test procedure shall be tied up during QAP Approval. | | | | | | | | | | | | | | |
| **3.11.12 VIBRATION ISOLATION SYSTEM** | | | | | | | | | | | | | | |
| **1.0** | **Raw Material Inspection** | | | | | | | | | | | | | |
| 1.1 | For Boxes | Chemical / Mechanical | Minor | Verify | One / Heat | | | IS 2062/Approved Diagram/ Approved Specification | MTC | √ | V | V | V | |
| 1.2 | For Springs | ) Chemical | Major | Verify | One / Lot | | | IS 2062/Approved Diagram/ Approved Specification | MTC | √ | V | V | V | |

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| | | ) Grain Size | Major | Verify | One / Lot | ASTM E 112/Approved Specification | MTC | √ | V | V | V | |
| | | ) Micro Structure | Major | Verify | One / Lot | Tempered Martensite / Approved Specification | MTC | √ | V | V | V | |
| 1.3 | Springs at Manufacturer's end | Hardness | Major | Test | One / Lot | IS 1500 / 415-460 BHN | MTC | √ | V | V | V | |
| 1.4 | Springs at Manufacturer's end | Decarburization | Major | Test | One / Lot | IS 6396 / Max. depth 0.5% bar dia – partial | MTC | √ | V | V | V | |
| 1.5 | Springs at Manufacturer's end | NDE after ompression | Major | MPI | 100% | IS 3703 / No cracks | MTC | √ | V | V | V | |
| 1.6 | Adhesive pads (jute) 4mm thick, Steel shims | Dimensions (mm) | Minor | Measurem ent/ Visual | 5% | Approved Drawing | Internal Record | √ | P | V | V | |
| 1.7 | Studs & Nuts | Chemical/ Mechanical | Minor | Verify | One / Lot | Approved Specification | Lab Test Report | √ | V | V | V | |
| | | Dimensions | Minor | Measurem ent | 5% | Approved Specification | Internal Record | √ | P | V | V | |
| 2.0 | In Process Inspection | | | | | | | | | | | |
| 2.1 | Welding | Visual/Surface exam (mm) | Major | Visual/ Measurem ent | 10% on welds | Approved Drawing/Data Sheet | Certificate | √ | P | V | V | |
| | | NDE | Major | DPT | 10% Random | ASTM/E 165 | Certificate | √ | P | V | V | |
| 2.2 | Boxes | Dimensions (mm) | Major | Measurem ent | 10% | Drawing/Data sheet | Internal Record | √ | P | V | V | |
| 3.0 | Final Inspection | | | | | | | | | | | |
| 3.1 | Shot Blasting | Picture | Major | Compare | 10% | Approved Drawing/Data Sheet | IR | √ | P | V | V | |
| 3.2 | Painting | Thickness (180 microns) | Major | Measurem ent/ Visual | 10% | Approved Drawing/Data Sheet | IR | √ | P | V | W | |

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| 3.3 | Spring Unit | Dimensions (Except HF&HV) | Minor | Measurement | 10% | | | Approved Drawing/Data Sheet | Internal Record | √ | P | W | W | |
| 3.4 | Constant of Spring Units (Vertical Kv) | Load Vs Displacement (kN/mm) | Critical | Test | 10% | | | Approved Drawing/Data Sheet | Certificate | √ | P | W | W | |
| 3.5 | Document Control | Verification of above documents (TC/IR) | Major | Compare | All | | | Approved MQP | Certificate | √ | P | V | W | |
| 3.6 | Packing / Marking | visual | Major | Visual/ Compare | 100% | | | Approved Specification | IR | √ | P | | V | |
| **3.11.13 PULLEY** | | | | | | | | | | | | | | |
| 1.0 | **Raw Material & Bought out Inspection** | | | | | | | | | | | | | |
| 1.1 | Shell Plate(MS) | Chemical, Mechanical, Physical | Major | Chemical Mechanical | 1/ Heat | 1/ Heat | 1/ Heat | Approved drawing | Mill TC/Lab TC | √ | P | V | V | UT fore plate above 25mm thickness |
| | | Ultrasonic test* | | NDT | 100% | 100% | 100% | ASTM A435 | UT Report | √ | P | V | V | |
| 1.2 | SS Plate for Non-magnetic pulley | Chemical, Mechanical | Major | Chemical Mechanical | 1/ Heat | 1/ Heat | 1/ Heat | Approved drawing | Mill TC/Lab TC | √ | P | V | V | |
| 1.3 | Shaft(forged) | Chemical, Mechanical, Physical, Heat Treatment, Microstructure & Hardness | Major | Chemical Mechanical HT | 1/ Heat | 1/ Heat | 1/ Heat | Approved drawing | Mill TC/Lab TC | √ | P | V | V | UT Applicable on above 40mm Dia shaf |
| | | Ultrasonic test* | | NDT | 100% | 100% | 100% | ASTM A 388 | UT Report | √ | P | V | V | |
| 1.4 | Hub | Chemical, Mechanical | Major | Chemical Mechanical | 1/Heat | 1/Heat | 1/Heat | Approved drawing | Mill TC/Lab TC | √ | P | V | V | UT Applicable on above 40mm Dia hub |
| | | Ultrasonic test* | | NDT | 100% | 100% | 100% | ASTM A 388 | UT Report | √ | P | V | V | |

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| 1.5 | SS Plate for Non-magnetic Pulley | Chemical, Mechanical | Major | Chemical Mechanical | 1/Heat | 1/Heat | 1/Heat | Approved drawing | Mill TC/Lab TC | √ | P | V | V | |
| 1.6 | Diaphragm | Chemical, Mechanical, Physical | Major | Chemical Mechanical | 1/Heat | 1/Heat | 1/Heat | Approved drawing | Mill TC/Lab TC | √ | P | V | V | UT fore plate above 25mm thickness |
| | | Ultrasonic test* | | NDT | 100% | 100% | 100% | ASTM A435 | UT Report | √ | P | V | V | |
| 1.7 | Rib Plate | Chemical, Mechanical | Major | Chemical Mechanical | 1/Heat | 1/Heat | 1/Heat | Approved drawing | TC/GC | √ | P | V | V | |
| 1.8 | Plummer Block & Bearing | Verification of make & Number | Major | Visual | Random | Random | | Approved drawing | TC | √ | P | V | V | |
| 2.0 | **In process Inspection** | | | | | | | | | | | | | |
| 2.1 | Fitup & Welding of shell plate & Diaphragm Plate | Mismatch/ Dimension /Weld Defects | Major | Visual & Measurement | 100% | 100% | 100% | Approved drawing | IR | √ | P | V | V | |
| 2.2 | NDT | (*)Pulley Shell L-seam | Major | RT/UT&MPI | 100% | 10% from each offered lot | | ASME SEC – V / ASME Sec VIII DIV.1 | NDT Report | √ | P | W | V | 10% Witness & 100% verification |
| | | Full penetration weld (End Disc to shell) | | UT&DPT | 100% | 10% from each offered lot | | ASME SEC – V / ASME Sec VIII DIV.1 | NDT Report | √ | P | W | V | |
| | | Filler weld (End Disc to Hub) | | DPT/MPI | 100% | 10% from each offered lot | | ASME SEC – V / ASME Sec VIII DIV.1 | NDT Report | √ | P | W | V | |
| 2.3 | Machining of Pulley Shaft | Measurement | Major | Dimension & run out | 100% | 100% | 100% | Approved drawing | IR | √ | P | W | V | |
| | | DPT on machined Shaft | Major | NDT | 100% | 100% | 100% | ASME SEC – V / ASME Sec VIII DIV.1 | DPT Report | √ | P | V | V | |

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| **3.0** | **Final Inspection** | | | | | | | | | | | | | |
| 3.1 | Visual, Dimensional, Out of roundness, Eccentricity & Static balancing before rubber lagging,Tensile,Elongation,Peel Off | Accuracy/appearance & conformity to the approved Drg. | Major | Visual, Measurement | 100% | 10% from each offered lot | | Approved Drg, Spec & IS: 8531 | IR | √ | P | W | V | |
| 3.2 | Rubber Lagging | Visual, Thickness, Shore hardness, Spark Test, Strength, EI & Abrasion loss, adhesion strength, specific gravity | Major | Visual, Measurement | 100% | 10% from each offered lot | | Approved drawing | IR | √ | P | W | V | |
| | | Ash content | Major | Test | 100% | 10% | 10% | Approved drawing / 12% Max | IR | √ | P | W | V | |
| 3.3 | Static balancing after lagging | Accuracy/appearance & conformity to the approved Drg. | Major | Measurement | 100% | 10% from each offered lot | | Approved Drg, Spec & IS: 8531 | IR | √ | P | W | V | |
| 3.4 | Painting | Surface preparation, Painting thickness & Shade | Major | Measurement | 100% | Random | | AS per painting specification | IR | √ | P | V | V | |
| 3.5 | QA documentation Marking, Packing | Checking of all QA point | Major | Visual | 100% | - | - | Approved Diagram | IR | √ | P | V | V | |
| 3.6 | Visual, Dimensional, Out of roundness, | Accuracy/appearance & conformity to the approved Drg. | Major | Visual, Measurement | 100% | 10% from each offered lot | | Approved Drg, Spec & IS: 8531 | IR | √ | P | V | V | |

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| | Eccentricity & Static balancing before rubber lagging. | | | | | | | | | | | | |
| 3.7 | Rubber Lagging | Visual, Thickness, Shore hardness, Spark Test, Strength, EI & Abrasion loss, adhesion strength, specific gravity | Major | Visual, Measurement | 100% | 10% from each offered lot | | Approved drawing | IR | √ | P | V | V | |
| | | Ash content | Major | Test | 100% | 10% | 10% | Approved drawing / 12% Max | IR | √ | P | V | V | |
| 3.8 | Static balancing after lagging | Accuracy/appearance & conformity to the approved Drg. | Major | Measurement | 100% | 10% from each offered lot | | Approved Drg, Spec & IS: 8531 | IR | √ | P | V | V | |
| 3.9 | Painting | Surface preparation, Painting thickness & Shade | Major | Measurement | 100% | Random | | AS per painting specification | IR | √ | P | V | V | |
| 3.10 | QA documentation Marking, Packing | Checking of all QA point | Major | Visual | 100% | - | - | Approved Diagram | IR | √ | P | V | V | |

| Sl. No | Component & operations | Characteristics | Class | Type of check | Quantum Of check | | Reference document | Acceptance norms | Format of record | | Agency | | | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | M | C/N | | | | | M | C | N | |
| 1. | 2. | 3. | 4. | 5. | 6. | | 7. | 8. | 9. | D* | ** 10 | | | 11. |

| ITEM /EQUIPMENT:<br>**BOILER STRUCTURE:- CEILING GIRDERS, COLUMNS, HORIZONTAL & BUILT-UP BEAMS**<br>SUB-SYSTEM : SG | |
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| 1.0 | Raw Material : The material of construction.shall be as per drawing/approved data sheet. Raw Material to be sourced from OWNER agreed subvendors. | | | | | | | | | | | | |
| 1.1 | Plates & Rolled sections<br>**Plates of IS 2062 E 250 Gr BR & E350 Gr BO shall be**:<br>i. Fully killed and impact tested<br>ii. Plates of thickness lesser than and including 12mm- as -rolled.<br>iii. Plates of thickness beyond 12 mm to and including 40 mm- Normalizing Rolling<br>iv. Plates of thickness greater than 40 mm- Furnace normalized<br>In addition, for plates of t > 40 mm: Vacuum degassing shall be done. | Chemical and Mechanical Properties | Critical | T.C.Verification | 100% | 100% | As per Material Specification / Drg. | Mfg TC | √ | P | V | V* | Raw.matl. correlated to TC on receipt. Further correlation to W.O. number & Material Grade. *Verification of Material TC by OWNER for plates t >40 mm. TC Verification not required for rolled products like angles, channels etc. **(* Refer to Note-4)** |
| | | Soundness (UT***) | Critical | T.C.Verification | 100% | 100% | ASTM A578 Level B-S2 | Mfg TC | √ | P | V | V | *** For plates of t >40 mm only. |

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| 2.0 | **Inprocess Controls : Refer QCP:002/ Rev. 04** | | | | | | | | | | | | |
| 2.1 | Preparation | | | | | | | | | | | | |
| 2.1.1 | Edge preparation (Shop welds) | NDE | Minor | LPI/MPI | 100%* | -- | As per Material Specification / Drg/ASME/ AWS D1.1 | R | - | P | V | | * Flame cut edges shall be ground before welding. & Note-2 |
| 2.1.2 | Edge preparation (Site welds) | NDE | Minor | LPI/MPI | 100%$ | 100% / 10% | Drg/ASME/, AWS D1.1 | R | √ | P | V | V | $ For t ≥32 mm |
| 2.1.3 | Edge preparation for Ceiling Girders (Site welds) | NDE | Major | UT | ** | ** | ASTM A 435 & AWS | R | | P | V | V | ** for a width of 100mm from the edge, before edge preparation |
| 2.2 | Welding | Welding & Procedure Qualification | Major | Review of Documents | 100% | 100% | AWS D 1.1 & SIP:NP:07 | PQR/ WPS | | P | V | V | |
| | | Personnel Qualification | Major | Review of Documents | 100% | 100% | AWS D 1.1 & SIP:NP:07 | R | | P | V | V | |
| 2.3 | Fit up | Dimension | Major | Measurement | 100% | 100% | AWS | R | | P | W | | |
| 2.4 | Pre-heat | Measurement | Major | Measurement | 100% | 100% | WPS | R | | P | V | | |
| 2.3.1 | Butt welds | Refer Note-1 | | | | | | | | | | | |

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2.3.1.1 | Back gouged weld grooves | Surface check | Min or | LPI | 100% | 100/ 10% | Drg/ASME/ AWS | R | | P | W | V | | |
| 2.3.1.2 | Finished butt welds | | | | | | | | | | | | | |
| i | Thickness ≥ 32mm | Weld quality | Maj | RT/ UT | 100% | 100% | Drg/ASME/ AWS | R | √ | P | W | V* | *Review of films for RT. | |
| ii | Thickness from 25 up to <32mm | Weld quality | Maj | RT<br>MPI | 10%#<br>100% | 10%<br>100% / 10% | Drg/ASME/ AWS | R<br>R | √ | P<br>P | W<br>W | V<br>W | # 10% of Joints per PGMA per Vendor.<br>Review of films for RT | |
| iii | Thickness below 25mm | Weld quality | Maj | MPI/LPI | 100% | 10% | Drg/ASME/ AWS | R | √ | P | W | W | | |
| 2.3.1.3 | Production test coupons for Columns & ceiling girders | Weld soundness | Maj | RT & Mech | ** | ** | Drg/ASME/ AWS | R | | P | W | W | | |
| | For Butt Welds ** | ** Quantum of check: 1. For '+' and 'H' columns, one test plate per column (Main columns).<br>2. For Ceiling girder: One test plate per Ceiling Girder for each Sub contractor/ vendor.<br>3. For other Main columns: One test plate for each Sub contractor/ vendor. | | | | | | | √ | | | | ** Only for Main Columns & Ceiling Girders. | |
| 2.3.2 | For Fillet welds | | | | | | | | | | | | | |
| 2.3.2.1 | Production Test coupons for "+"and "H " Columns (Main columns) & ceiling girders | Weld fusion | Maj | Macroetch | $$ | $$ | AWS D1.1, ASTM E 340/CIP:033 | R | | P | W | W | | |
| | | $$ Quantum of check: In case of Main columns, TWO Macros for each "+" and "H" columns out of which the first macro from the first column piece and the second from the last column piece welded – as manufactured. | | | | | | | | | | | | |
| 2.3.2.2 | Groove & Fillet Welds quality | NDE | Maj | LPI / MPI | 100 | 100/ 10% | Drg/ASME/ AWS | R | √ | P | W | W | | |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2.4 | Heat Treatment | Time & Temp | Maj | Review of documents | 100% | 100% | Drawing/TECH SPEC | R | - | P | V | V | |
| 3.0 | **Final Inspection** | | | | | | | | | | | | |
| 3.1.1 | Dimensions | Straightness, web shift ,Web verticality, twist, Squareness | Maj | Visual and Measurement | 100% | 100% | Drg/ASME/ AWS | R | | P | W | | |
| 3.2 | Individual Pieces(Welded Structure): Columns, Ceiling Girders & Beams & Vertical bracings | Shape,Size & Overall Dimensions<br>Length<br>Orientation ,Weld size and quality | Maj | Visual, Verification& Measurement | 100% | 100% | Drawing/TECH SPEC | R | √ | P | W | W | *For columns with welded gussets, match marking with splice plates to be ensured.<br>** Ensure the following dimensions of columns gussets and vertical bracings, as per the relevant drawing-<br>a. Hole size& Pitch<br>b. Location of holes |
| 3.2.1 | Individual Pieces(Bolted Structure): Columns*, Ceiling Girders, Beams & Vertical Bracings** | Shape,Size & Overall Dimensions<br>Length<br>Orientation ,Weld size and quality | Maj | Visual,Verification& Measurement | 100% | 100% | Drawing/TECH SPEC | R | √ | P | W | W | |
| 3.3 | Trial Assy:<br>i. Columns$<br>ii. Ceiling girders $ along with cross members | Dimensions.<br>Alignment, Match marking as per Drg orientation | Maj | Visual & Measurment | 100% | 100% | Drawing/TECH SPEC | R | √ | P | W | W | $ At least two consecutive girders/columns to be assembled at a time.<br># Applicable only for vertical bracings of welded structure |
| | iii. Vertical bracings of Welded Structures<br>iv. Split type Ceiling Girder- Individual Top & Bottom piece.<br>v. Split type -Ceiling Girders Compartmental Assy - Bottom pieces of two consecutive Girders with cross members. | Lay-out #<br><br>Dimensions.<br>Alignment, Match marking | | Visual & Measurment<br><br>Visual & Measurment | 100% | 100% | Drawing/TECH SPEC | R | √ | P | W | W | |
| 3.4 | Verification of Completion | Dimensions<br>Orientations<br>Data folder<br>Compilations for Ceiling Girders &Main columns | Maj | Verification<br>Visual | 100% | 100% | As per Drawing<br>NDT reports, HT chart extracts, Trial assembly reports & Final CHP clearance | R | √ | P | V | W | |
| 3.5 | Painting ,Preservation& | Finish & | Mi | | 100% | -- | Drawing & Painting | - | | P | V | -- | *Approved by OWNER |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | protection | coat thickness, Surface preparation | n | Visual Measurement | Random | | Scheme * | | | | | | Engg. |
| 3.6 | Identification | W.O NO, DU project, Match Marking, Elevation marking. | Min | Visual | 100% | 100% | Drawing | R | √ | P | V | | |

**NOTE:1** NDE FOR WELDS shall be carried out by qualified personnel and records to be maintained for verification.

**NOTE:2** HEAT TREATMENT REQUIREMENTS (AWS D1.1)

1) All butt welds when t> 50mm and all welds in a tension flange of ceiling Girder other than web-to- flange fillet welds and web stiffener welds at end bearing locations as per WPS. 2) All gas cut edges of load bearing members above 50 mm thickness shall be heat treated for minimum 30 minutes (600-650 □C)- . Alternatively, the gas cut edges shall be ground / machined to 3mm.

**NOTE:3** VISUAL INSPECTION;

a) Visual inspection of welds shall be performed after completion of welding and subsequent cooling to room temperature.

b) All welds shall be cleaned to remove the slag, spatter etc. and visually examined for defects like crack, undercut, porosity, lack of fusion etc.

c) The welds shall be examined as below for size, shape and reinforcements.

| **Nature of defects** | **Accepted norms.** | **Disposition** |
|---|---|---|
| i) Crack, Lack of fusion & overlap | Not accepted | To be repaired & retested by LPI/MPI |
| ii) Crater | Not accepted. | To be repaired |
| iii) Under cut, Porosity Undersize & weld reinforcement | AWS D1.1 | |

v) WELD CONTOUR

Face of fillet Flat or concave accepted.

Convexity up to < 0.1S + 1.5mm is acceptable where S is the fillet size (minimum) as per drawing.

Under size up to 1.6mm for a cumulative length of 10% of total length permitted

vi) For all SQP, SIP, NDT & other MANUFACTURER procedures referred in CQP 1476, MANUFACTURER ‘s latest revisions are applicable.

In case of outsourcing of PWHT and NDT, MANUFACTURER approved agency to be deployed. MANUFACTURER approved procedures to be followed. Physical Surveillance at vendor works shall be done by MANUFACTURER as per internal schedule.

**NOTE :4**

Materials identified against mill sheet or test certificate only shall be used for construction. Strict compliance to the same shall be ensured by the sub-contractors/vendors. MANUFACTURER will verify MTC for plates in B2B system. OWNER will carry out random surveillance checking of MTC for plates of thickness t ≤ 40 mm and in case of any non-conformance, suitable action as deemed fit will be taken by MANUFACTURER & OWNER on the sub- contractor/vendor concerned.

| | MANUFACTURER NAME & ADDRESS | **MANUFACTURING QUALITY PLAN** | | |
|---|---|---|---|---|
| | | **ITEM: DUCT** | | **PACKAGE:** Main Plant Package (Steam Generator & Auxiliary) |
| | | **SUBSYSTEM** : **Ducting** | | |

| SL No. | COMPONENT & OPERATIONS | CHARACTERISTICS | CLASS | TYPE OF CHECK | QUANTUM OF CHECK | | REFERENCE DOCUMENT | ACCEPTANCE NORMS | FORMAT OF RECORD | | AGENCY | | | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | M | C/N | | | | D* | M | C | N | |
| 1 | 2 | 3 | 4 | 5 | 6 | | 7 | 8 | 9 | | 10 | | | 11 |
| 1.0 | **Raw Material** | | | | | | | | | | | | | |
| 1.0 | Raw Material | Chemical & physical properties | Major | Review of MTC | 100% | 100% | Drawing/ Specification | Specification | MTC | √ | P | R | -- | |
| | | Surface Finish & Dimensions | Major | Visual & Measurement | 100% | 100% | Free from surface defects & Drawing / Note | No Surface Defects | -- | -- | P | R | -- | |
| **2.0** | **Welding & NDT** | | | | | | | | | | | | | |
| 2.1 | Procedure Qualification | WPS, PQR and WPQ | Major | Review | 100% | 100% | Drawing / ASME Sec IX | ASME Sec IX | WPS, PQR and WPQ | √ | P | *V | -- | *Witness for all new qualification |
| 2.2 | Welding Inspection | Weld completion | Major | Size and Visual | 100% | 100% | Drawing | Drawing | IR | √ | P | V | -- | |
| 2.2.1 | | Weld Surface Quality | Major | DPT | 10% | 10% | ASME Section VIII Div I | ASME Section VIII Div I | IR | √ | P | V | -- | |
| **3.0** | **In Process** | | | | | | | | | | | | | |
| 3.1 | Marking, cutting & edge preparation | Dimensions & Straightness | Minor | Measurement | 100% | -- | Drawing | Drawing | -- | -- | P | -- | -- | |
| 3.2 | Joint setup | Set up Dimensions, offset, Matching | Major | Visual & Measurement | 100% | -- | Drawing | Drawing | -- | -- | P | -- | -- | |
| 3.3 | Bending | Shape / Dimensions | Major | Visual & Measurement | 100% | Random | Drawing / Welding is not acceptable in place of bending | Drawing | -- | -- | P | V | -- | |
| 3.4 | Hole Drilling | Hole Centers and diameter | Major | Measurement | 100% | | Drawing | Drawing | -- | -- | P | -- | -- | |
| **4.0** | **Ducts** | | | | | | | | | | | | | |
| 4.1 | Ducts* | Overall Dimension & Orientations | Major | Visual & Measurement / layout matching | 100% | 100% | Drawing | Drawing | IR | √ | P | W | V | *Bends, Transition Ducts to be trial assembled with adjacent member |
| | | Diagonals | Major | Measurement | 100% | 100% | Drawing | Drawing | IR | √ | P | W | V | |
| | | Stiffeners Location | Major | Visual & Measurement | 100% | 100% | Drawing | Drawing | IR | √ | P | W | V | |
| | | Guide vane/ Baffle plate locations | Major | Visual & Measurement | 100% | 100% | Drawing | Drawing | IR | √ | P | W | V | |

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 4.2 | Ducts * | Free of Bulging / Waviness | Major | Visual | 100% | 100% | Bulging/ Waviness | 5 mm Max | IR | √ | P | W | V | |
| | | Match Marking | Major | Visual | 100% | 100% | Drawing / Hard Punching | Drawing | IR | √ | P | W | V | |

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **5.0** | **Final Inspection** | | | | | | | | | | | | | |
| 5.1 | Surface Preparation | Surface Finish | Major | Visual | 100% | 100% | Drawing / PO | Drawing / PO | | -- | P | V | -- | |
| 5.2 | Painting | Paint shade , type , DFT and Finish | Major | Visual & Measurement | 100% | Random | Drawing / PO | Drawing / PO | IR | √ | P | W | -- | |
| 5.3 | Date Folder | QAP Compliance & Inspection Clearance | Major | Review | 100% | 100% | Raw Material Test Certificates, Inspection Reports; NDT Reports; | Final Dossier | MICN | √ | P | H | -- | |
| 5.4 | Pre-Shipment | Packing | Major | Visual | 100% | 100% | Packing Procedure , MICN & PO | Packing Procedure | Packing list | √ | P | V | -- | |

Note: The thickness mentioned in the order/drawing for various sections shall not vary more than +/- 2.5% & the mentioned thickness shall be available in at least 75% of the material used.

| | Manufacturer's Name & Address | REFERENCE QUALITY PLAN | | | |
|---|---|---|---|---|---|
| | | ITEM: **HOPPER** | | | |
| | | SUB-SYSTEM: | | | |

| Sl No | Component & Operation | Characteristics | Class | Type of Check | Quantum of Check | | Reference Documents | Acceptance Norms | Format of Record | | Agency | | | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | M | C/N | | | | | M | C | N | |
| 1 | 2 | 3 | 4 | 5 | 6 | | 7 | 8 | 9 | D* | **10 | | | 11 |
| **1.0** | **Raw Material:** Raw Material to be procured from OWNER-approved sources. | | | | | | | | | | | | | |
| 1.1 | Plates & Rolled Sections | a. Visual & Dimensional | Major | Visual & Measurement | 100 % | 100 % | Material spec./ OWNER Approved GA Drawings. / Mfg. Drawings | | Inward Inspection Report | -- | P | V | -- | Refer Note 2 & 3 |
| | | b. Chemical Composition | Critical | Document Review | 1 per Heat / Lot | 1 per Heat / Lot | | | MTC | √ | P | V | V | |
| | | c. Mechanical Properties | Critical | Document Review | 1 per Heat / Lot | 1 per Heat / Lot | | | MTC | √ | P | V | V | |
| | | d. UT (Bars > 50 mm) | Critical | Document Review | 100 % | 100% | ASTM 388 | | MTC | √ | P | V | V | |
| | | e. UT (Plates Thk. > 40 mm) | | | 100 % | 100 % | ASTM A 578 Level B S2 | | | √ | P | V | V | |
| **2.0** | **Welding / Fit-Up** | | | | | | | | | | | | | |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2.1 | Welding | Welding Procedure – WPS & PQR | Major | Document Review | 100 % | 100 % | AWS D1.1 / ASME Sec. IX | WPS | √ | P | V | V | - WPS & PQR.<br>- |
| | | Welder Performance Qualification – WPQ | Major | | 100 % | 100 % | | WPQ | √ | P | V | V | |
| 2.2 | Welding consumable | Verification of Make, Type & Batch No. | Major | Visual | 100 % | 100 % | ASME Sec II Part C | BTC | √ | P | V | - | As per the MAIN SUPPLIER-approved list |
| 2.3 | Straightening Marking, Cutting, Edge Preparation, Drilling and Splicing | a. Shape<br>b. Size<br>c. Diagonal<br>d. Straightness | Major | Visual & Measurement | 100% | ----- | Drawings / spec. | Job History Card | -- | P | -- | -- | |
| 2.4 | Fit Up, Welding, Dimensional Control, | Orientation, Weld Visual, Dimensions, Offset, Straightness, Shape, Diagonal & etc. | Major | Visual & Measurement | 100 % | -- | Drawings / spec. | Job History Card | -- | P | -- | -- | |
| 2.5 | Pre-heating (as applicable) | Preheating Temperature Control | Major | Measurement | 100 % | 100 % | As per WPS & Tech. Spec. | Register | -- | P | V | V | |
| **3.0** | **Non-Destructive Examination** | | | | | | | | | | | | |

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3.1 | Edge Preparation for Plates THK ≥ 32mm | Lamination/ Flaws | Major | MPT/LPT | 100 % | 100 %/ 10% | AWS D1.1 | AWS D1.1 | MPT / LPT Report | √ | P | V | V | |
| 3.2 | Butt weld Joints for Plates THK ≥ 32mm | Weld Soundness | Critical | *RT / UT | 100 % | 100 % / 10 % | AWS D1.1 | AWS D1.1 | RT / UT Report | √ | P | W | W | *RT films review |
| 3.3 | Butt Weld Joints for Plates 25mm≥THK < 32mm | Weld Soundness | Critical | MPT / LPT | 100 % | 100 % / 10 % | AWS D1.1 | AWS D1.1 | MPT / LPT Report | √ | P | W | W | |
| | | | | *RT / UT | 10 % | 10 % | AWS D1.1 | AWS D1.1 | RT / UT Report | √ | P | W | W | *RT films review |
| 3.4 | All Butt Weld Joints of Plates THK < 25mm | Weld Soundness | Critical | MPT / LPT | 10 % | 10 % | AWS D1.1 | AWS D1.1 | MPT / LPT Report | √ | P | W | W | |
| 3.5 | All fillet Weld Joints | Weld Soundness | Major | MPT / LPT | 10 % | 10 % | AWS D1.1 | AWS D1.1 | MPT / LPT Report | √ | P | W | W | |
| 3.6 | All fillet weld of Built-up Girders, including the Bracket | Weld Soundness | Major | MPT / LPT | 100 % | 100 % / 10 % | AWS D1.1 | AWS D1.1 | MPT / LPT Report | √ | P | W | W | |

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3.7 | Fillet weld at Base and Top Plate Welding in Columns | Weld Soundness | Major | MPT / LPT | 100 % | 100 % / 10 % | AWS D1.1 | AWS D1.1 | MPT / LPT Report | √ | P | W | W | |
| 3.8 | Weld Visual | Completeness of welding, Surface Defects, Weld Size | Major | Visual | 100 % | 100 % / 10 % | Mfg. Drawings | AWS D1.1 | Inspection Report | √ | P | W | W | |
| 3.9 | Bend line – Hopper, Funnel & etc. | Bending area | Major | MPI / LPT | 100 % | 10 % | AWS D1.1 | AWS D1.1 | MPT / LPT Report | √ | P | W | W | |
| **4.0** | **Final Inspection** | | | | | | | | | | | | | |
| 4.1 | Orientation and Dimensional Inspection | Verification of Orientation, Dimensions, hole & position. Straightness, Twist, Web verticality, web shift - as applicable | Major | Visual and Measurement | 100 % | 100 % / 10 % | Drawings / Applicable Standard | | Inspection Report | √ | P | W | W | If columns are to be dispatched in two or more parts, a mock-up assembly of the columns must be conducted at the shop.<br><br>Ground Mock-up assembly of 1st Hopper shall be performed at each Manufacturer. |
| 4.2 | Match Marking & Identification | Material Identification Mark No. with DU No | Major | Visual | 100 % | 100 % | | | Inspection Report | √ | P | W | R | All Components except Loose materials shall be identified by a Hard Punch. The same shall be highlighted by silver Paint and stencilled by Weatherproof Paint. |
| **5.0** | **Surface Preparation And Painting** | | | | | | | | | | | | | |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 5.1 | Surface Preparation & Painting | Removal of Scale, Rust, Foreign Materials, etc. | Major | Visual | 100% | 100% | Approved Painting Scheme/ Approved Drawing / Tech. Spec. | Inspection Report | √ | P | R | - | |
| | | Review of Paint Certificate | Major | Visual | Per Batch | Per Batch | | Paint Mfr. TC | √ | P | R | **V** | |
| | | Complete Coverage of Paint | Major | Visual | 100 % | Random | | Inspection Report | √ | P | W | **V** | |
| | | DFT | Major | Measurement | 100 % | Random | | Inspection Report | √ | P | W | **V** | |
| 5.2 | Completeness of Supply | Verification of Scope of Supply & Correctness of QA Documents | Major | Verification | 100 % | 100 % | Purchase Order / Quality Plan / Drawing | Inspection reports | -- | P | V | -- | |

**Notes:**

1. M/s OWNER and M/s MAIN SUPPLIER inspectors shall have full access to take photos of the respective jobs without seeking prior permission from the manufacturer.
2. Raw Materials must be sourced from OWNER-approved suppliers, and the MTC must be submitted.
3. The manufacturer shall provide appropriate storage for Raw Materials, ensuring colour coding and traceability.
4. The Heat Number or Internal Allocation Number (IAN) shall be provided on the main parts (Flange & Web), excluding attachments.
5. Qualified and continuously employed welders may be deployed without requalification. Records of their qualification and continuity must be available for verification. A newly qualified welder by the Main Contractor shall be deployed for welding.

| | MANUFACTURER'S NAME AND ADDRESS | ITEM / EQUIPMENT: **DAMPERS** | QP NO | | SIGN. OF MFGR'S | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | |
| | | | PAGE NO | | | | | | |

| SL. NO | COMPONENT & OPERATIONS | CHARACTERISTICS | CLASS | TYPE OF CHECK | QUANTUM OF CHECK | | REFERENCE DOCUMENT# | ACCEPTANCE NORMS | FORMAT OF RECORD | | *AGENCY* | | | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | M | C/N | | | | | M | C | N | |
| 1. | 2. | 3. | 4. | 5. | 6. | | 7. | 8. | | D* | ** 10. | | | 11. |
| **1.0** | **Raw Material** | | | | | | | | | | | | | |
| 1.1 | Plates, Rolled sections | Chemical & Mechanical Properties | Major | TC Verification | 100% | 100% | As per drawing/GMS | | TC | | P | V | V | |
| | | Soundness (UT)# | Critical | TC Verification | 100% | 100% | ASTM A 435 | | TC | | P | V | V | |
| 1.2 | Rounds | Chemical & Mechanical properties | Major | TC Verification | 100% | 100% | As per drawing / GMS | | TC | | P | V | V | |
| | | Soundness (UT) # | Critical | TC Verification | 100% | 100% | ASTM A 388 / ASME Sec VIII Div–2 | | TC | | P | V | V | |
| 1.3 | Seals | Chemical & Mechanical properties | major | TC Verification | 100% | **100%** | As per drawing/GMS | | TC | | P | V | V | |
| 1.4 | Sub deliveries | Conformance to PO & as per drawing/GMS | Major | TC Verification | 100% | 100% | Note 3 | | TC | | P | V | V | |

TC - Test Certificate

- Review of material TCs shall be for plates above 40 mm thickness only. For plates of thickness less than or equal to 40 mm, COC will be submitted by MAIN SUPPLIER to OWNER
- TC verification of channels of size 400 mm and above (if applicable) and Beams of Size 450,500 and 600 mm.
- # Plates of thickness more than 40 mm and Rounds of Dia. more than 40 mm shall be UT tested.
- ## Surveillance checks of TC verification will be carried out at Raw Materials.

| | |
|---|---|
| **2.0** | **In process Control** |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Welders are Qualified to AWS D1.1. Procedures are prequalified & OWNER will review procedures and welder's qualification records | | | | | | | | | | | | |
| 2.1 | Weld Inspection | Weld Quality & Size | Major | Visual & Measurement | 100% | 100%(C)<br>10% (N) | Note – 1 | Report | | P | W | V | |
| 2.2 | Welds of studs with gland plate & butt welds of frame | Weld Soundness | Major | MPI/LPI | 100% | 100% | Drawing &<br>Tech Spec/ ASME/ AWS | Report | | P | W | W | |
| 2.3 | Welds of blade block, mounting bracket and all other welds | Weld Soundness | Major | MPI / LPI | 100% | 10% | Drawing &<br>Tech Spec/ ASME/ AWS | Report | | P | W | V | |
| 2.4 | Assembly | Overall Dimensions & Match marks | Major | Measurement | 100% | 100% | Drawing | Report | | P | W | V | |
| **3.0** | **Final Inspection** | | | | | | | | | | | | |
| 3.1 | Trial operation | Free operation. | Major | Open and close Movement | 100% | 100% | Drawing & Tech Spec & Main supplier procedure | Report | √ | P | W | W | |
| 3.2 | Trial operation | Seal Tightness. | Major | Check with Feeler Gauge | 100% | 100% | Drawing/ Tech Spec / Main supplier procedure/ OWNER Engg approved test procedure<br>and Damper testing schedule | Report | √ | P | W | W | |
| 3.3 | Performance Leak Tightness Test (For Bi plane Damper only) | Leak Tightness Test (as per contract) | Major | Performance Testing | Refer Test Schedule | Refer Test Schedule | OWNER Engg approved test procedure and Damper testing schedule | Report | √ | P | W | W | Witness by OWNER Engg |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3.4 | Verification of completion | Over all dimension, Orientation | Major | Verification / Visual | 100% | 100% | As per drawing, All identified by □ mark under D in QP | Report | | P | W | V | |
| 3.5 | Painting, preservation & protection. | Finish | Minor | Visual | 100% | 100% | Drawing | Report | | P | W | V | |
| | | Paint DFT | Major | Measurement | 10% | 10% | As per OWNER approved Painting scheme | Report | | P | W | V | |

**NOTE 1: VISUAL INSPECTIONS**

a) Visual inspection of welds shall be performed after completion of welding on shaft, Blower air mounting brackets welds to be witness by MAIN SUPPLIER & verification of reports by OWNER
b) All welds shall be cleaned to remove slag, spatter etc and visually examined for defects like crack, undercut, porosity, lack of fusion etc.
c) The welds shall also be examined for size, shape and re-inforcement.

| **Nature of defects** | **Acceptance Norms** | **Disposition** |
|---|---|---|
| Crack, lack of fusion, overlap | Not accepted repair and retest. | Confirm by LPI/MPI. |
| Crater | Not accepted | Fill by weld deposit |
| Undercut | Up to 0.8 mm accepted.<br>>0.8 mm not accepted | -------<br>Fill and grind smooth |
| Porosity for butt/fillet welds | One pore of dia < 2.4 mm every 100 mm length is permitted.<br>However, pores of dia > 2.4 mm not accepted. | --------<br>To be repaired. |

**Weld contour**

| | |
|---|---|
| 1. Face of fillet | Flat or concave accepted. Slightly convex also accepted provided convexity < 0.1 S + 1.5 mm where S is fillet size. |
| 2. Size (Minimum) | As per drawing. Under size permitted up to 1.6 mm for a cumulative length of 10% of total length. |
| 3. Reinforcement | Max 3 mm up to 19 mm., Max 5 mm above 19 mm. |

ITEM / EQUIPMENT: **ROTOR POST ASSY**
SUB-SYSTEM:**APH**

| SL. NO | COMPONENT & OPERATION | CHARACTERISTICS | CLASS | TYPE OF CHECK | QUANTUM OF CHECK | | REFERENCE DOCUMENT# | ACCEPTANCE NORMS | FORMAT OF RECORD | | *AGENCY* | | | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | M | C/N | | | | | M | C | N | |
| 1. | 2. | 3. | 4. | 5. | 6. | | 7. | 8. | | D * | ** 10. | | | 11. |
| **1.0** | **Raw Materials** | | | | | | | | | | | | | |
| 1.1 | Plates | Chemical & Mechanical properties. | Major | Chemical & Tensile Bend | Each Heat | Refer Notes- 1 & 2 | As per Drawing / GMS | As per Drawing / GMS | TC | | P | V | V | *** When back wall Echo is set to 100 % of FSH in Sound area a) Defect Echo not to exceed 20 % of FSH during scan. b) Back wall Echo loss permissible is 20 % of FSH. |
| | | Soundness | Major | UT for Plates > 40 mm | 100% | Refer Notes- 1 & 2 | As per Drawing / GMS | As per Drawing / GMS | TC | | P | V | V | |
| 1.2 | Trunnion Forging | Chemical & Mechanical properties. | Major | Chemical, Tensile | 100% | Refer Notes- 1 & 2 | As per Drawing / GMS | As per Drawing / GMS | TC | | P | V | V | |
| | | Soundness | Major | UT | 100% | Refer Notes- 1 & 2 | As per Drawing / GMS | As per Drawing / GMS | TC | | P | V | V | |
| 1.3 | Header Plate | Chemical & Mechanical properties. | Major | Chemical, Tensile | 100% | Refer Notes- 1 & 2 | As per Drawing / GMS | As per Drawing / GMS | TC | | P | V | V | |
| | | Soundness | Major | UT for Thick ³ 25mm | 100% | 100% | ASTM-A 435/A 388 | ASTM-A-435/ A 388 (***) (No laminations) | TC | | P | V | V | |
| 1.4 | Lower Post Pins | Chemical & Mechanical Properties | Major | Chemical, Tensile, Hardness | Each heat | Refer Notes- 1 & 2 | As per Drawing / GMS | As per Drawing / GMS | TC | | P | V | V | |
| | | Soundness | Major | UT for > 50mm | 100% | 100% | ASTM A388 | ASTM A388*** | DR | | P | V | V | |
| **2.0** | **In Process Control** | | | | | | | | | | | | | |
| | WELDERS ARE QUALIFIED TO AWS D1.1 & PROCEDURES ARE PREQUALIFIED. OWNER WILL REVIEW PROCEDURES AND WELDERS QUALIFICATION RECORDS | | | | | | | | | | | | | |
| 2.1 | Welding | Weld Size | Major | Measurement | 100% | 100% | Drawing | Drawing | DR | | P | W | - | |
| | | Finish | Major | Visual | 100% | 10% | -- | -- | -- | | P | W | - | |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2.2 | Rotor post assy. after welding | Dimensions | Major | Measurement | 100% | 100% | Drawing | HC | | P | W | V | |
| 2.3 | Support Trunnion Shell Butt Weld | Weld soundness | Major | RT | 100 % | 100% | BHE:NDT:RP:RT:01 (Latest) | NDT Report | Ö | P | V | V | CHP RT Film Review |
| | Support Trunnion Shell to common Header Plate | Weld soundness | Major | UT/MT (Refer Note – 3) | 100 % | 100% | BHE:NDT:RP:UT:04 (Latest) BHE:NDT:RP:MT:01 (Latest) | NDT Report | Ö | P | W | V | |
| | Rotor Post Butt Weld | Weld soundness | Major | PT/ MT | 100 % | 100% | BHE:NDT:RP:PT:01 (Latest) BHE:NDT:RP:MT:01 (Latest) | NDT Report | Ö | P | W | V | |
| | Header Plate to Rotor Post Shell | Weld soundness | Major | PT/ MT | 100 % | 100% | BHE:NDT:RP:PT:01 (Latest) BHE:NDT:RP:MT:01 (Latest) | NDT Report | Ö | P | W | V | |
| | Rotor Post Shell to Common Header Plate | Weld soundness | Major | PT/ MT | 100 % | 100% | BHE:NDT:RP:PT:01 (Latest) BHE:NDT:RP:MT:01 (Latest) | NDT Report | Ö | P | W | V | |
| | Support trunnion shell to Header plate | Weld soundness | Major | PT/ MT | 100 % | 100% | BHE:NDT:RP:PT:01 (Latest) BHE:NDT:RP:MT:01 (Latest) | NDT Report | Ö | P | W | V | |
| | Lifting Lug Welding | Weld soundness | Major | PT/ MT | 100 % | 100% | BHE:NDT:RP:PT:01 (Latest) BHE:NDT:RP:MT:01 (Latest) | NDT Report | Ö | P | W | V | |
| 2.4 | Rotor post Dimensions after Machining. | Critical Dim. Drilling & Tapping | Major | Measurement | 100% | 100% | Drawing | HC | Ö | P | W | W | |
| 2.5 | Guide Trunnion to Adaptor Sleeve | Pressure Test for Taper Match with Adapter Sleeve | Major | Pressure Test | 100% | See remarks | No Leakage and PRQA:403 (latest revision) | HC | Ö | P | W | W | 100% by MAIN SUPPLIER 10% (minimum 1 No. per unit) by OWNER |
| **3.0** | **Final Inspection** | | | | | | | | | | | | |
| 3.1 | Rotor post assembly and Trunnion spool assembly | Overall Dimensions | Major | Measurement | 100% | 100% | Drawing | HC | | P | W | V | |
| 3.2 | Painting and Preservation | Painting DFT | Major | Visual & Measurement | 100% | 10% | OWNER Engineering approved painting scheme. | Report | | P | W | V | |

Notes:

1. Review of material TCs shall be for plates above 40 mm thickness only. For plates of thickness less than or equal to 40 mm, COC will be submitted by MAIN SUPPLIER to OWNER.
2. TC verification for trunnion forgings, header plate forgings, adopter plate forgings, adopter sleeve forgings.
3. UT to be carried out in case of design without ring weld and in other cases where design is with ring weld, layer by layer MPI to be performed after every 5 mm of welding.

ITEM / EQUIPMENT: **Module Assembly**

SUB-SYSTEM:**APH**

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **1.0** | **Raw Materials** | | | | | | | | | | | | | |
| 1.1 | Lug plates | Chemistry & Mechanical properties | Major | Chemical & Mechanical | Each Heat | Note -1 | As per Drawing/GMS | As per Drawing/GMS | TC | Ö | P | V | V | |
| | | Soundness | Major | UT for Plates > 40 mm | 100% | Note -1 | ASTM A 435 | ASTM A 435 | TC | Ö | P | V | V | |
| 1.2 | Heating element (Hot /Hot intermediate) | Chemistry & Hardness, and Erichsen Cupping value | Major | Chemical & Hardness, and Erichsen Cupping Test. | Each Heat | Note -1 | As per Drawing/GMS | As per Drawing/GMS | TC | Ö | P | V | V | |
| 1.3 | Heating element (cold) | Chemical & Mechanical | Major | Chemical & Mechanical. | Each Heat | Note -1 | As per Drawing/GMS | As per Drawing/GMS | TC | Ö | P | V | V | |
| 1.4 | Diaphragm plates | Chemical & Mechanical | Major | Chemical & Mechanical. | Each Heat | Note -1 | As per Drawing/GMS | As per Drawing/GMS | TC | Ö | P | V | V | |
| 1.5 | Stay plates, Basket support bar | Chemical & Mechanical | Major | Chemical & Mechanical | Each Heat | Note -1 | As per Drawing/GMS | As per Drawing/GMS | TC | Ö | P | V | V | |
| 1.6 | Grating flats, plates | Chemical & Mechanical | Major | Chemical & Mechanical. | Each Heat | Note -1 | As per Drawing/GMS | As per Drawing/GMS | TC | Ö | P | V | V | |
| **2.0** | **In process control** | | | | | | | | | | | | | |
| | WELDERS ARE QUALIFIED TO AWS D1.1 PROCEDURES ARE PREQUALIFIED & OWNER WILL REVIEW PROCEDURES AND WELDERS QUALIFICATION RECORDS. | | | | | | | | | | | | | |
| 2.1 | Lug plate cutting | Dimensions | Major | Check with template | 100% | 100% | Drawing | Drawing | DR | | P | W | V | |

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2.2 | Stress Relief Heat Treatment of Lug Plate | Compliance to SR cycle. | Major | Verification of HT chart | 100% | 100% | BAP: HT: 001 (Latest) | BAP: HT: 001 (Latest) | Chart | | P | V | V | | |
| 2.3 | Welding | Weld size | Major | Measurement | 100% | 10% | Drawing | Drawing | DR | | P | W | V | | |
| | | Finish | Major | Visual | 100% | 10% | AWS D1.1 | AWS D1.1 | --- | | P | W | V | | |
| 2.4 | NDE | Soundness | Major | PT | 10% | 10% | BHE: NDT: RP: PT: 01 (Latest) | BHE: NDT: RP: PT:01 (Latest) | NDE Report | Ö | P | W | W | | |
| 2.5 | Lug Assembly Machining | Dimensions | Critical | Measurement | 100% | Note-2 | Drawing / MAIN SUPPLIER Procedure PRQA: 417 | Drawing / MAIN SUPPLIER Procedure PRQA: 417 | HC | | P | W | W | | |
| **3.0** | **Final Inspection** | | | | | | | | | | | | | | |
| 3.1 | Module Assy (**Note-3)** (In Fixture) | Over All Dimensions. | Major | Measurement | 100% | Note-3 | Drawing | Drawing | HC | | P | W | W | | |
| | | Weld size Weld finish | Major | Visual | 100% | 10% | AWS D 1.1 | AWS D 1.1 | -- | | P | W | V | | |
| 3.2 | Painting & Preservation. | Painting DFT | Major | Visual / Measurement. | 100% | 10% | OWNER Engineering approved painting scheme | HC | | P | W | V | | | |

**Note -1:**

- Review of material TCs shall be for plates above 40 mm thickness only. For plates thickness more than or equal to 40 mm, COC will be submitted by MAIN SUPPLIER to OWNER
- TC verification for lug plates, HE coils.

**Note-2:** 100% Inspection by MAIN SUPPLIER. Quantum of inspection for OWNER is 3 Nos for rotor of 12 modules and 6 Nos for rotor of 24 modules.

**Note-3:** Lug assembly and module diaphragm plates are placed in fixture for fit up and dimension check by MAIN SUPPLIER. FOT is offered for OWNER in fixture. For other modules inspection in fixture is done by MAIN SUPPLIER and full welding is carried out after removal from fixture and offered for OWNER inspection in all cases.

ITEM / EQUIPMENT: **Connecting Plate Assembly**
SUB-SYSTEM:**APH**

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **1.0** | **Raw Materials** | | | | | | | | | | | | | |
| 1.1 | Structural Plates, Sheets, Angles | Chemical & Mechanical Properties | Major | Analysis Tensile Test | Each Heat | Refer Notes | As per Drawing / GMS | As per Drawing / GMS | TC | | P | V | V | ## When back wall Echo is set to 100 % of FSH in Sound area a) Defect Echo not to exceed 20 % of FSH during scan. b) Back wall Echo loss permissible is 20 % of FSH. |
| | | Soundness | Major | UT for Plates > 40 mm | 100% | Refer Notes | ASTM A 435 | ASTM A435 | TC | | P | V | V | |
| 1.2 | Pipes | Chemical& Mechanical Properties | Major | Analysis Tensile Test | Each Heat | Refer Notes | As per Drawing / GMS | As per Drawing / GMS | TC | | P | V | V | |
| 1.3 | Rods | Chemical& Mechanical Properties | Major | Analysis Tensile Test | Each Heat | Refer Notes | As per Drawing / GMS | As per Drawing / GMS | TC | | P | V | V | |
| | | Soundness | Major | UT for Rod Dia > 50 mm | 100% | 100% | ASTM A 388 | ASTM A388 ## | TC | | P | V | V | |
| **2.0** | **In Process Control** | | | | | | | | | | | | | |
| | Welders are qualified to AWS D1.1. Procedures are Pre-qualified & OWNER will review procedures and welder's qualification records | | | | | | | | | | | | | |
| 2.1 | Welding | Weld Size | Major | Measurement | 100% | 10% | Drawing | Drawing | DR | | P | W | V | |
| | | Finish | Major | Visual | 100% | 10% | -- | -- | -- | | P | W | - | |
| 2.2 | a) Butt weld of CE center section base or bottom plate | Soundness | Major | UT | 100% | 10% | BHE: NDT: RP: UT/04 (Latest) | BHE: NDT: RPT: UT/04 (Latest) | NDT Report | Ö | P | W | W | |
| | b) Butt weld of CE center section H- Frame | Soundness | Major | UT | 100% | 10% | BHE: NDT: RP: UT/04 (Latest) | BHE: NDT: RPT: UT/04 (Latest) | NDT Report | Ö | P | W | W | |
| | c) CE sidewall butt weld >25 mm | Soundness | Major | UT | 100% | 10% | BHE: NDT: RP: UT/04 (Latest) | BHE: NDT: RPT: UT/04 (Latest) | NDT Report | Ö | P | W | W | |

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2.2 | d) CE sidewall butt weld <25 mm & other butt welds of CE. | Soundness | Major | MPI (both sides) with Root LPI | 100% | 100% | BHE: NDT: RP: PT:01 (Latest), MT:01 (Latest) | BHE: NDT: RP: PT:01 (Latest) MT:01 (Latest) | NDT Report | Ö | P | W | V | |
| | e) HE Center section Butt weld. | Soundness | Major | PT | 100% | 100% | BHE: NDT: RP: PT:01 (Latest) | BHE: NDT: RP: PT :01 (Latest) | NDT Report | Ö | P | W | V | |
| | f) other welds of HE & CE | Soundness | Major | PT | 10% | 10% | BHE: NDT: RP: PT:01 (Latest) | BHE: NDT: RP: PT :01 (Latest) | NDT Report | Ö | P | W | V | |
| 2.3 | Sector plate after welding | Dimensions | Major | Measurement | 100% | 100% | Drawing | HC | | P | W | V | | |
| 2.4 | Stress relief of sector plate. | Compliance to stress relief cycle | Major | Verification of HT Chart | 100% | 100% | BAP: HT:001 (Latest) | HT Chart | Ö | P | V | V | | |
| 2.5 | Sector plate after machining. | Dimensions | Major | Measurement | 100% | 100% | Drawing | HC | | P | W | V | | |
| | | Finish | Major | Visual | 100% | 10% | Drawing | HC | | P | W | - | | |
| **3.0** | **Final Inspection** | | | | | | | | | | | | | |
| 3.1 | Trial assembly of CPA | Over all dimension | Major | Measurement | 100% | 100% | Drawing | HC | Ö | P | W | W | | |
| 3.2 | Sector plate fixing and checking on center section and primary center section | Dimensions | Major | Measurement | 100% | 100% | Drawing | HC | Ö | P | W | V | | |
| 3.3 | Checking movement of sector plate | Movement | Major | Measurement | 100% | 100% | Drawing | HC | Ö | P | W | W | | |
| 3.4 | Painting and preservation | Painting DFT | Major | Visual / measurement | 100% | 10% | OWNER Engineering Approved painting scheme | Report | | P | W | V | | |

## Note:

1. Review of material TCs shall be for plates above 40 mm thickness only. For plates of thickness less than or equal to 40 mm, COC will be submitted by MAIN SUPPLIER to OWNER.
2. TC verification of channels of size 400 mm and above (if applicable) and Beams of Size 450, 500 and 600 mm.
3. TC verification for Bracing pipe.

ITEM / EQUIPMENT: **GUIDE BEARING ASSY**

**SUB-SYSTEM:**APH

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **1.0** | **Raw Material** | | | | | | | | | | | | | |
| 1.1 | Plates, Sheets | Chem. & Mech Properties | Major | Chem.& tensile Test | Each Heat | Refer Notes–1&2 | As per Drawing / GMS | As per Drawing / GMS | TC | | P | V | V | **When back wall echo is set to 100% of FSH in sound area a) Defect echo not to exceed 20% of FSH during scanning. b) Back wall echo loss permissible 20% of FSH. |
| 1.2 | Rods | Chem. & Mech Properties | Major | Chem.& tensile Test | Each Heat | Refer Notes–1&2 | As per Drawing / GMS | As per Drawing / GMS | TC | | P | V | V | |
| | | Soundness | Major | UT > 50 mm | 100% | 100% | ASTM A 388 | ASTM A 388** | TC | | P | V | V | |
| 1.3 | Tubes | Chem. & Mech Properties | Major | Chem.& Tensile Test | Each Heat | Each heat | As per Drawing / GMS | As per Drawing / GMS | TC | | P | V | V | |
| 1.4 | Adapter sleeve forgings | Chem. & Mech Properties | Major | Chem.& Tensile Test | Each Heat | Each heat | As per Drawing / GMS | As per Drawing / GMS | TC | | P | V | V | |
| | | Soundness | Major | UT | 100 % | Refer Notes–1&2 | ASTM A 388 | ASTM A 388** | TC | | P | V | V | |
| 1.5 | Housing Sleeve Castings | Chem. & Mech Properties | Major | Chem. & tensile test | Each Heat | Refer Notes–1&2 | As per Drawing / GMS | As per Drawing / GMS | TC | | P | V | V | |
| | | Soundness | Major | UT | 100% | Refer Notes–1&2 | ASTM A609 | ASTM 609 Level II | TC | | P | V | V | |
| 1.6 | Bearings | Compliance to Drawing | Major | Verification | 100% | Refer Notes–1&2 | As per Drawing / GMS | As per Drawing / GMS | CC | | P | V | V | |
| **2.0** | **In Process Control** | | | | | | | | | | | | | |
| | Welders are qualified to AWS D1.1 & procedures are pre-qualified. OWNER will review procedures & welders qualification records | | | | | | | | | | | | | |
| 2.1 | Welding | Weld size | Major | Measurement | 100% | 100% | Drawing | Drawing | DR | | P | W | V | |
| | | Soundness | Major | MT/PT | 10% | 10% | BHE: NDT: RP: MT:01 (Latest) BHE: NDT: RP: PT:01 (Latest) | NDT Report | | P | W | V | | |

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2.3 | Machining of Guide bearing Housing | Dimensions | Critical | Measurement | 100 % | 100% | Drawing | Drawing | HC | Ö | P | W | W | | |
| 2.4 | Kerosene Leak Test after machining | Soundness | Major | Visual | 100 % | 100% | No leakage | HC | Ö | P | W | V | | | |
| **3.0** | **Final Inspection** | | | | | | | | | | | | | | |
| 3.1 | Assembly of Guide Bearing Housing with Bearing, Adapter Sleeve, Housing Sleeve & Housing Cover | Assembly Clearances of Bearing with Housing Sleeve / Adapter Sleeve<br>Free rotation | Critical | Measurement | 100 % | 100% | Drawing | Drawing | DR | Ö | P | W | **$**<br>W | **$** Free rotation witness by OWNER. Other checks in column 3 against clause 3.1 verification by OWNER | |
| 3.2 | Painting and Preservation. | Painting DFT | Major | Visual | 100 % | 10% | OWNER Engineering approved painting scheme | Report | | P | W | V | | | |

## Notes:

1. Review of material TCs shall be for plates above 40 mm thickness only. For plates of thickness less than or equal to 40 mm, COC will be submitted by MAIN SUPPLIER to OWNER
2. TC verification for adopter plate forgings, adopter sleeve forgings, adopter sleeve forgings.

**LEGEND:** * RECORDS IDENTIFIED WITH **"TICK" (Ö)** SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA

ITEM / EQUIPMENT: **SUPPORT BEARING ASSY**
**SUB-SYSTEM:** APH

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **1.0** | **Raw Materials** | | | | | | | | | | | | | |
| 1.1 | Plates and structural | Chem.& Mech. Properties | Major | Chem. &Tensile Test. | Each Heat | Note-1 | As per Drawing/GMS | As per Drawing/GMS | TC | | P | V | V | **CC:** compliance certificate |
| | | Soundness | Major | UT for plates > 40 mm | 100% | Note-1 | ASTM A 435 | ASTM A 435 | TC | | P | V | V | |
| 1.2 | Adapter plate | Chem.& Mech. Properties | Major | Chem. &Tensile Test. | 100% | Note-1 | As per Drawing/GMS | As per Drawing/GMS | TC | Ö | P | V | V | |
| | | Soundness | Major | UT | 100% | 100% | ASTM A 435 | ASTM A 435/ No Lamination | TC | Ö | P | V | V | |

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1.3 | Bearings | Compliance to Drawing/GMS | Major | Verification | 100% | 100% | As per Drawing/GMS | As per Drawing/GMS | CC | Ö | P | V | V | |
| 2.0 | **Inprocess Control** | | | | | | | | | | | | | |
| | WELDERS ARE QUALIFIED TO AWS D1.1 & PROCEDURES ARE PREQUAIFIED. OWNER WILL REVIEW PROCEDURES AND WELDERS QUALIFICATION RECORDS | | | | | | | | | | | | | |
| 2.1 | Welding of Support Bearing Housing | Weld Size & Finish | Major | Measurement | 100% | 10% | DRAWING | DRAWING | DR | | P | W | V | |
| | Weld between Housing Ring & Bottom Plate | Soundness | Major | MPI | 100% | 100% | BHE: NDT:RP: MT:01 (Latest) | BHE: NDT: RP MT:01 (Latest) | REP | Ö | P | W | V | |
| | Other areas | Soundness | Major | LPI | 10% | 10% | BHE: NDT: RP PT:01 (Latest) | BHE: NDT: RP: PT:01 (Latest) | REP | Ö | P | W | V | |
| 2.2 | Machining of support bearing Housing | Bearing. Seating diameter | Major | Measurement | 100% | 100% | Drawing | Drawing | DR | | P | W | V | |
| | | Kerosene leak test for soundness | Major | Visual | 100% | 100% | No Leakage | No Leakage | HC | Ö | P | W | V | |
| **3.0** | **Final Inspection** | | | | | | | | | | | | | |
| 3.1 | Assembly checks | A) Clearance of bearing seating area | Critical | Measurement | 100% | 100% | Drawing | Drawing | DR | Ö | P | W | W | |
| | | B) Free rotation of bearing inside housing | Critical | Visual | 100% | 100% | Drawing | Drawing | DR | Ö | P | W | W | |
| 4.0 | Painting & preservation | Painting DFT | Major | Visual/ Measurement. | 100% | 10% | OWNER Engineering approved painting scheme | REP | | P | W | V | | |

**Note-1:**

Review of material TCs shall be for plates above 40 mm thickness only. For plates of thickness less than or equal to 40 mm, COC will be submitted by MAIN SUPPLIER to OWNER.

ITEM / EQUIPMENT: **ROTOR DRIVE ASSY**

**SUB-SYSTEM:** APH

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **1.0** | **Raw Material** | | | | | | | | | | | | | |
| 1.1 | Plates, sheets, Structural | Chemistry & Mech. Properties | Major | Chemical & Tensile Test | Each heat | See notes below | As per Drawing /GMS | | TC | | P | V | V | |
| 1.2 | Sub Deliveries (BOI) | | | | | | | | | | | | | |
| 1.2.1 | Pinion | Compliance to Drawing | Major | Verification | 100% | 100% | As per Drawing /GMS | | TC | Ö | P | V | V | |
| 1.2.2 | Air Motor | Compliance to Drawing | Major | Verification | 100% | 100% | As per Drawing /GMS | | TC | Ö | P | V | V | |
| 1.2.3 | Gear Box | Compliance to Drawing | Major | Verification | 100% | 100% | As per Drawing /GMS | | TC | Ö | P | V | V | |
| 1.2.4 | Motor<br>a) Make, type & rating | Compliance to Drawing | Major | Verification | 100% | 100% | OWNER Approved Drawing / Data sheet / Makes as per LOA | | TC | Ö | P | V | V | |
| | b) COC for motor | Compliance to Drawing | Major | Verification | 100% | 100% | Note-1 | | TC | Ö | P | V | V | |
| **2.0** | **In process Control** | | | | | | | | | | | | | |
| | WELDERS ARE QUALIFIED TO AWS D1.1 & PROCEDURES ARE PREQUALIFIED. OWNER WILL REVIEW PROCEDURES AND WELDERS QUALIFICATION RECORDS | | | | | | | | | | | | | |
| 2.1 | Welding | Weld size | Major | Measurement | 100% | 10% | Drawing | Drawing | DR | | P | W | V | |
| | | Finish | Major | Visual | 100% | 10% | -- | | DR | | P | W | V | |
| 2.2 | NDE | Soundness | Major | PT | 100% | 100% | BHE: NDT: RP: PT:01 (Latest) | | NDT Report | | P | W | V | |

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2.3 | Dimensional checks of Rotor Drive base assy,<br><br>Motor Bracket and pinion cover assy. | Overall Dimension | Major | Measurement | 100% | 100% | Drawing | DR | Ö | P | W | V | | |

ITEM / EQUIPMENT: **ROTOR DRIVE ASSY** SUB-SYSTEM: **APH**

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **3.0** | **Final Inspection** | | | | | | | | | | | | | |
| 3.1 | No Load Run Test | 1) Noise level of electric & air motors | Major | Measurement | 100% | 100% | Noise level of Air motor shall be checked at a distance of 1M from shaft horizontally & at 1.5 M elevation from shaft axis and acceptance norms shall be as per OWNER technical specification | DR | Ö | P | W | W | *-No load run test power consumption requirement as indicated in the QP is for record purpose only. | |
| | | 2) Power Consumption* | Major | Measurement | 100% | 100% | IS 325 | DR | Ö | P | W | W | | |
| | | 3) Wobble | Major | Measurement | 100% | 100% | Drawing | DR | Ö | P | W | W | | |
| 3.2 | Painting and preservation | Painting DFT | Major | Visual / Measurement | 100% | 10% | OWNER approved painting scheme. | -- | | P | W | V | | |

## Notes:

- Review of material TCs shall be for plates above 40 mm thickness only. For plates of thickness less than or equal to 40 mm, COC will be submitted by MAIN SUPPLIER to OWNER.

## Note 1:

a) Less than 50 KW

Acceptance of Motor less than 50 KW is based on COC of the manufacturer & the contractor confirming as follows:

It is hereby confirmed that the above-mentioned motor /motors was/ were manufactured taking care of OWNER specific requirements regarding ambient temp., voltage & frequency variation, hot starts, pull out torque, starting KVA/KW, temp. rise, distance between centre of stud & gland plate and tested in accordance with approved drawing /data sheets.

ITEM / EQUIPMENT: **UPPER ROTOR POST PIN**
**SUB-SYSTEM:** APH

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **1.0** | **Raw Materials** | | | | | | | | | | | | | |
| 1.1 | Plates | Chemistry Mech. Properties | Major | Chemical & Mechanical | Each heat | Each heat | As per Drawing/GMS | As per Drawing/GMS | TC | | P | V | V | #When back wall Echo is set to |

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1.2 | Rods | Chemistry Mech. Properties | Major | Chemical & Mechanical | Each heat | Each heat | As per Drawing/GMS | As per Drawing/GMS | TC | | P | V | V | 100 % of FSH in Sound area<br>a) Defect echo not to exceed 20 % of FSH during scanning.<br>b) Back wall echo loss permissible 20 % of FSH. |
| | | Soundness | Major | UT for Rod > 50mm | 100% | 100% | ASTM A388 | ASTM A388 # | TC | | P | V | V | |
| **2.0** | **In Process Control** | | | | | | | | | | | | | |
| 2.1 | Welding | Weld size | Major | Measurement | 100% | 100% | DRAWING | DRAWING | DR | Ö | P | W | V | |
| **3.0** | **Final Inspection** | | | | | | | | | | | | | |
| 3.1 | Dimensional Check | Overall dimensions | Major | Measurement | 100% | 10% of lot | DRAWING | DRAWING | DR | Ö | P | W | V | |
| 3.2 | Painting and preservation | Painting DFT | Major | Visual / Measurement | 100% | 10% of lot | OWNER Engineering approved painting scheme | | REP | Ö | P | W | V | |

ITEM / EQUIPMENT: **ROTOR HOUSING ASSY**
SUB-SYSTEM: **APH**

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **1.0** | **Raw Material** | | | | | | | | | | | | | |
| 1.1 | Plates & structural | Chemistry & Mech. Properties | Major | Chemical & Tensile Test | Each heat | Each heat | As per Drawing/GMS | As per Drawing /GMS | TC | Ö | P | V | V | |
| | | Soundness | Major | UT for plates >40mm | 100% | Note-1 | ASTM A435 | ASTM A435 | TC | | P | V | V | |
| **2.0** | **In process control** | | | | | | | | | | | | | |
| | Welders are qualified to AWS D1.1 & Procedures are prequalified. OWNER will review procedures and welder's qualification Records | | | | | | | | | | | | | |

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2.1 | Welding | Weld size | Major | Measurement | 100% | 10% | Drawing | Drawing | DR | | P | W | V | V/W * W for Main pedestal. V for Other pedestal & Panels |
| 2.2 | NDE | Soundness | Major | LPI/MPI | 10% | 10% | BHE: NDT: RP: PT: 01 (Latest) BHE: NDT: RP: MT: 01 (Latest) | | NDT Report | Ö | P | W | V/ W * | |
| **3.0** | **Final Inspection** | | | | | | | | | | | | | |
| 3.1 | Dimensional Inspection | Over all dimension | Major | Measurement | 100% | 100% | Drawing | Drawing | DR | Ö | P | W | V/ W * | |
| 3.2 | Painting and Preservation. | Painting DFT | Major | Visual /Measurement | 100% | 10% | OWNER Engineering approved painting scheme | | DR | | P | W | V | |

**Note-1:**

- Review of material TCs shall be for plates above 40 mm thickness only. For plates of thickness less than or equal to 40 mm, COC will be submitted by MAIN SUPPLIER to OWNER.
- TC verification of channels of size 400 mm and above (if applicable) and Beams of Size 450mm and above

## 1.6 ELECTRICAL SYSTEMS

**1.6.1 Generator and auxiliary systems**

**1.6.1.1 Process check for static parts of generator/ exciter**

| Items/ Components/ Process | Tests/ Checks | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Visual, dimension | Chemical property (Raw Material) | Heat treatment | Mechanical property (Raw Material) | Impact (Raw Material) | Hydraulic test | Pneumatic test | RT or UT (10% for butt weld) | MP or DPT (All welds) | Relative permeability | Ferrite content | DIN 43760, IS:2848,7358 | DIN 48124 |
| **Sheet and Fabrication :** | | | | | | | | | | | | | |
| - END shield | Y | Y | Y | Y | Y | Y | Y | Y | Y | | | | |
| - Stator casing | Y | Y | Y | Y | Y | Y | Y | Y | Y | | | | |
| - Bushing boxes | Y | Y | Y | Y | Y | Y | Y | Y | Y | | | | |
| - Terminal plates | Y | Y | Y | Y | Y | Y | Y | | Y | | | | |
| - Manhole andcovers | Y | Y | Y | Y | Y | Y | Y | | Y | | | | |
| - Trunniuns | Y | Y | Y | Y | Y | | | Y | Y | | | | |
| - Core bar | Y | Y | | Y | | | | | | | | | |
| - Press ring | Y | Y | | Y | | | | | Y | | | | |
| - Core bolt (insulated) | Y | Y | | Y | | | | Y | Y | | | | |
| - Gaskets | Y | | | Y | | | | | | | | | |
| - Bearing sealsand hydrogen seals | Y | Y | | Y | | | | Y1 | | | | | |
| - Terminalbushing | | | | | | | | | | | | | Y |
| - RTD/ Thermocouple | | | | | | | | | | | | Y | |
| Additional check for nonmagnetic components | | | | | | | | | | Y | | | |
| Non magnetic componentswelding | | | | | | | | | | | Y | | |

Y=Test applicable, Y1=UT on babbit for bearing

| 1.6.1.2 Process check for core of generator/ exciter (Table 1/2) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Items/ Components/ Process | Tests/ Checks | | | | | | | | |
| | Specific loss before and after ageing | Magnetisation | Anotrophy of losses | Stacking factor | Burr level | Check for varnish, insulation (chemical, electrical, viscosity, cure time, solid content, dielectric properties ) | Dimension and surface (uniformity of varnish coat | Spot weld check | |
| Core lamination | Y | Y | Y | Y | | Y | Y | | |
| After punching insulated core laminations | | | | | Y | Y | Y | | |
| Ventilation stamping | | | | | | | | Y | |
| Core assembly | Y | Y | | | | | Y1 | | |
| Y = Test applicable, Y1 = Visual checks | | | | | | | | | |

| 1.6.1.2 Process check for core of generator/ exciter (Table 2/2) | | | | | | |
|---|---|---|---|---|---|---|
| Items/ Components/ Process | Tests/ Checks | | | | | |
| | Process check including heating and | Insulation test of core tension bolt and core bar | Functional check of ventilation ducts | Hot spot by infra red camera, ELCID pressure application | Location of temperature detectors | Iron loss at rated flux density |
| Core assembly (additional checks for generator) | Y | Y | Y | Y | Y | |
| Y = Test applicable, Y1 = Visual check | | | | | | |

**1.6.1.3 Process check for stator conductor and winding of generator/ exciter (Table 1/3)**

| | Tests/ Checks | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Mechanical Properties (sample) | Chemical Properties (sample) | Resistivity/ Resistance | Metallography properties | Eddy current and pressure test | Insulation adhesion | Flexibility of bending | Dielectric test | Dimension/ visual | Electric test | Physical properties | Brazing procedure |
| Winding copper and connecting busbars | Y | Y | Y | | Y1 | | | | Y | | | |
| Insulated conductor | | | | | | Y | Y | Y | Y | Y | | |
| Insulation material | Y | Y | | | | | | | Y | Y | Y | |
| Manufacturing winding bar and phase bar | | | | | | | | Y | Y | Y | | Y |
| Winding laying | | | | | | | | Y | Y | Y | | |
| Water supply hoses | Y | Y | | | | | | Y | Y | | | |
| Winding supportring | | Y | | | | | | | Y | | Y | |
| Connection between bars | | | | | | | | | | | | Y |
| Wound stator | | | | | | | | | | | | |
| Y = Test applicable, Y1 = Visual checks | | | | | | | | | | | | |

**1.6.1.3 Process check for stator conductor and winding of generator/ exciter**

**(Table 2/3)**

| Items/ Components / Process | Tests/ Checks | | | | |
|---|---|---|---|---|---|
| | X-Ray | Process check | Flow test | Helium leak test and pressure test | Check on RTD and location |
| Winding copper and connecting busbars | | | | | |
| Insulated conductor | | | | | |
| Insulation material | | | | | |
| Manufacturing winding bar and phase bar | | Y | Y1 | Y | |
| Winding laying | | Y | | | Y |
| Water supply hoses | | | | Y | |
| Winding support ring | | | | | |
| Connection between bars | | | | | |
| Wound stator | | | | Y1 | |
| Y = Test applicable, Y1 = Visual checks | | | | | |

| 1.6.1.3 Process check for stator conductor and winding of generator/ exciter (Table 3/3) | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Items/ Components/ Process | Tests/ Checks | | | | | | | | | | | |
| | Tan delta and delta ( tan delta upto 1.2 Un) | Corona protection resistance | Reactance of stator winding | Magnetic permeability of metallic parts | Magnetic test and Vibration fatigue | Dielectric test at elevated, room temperature | Inter strand Insulation test | Thermal shock and boroscopic examination of brazed water box | Slot wedge tightness and radial movement | Type test on two bars for heating cycle test, Thermal stability test, Voltage endurance test | Support arrangement | Stator-NFT Test |
| Winding copper and connecting bus bars | | | | | | | | | | | | |
| Insulated conductor | | | | | | Y | | | | | | |
| Insulation material | | | | | | | | | | | | |
| Manufacturing winding bar and phase bar | Y | Y | | | | | Y | Y1 | | Y | | |
| Winding laying | Y | | | | | | | | | | Y | |
| Water supply hoses | | | | Y | Y | | | | | | Y | |
| Winding support ring | | | | | | | | | | | | |
| Connection betweenbars | | | | | | | Y | | | | | |
| Wound stator | Y | | Y | | | | | | Y | | | Y |
| Y = Test applicable, Y1= Applicable for hollow conductor | | | | | | | | | | | | |

**1.6.1.4 Process check for rotor and assembly of generator / exciter (Table 1/4)**

| Items/ Components/ Process | Tests/ Checks | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Sample tensile stress | Sample 0.2 limit | Sample elongation | Hardness on sample | Impact and stress rupture propertiescheck on sample | Sample chemical properties | NDTT, FATT | Process check including heat treatment (as applicable) | Ultrasonic test/ RT (at suppliers works and after preliminary machining) | Sulphur prints check flux carrying capacity/ magnetic | Flux carrying capacity/ magneticproperties | Boroscopic examination |
| Rotor forging and slip ring shaft | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y |
| Rotor end retaining ring and cover, locking ring and slip ring forgings, diode wheel | Y | Y | Y | | Y | Y | | Y | Y | | | |
| Rotor winding copper rotor wedges, damper wedges, CC-bolts and D-leads | Y | | Y | | | Y | | Y | Y | | | |
| Rotor slot boxes/ insulating material | | | | | | Y | | | | | | |
| Coil manufacture | | | | | | | | | | | | |
| Rotor winding | | | | | | | | Y | | | | |
| Winding connection studsand assembly | | | | | | | | | | | | |
| Complete rotor | | | | | | | | Y | | | | |
| Test on completed rotor at various speed upto rated speed | | | | | | | | | | | | |
| Test on completed rotor before and after overspeed | | | | | | | | | | | | |
| Fan hubs/ blades | | | | | | Y | | Y | Y | | | |
| Generator assembly | | | | | | | | | | | | |
| Rectifier wheel | Y | | Y | | | | | Y | Y | | | |
| Permanent magnet | | | | | Y | | | | | | Y | |
| Exciter assembly | | | | | | | | | | | | |
| Y = Test applicable | | | | | | | | | | | | |

**1.6.1.4 Process check for rotor and assembly of generator / exciter (Table 2/4)**

| Items/ Components/ Process | Tests/ Checks | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | MPI or DP, NDT | Visual, dimension, cleanliness | Adhesion, thickness of coat onsilver plating | Electrical conductivity andoxygen content | Mechanical test on sample | Electrical test | Resistance measurement | Purge test on vents | Helium leak test for $H_2$ cooled machine | Inter-turn test | Dielectric test | Gas tightness |
| Rotor forging and slip ring shaft | Y | Y | | | | | | | | | | |
| Rotor end retaining ringand cover, locking ring and slip ring forgings, diode wheel | Y | | Y | | | | | | | | | |
| Rotor winding copper rotor wedges, damper wedges, CC-bolts andD-leads | Y | | Y | Y | Y | Y | | | | | | |
| Rotor slot boxes/ insulating material | | | | | Y | Y | | | | | | |
| Coil manufacture | | Y | | | | | | | | | | |
| Rotor winding | Y | Y | | | | Y | Y | Y | Y | Y | Y | |
| Winding connection studs and assembly | Y | | | | Y | | | | | | Y | Y |
| Complete rotor | | | | | | | Y | | | | Y | |
| Test on completed rotor at various speed upto rated speed | | | | | | | Y | | | Y | Y1 | |
| Test on completed rotor before and after over- speed | | Y | | | | | | | | Y | Y | |
| Fan hubs/ blades | Y | Y | | | | | | | | | | |
| Generator assembly | | Y | | | | | | | | | | |
| Rectifier wheel | | Y | | | | Y | | | | | | |
| Permanent magnet | | Y | | | Y | | | | | | | |
| Exciter assembly | | Y | | | | Y | | | | | | |
| Y=Test applicable, Y1= at rated speed only | | | | | | | | | | | | |

**1.6.1.4 Process check for rotor and assembly of generator / exciter (Table 3/4)**

| Items/ Components/ Process | Tests/ Checks | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Insulation Resistance | PI at 5 kV | Radial run out/ alignment | Impedence measurement/ Repetitive Surge Oscillograph | Dynamic balancing ISO 5393, 5406, 2372, 1940 including Air run test | Over speed test (120%) for 2 minute | Functional test | Axial run out, seal ring holder | Metallography examination | Torque on joint bolts | Fitting and locking of balancing weights | Brazer and brazing procedure |
| Rotor forging and slip ring shaft | | | | | | | | | Y | | | |
| Rotor end retaining ring and cover, locking ring and slip ring forgings, diode wheel | | | | | | | | | | | | |
| Rotor winding copper rotor wedges, damper wedges, CC-bolts and D-leads | | | | | | | | | | Y | | |
| Rotor slot boxes/ insulating material | | | | | | | | | | | | |
| Coil manufacture | | | | | | | | | | | | Y |
| Rotor winding | | | | | | | | | | | | Y |
| Winding connection studs and assembly | Y | | | | | | | | | | | |
| Complete rotor | Y | | Y | Y | Y | Y | | | | Y | | |
| Test on completed rotor at various speed upto rated speed | | | | Y | | | | | | | | |
| Test on completed rotor before and after over-speed | Y | | Y | Y | | | | | | | | |
| Fan hubs/ blades | | | | | | | | | | | Y | |
| Generator assembly | Y | Y | Y | | | | Y | | Y | Y | Y | Y |
| Rectifier wheel | | | Y | | | | | Y | | Y | Y | |
| Permanent magnet | | | | | | | | | | | | |
| Exciter assembly | | | Y | | | | Y | | | Y | Y | |
| Y=Test applicable | | | | | | | | | | | | |

| **1.6.1.4 Process check for rotor and assembly of generator/ exciter ( additional checks for exciter)** | | | | | | | | | **(Table 4/4)** |
|---|---|---|---|---|---|---|---|---|---|
| Item/ Components/ Process | **Tests/ Checks** | | | | | | | | |
| | As per IEC-146 | As per IEC-76 | Pole parallelism and polarity | Mechanical chemical andMagnetic properties | Functional check | Insulation resistance | IEEE/ ANSI-C37.18 | As per specification | Dimensional and visual |
| Fuse diode and filter Circuit | Y | | | | | | | | Y |
| PMG and exciter stator | | | Y | Y | | Y | | | |
| Banding wire | | | | Y | | | | | |
| Exciter field Breaker, field discharge resistor | | | | | Y | | | | |
| Bearing, exciter armature field, axis coil RTD | | | | | | Y | | | |
| Voltage Regulator | | | | | | | | Y | |
| Y = Test applicable | | | | | | | | | |

**1.6.1.5 Final acceptance tests for generator/ exciter (Table 1/3)**

| Item/ Components/ Process | Tests/ Checks | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Gas tightness for $H_2$ cooled | Resistance measurement | Rotor impedance at various speeds | Heat run test | Function check | Voltage regulation | OCC | SCC | Record auxiliary parameters | Steady state reactance | Efficiency by separation of losses |
| Works tests on running generator | Y | Y | Y | Y | | | Y | Y | Y | Y | Y |
| Without Excitation, OC and SC with rated voltage and current for generator | | | | Y | | | | | | | |
| On total winding/ phases at interval 0.2Un for generator | | | | | | | | | | | |
| Condition after dismantling | | | | | | | | | | | |
| Works tests on brushless exciter | | Y | | Y | | | Y | | | | |
| PMG works tests | | Y | | Y | | Y | | | | | |
| Full load for PMG and converter assembly | | | | Y | | | | | | | |
| Converter assembly | | | | Y | | | | | | | |
| Y = Test applicable | | | | | | | | | | | |

| 1.6.1.5 Final acceptance tests for generator / exciter (Table 2/3) | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Item/ Components/ Process | Tests/ Checks | | | | | | | | | |
| | Insulation resistance at 5 kV | Polarization index at 5 kV | Phase sequence voltage balance | Shaft voltage and current | HV test (except electronic circuit) | RTD, BTD Check | Capacitance measurement | Tan delta, delta tan-delta | Rotor journal | Bearing oil catcher |
| Works tests on running generator | Y | Y | Y | Y | Y | Y | Y | Y | | |
| Without Excitation, OC and SC with rated voltage and current for generator | | | | | | | | | | |
| On total winding/ phases at interval 0.2Un for generator | | | | | | | Y | Y | | |
| Condition after dismantling | | | | | | | | | Y | Y |
| Works tests on brushless exciter | Y | | | | Y | | | | | |
| PMG works tests | Y | | Y | | Y | | | | | |
| Full load for PMG and converter assembly | | | | | | | | | | |
| Converter assembly | Y | | | | Y | | | | | |
| Y = Test applicable | | | | | | | | | | |

| 1.6.1.5 Final acceptance tests for generator/ exciter (Table 3/3) | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Item/ Components/ Process | Tests/ Checks | | | | | | | | | |
| | Seal rings, liners | Winding overhang | Vibration measurement | Reduced voltage running and No load | Load characteristics | Characteristics of search coil, quadrature | Ripple content | Visual and dimension | Partial discharge, DLA | Routine tests as per IS/ IEC |
| Works tests on running generator | | | Y | | | | | Y | Y | Y |
| Without Excitation, OC and SC with rated voltage and current for generator | | | | | | | | | | |
| On total winding/ phases at interval 0.2Un for generator | | | | | | | | | | |
| Condition after dismantling | Y | Y | | | | | | | | |
| Works tests on brushless exciter | | | Y | Y | Y | Y | | Y | | |
| PMG works tests | | | | Y | Y | | | | | |
| Full load for PMG and converter assembly | | | | | | | | | | |
| Converter assembly | | | | | | | | | | |
| Y =Test applicable | | | | | | | | | | |

Note:

1. All generators shall be assembled at works and shall be tested to verify/ ensure design and workmanship in accordance with IEC-34, VDE-0530, IEEE-115, IEEE 43. The manufacturer shall submit detailed test procedure which clearly specify test set up, instruments to be used, acceptance norms (wherever applicable), recording of different parameter, interval of recording, precautions, etc.
2. MQP shall be submitted by the manufacturer comprising the tests/checks as stipulated in the matrix/table attached for the specific item/component by the respective manufacturer.

### 1.6.1.6 Type tests

#### 1.6.1.6.1 Type tests (Category-I)

i) Generator

One number assembled generator shall be tested at works as per IEC-34. The tests shall be carried out keeping all conditions/ parameters as close as possible to site conditions with all the built-in instrumentation (like RTD etc.) suitably wired and the readings recorded. During various tests, bearing and shaft overhang vibrations shall also be measured with and without excitation. Recording ofvarious parameters of bearing, seal oil system, gas system, stator water cooling system and environmental conditions (like temperature etc.) shall also be done. The following tests shall be conducted:

a) Instantaneous short circuit test to determine transient and sub-transient reactance parameters and to ensure stability of winding during sudden short circuit condition

b) Negative sequence and zero sequence impedance

c) Voltage waveform factor and Total Harmonic Factor

d) Short circuit heat run test at rated pressure and cooling parameters with one cooler out of circuit at two third of rated stator current. In case of unsymmetrical cooler configuration, test with all possible variants of one cooler out of circuit shall be carried out.

e) Vibration measurement on all planes on stator overhang winding at suitable locations on each end and at other critical locations to be decided by purchaser for the following conditions:

- Open circuit operation
- Short circuit operation
- Sudden short circuit conditions
- Stand still condition - with Hammer test

ii) Brushless excitation system

a) Exciter - Temperature rise test at peak rating of excitation system. Ceiling duty condition shall also be demonstrated

b) Permanent magnet generator - Temperature rise test at peak rating ofexcitation system and ceiling duty condition shall also be demonstrated

c) Converter assembly (of the exciter field) - Temperature rise test at peak rating of excitation system. Ceiling duty condition shall also be demonstrated

**1.6.1.6.2 Type test (Category-II)**

Brushless excitation system

a) Converter assembly of the exciter field
   - Input and output surge withstand capability test
   - Soak test for Electronic module

b) Degree of protection test for Excitation system panels

**1.6.1.7 Site tests**

The tests to be conducted on each generator at site shall include but not be limited to those listed below. Any other test considered necessary by the contractor shall also becarried out :

a) Electrical

i) Measurement of the insulation resistance of the stator and rotor windingsto the frame and between phases, after drying out the machine and measurement of the polarisation index
ii) Measurement of the DC resistance of all windings and embedded temperature detectors
iii) Measurement of the insulation resistance of bearings
iv) Capacitance measurement and dissipation factor between the winding and body at rated voltage
v) Stator -Partial Discharger test @ 1.3 Phase to Neutral voltage for PRPD & Extinction & inception voltages (as per manufacturer's practice).
vi) Open circuit and short circuit tests
vii) Performance capability of the machine
viii) Line charging capacity
ix) Short circuit tests on the generator HV end and the generator transformer HV end to check the stability and operation of the generator and the overall (i.e. generator and generator transformer) differential protections and negative phase sequence protection.
x) Rotor-IR, Winding resistance, Impedance & RSO test
xi) Shaft voltage

b) Mechanical

i) Hydrogen leakage test
ii) Vibration test
iii) Over-speed test
iv) Hydraulic tests on coolers
v) Bearing and shaft current test

c) Load throw-off tests.

**1.6.2 Generator Isolated Phase Bus ducts and Neutral Grounding equipment**

**1.6.2.1 Generator Isolated Phase Bus duct (Table 1/2)**

| Items/ Components/ Sub-systems | Tests/ Checks | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Visual and Dimensional Checks | Electrical/ Mechanical/ Chemical Properties | WPS and PQR | NDT, DP or MPI, RT | Painting shade and adhesion test | Galvanizing test as per IS: 2629/ 2633/ 6745 | Electrical clearance and Creepage | Functional/ Operational check | Make, Type, Rating, Model, TC, General physical inspection | Routine test as per relevant standard |
| Enclosure/ cubicle | Y | Y | | Y | Y | | Y | | | |
| Busbar flexible connector and dis-connector link | Y | Y | | | | | | | | |
| Galvanized steel structure and plate | Y | | | | | Y | | | | |
| Seal of bushing and post insulator IS:5621, 2544 | Y | Y | | | | | Y | | Y | Y |
| Welding of enclosure and conductor | Y | | Y | Y | | | | | | |
| Gasket, silicagel breather, CT, VT, surge capacitor and arrestor, NGT, NGR, elastomer spring head | | | | | | | | Y | Y | Y |
| Busbar pressurisation system | Y | | | | | | | Y | | |
| Complete busduct IS:8084 | Y | | | | Y | | | | | Y |
| Y =Test applicable | | | | | | | | | | |

**1.6.2 Generator Isolated Phase Bus ducts and Neutral Grounding equipment**

**1.6.2.1 Generator Isolated Phase Bus duct (Table 2/2)**

| Items/ Components/ Sub-systems | Tests/ Checks | | | | |
|---|---|---|---|---|---|
| | Trial assembly at works : Heat run test and Milli volt drop measurement acrossbolted flexible joints | Trial assembly at works : Short circuit withstand test | Trial assembly at works: Impulse withstand test | Trial assembly at works: one minute high voltage power frequency | Trial assembly at works: Air leakage rateand water tightness test |
| Enclosure/ cubicle | | | | | |
| Busbar flexible connector and disconnector link | | | | | |
| Galvanized steel structure and plate | | | | | |
| Seal of bushing and post insulator IS:5621, 2544 | | | | | |
| Welding of enclosure and conductor | | | | | |
| Gasket, silicagel breather, CT, VT, surge capacitor and arrestor, NGT, NGR, elastomer spring head | | | | | |
| Busbar pressurisation system | | | | | |
| Complete busduct IS:8084 | Y | Y | Y | Y | Y |

Y =Test applicable

Note: MQP shall be submitted by the manufacturer comprising the tests/checks as stipulated in the matrix/table attached for the specific item/component by the respective manufacturer.

**1.6.2 Generator Isolated Phase Bus ducts and Neutral Grounding equipment**

**1.6.2.2 Neutral Grounding Resistor**

| Items/ Components/ Sub-systems | Tests/ Checks | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Visual and Dimensional check | Mechanical properties | Electrical strength | Chemical Composition | Make, Type, Rating, Model, TC, Generalphysical inspection. | Insulation resistance measurement beforeand after HV Test | HV Test | Degree of protection test | Routine test as per relevant standard | Galvanizing test | Routine test |
| Resistor | Y | Y | Y | Y | | Y | | | | | |
| Cubicle | Y | | Y | | | | | Y | | | |
| Galvanized steel structures (IS:2633/ 2629/ 6745/ 2062) | Y | Y | | | | | | | | Y | |
| Bushing/ Post and support Insulator ( IS:2544/ 5621) | Y | Y | Y | | Y | Y | | | Y | | Y |
| Complete NGR (IEEE-32) | Y | | | | | Y | Y | Y | Y | | Y |

Y =Test applicable

Note: MQP shall be submitted by the manufacturer comprising the tests/checks as stipulated in the matrix/table attached for the specific item/component by the respective manufacturer.

### 1.6.2.3 Type Tests

#### 1.6.2.3.1 Type test (Category-I)

The following type tests shall be conducted on one bus-ducts of each rating:

a) Heat run test on an assembly of representative sections and fittings with all types of flexibles, CTs etc

b) Short circuit withstand test (set up same as for heat run)

c) Impulse withstand test (set up shall include typical X-section with flexible connections, $90^0$ bend, CT's in position, seal off bushing, inspection cover and bellows)

d) One minute high voltage power frequency withstand test (set up as for short circuit test)

e) Air leakage rate and water tightness test (set up shall include inspection cover, flanged joint and bellow)

**1.6.2.3.2 Type test (Category-II)**

- Panels, cubicles and marshalling boxes shall be type tested for the degree of protection provided by the enclosure as given below :

  - For 5X-it shall not be possible to insert a thin sheet of paper under gaskets and through enclosure joints.
  - For 4X-It shall not be possible to insert a one mm diameter steel wire into enclosure from any direction without force.
  - For 2X-It shall not be possible to insert a twelve (12) mm dia steel wire into the enclosure from any direction without any force.
  - Test for second digit shall be in line with IS:13947 part-1

- For the equipment and materials such a current transformers, voltage transformers, lightning arresters, grounding transformers, loading resistors, bushings and surge capacitors for which type test are not specified in this section,successful type tests certificate shall be submitted to the purchaser.

**1.6.2.4 Site tests**

i) 10% radiography and 100% DP test on all site welded joints of busbar and enclosure (for Root & Final welding).

ii) Milli-volt drop test

iii) Ratio and polarity tests on current and voltage transformers

iv) Insulation measurement of equipment and all wiring

v) Functional test on pressurization (Tightness test as per ANSI 37.20)

vi) One minute high potential power frequency withstand test at 75% of rated test voltage

vii) Enclosure Isolation test with support frame.

viii) Air pressurisation test.

| 1.6.3 Power Transformers |
|---|
| **1.6.3.1 Generator Transformers/ Unit auxiliary transformers/ Station transformers)**<br><br>**Please refer QAP for transformer mentioned in Annexure – A of Model Quality Assurance Plan (MQAP) For Equipment Of Substation, Switchyards And Transmission Lines** |

**1.6.4 HT BUSDUCT**

**1.6.4.1 11kV, 6.6kV & 3.3kV Segregated Phase Bus ducts**

| Items/ Components/ Sub-systems | Tests/ Checks | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Visual and Dimensional Checks | Electrical, Mechanical, Chemical properties | WPS and PQR | NDT, DP or MPI, RT | Paint shade and Adhesion test | Galvanizing Test as per IS: 2629/ 2633/ 6745 | Electrical clearance and creepage | Functional/ Operational check | Make, Type, Rating, Model, TC, General physical inspection | Routine tests on complete busduct |
| Enclosure/ cubicle<br>Arc test at rated short circuit current | Y | Y | | Y | Y | | | | | |
| Busbar flexible connector and disconnector link | Y | Y | | | | | | | | |
| Steel structure and plate IS:2062 | | Y | | | | Y | | | | |
| Bushing, post and support insulator (IS:9431 and 2544) | Y | | | | | | Y | | | Y |
| Welding of enclosure and conductor | Y | | Y | | | | | | | |
| Gasket, silicagel breather | | | | | | | | Y | Y | Y |
| Complete busduct IS:8084 | Y | | | | Y | | | | | Y |

Y =Test applicable

Note: MQP shall be submitted by the manufacturer comprising the tests/checks as stipulated in the matrix/table attached for the specific item/component by the respective manufacturer.

**1.6.4.2 Type test (Category-II)**

(a) All bus-ducts supplied shall be of type tested quality.

(b) Type test reports for the following shall be submitted:

- One minute power frequency voltage withstand test
- Temperature rise test. Milli volt drop shall also be measured across boltedflexible joint
- Impulse voltage withstand test

- Short time current test
- Water tightness test (as per IS:8084)
- Arc test at rated short circuit for rated time
- Air leakage test

**1.6.4.3 Site tests**

The following minimum tests/ checks shall be conducted at site. Any other tests/ checksas per the manufacturer's recommendation shall also be carried out

- Power frequency voltage withstand test
- Air leakage test
- Insulation resistant measurement of equipment and all wiring
- Milli-volt drop
- Tightness test for bus bar joints.

**1.6.5 Auxiliary Service Transformers**

**1.6.5.1 Oil-filled Outdoor Transformers**

| | **Tests/ Checks** | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Items/ Components/ Sub-systems | Visual and Dimensional checks | Mechanical properties | Electrical strength | Thermal properties | Chemical Composition | Compatibility with oil | Core Loss (on first Job) Hot Spot | NDT, DP or MPI, UT | Ageing Test | Voltage Ratio, Vector Group andPolarity, Magnetic balance test | Make, Type, Rating, Model, TC, General physical Iispection. | WPS and PQR | Vacuum and Pressure Test | Routine Tests |
| Tank, HV and LV Cable Box/ Flange throat | Y | Y | | | | | | Y | | | | Y | Y | |
| Conservator/ Radiator/ Cooler/ Pipes | Y | Y | | | | | | Y | | | | Y | | |
| Copper Conductor (IS:191) | Y | Y | Y | | Y | | | | | | | | | |
| Insulating Material | Y | Y | Y | Y | Y | Y | | | | | | | | |
| CRGO Lamination and Built Core | Y | Y | Y | | Y | Y | Y | | | | | | | |
| Bushing / Insulator ( IS:2544/ 5621) | Y | Y | | | | | | | | | Y | | | Y |
| Gasket | Y | | | | Y | Y | | | Y | | | | | |
| Transformer oil ( IS:335) | | | | | | | | | | | | | | Y |
| Off-circuit tap changer | Y | | | | | | | | | | Y | | | Y |
| Core coil assembly and pre-tanking | Y | | | | | | | | | Y | | | | |
| Marshalling box | Y | Y | | | | | | Y | | | | | | Y |
| WTI, OTI, MOG, PRD, Breather, Terminal Connector, Bucholz Relay, Globe and Gate Valve, | Y | | | | | | | | | | Y | | | |
| Welding (ASME Sect-IX) | Y | | | | | | | | | | | Y | | |
| Complete Transformer (IS:2026) | Y | | | | | | | | | Y | | | | Y |

Y =Test applicable

Note: MQP shall be submitted by the manufacturer comprising the tests/checks as stipulated in the matrix/table attached for the specific item/component by the respective manufacturer.

**1.6.5.2 Dry Type Indoor Transformers**

| Items/ Components/ Sub-systems | Tests/ Checks | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Visual and dimensional check | Mechanical properties | Electrical strength | Thermal properties | Chemical properties | Core loss (on first job), Hot | NDT, DP or MPI | Voltage ratio, vector group and polarity | Make, Type, Rating, Model, TC,General physical inspection | WPS and PQR | Measurement of capacitance andtan delta between winding | Routine tests |
| Enclosure door, HV and LV Cable box/ Flange throat | Y | Y | | | | | | | Y | | | |
| Copper conductor | Y | Y | Y | | Y | | | | | | | |
| Insulating material | Y | | | Y | Y | | | | | | | |
| CRGO lamination and built core | Y | | | | | Y | | | | | | |
| Bushing/ Insulator ( IS:2544/ 5621) | Y | | | | | | | | Y | | | Y |
| Gasket | Y | | | | | | | | Y | | | Y |
| Off-circuit tap changer | Y | | | | | | | | Y | | | |
| Core coil assembly | Y | | | | | | | Y | | | | |
| Marshalling box | Y | | | | | | | | | | | |
| WTI, Thermister, Terminal connector | Y | | | | | | | | Y | | | |
| Welding | | | | | | | | | | Y | | |
| Complete transformer (IS:11171) | Y | | | | | | | Y | | | Y | Y |

Y =Test applicable

Note: MQP shall be submitted by the manufacturer comprising the tests/checks as stipulated in the matrix/table attached for the specific item/component by the respective manufacturer.

**1.6.5.3 Type tests**

**1.6.5.3.1 Type tests (Category-I)**

The transformer shall be subjected to the following type tests for rating above 2 MVA.

i) Short Circuit test – This test shall be carried out after conducting the routinetests. Rest of the type tests shall be conducted after successful short circuit testing.
ii) Noise level measurement
iii) Enclosure IP Degree test (for Dry Type Transformers only)
iv) Measurement of zero phase sequence impedance
v) Measurement of the harmonics of no load current
vi) Temperature rise
vii) Lightning impulse voltage test on all the three limbs as per Cl. 13 of IS:2026Part-III,2018

**1.6.5.3.2 Additional Type tests (Category-I) (for Oil Filled Transformers only)**

I. Vacuum Test on Transformer Tank - One Transformer tank of each rating shall be subjected to the specified vacuum. The tank designed for full vacuum shall betested at an internal pressure of 0.35 kg/ $cm^2$ (absolute, 250 mm of Hg) for one hour. The permanent deflection of flat plates after the vacuum has been released shall not exceed the values specified below :

| Horizontal Length of Flat Plate (mm) | Permanent deflection (mm) |
|---|---|
| Upto and including 750 | 5.0 |
| 751 to 1250 | 6.5 |
| 1251 to 1750 | 8.0 |
| 1751 to 2000 | 9.5 |
| 2001 to 2250 | 11.0 |
| 2251 to 2500 | 12.0 |
| 2501 to 3000 | 16.0 |
| Above 3000 | 19.0 |

II. Pressure Test on Transformer Tank - One transformer tank of each rating shall be subjected to a pressure corresponding to twice the normal pressure of normal pressure plus 0.35 kg/ cm2 whichever is lower measured at the base of the tank and maintained for an hour. The permanent deflection of flat plates after the excess pressure has released shall not exceed the figure for vacuum test.

III. Oil Leakage Test - All tanks and oil filled compartments shall be tested for oil tightness by oil of a viscosity not greater than that of insulating oil to IS:335, at the specified ambient temperature and subjected to a pressure equal to the normalpressure plus 35 KN/ $m^2$ (51 lb/ $inch^2$) measured at the base of the tank. This pressure shall be maintained for a period of not less than 12 hours, during which time no leakage shall occur.

IV. Tests on associated equipment - Porcelain bushings, bushing current transformers, winding temperature indicating devices, dial thermometers, buchholz relays, ON/OFF load tap changer, auxiliary motors and motor starting contactors, coolers, control device, Insulating oil and other associated equipment shall be tested in accordance with relevant IS. The following checks shall also be made before dispatch:

ii) Check for proper packing and preservation of accessories like radiators, bushings, explosion vent, dehydrating breather, Buchholz relay, conservator etc.

iii) Check for proper provision of bracing to arrest the movement of core and winding assembly inside the tank.

iv) Test for Gas tightness and derivation of leakage rate to ensure adequate reserve gas capacity during transit and storage.

**a. Type tests (Category-II)**

All indoor transformers below and equal to 2 MVA rating to be supplied shall be of type tested quality. The test reports of the following type tests shall be submitted.

v) Short Circuit test – This test shall be carried out after conducting the routinetests. Rest of the type tests shall be conducted after successful short circuittesting.
vi) Noise level measurement
vii) Measurement of zero phase sequence impedance
viii) Measurement of the harmonics of no load current
ix) Temperature rise
x) Lightning impulse voltage test on all the three limbs as per Clause 13 of IS:2026 Part-III,2018

**1. Site tests**

i) The following minimum tests/ checks shall be conducted at site. Any other tests/ checks as per the manufacturer's recommendation shall also be carried out

a) Dry out test
b) Resistance measurement of windings
c) Ratio test
d) Vector group test
e) Tap changer test
f) Buchholz relay test
g) Low oil level alarm.
h) Temperature indicators
i) Marshalling kiosk
j) Protective relays
k) Magnetizing current
l) Door interlock tests

ii) The following additional checks shall be made to see the following:

a) All oil valves are in correct position closed or opened as required
b) All air pockets are cleared
c) Thermometer pockets are filled with oil
d) Oil is at correct level in the bushing, conservator, divertor switch, tank etc.
e) Earthing connections are made
f) Colour of silica gel is blue
g) Bushing arcing horn is set correctly
h) CT polarity is correct (when bushing mounted CTs are provided)

**1.6.6 Motors**

| Item/ Components/ Sub-system | Tests/ Checks | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Visual | Dimensional | Make,Type,Rating,TC,General physical | Mechanical, Chemical properties | NDT, DP or MPI, UT | Metallography | Electrical characteristics | Welding/ Brazing (WPS/ PQR) | Heat treatment | Magnetic characteristics | Hydraulic, Leak, Pressure test | Thermal characteristics | Run out | Dynamic balancing | All routine tests as per IS:325/ IS:4722/ IS:9283 | Vibration | Over speed | Tan delta, shaft voltage and polarisation index test |
| Plates for stator frame, end shield, spider etc. | Y | Y | Y | Y | | | | | Y | | | | | | | | | |
| Shaft | Y | Y | Y | Y | Y | Y | | | Y | | | | | | | | | |
| Magnetic material | Y | Y | Y | Y | Y | | Y | | | Y | | Y | | | | | | |
| Rotor copper/ Aluminium | Y | Y | Y | Y | | Y | Y | | Y | | | | | | | | | |
| Stator copper | Y | Y | Y | Y | | | Y | | Y | | | Y | | | | | | |
| SC ring | Y | Y | Y | Y | Y | Y | Y | Y | Y | | | | | | | | | |
| Insulating material | Y | | Y | Y | | | Y | | | | | Y | | | | | | |
| Tubes for cooler | Y | Y | Y | Y | Y | | | | Y | | Y | | | | | | | |
| Sleeve bearing | Y | Y | Y | Y | Y | | | | Y | | Y | | | | | | | |
| Stator, Rotor coils | Y | Y | Y | | | | Y | Y | | | | | | | | | | Y |
| Castings, stator frame, terminal box and bearing housing etc. | Y | Y | Y | Y | Y | | | Y | | | | | | | | | | |
| Fabrication and machining of stator, rotor, terminal box | Y | Y | | | Y | | | | Y | | | | | | | | | |
| Wound stator | Y | Y | | | | | Y | Y | | | | | | | | | | Y |

| | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Rotor complete | Y | Y | | | | | Y | | | | | | Y | Y | | | | |
| Stator, Rotor, Terminal Box assembly | Y | Y | | | | | Y | | | | | | | | | | | |
| Accessories, RTD, BTD,CT, Brushes, Diodes, space heater, antifriction bearing, cable glands, lugs, gaskets etc. | Y | Y | Y | | | | | | | | | | | | | | | |
| Complete motor (IS: 325/ IS:4722/ IS:9283) | Y | Y | Y | | | | Y | | | | | | | | Y | Y | Y | Y 1 |
| Y =Test applicable, Y1 = for 11kV, 6.6 kV and 3.3kV motors only | | | | | | | | | | | | | | | | | | |
| **Notes** | | | | | | | | | | | | | | | | | | |
| 1) | This is an indicative list of tests/ checks. The manufacture is to furnish the detailed Quality Plan indicating the practices and procedure followed along with relevant supporting documents during QP finalization. However QP approval is not envisaged for 415V motors upto 50 KW. | | | | | | | | | | | | | | | | | |
| 2) | Note: MQP shall be submitted by the manufacturer comprising the tests/checks as stipulated in the matrix/table attached for the specific item/component by the respective manufacturer. | | | | | | | | | | | | | | | | | |

**1.6.6.1 Type tests**

**1.6.6.1.1 Type tests (Category-I)**

<u>11kV, 6.6kV and 3.3kV motors</u>

The following type tests shall be conducted on each type and rating of 11kV, 6.6kV 3.3kVmotor:

- No load saturation and loss curves upto approximately 115% of rated voltage

- Measurement of noise at no load

- Momentary overload test (subject to test bed constraint)

- Full load test (subject to test bed constraint)

- Temperature rise test at rated conditions (During heat run test, bearing temperature, winding temperature, core temperature, coolant flow and its temperature shall also be measured. In case the temperature rise test is carried at load other than rated load, specific approval for the test method and procedure is required to be obtained.Wherever ETD's are provided, the temperature shall be measured by ETD's also for the record purpose).

**1.6.6.1.2 Type tests (Category-II)**

i) 11kV, 6.6kV and 3.3kV motors

The following type test reports shall be submitted for each type and rating ofmotor.

- Degree of protection test for the enclosure followed by IR, HV and no load run test

- Terminal box-fault level withstand test for each type of terminal box

- Type test on Elastimold termination kit as per relevant standard

ii) 415V motors

415V motors shall be of type tested quality. The type test reports for type tests as per relevant standards shall be submitted for each type and rating of 415V motors (above 100KW only)

iii) Impulse Voltage test (on the sample coil after placing it in stator core at (4U+5kV) and with at least five impulse of 1.2/50 micro-second wave, for MV motors only, where U is the line to line voltage in kV).

**1.6.6.2 Site Tests**

The following minimum tests/ checks shall be conducted at site. Any other tests/ checksas per the manufacturer's recommendation shall also be carried out

i) Measurement of vibration.

ii) Measurement of insulation resistance and polarization index.

iii) Measurement of winding resistance of stator winding

iv) HV Power frequency test for 1 minute preceded and followed by measurement of IR values.

v) Capacitance & Tan Delta & Tip Up till rated voltage

vi) Measurement of full load current.

vii) Test running of the motors, checking the temperature rise and identifying the hot spotetc.

**1.6.7 11kV, 6.6kV and 3.3kV Switchgear (Table 1/2)**

| Items/ Components/ Sub-systems | Tests/ Checks | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Make, Type, Model, Rating and TC | Electrical Properties | Mechanical properties | Chemical properties | Dimensions and Finish | Functional and operational features | Item to conform to relevant Standards | Pretreatment as per IS 6005 | Paint shade, thickness, adhesion and finish | Functional Checks | HV and IR Test | Degree of Protection - Routine test | CB Operation timing check | All Routine Tests as per relevant standards |
| Aluminum busbar material (IS: 5082) | Y | Y | Y | Y | Y | | Y | | | | | | | |
| Copper busbar material (IS:613 ) | Y | Y | Y | Y | Y | | Y | | | | | | | |
| Bus bar support insulation (IS:9431) | Y | Y | Y | | Y | | Y | | | | Y | | | |
| HT Circuit Breaker (IEC:56 ) | Y | | | | Y | Y | Y | | | Y | | | Y | Y |
| HT Contactors ( IS:9046 ) | Y | | | | Y | Y | Y | | | Y | | | | Y |
| Protection and auxiliary relays (IS:3231/ 8686 ) | Y | | | | Y | Y | Y | | | Y | | | | Y |
| HT CT's and PT's (IS:2705/ 3156) | Y | | | | Y | | Y | | | | | | | Y |
| HT Fuses ( IS:9385 ) | Y | | | | Y | Y | Y | | | | | | | |
| Surge arrester ( IEC:99-4 ) | Y | | | | Y | | Y | | | | | | | Y |
| LT Contactors ( IS:13947) | Y | | | | Y | Y | Y | | | Y | | | | |
| Control and selector switches (IS:6875) | Y | | | | Y | Y | Y | | | Y | | | | |
| Indicating meters (IS:1248) | Y | | | | Y | Y | Y | | | Y | | | | Y |
| Indicating lamps (IS:13947) | Y | | | | Y | Y | Y | | | Y | | | | |
| Push buttons (IS: 4794) | Y | | | | Y | Y | Y | | | Y | | | | |
| Control transformer (IS:12021) | Y | | | | Y | Y | Y | | | | | | | Y |
| LT fuses (IS:13703) | Y | | | | Y | Y | Y | | | | | | | |
| Energy meters (IS:722 ) | Y | | | | Y | Y | Y | | | | | | | Y |
| Transducers (IEC:60688) | Y | | | | Y | Y | Y | | | | | | | Y |

Y =Test applicable

Note: MQP shall be submitted by the manufacturer comprising the tests/checks as stipulated in the matrix/table attached for the specific item/component by the respective manufacturer.

**1.6.7 11kV, 6.6kV and 3.3kV Switchgear (Table 2/2)**

| Items/ Components,/ Sub-system | Tests/ Checks | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Make, Type, Model, Rating and TC | Electrical properties | Mechanical properties | Chemical properties | Dimensions and Finish | Functional and Operational features | Item to conform to relevant standards | Pretreatment as per IS: 6005 | Paint shade, thickness, adhesion and | Functional checks | HV and IR Test | Degree of Protection - Routine test | CB Operation timing check | All Routine Tests as per relevant standard |
| Diodes | Y | Y | | | | Y | Y | | | Y | | | | |
| Terminal Blocks | Y | Y | | | | Y | Y | | | | | | | |
| Synthetic Rubber Gasket (IS:11149/ 3400 ) | Y | Y | | | Y | | Y | | | | | | | |
| Breaker Handling Trolley | Y | | | | Y | Y | | | Y | Y | | | | |
| HT Switchgear Panel ( IS:3427) | Y | | | | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y |

Y =Test applicable

Note: MQP shall be submitted by the manufacturer comprising the tests/checks as stipulated in the matrix/table attached for the specific item/component by the respective manufacturer.

**1.6.7.1 Type test (Category-II)**

All 11kV, 6.6kV and 3.3kV Switchgears supplied shall be of type tested quality.

a) Type test reports for the following shall be submitted:

i) Circuit breaker/ circuit breaker panels, of each voltage class and current rating:

- Short circuit duty test on circuit breaker, mounted inside the panel offered alongwith CTs, bushing and separators

- Short time withstand test on circuit breaker, mounted inside paneloffered together with CTs, bushings and separators

- Power frequency withstand test on breaker mounted in side panel

- Lightning impulse withstand test on breaker mounted in side panel
- Temperature rise test on breaker and panel together. For this test, the test set up shall include three panels with breakers, the test breaker and panel being placed in the Center.

The adjacent panels shall also be loaded to their rated current capacity. Alternatively the test panel may be suitably insulated at the sides, which will be adjoining to other panels in actual site configuration

- Test to verify pressure relief devices operation of the panel. Thisshall be done on one panel of each voltage class
- measurement of resistance of main circuit
- Mechanical endurance test on breaker
- Mechanical operation test

ii) Contactor and contactor panels of each type and rating:

- Verification of rated making and breaking capacities of the contactor
- Short time withstand test of panel
- Power frequency test on the contactor mounted in side panel
- Lightning impulse voltage withstand test of the contactor mounted inside panel
- Measurement of resistance of main circuit
- Test to confirm coordination between fuse and contactor

iii) Surge arrestor/ lightning arrestor (as applicable) of each type:

- Standard lightning impulse voltage spark-over test
- Front of wave sparkover test (For surge arrestor used alongwithmotor feeder, this test shall be carried out with a voltage wavehaving a rate of rise of not less than 142kV/ micro-second for arrestor used in 11kV system, 85kV/ micro-second for 6.6kV system and 44kV/ micro-second for arrestor used in 3.3kV system).
- Power frequency sparkover and temporary overvoltage test
- Residual voltage test
- Operating duty test
- Current impulse withstand test (long duration and high current impulse)

- Pressure relief test

iv) Short circuit withstand test of earthing device (truck/ switch)

b) Shop testing of components and bought out items

For various bought out items like CT, VT, relays, meters, surge arrestors etc. for which identification can be physically verified and test certificate from manufacturer can be co-related, following shall be indicated in the QP.

- Review of manufacturer's Test Certificate (TC) as per relevant standard and compliance to requirements of this specification
- Physical check and functional/ operational check to ensure that item is fitfor assembly on the switch board cubicle.

For all other items where identification has not been envisaged by manufacturers,a certificate of conformance to be obtained from manufacturer, and component identification shall be tagged as per approved drawing/ schematic. Either of the following or both shall be adopted .

- Random sample to be tested either in-house or at an independent laboratory for all tests envisaged in relevant standard.
- Physical check and functional/ operation check to ensure the item is fit for assembly on the switch board cubicle.

**1.6.7.2 Site tests**

The following minimum tests/ checks shall be conducted at site. Any other tests/ checks as per the manufacturer's recommendation shall also be carried out

a) S.N. General

i) Check name plate details according to specification
ii) Check for physical damage
iii) Check tightness of all bolts, clamps and connecting terminals
iv) Check earth connections
v) Check cleanliness of insulators and bushings
vi) Check heaters are provided
vii) HV test on complete switchboard with CT and breaker/ contactor in position
viii) Check all moving parts are properly lubricated
ix) Check for alignment of busbars with the insulators to ensure alignment and fitness of insulators
x) Check for interchangeability of breakers/ contactors
xi) Check continuity and IR value of space heater
xii) Check earth continuity for the complete switchgear board

b) S.N. Circuit Breaker/ Contactors

i) Check alignment of trucks for free movement
ii) Check correct operation of shutters
iii) Check slow closing operation (if provided)
iv) Check control wiring for correctness of connections, continuity and IRvalues
v) Manual operation of breakers completely assembled
vi) Power closing/ opening operation, manually and electrically at extremecondition of control supply voltage
vii) Closing and tripping time
viii) Trip free and anti-pumping operation
ix) IR values, resistance and minimum pick up voltage of coils
x) Simultaneous closing of all the three phases
xi) Check electrical and mechanical interlocks provided
xii) Checks on spring charging motor, correct operation of limit switchesand time of charging
xiii) Check $SF_6$ pressure/ Leakage current in case of VCB
xiv) All functional checks

c) S.N. Current Transformers

i) Insulation resistance between windings and winding terminals to body
ii) Polarity tests
iii) Ratio identification checking of all ratios on all cores by primary injection of current
iv) Magnetisation characteristics (Knee point) and secondary winding resistance
v) Spare CT cores to be shorted to earth

d) S.N. Voltage Transformers

i) Insulation resistance test
ii) Ratio test on all cores
iii) Polarity test
iv) Line connections as per connection diagram

e) S.N. Cubicle Wiring

i) Check all switch developments
ii) It should be made sure that the wiring is as per relevant drawings. Allinterconnections between panels shall similarly be checked
iii) All the wires shall be meggered to earth
iv) Functional checking of all control circuit e.g. closing, tripping interlock, supervision and alarm circuit including proper functioning of component/equipment
v) Check terminations and connections

| | | |
|---|---|---|
| | vi) | Wire ducting |
| | vii) | Gap sealing and cable bunching |
| f) | S.N. | Relays |
| | i) | Check internal wiring |
| | ii) | Insulation resistance between all terminals and body |
| | iii) | Insulation resistance between AC to DC terminals |
| | iv) | Check operating characteristics by secondary injection |
| | v) | Check minimum pick up voltage of DC coils |
| | vi) | Check operation of electrical/ mechanical targets |
| | vii) | Check CT connections with particular reference to their polarities fordifferential type relays |
| | viii) | Relay pickup & timing test as per Relay settings |
| g) | S.N. | Meters |
| | i) | Insulation resistance of all insulated portions |
| | ii) | heck CT and VT connections with particular reference to their polarities for power type meter |

**1.6.8 415V Switchgear and Bus duct**

**1.6.8.1 415V Switchgear (Table 1/2)**
**(MCC, PCC, ACDB, DCDB, Local push button station, Local motor starters)**

| Items/ Components/ Sub-system | Tests/ Checks | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Make, Model, Type, Rating and TC | Dimensions and Finish | Electrical properties | Mechanical properties | Chemical properties | Functional and Operational features | Item to conform to relevant standards | Pretreatment as per IS 6005 | Paint shade, adhesion, thickness and finish | Functional checks | Milli-volt drop Test | IR – HV – IR Test | Degree of protection Routine test | All Routine tests as per relevant standards |
| Sheet steel (IS:513) | Y | Y | | Y | Y | | Y | | | | | | | |
| Aluminum bus bar material (IS:5082) | Y | Y | Y | Y | Y | | Y | | | | | | | |
| Copper bus bar material (IS:613) | Y | Y | Y | Y | Y | | Y | | | | | | | |
| Support insulator (IS:943, IS:10912, IEC: 660 ) | Y | Y | Y | Y | | | Y | | | | | | | |
| Air circuit breaker(IS:13947) | Y | Y | | | | Y | Y | | | Y | Y | | | Y |
| Energy meters ( IS:722 ) | Y | Y | | | | Y | Y | | | Y | | | | Y |
| Power and auxiliary contactor (IS:13947) | Y | Y | | | | Y | Y | | | Y | | | | |
| Protection and auxiliary relays (IS:3231) | Y | Y | | | | Y | Y | | | Y | | | | Y |
| Control and selector switches (IS:6875) | Y | Y | | | | Y | Y | | | Y | | | | |
| CT and VT (IS 2705/ 3156) | Y | Y | | | | | Y | | | | | | | Y |
| MCCB ( IS:13947 ) | Y | Y | | | | | Y | | | Y | | | | |
| Indicating meters (IS:1248) | Y | Y | | | | Y | Y | | | Y | | | | Y |
| Indicating lamps (IS:13947) | Y | Y | | | | Y | Y | | | Y | | | | |
| Air break switches ( IS:13947 ) | Y | Y | | | | Y | Y | | | Y | | | | |
| Control terminal blocks | Y | Y | | | | Y | Y | | | | | | | |

Y =Test applicable

Note: MQP shall be submitted by the manufacturer comprising the tests/checks as stipulated in the matrix/table attached for the specific item/component by the respective manufacturer.

**1.6.8.1 415V Switchgear (Table 2/2)**
**(MCC, PCC, ACDB, DCDB, Local push button station, Local motor starters)**

| Items/ Components/ Sub-system | Tests/ Checks | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Make, Model, Type, Rating and TC | Dimensions and Finish | Electrical properties | Mechanical properties | Chemical properties | Functional and Operational Features | Item to conform to relevant standards | Pretreatment as per IS: 6005 | Paint Shade, Adhesion, Thickness and | Functional checks | Milli-volt drop Test | IR – HV – IR Test | Degree of Protection - Routine test | All Routine tests as per relevant standards and |
| Fuse (IS:13703) | Y | Y | | | | Y | Y | | | Y | | | | |
| Control transformer (IS:12021) | Y | Y | | | | Y | Y | | | Y | | | | Y |
| Push Buttons (IS:4794) | Y | Y | | | | Y | Y | | | Y | | | | |
| Transducer (IEC:60688) | Y | Y | | | | Y | Y | | | Y | | | | Y |
| MCB (IS:8828) | Y | Y | | | | Y | Y | | | Y | | | | |
| Breaker handling trolley | Y | Y | | | | Y | | | Y | Y | | | | Y |
| Synthetic rubber gasket (IS:11149) | Y | Y | | Y | Y | | Y | | | | | | | |
| 415V Switchgear (IS:8623 ) | Y | Y | | | | Y | Y | Y | Y | Y | Y | Y | Y | Y |

Y =Test applicable

Note: MQP shall be submitted by the manufacturer comprising the tests/checks as stipulated in the matrix/table attached for the specific item/component by the respective manufacturer.

**1.6.8.2 415V Bus duct**

| Items/ Components | Tests/ Checks | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Dimension and surface finish | Make, Type, Rating and Test certificate (TC) | Electrical properties | Mechanical properties | Chemical properties | Item to conform to relevant IS | WPS approval, Welder qualification | Weld quality check ( DP test and X-ray) | Paint shade, Thickness, Adhesion and finish | Tightness by torque measurement | Electrical clearances | Galvanizing test as per IS 2629/ 2633 | IR – HV – IR test | Phase sequence check | Degree of protection routine test |
| Aluminum sheets/ plates/ strips/ flexibles/ tubes (IS:5082/ 737) | Y | Y | | Y | Y | Y | Y | Y | | | | | | | |
| CRCA flats/ ISMC (IS:2062) | Y | Y | | Y | Y | Y | | | | | | | | | |
| Neoprene/ synthetic rubber gaskets (IS:11149/ 3400) | Y | Y | | Y | Y | | | | | | | | | | |
| Rubber bellows (IS:3400) | Y | Y | | Y | Y | | | | | | | | | | |
| Support insulator (BS:2782, IEC:660, IS:10912 ) | Y | Y | Y | Y | | | | | | | | | | | |
| Galvanized structure and GI earthing flat (IS:2629/ 2633/ 4749) | Y | Y | | | | Y | | | | | | Y | | | |
| Space heater and Thermostat | | Y | Y | | | | | | | | | | | | |
| LT busduct (IS:8623 Part 2) | Y | Y | | | | Y | Y | Y | Y | Y | Y | | Y | Y | Y |

Y = Test applicable

Note: MQP shall be submitted by the manufacturer comprising the tests/checks as stipulated in the matrix/table attached for the specific item/component by the respective manufacturer.

### 1.6.8.3 Type test (Category-II)

All 415V Switchgears and bus duct supplied shall be of type tested quality.

a) Type test reports for the following tests shall be submitted on each type and rating of 415V switchgear and AC, DC distribution boards:

   i) Short time withstand test with circuit breaker mounted inside the switchgear panel

   ii) Temperature rise test

   iii) Arc test at rated short circuit capacity

   iv) Type II - Short circuit co-ordination test for any three ratings of MCC module

   v) Test sequence-1 and combined test sequence shall be carried out on each rating of circuit breaker mounted inside the panel

   vi) Degree of protection test

b) Type test reports for the following tests shall be submitted on each type and rating of 415V bus duct:

   i) Heat run test on an assembly of representative sections and fittings

   ii) Short circuit test for a duration and current on an assembly of representative section

   iii) One minute high potential power frequency voltage withstand test

   iv) Air and water tightness test on a typical section

### 1.6.8.4 Site tests

The following minimum tests/ checks shall be conducted at site. Any other tests/ checksas per the manufacturer's recommendation shall also be carried out

a)

| S.N. | General |
|---|---|
| i) | Check name plate details according to specification |
| ii) | Check for physical damage |
| iii) | Check tightness of all bolts, clamps and connecting terminals |
| iv) | Check earth connections |
| v) | Check cleanliness of insulators and bushings |
| vi) | Check heaters are provided |
| vii) | HV test on complete switchboard with CT and breaker/ contactor inposition |
| viii) | Check all moving parts are properly lubricated |

| | | |
|---|---|---|
| | ix) | Check for alignment of busbars with the insulators to ensure alignmentand fitness of insulators |
| | x) | Check for interchange ability of breakers/ contactors |
| | xi) | Check continuity and IR value of space heater |
| | xii) | Check earth continuity for the complete switchgear board. |
| | xiii) | Check Closed door operation - service, test & isolated positions, if applicable. |
| b) | S.N. | Circuit Breaker/ Contactors |
| | i) | Check alignment of trucks for free movement |
| | ii) | Check correct operation of shutters |
| | iii) | Check slow closing operation (if provided) |
| | iv) | Check control wiring for correctness of connections, continuity and IRvalues |
| | v) | Manual operation of breakers completely assembled |
| | vi) | Power closing/ opening operation, manually and electrically at extremecondition of control supply voltage |
| | vii) | Closing and tripping time |
| | viii) | Trip free and anti-pumping operation |
| | ix) | IR values, resistance and minimum pick up voltage of coils |
| | x) | Simultaneous closing of all the three phases |
| | xi) | Check electrical and mechanical interlocks provided |
| | xii) | Checks on spring charging motor, correct operation of limit switchesand time of charging |
| | xiii) | Check $SF_6$ pressure/ vacuum (as applicable) |
| | xiv) | All functional checks |
| c) | S.N. | Current Transformers |
| | i) | Insulation resistance between windings and winding terminals to body |
| | ii) | Polarity tests |
| | iii) | Ratio identification checking of all ratios on all cores by primary injection of current |
| | iv) | Magnetisation characteristics (knee Point) and secondary winding resistance |
| | v) | Spare CT cores, if any to be shorted and earthed |
| d) | S.N. | Voltage Transformers |
| | i) | Insulation resistance test |
| | ii) | Ratio test on all cores |
| | iii) | Polarity test |
| | iv) | Line connections as per connection diagram |
| e) | S.N. | Cubicle Wiring |
| | i) | Check all switch developments |
| | ii) | It should be made sure that the wiring is as per relevant |

drawings. Allinterconnections between panels shall similarly be checked

iii) Insulation resistance of all wires with respect to earth

iv) Functional checking of all control circuit e.g. closing, tripping interlock, supervision and alarm circuit including proper functioning of component/equipment

v) Check terminations and connections

vi) Wire ducting

vii) Gap sealing and cable bunching

f) S.N. Relays

i) Check internal wiring

ii) Insulation resistance between all terminals and body

iii) Insulation resistance between AC and DC terminals

iv) Check operating characteristics by secondary injection

v) Check minimum pick up voltage of DC coils

vi) Check operation of electrical/ mechanical targets

vii) Check CT connections with particular reference to their polarities fordifferential type relays

viii) Relay pickup & timing as per Relay settings

g) S.N. Meters

i) Insulation resistance of all insulated portions

ii) Check CT and VT connections with particular reference to theirpolarities for power type meter

h) S.N. Bus duct

i) Visual inspection

ii) Power frequency voltage withstand test

iii) Insulation resistant measurement of equipment and all wiring

iv) Milli-volt drop

**1.6.9 Power and Control Cables :**

**1.6.9.1 11kV, 6.6kV and 3.3kV Power Cables (Table 1/2)**

| Item/ Components/ Sub-system | **Tests/ Checks** | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Make, Type, Rating and TC | Dimension/ surface finish | Mechanical properties | Chemical composition | Spark test | Curing properties | Electrical properties | Hot set test, Eccentricity and Ovality | Lay length and sequence | Armour coverage, cross over, looseness, gap between two wire | Sequential marking/ surface finish/ cable length | Tensile strength and elongation before and after ageing on outer sheath and insulation | Thermal stability on outer sheath | Metallic screening ( if applicable) |
| Aluminium (IS-8130) | Y | Y | Y | Y | | | Y | | | | | | | |
| Semi conducting compound | Y | | Y | | | Y | Y | | | | | | | |
| XLPE compound(IS-7098-Part-II) | Y | | Y | | | Y | Y | | | | | Y | | |
| FRLS HR PVC compound (IS- 5831, ASTM-D2843, ASTM-2863, IEC-754 Part-1) | Y | | Y | | | | | | | | | Y | Y | |
| Triple extrusion and curing/ Manufacturing of core | | Y | | | Y | | | Y | Y | | | | | |
| Copper tape | Y | Y | Y | | | | Y | | | | | | | |
| Polyster tape | Y | Y | | | | | | | | | | | | |
| Armour wire/strip | Y | Y | Y | | | | | | | | | | | |
| Copper tapping | Y | Y | | | | | | Y | | | | | | |
| Inner sheath | Y | Y | | | | | | | | | | | | |
| Armouring | | | | | | | | | | Y | | | | Y |
| Outer sheathing | | Y | | | | | | | | | Y | Y | Y | |
| Power cable (Finished) (IS :7098 Part-II) IEC:332, IS-5831, ASTM-D2843, ASTM-2863, IEC-754 Part-1)<br>Cable Drum Rewinding | Y | | | | | | | | Y | Y | Y | Y | Y | |
| Wooden drum (IS:10418)/ Steel drum | | Y | | | | | | | | | | | | |

Y =Test applicable

Note: MQP shall be submitted by the manufacturer comprising the tests/checks as stipulated in the matrix/table attached for the specific item/component by the respective manufacturer.

| **1.6.9.1 11kV, 6.6kV and 3.3kV Power cables** | **(Table 2/2)** | | | |
|---|---|---|---|---|
| Item/ Components/ Sub-system | **Tests/ Checks** | | | |
| | Anti termite coating on wooden drums | Constructional requirements feature as per specification | Routine and acceptance test as per relevant standard and specification | FRLS tests |
| Aluminium (IS-8130) | | | | |
| Semi conducting compound | | | | |
| XLPE compound (IS-7098- Part-II) | | | | |
| FRLS HR PVC compound (IS-5831, ASTM-D2843, ASTM-2863, IEC-754 Part-1) | | | | Y |
| Triple extrusion and curing/ Manufacturing of core | | | | |
| Copper tape | | | | |
| Polyster tape | | | | |
| Armour wire/strip | | | | |
| Copper tapping | | | | |
| Inner sheath | | | | |
| Armouring | | | | |
| Outer sheathing | | Y | | Y |
| Power cable (Finished) (IS : 7098 Part-II) IEC: 332, IS-5831, ASTM-D2843, ASTM-2863,IEC-754 Part-1)<br>Cable Drum Rewinding | | Y | Y | Y |
| Wooden drum(IS-10418) /Steel Drum | Y | | | |
| Y =Test applicable | | | | |
| **Notes** | | | | |
| 1) | Additional acceptance tests like FRLS, thermal stability, tensile strength and elongation after ageing shall be done on one sample/ lot | | | |
| 2) | Length measurement/ surface finish/ eccentricity/ ovality shall be checked on one length/ size/ lot | | | |
| 3) | Routine test shall be carried out on each drum length as per specifications. | | | |
| 4) | MQP shall be submitted by the manufacturer comprising the tests/checks as stipulated in the matrix/table attached for the specific item/component by the respective manufacturer. | | | |

**1.6.9.2 1.1 kV PVC and XLPE cables (Table1/2)**

| Item/ Components/ Sub-system | Tests/ Checks | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Make, Rating, Type and TC | Dimension/surface finish | Mechanical properties | Chemical composition | Electrical properties | Spark test | Hot set test (XLPE) | Lay length/ sequence | Armour coverage, cross over, looseness,Gap between two armour wire/ strip | Sequential marking/ surface finish/ cable length | Tensile strength, elongation before and after ageing of insulation and outer sheath | Thermal stability of insulation and outer sheath * |
| Aluminum (IS-8130) | Y | Y | Y | Y | Y | | | | | | | |
| PVC compound (IS-5831) | Y | | Y | | Y | | | | | | Y | |
| XLPE compound (IS-7098 Pt-I) | Y | | Y | | Y | | Y | | | | Y | |
| FRLS HR PVC compound (IS-5831 )ASTM-D-2843/ ASTM-D-2863 IEC-754 Part-I | Y | | Y | | | | | | | | Y | |
| Armour wire/strip (IS-3975) | Y | Y | Y | | | | | | | | | |
| Insulated core | | Y | | | | Y | Y | | | | | Y |
| Laid up core | | Y | | | | | | Y | | | | |
| PVC Inner sheath | | Y | | | | | | | | | | |
| Armouring | | Y | | | | | | | Y | | | |
| Outer sheath | | Y | | | | | | | | Y | Y | Y |
| Finish cable (IS-1554 and 7098 – Part-1) ASTM-D-2843/ ASTM-D-2863 IEC-754 Part-I Swedish Chimney SS 4241475 for (F3 category) Flammability test IEC-332 Part –3 Cat-B Cable Drum Rewinding | Y | Y | | | | | | | Y | Y | Y | Y |
| Wooden drum (IS-10418) / Steeldrum | | Y | | | | | | | | | | |

Y =Test applicable

Note: MQP shall be submitted by the manufacturer comprising the tests/checks as stipulated in the matrix/table attached for the specific item/component by the respective manufacturer.

| 1.6.9.2 1.1 kV PVC and XLPE CABLES | (Table 2/2) | | | |
|---|---|---|---|---|
| Item/ Components/ Sub-system | Tests/ Checks | | | |
| | Anti termite treatment on wooden drums | Constructional/ requirement as per specification | Routine and acceptance test as per relevant standard and specification | FRLS Tests |
| Aluminum (IS-8130) | | | | |
| PVC Compound (IS-5831) | | | | |
| XLPE Compound (IS-7098 Pt-I) | | | | |
| FRLS PVC Compound (IS-5831 ) ASTM-D-2843/ASTM-D-2863 IEC-754 Part-I | | | | Y |
| Armour wire/strip (IS-3975) | | | | |
| Insulated Core | | | | |
| Laid up core | | | | |
| PVC Inner sheath | | | | |
| Armouring | | | | |
| Outer sheath | | | | Y |
| Finish cable (IS-1554 & 7098 – Part-1) ASTM-D-2843/ASTM- D-2863 IEC-754 Part-I Swedish Chimney SS 4241475 for (F3 category) Flammability test IEC-332 Part –3 Cat-B<br>Cable Drum Rewinding | | Y | Y | Y |
| Wooden drum (IS-10418) / Steel drum | Y | | | |
| Y =Test applicable | | | | |

| Notes | |
|---|---|
| 1) | (*) Not applicable for XLPE insulation |
| 2) | Additional acceptance tests like FRLS, thermal stability, tensile strength and elongation after ageing shall be done on one sample / lot. |
| 3) | Length measurement / surface finish shall be checked on one length/ size/ lot |
| 4) | Routine test shall be carried out on each drum length as per specifications. |
| 5) | MQP shall be submitted by the manufacturer comprising the tests/checks as stipulated in the matrix/table attached for the specific item/component by the respective manufacturer. |

**1.6.9.3 1.1 kV PVC Control cables (Table 1/2)**

| Item/ Components/ Sub-system | Tests/ Checks | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Make, Type, Rating, Test certificate (TC) | Dimension/ surface finish | Mechanical properties | Chemical composition | Electrical properties | Spark test | Lay length/ sequence | Armour coverage, cross over, looseness, gap between two armour wire | Sequential marking/ surface finish/ cable length | Tensile strength, elongation before and after ageing of insulation and outer sheath | Thermal stability of insulation and outer sheath |
| Copper conductor (IS-8130) | Y | Y | Y | Y | Y | | | | | | |
| PVC compound (IS-5831) | Y | | Y | | Y | | | | | Y | |
| FRLS PVC compound IS-5831 ASTM-D-2843/ ASTM-D-2863 IEC-754 Part-1 | Y | | Y | | | | | | | Y | |
| Armour wire/strip (IS-3975) | Y | Y | Y | | | | | | | | |
| Insulated core | | Y | | | | Y | Y | | | | |
| Laid up core | | Y | | | | | Y | | | | |
| PVC Inner sheath | | Y | | | | | | | | | |
| Armouring | | Y | | | | | | Y | | | |
| Outer sheath | | Y | | | | | | | Y | Y | Y |
| Finished cable (IS-1554) ASTM-D-2843/ ASTM-D-2863 IEC-754 Part-1 Swedish Chimney: SEN SS 424-1475( F3 category) Flammability test IEC-332 Part-3 Cat-B<br>Cable Drum Rewinding | Y | Y | | | | | | Y | Y | Y | Y |
| Wooden drum( IS:10418)/ Steel drum | | Y | | | | | | | | | |

Y =Test applicable

Note: MQP shall be submitted by the manufacturer comprising the tests/checks as stipulated in the matrix/table attached for the specific item/component by the respective manufacturer.

| 1.6.9.3 1.1 kV PVC Control cables | (Table 2/2) | | | |
|---|---|---|---|---|
| | Tests/ Checks | | | |
| Item/ Components/ Sub-system | Anti termite treatment on wooden drums | Constructional feature as per specification | Routine and Acceptance test as per relevant standard and specification | FRLS test |
| Copper conductor (IS-8130) | | | | |
| PVC compound (IS-5831) | | | | |
| FRLS PVC compound IS-5831 ASTM-D-2843/ ASTM-D-2863 IEC-754 Part-1 | | | | Y |
| Armour wire/strip (IS-3975) | | | | |
| Insulated core | | | | |
| Laid up core | | | | |
| PVC Inner sheath | | | | |
| Armouring | | | | |
| Outer sheath | | | | Y |
| Finished cable (IS-1554) ASTM-D-2843/ ASTM-D-2863 IEC-754 Part-1 Swedish Chimney: SEN SS 4241475 (F3 category) Flammability test IEC-332 Part-3 Cat-B Cable Drum Rewinding | | Y | Y | Y |
| Wooden drum( IS : 10418) / Steel drum | Y | | | |
| Y =Test applicable | | | | |
| **Notes** | | | | |
| 1) | Additional acceptance tests like FRLS, thermal stability, tensile strength and elongation after ageing shall be done on one sample/ lot | | | |
| 2) | Length measurement / surface finish shall be checked on one length/ size/ lot | | | |
| 3) | Routine test shall be carried out on each drum length as per specifications. | | | |
| 4) | MQP shall be submitted by the manufacturer comprising the tests/checks as stipulated in the matrix/table attached for the specific item/component by the respective manufacturer. | | | |

**1.6.9.4 Type tests (Category-I)**

The type tests on one drum for each type and size ofcables shall be conducted.

a) Annealing test (for copper) as per IS:8130

b) Tensile test (for Aluminium) as per IS:8130

c) Wrapping test (for Aluminum) as per IS:8130

d) Conductor resistance test as per IS:8130

e) Test for armour wires/ strips as per IS:3975 - The hard drawn aluminium wires armour (in case of single core cables) shall also comply with the tensile test and wrapping test as per IS:8130.

f) Test for thickness of insulation and sheath - Requirement and methods of test for the thickness of insulation and sheaths shall be as per relevant IS. The calculated diameter over stranded core and "Calculated nominal diameter under outer sheath" shall, however, be determined by the method given in Appendix "A" of IEC-60502.

g) Tensile strength and elongation test for insulation and sheath - The value of tensile strength and elongation at break-point shall not be less than 125kg/cm$^2$and 150% respectively for the type 'A' and type ST1 PVC compounds. For XLPE insulation these tests shall be carried out in accordance with IS:7098 (Part-III). The tensile strength and elongation at a break shall not be less than 125kg/cm$^2$ and 200% respectively.

h) Ageing test for insulation and sheath - The ageing test shall be carried out as per the procedures laid down in relevant IS, however the period of test shall be 168 hours, instead of 120 hours. The test value obtained for the tensile strength and elongation must not differ from the corresponding values obtained before ageing by more than ±25% in case of type ST2 PVC and XLPE compounds and by morethan ±20% in case of type A, and type STI PVC compound.

i) Loss of mass test - This test is to be carried out on the PVC insulation and sheaths as per IEC-60540. The maximum permissible loss of mass shall be 2mg/cm$^2$.

j) Shrinkage test - This test shall be carried out on the PVC insulation and sheath. The test procedures and test values shall comply with IS:5831.

k) Cold bend test - This test is to be carried out upto 6mm$^2$ cables size in accordance with IS:5831.

l) Cold impact test - This test shall be carried out on the PVC insulation and sheath in accordance with IS-5831.

m) Heat shock test for PVC insulation and sheath - This test shall be carried out as per IEC-60540 and IEC-60502.

n) Thermal stability test for PVC insulation and sheath - This test shall be carried out in accordance with IEC-60540/60540A and shall pass the minimum requirement of 100minutes.

o) Test for bleeding and blooming of pigments for PVC - This test shall be carriedout as per IS :5831.

p) Fire resistance test - This test shall be carried out in accordance with relevantclause of IS:5831.

q) Measurement of insulation resistance - This test shall be carried out as perIS:5831. The volume resistivity of the PVC insulated cables shall not be less than $1x10^{14}$ ohm-cm at 27°C and $1x10^{11}$ ohm-cm at 70°C.

r) High voltage test - This test shall be performed as per IS:1554 (Part-I).

The cable with insulation/ sheath material other than PVC shall be subject to all the tests mentioned in their respective Indian or International Standards to which they are conforming. In that case if any of the above test is not applicable, the same will not be carried out.

s) Hot set test for insulation - This test shall be carried out as per IEC-60540 and shall pass the requirement given in IEC-60502.

t) Partial discharge test - This test shall be carried out in accordance with IEC-60540 and IEC-60502. The test requirements are as given in IEC-60502.

u) Bending test - The method and test requirement shall be as per IEC-60502 and on completion of this test, the sample be subject to partial discharge measurement and comply with the requirements.

v) Tan delta measurement as a function of voltage and capacitance measurement - This test shall comply with clause 16.1.6 of IEC-60502.

w) Tan delta measurement as a function of temperature - This test shall comply with clause 16.1.7 of IEC-60502.

x) Heating cycle test plus partial discharge test - This test shall be carried out as per IEC-540 and IEC-502.

y) Impulse withstand test - This test shall be carried out as per IS:7098 (Part-II). The impulse withstand voltage shall be 75 kV.

z) High voltage test - This test shall be performed as per IS:7098 (Part –II). The normal sequence of electrical test shall be as per clause 16.1.1 of IEC-60502.

**1.6.9.5 Type test (Category-I) - Additional type tests on flammability**

a) The oxygen index test shall be carried out as per ASTM-D-2863. The minimum oxygen index shall be 29.

b) Accelerated water absorption test and dielectric retention test - This test shall be carried out in accordance with NEMA-WC-5 irrespective of thickness of insulation (applicable for the thermoplastic material only).

c) Temperature index test for sheath - As per ASTM-D-2863 at different temperature upto $250^0$C. However, the test shall be carried out by extrapolation method beyond temperature at which the material of sheath may startdeformation as per BICC Hand Book Chapter-6 on cables in fire. The number ofmeasurements up to 200°C (room temperature, 50°C, $100^0$C, $150^0$C and $200^0$C) plotted on a graph and than extrapolated. The minimum temperature index shall be 250°C.

d) Flammability of finished cables - The test shall be carried out as per requirement of Swedish Standards SS-4241475 class-F3, IEEE-383, IEC-60332 and IEC- 60331 (for fire survival cables only) and cables should meet the requirement ofall the above standards as mentioned in the respective category of cables.

e) Acid gas generation during fire of sheath - The test shall be carried out as per IEC-60754-1 as well as per BS or other standard applicable for evaluation of halogen gases and the requirement of maximum halogen gases liberated shall be less than as mentioned elsewhere in the respective category of cables.

f) Smoke generation by sheath under fire - The test shall be carried out as per ASTMD-2843.

g) Test for rodent and termite repulsion property of sheath - The details to be given by the manufacturer.

**1.6.9.6 Site tests**

The following minimum tests/ checks shall be conducted at site. Any other tests/ checksas per the manufacturer's recommendation shall also be carried out

1.4.6.5.1.1 Insulation resistance test

1.4.6.5.1.2 High voltage test

**1.6.10 Installation of Cables, Earthing system and Lightning Protection system**

| Items/ Components/ Sub-systems | Tests/ Checks | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Make, Type, Model, Rating and TC | Dimension | Pre-treatment of sheet | Paint shade, paint thickness, adhesion | IP protection | Bought out items/ Bill of material | HV and IR | Galvanize test | Functional test as per specification | Proof load | Deflection test | Constructional feature as per specification | All Routine and acceptance tests | Item conform to relevant standard |
| Switch box/ Junction box/ Receptacles (IS-513, IS:5, IS:2629, IS:2633, IS:6745) | Y | Y | Y | Y | Y | Y | Y | Y | Y | | | Y | Y | |
| Cable glands (BS:6121) | Y | Y | | | | | | | | | | | | Y |
| Cable lug (IS:8309) | Y | Y | | | | | | | | | | | | Y |
| Lighting wire (IS:694) | Y | Y | | | | | | | | | | Y | | Y |
| Flexible conduits | Y | Y | | | | | | | | | | Y | | Y |
| Conduits (Galvanize and Epoxy) IS:9537, IS:2629, IS:2633 and IS:6745 | Y | Y | Y | | | | | Y | | | | | Y | |
| RCC hume pipe (IS:458) | Y | Y | | | | | | | | | | | | Y |
| Cable termination and Straight through joint (VDE-0278) | Y | Y | | | Y | Y | | | | | | Y | Y | |
| Cable Trays, Flexible supports system and accessories IS:513, IS:2629, IS:2633 and IS:6745 | Y | Y | Y | | | Y | | Y | | Y | Y | Y | Y | |
| Trefoil clamp | Y | Y | | | | | | | | | | | | Y |
| GI flats for earthing and lightning protection (IS:2062, IS:2629, IS:6745 and IS:2633) | Y | Y | Y | | | | | Y | | | | | | Y |
| GI wire (IS-280) | Y | Y | Y | | | | | Y | | | | | | Y |

Y =Test applicable

Note: MQP shall be submitted by the manufacturer comprising the tests/checks as stipulated in the matrix/table attached for the specific item/component by the respective manufacturer.

**1.6.10.1 Type test (Category-II)**

i) All cable trays, supports and accessories etc supplied shall be of type testedquality.

ii) Cable termination kit and straight through joints shall be tested as per IS:3573 for 3.3kV and 11kV class.

iii) Fire proof cable penetration system shall be tested for the following tests:

- Accelerated ageing test
- Water absorption test
- Fire rating test
- Hose stream test
- Vibration test followed by fire rating test

iv) Galvanizing tests

The quality of galvanizing shall be inspected visually and shall be smooth, continuous, free from flux stains.

In addition following tests shall be conducted :

- Uniformity of coating – The coating of any article shall withstand for 1 minute dips in standard copper sulphate solution without the formation of an adherent red spot of metallic copper upon the basic metal.

- The quality of cadmium/ zinc plating on items with screw threads shall be inspected visually and shall be free from visible defects such as unplated areas, blisters and modules.

- In addition, the plating thickness shall be determined microscopically/ chemically or electronically.

v) Welding

The quality of welding shall be visually inspected, particular attention being paidto the following points.

- The welded joints shall be continuous along its length on both sides and of uniform width and thickness. It should be free from blow holes.

- The weld metal shall be properly fused with the parent metal without undercutting.

- The outside surface of the weld shall be clean. All slag shall have been removed. All welding shall be regularly checked for cracking using magnetic particle inspection or their equivalent technique.

vi) Physical and dimensional checks for all items

vii) Deflection test for cable trays

viii) Following tests shall also be carried out on each type of equipment, devices and materials/ items supplied:

- Physical and Dimensional checks

- Check/ measurement of thickness for Nickel chrome plating for cable glands and tinning for cable lugs.

- Check chemical composition of brass parts for cable glands

- Hardness check on gaskets

- Test for uniformity of galvanization

**1.6.10.2 Site tests**

The following minimum tests/ checks shall be conducted at site. Any other tests/ checksas per the manufacturer's recommendation shall also be carried out

i) Cables

a) Check for physical damage.

b) Check for insulation resistance before and after termination/ jointing.

c) HT cables shall be pressure tested (test voltage as per IS:7098) before commissioning.

d) Check of continuity of all cores of the cables.

e) Check for correctness of all connections as per relevant wiring diagrams. Any minor modification to the panel wiring like removing/ inserting, shorting, change in terminal connections, etc shall be carried out.

f) Check for correct polarity and phasing of cable connections.

g) Check for proper earth connections for cable glands, cable boxes, cable armour, screens etc.

h) Check for provision of correct cable tags, core ferrules, tightness of connections.

ii) Cable trays/ supports and accessories

a) Check for proper galvanizing/ painting and identification number of the cable trays/ supports and accessories.

b) Check for continuity of cable trays over the entire route.

c) Check that all sharp corners, burrs, and waste materials have beenremoved from the trays supports.

d) Check for earth continuity and earth connection of cable trays.

iv) Earthing and Lightning protection system

a) Earth continuity checks.

b) Earth resistance of the complete system as well as sub-system.

**1.6.11 DC Storage Battery**

**1.6.11.1 Lead-Acid type battery**

| Item/ Components/ Sub-system | Tests/ Checks | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Dimensions and finish | Conformance to relevant drawing | Chemical composition | Lead coating thickness (minimum 25 microns, IS:6848and Adhesion check | Conformance to CPWD Specification for teak wood | Paint process checks, paint shade, thickness, adhesionand finish | Constructional requirements as per specification | Insulation Resistance | Marking ( Routine and Acceptance test) | Checking of polarity and absence of short circuit (Routine and Acceptance test) | Test for capacities for 10 hours discharge rate along with the test for voltage during discharge (Acceptance test) |
| Container and Lids (IS:1146) | Y | Y | | | | | | | | | |
| Vent plugs | Y | Y | | | | | | | | | |
| Sealing compound (IS:3116) | | Y | Y | | | | | | | | |
| Positive and Negative plates | | Y | Y | | | | | | | | |
| Separators ( IS:6071 ) | Y | Y | | | | | | | | | |
| Electrolyte (water/ sulphuric acid ) (IS:1069/ 266) | | Y | Y | | | | | | | | |
| Inter-cell connectors and fasteners | Y | Y | | Y | | | | | | | |
| Battery stand | Y | Y | | | Y | Y | | | | | |
| Cell insulators | Y | Y | | | | | | Y | | | |
| Stack assembly | Y | Y | | | | | | | | | |
| Lead-Acid battery (IS:1652 ) | Y | | | | | | Y | | Y | Y | Y |

Y =Test applicable

Note: MQP shall be submitted by the manufacturer comprising the tests/checks as stipulated in the matrix/table attached for the specific item/component by the respective manufacturer.

| 1.6.11.2 Ni - Cd type battery | | | | | | | | | | (Table 1/2) |
|---|---|---|---|---|---|---|---|---|---|---|
| Items/ Components/ Sub-system assembly | Tests/ Checks | | | | | | | | | |
| | Dimensions and finish | Impact strength | Conformance to relevant part drawing and Manufacturer's standards | Resistance to alkali | Chemical composition | Nickle plating thickness | Paint shade, thickness, adhesion and finish | Air pressure test after heat sealing | Marking and mass (Routine and Acceptance test) | Air pressure test (Acceptance test) |
| Container and Lids ( IS:1146) | Y | Y | Y | Y | | | | | | |
| Vent Plugs | Y | | Y | Y | | | | | | |
| Perforated steel strips | Y | | Y | Y | | Y | | | | |
| Active material for positive and negative Plates | | | Y | | Y | | | | | |
| Separators | Y | | Y | Y | | | | | | |
| Electrolyte | | | Y | | Y | | | | | |
| Inter-cell connectors and fasteners | Y | | Y | Y | | Y | | | | |
| Battery stand | Y | | | Y | | | Y | | | |
| Cell Insulators | Y | | Y | Y | | | | | | |
| Stack assembly | Y | | Y | | | | | Y | Y | |
| Ni-Cd Battery (IS:10918 ) | Y | | | | | | | | Y | Y |

Y =Test applicable

Note: MQP shall be submitted by the manufacturer comprising the tests/checks as stipulated in the matrix/table attached for the specific item/component by the respective manufacturer.

| 1.6.11.2 Ni- Cd type battery | | | | (Table 2/2) |
|---|---|---|---|---|
| Items/ Components/ Sub-system assembly | Tests/ Checks | | | |
| | Retention of charge test (Acceptance test) | AH test (Acceptance test) | Insulation Resistance (Acceptance test) | Polarity and absence of short circuit (Routine and Acceptance test) |
| Container and Lids ( IS:1146) | | | | |
| Vent Plugs | | | | |
| Perforated steel strips | | | | |
| Active material for positive and negative Plates | | | | |
| Separators | | | | |
| Electrolyte | | | | |
| Inter-cell connectors and fasteners | | | | |
| Battery stand | | | | |
| Cell Insulators | | | | |
| Stack assembly | | Y | | Y |
| Ni-Cd Battery (IS:10918 ) | Y | Y | Y | Y |
| Y =Test applicable<br><br>Note: MQP shall be submitted by the manufacturer comprising the tests/checks as stipulated in the matrix/table attached for the specific item/component by the respective manufacturer. | | | | |

**1.6.11.3 Type test (Category-II)**

All batteries supplied shall be of type tested quality.

**1.6.11.3.1 Lead -Acid Plante battery**

i) Type test reports for the following shall be submitted for purchaser's approval :

a) Container (Rubber and Plastic containers)

- High voltage test
- Drop ball test
- Plastic Yield test
- Acid resistance test
- Hydraulic thrust endurance test.

b) Cells and batteries

- Tests for capacities for 10 hr and 30 minutes discharge rates and test for voltage during discharge.
- Ampere hours and watt-hour efficiency test.
- Tests for retention of charge.
- Endurance tests.

ii) Acceptance Tests - All acceptance tests as listed below shall be carried out on sample cell selected at random by the purchaser before dispatch and at site after completion of installation.

- Verification of markings.
- Verification of dimensions.
- Test for capacities for 10 hrs discharge rate along with the testfor voltage during discharge.

If a battery fails to meet the guaranteed requirements, the purchaser shall havethe option of asking to replace the same.

**1.6.11.3.2 Nickel-Cadmium battery**

i) Type test reports for the following shall be submitted for purchaser's approval :

- Life cycle test
- Tests for capacities for 5 hr. and ½ hr. discharge rates and test for voltage during discharge
- Ampere hours and watt-hour efficiency test
- Tests for retention of charge
- Endurance tests
- Discharge performance at low temperature

ii) Acceptance Tests - All acceptance tests as listed below shall be carried out on sample cell selected at random by the purchaser before dispatch and at site after completion of installation.

a) Physical examination
b) Dimensions, mass and layout
c) Marking
d) Polarity and absence of short circuit.
e) Air pressure test
f) Ampere - hour capacity
g) Retention of charge

h) Insulation resistance
i) Test for capacities for 5 hrs. and ½ hr. discharge rates and test for voltage during discharge

If a battery fails to meet the guaranteed requirements, the purchaser shall havethe option of asking to replace the same.

**1.6.11.4 Site tests**

The following minimum tests/ checks shall be conducted at site. Any other tests/ checksas per the manufacturer's recommendation shall also be carried out

- Physical examination
- Dimensions, mass and layout
- Marking
- Polarity
- Insulation resistance
- Impedance measurement

**1.6.12 Battery Charger**

| Item/ Components/ Sub-system | Tests/ Checks | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Make, Model, Type, Rating and Finish | Chemical and Mechanical tests | Sheet steel pretreatment and painting process | Conform to relevant standard | Dimensional check and paint shade, thickness, adhesion and finish checks | Complete physical examination for constructional features of battery charger as per specification | Temperature rise test | Dynamic response test | Ripple content test, load limiter and Annunciator and AVR operation test | Operational and functional checks | HV and IR test | Burn-in test at $50^0$C for 48 hrs. | Degree of protection test . |
| Rectifier transformer (IS:2026) | Y | | | Y | | | Y | | | | Y | | |
| Electronic components including potentiometer ( vernier type) | Y | | | Y | | | | | | | | | |
| PCB and electronic cards | Y | | | Y | | | | | | | | | |
| 19"standard racks for electronic card | Y | | | | | Y | | | | | | | |
| Control and selector switches (IS:6875) | Y | | | Y | | | | | | Y | | | |
| Indicating meters (IS:1248 ) | Y | | | Y | | | | | | Y | | | |
| Indicating lamps (IS:13947) | Y | | | Y | | | | | | Y | | | |
| Air break switches/ Fuses( IS:13947/ 13703) | Y | | | Y | | | | | | Y | | | |
| Control terminal blocks (IS:13947) | Y | | | Y | | | | | | | | | |
| Control transformer ( IS:12021) | Y | | | Y | | | | | | Y | | | |
| Push buttons ( IS:4794 ) | Y | | | Y | | | | | | Y | | | |
| MCB ( IS:8828) | Y | | | Y | | | | | | Y | | | |
| PVC insulated copper control wires (IS:694 ) | Y | | | Y | | | | | | | | | |
| Sheet steel ( IS:513 ) | Y | Y | Y | Y | | | | | | | | | |
| Synthetic rubber gaskets | Y | Y | | Y | | | | | | | | | |
| Annunciator | Y | | | | | | | | | Y | | Y | |
| Battery charger | Y | | | | Y | Y | Y | Y | Y | | Y | Y | Y |

Y =Test applicable

Note: MQP shall be submitted by the manufacturer comprising the tests/checks as stipulated in the matrix/table attached for the specific item/component by the respective manufacturer.

### 1.6.12.1 Type test (Category-II)

All battery chargers supplied shall be of type tested quality.

Type test reports for the following shall be submitted for purchaser's approval :

i) Complete physical examination
ii) Temperature rise test at full load.
iii) Temperature rise test of rectifier assembly at 200% of full load (for chargers up to 400 A rating).
iv) Insulation resistance test.
v) High voltage (power frequency) test on power and control circuits exceptlow voltage electronic circuits.
vi) Ripple content test at no load, half load and full load
vii) Automatic voltage regulator operation test at specified AC supplyvariations at no load, half load and full load
viii) Load limiter operation test
ix) Efficiency and power factor measurement.
x) Input and output surge withstand capability test. Surge voltage as per ANSI-C37.90a shall be applied for period not less than 2 second at the following points of the charger operating at $50^0$C at full load :

- Across each AC input phase
- Across AC input line to ground.
- Across DC output terminals.
- Across each DC output terminal to ground

The charger shall not exhibit any component damage and there shall beno change in performance as per tests at (vii) and (viii).

xi) Environmental tests - Steady state performance tests (vii) and (viii) shall be carried out before and after each of the following tests.

a) Soak Test - The electronic modules shall be subjected to continuous operation for a minimum period of 72 hours. During last 48 hours,the ambient temperature shall be maintained at $50^0$C. The 48 hourtest period shall be divided into four equal 12 hour segments. The input voltage during each 12 hours shall be nominal voltage for 11 hours followed by 110% of nominal voltage for 30 minutes, followedby 90% of nominal voltage for 30 minutes.

b) Degree of protection test.

### 1.6.12.2 Site tests

The following minimum tests/ checks shall be conducted at site. Any other tests/ checks as per the manufacturer's recommendation shall also be carried out

j) Complete physical examination
ii) Checking of proper operation of annunciation system

iii) Temperature rise test at full load for 30 min

v) Insulation resistance test

vi) Automatic voltage regulator operation

vii) Load limiter operation.

viii) Dynamic response test - overshoot/ undershoot in output voltage of the charger asa result of sudden change in load from 100% to 20% and 20% to 100% shall be measured with the batteries connected and disconnected. Output voltage of the charger connected with battery shall be within 94% to 106% of the voltagesetting in above conditions and shall return to, and remain, within the limits specified as mentioned elsewhere, in less than 2seconds (as applicable).

ix) Regenerative / pumping back to grid test.

**1.6.13 Protection and relay panel for generator, generator transformer and UATs**

| Items/ Components/ Sub-systems | Tests/ Checks | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Make, Type, Model, Rating and TC | Electrical Properties | | | Dimensions and Finish | Functional and operational features | Item to conform to relevant Standards | Pretreatment as per IS 6005 | Paint shade, thickness, adhesion and finish | Functional checks | HV and IR test | Degree of Protection - Routine test | | All Routine & acceptance tests as per relevant IS / IEC and specification |
| Protective relays (IS:3231/ EC:60255 / IEC:61850 | Y | | | | Y | Y | Y | | | Y | Y | Y | | Y |
| Auxiliary relays (IS:3231/ / IS:13947 ) | Y | | | | Y | Y | Y | | | Y | Y | Y | | Y |
| Control and selector switches (IS:6875) | Y | | | | Y | Y | Y | | | Y | | | | |
| Indicating meters (IS:1248) | Y | | | | Y | Y | Y | | | Y | | | | Y |
| Indicating lamps (IS:13947) | Y | | | | Y | Y | Y | | | Y | | | | |
| Push buttons (IS: 4794) | Y | | | | Y | Y | Y | | | Y | | | | |
| Control transformer (IS:12021) | Y | | | | Y | Y | Y | | | | Y | | | Y |
| LT fuses (IS:13703) | Y | | | | Y | Y | Y | | | | | | | |
| Energy meters (IS:722, IS:14697, IEC 62052, IEC:62053 | Y | | | | Y | Y | Y | | | | | | | Y |
| Transducers (IEC:60688) | Y | | | | Y | Y | Y | | | | | | | Y |
| Diodes | Y | Y | | | | Y | Y | | | Y | | | | |
| Terminal Blocks | Y | Y | | | | Y | Y | | | | | | | |
| Synthetic Rubber Gasket (IS:11149/ 3400 ) | Y | Y | | | Y | | Y | | | | | | | |
| Complete Panel (IS:3427) | Y | | | | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y |
| Test realy kit | Y | | | | | | | | | Y | | | | Y |

Y =Test applicable

Note: MQP shall be submitted by the manufacturer comprising the tests/checks as stipulated in the matrix/table attached for the specific item/component by the respective manufacturer.

**1.6.13.1 Type test (Category-II)**

The Protection and Relay panels shall be of type tested quality.

i) For various bought out items like CT, VT, relays etc. for which identification can be physically verified and test certificate from manufacturer can be co-related, following shall be indicated in the QP.

- Review of manufacturer's TC as per relevant standard and compliance to requirements of this specification
- Physical check and functional/ operational check to ensure that item is fitfor assembly on the switch board cubicle.

ii) For all other items where identification has not been envisaged by manufacturers,a certificate of conformance to be obtained from manufacturer, and component identification shall be tagged as per approved drawing/ schematic. Either of the following or both shall be adopted .

- Random sample to be tested either in-house or at an independentlaboratory for all tests envisaged in relevant standard.
- Physical check and functional/ operation check to ensure the item is fitfor assembly on the panel.

iii) Type Test of Protective relays / Numerical relays : Type test reports for the following shall be submitted for purchaser's approval as per IEC:60255. The Reports / Certificates of tests conducted in accredited Laboratories (accredited by the national accrediting body of the country where the lab is located) is acceptable

a) Insulations tests,
b) Electrical environment tests
c) EMC tests
d) Atmospheric environment tests
e) Mechanical Stress tests
f) Conformance tests

iii) Factory Acceptance Tests (FAT) shall include all tests required to fully demonstrate to purchaser's satisfaction that each equipment/sub-system/system as software modules furnished as per this specification. The following minimum tests/ checks shall be conducted as FAT. Any other tests/ checks as per the manufacturer's recommendation and as agreed between Manufacturer and Purchasers hall also be carried out .The Manufacturer shall submit a detailed FAT procedure for Purchaser's approval

a) Pre power on checks
b) Power on checks
c) Hardware tests
d) Functional tests
e) Parametric tests
f) Specific tests on electronic hardware
g) Power failure auto-restart tests

h) Testing of interlocking

**1.6.13.2 Site tests**

The following minimum tests/ checks shall be conducted at site. Any other tests/ checksas per the manufacturer's recommendation shall also be carried out

a) Cubicle Wiring

i) It should be made sure that the wiring is as per relevant drawings. All interconnections between panels shall similarly be checked
ii) Insulation resistance of all the wires with respect to earth
iii) Functional checking of all control circuit e.g. closing, tripping interlock, supervision and alarm circuit including proper functioning of component/ equipment
iv) Check terminations and connections
v) Wire ducting
vi) Gap sealing and cable bunching

b) Relays

i) Check internal wiring
ii) Insulation resistance between all terminals and body
iii) Insulation resistance between AC and DC terminals
iv) Check operating characteristics by secondary injection
v) Check minimum pick up voltage of DC coils
vi) Check operation of electrical/ mechanical targets
vii) Check CT connections with particular reference to their polarities for differential type relays
viii) Pickup & timing test as per Relay settings
ix) Configuration checks & communication checks.

c) Meters

i) Insulation resistance of all insulated portions
ii) Check CT and VT connections with particular reference to theirpolarities for power type meter

d) General

i) Wiring check in conformity with schematics.
ii) Insulation check.
iii) Primary injection test.
iv) Secondary injection test.
v) On load test.
vi) DC sequential test.

e) The following minimum tests/ checks shall be conducted at site. as commissioning tests Any other tests/ checks as per the manufacturer's recommendation shall also be carried out .

i) Start-up tests
ii) Calibration and configuration checks
iii) Pre-commissioning tests
iv) Point-to-point testing of all the I/O signals
v) Verification of all status indications by operating the plant
vi) Verification of event / alarm indications by simulating alarm conditions
vii) Verification of all analogue indications by injection testing
viii) Verification of all controls by operating the plant

**1.6.14 Emergency Diesel Generating Set**

**1.6.14.1 Diesel Engine**

| Items/ Components | Tests/ Checks | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Material test | DP or MPI | UT (on forging and piston bonding) | Balancing | Hydraulic, water fill test | Assembly, Fit up | Dimension | Functional/ Operation test | Performance test as per BS-5514/ or equivalent IS/ ISO Standard including Governing test for 3 hours at full load and one hour at 110% | Fuel consumption (lit/ Kwh), rated power measurement, rated speed | All other tests (if applicable) as per specification and standard |
| Crank shaft | Y | Y | Y | Y | | | | | | | |
| Cylinder blocks/ heads | Y | | | | Y | | | | | | |
| Liner radiator | Y | | | | Y | | | | | | |
| Rotating, moving parts other than crank shaft | Y | Y | | | | | | | | | |
| Piston | Y | Y | Y | | | | | | | | |
| Diesel Engine | | | | | | Y | Y | Y | Y | Y | Y |

Y =Test applicable

Note: MQP shall be submitted by the manufacturer comprising the tests/checks as stipulated in the matrix/table attached for the specific item/component by the respective manufacturer.

**1.6.14.2 Alternator** **(Table 1/2)**

| Items/ Components | Tests/ Checks | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Visual | Dimension | Make, Type, Rating, TC, General physical inspection | Mechanical, Chemical properties | NDT, DP or MPI, UT | Metallography | Electrical characteristics | Welding/ Brazing (WPS/ PQR) | Heat treatment | Magnetic characteristics. | Hydraulic, Leak, Pressure test | Thermal characteristics | Run out | Dynamic balancing |
| Plates for stator frame, end shield, spider etc. | Y | Y | Y | Y | | | | | Y | | | | | |
| Shaft | Y | Y | Y | Y | Y | Y | | | Y | | | | | |
| Magnetic material | Y | Y | Y | Y | Y | | Y | | | Y | | Y | | |
| Rotor copper/ aluminium | Y | Y | Y | Y | | Y | Y | | Y | | | | | |
| Stator copper | Y | Y | Y | Y | | | Y | | Y | | | Y | | |
| SC ring | Y | Y | Y | Y | Y | Y | Y | Y | Y | | | | | |
| Insulating material | Y | | Y | Y | | | Y | | | | | Y | | |
| Tubes for cooler | Y | Y | Y | Y | Y | | | | Y | | Y | | | |
| Sleeve bearing | Y | Y | Y | Y | Y | | | | Y | | Y | | | |
| Stator, Rotor, Exciter coils | Y | Y | Y | | | | Y | Y | | | | | | |
| Castings, stator frame, terminal box and bearing housing etc. | Y | Y | Y | Y | Y | | | Y | | | | | | |
| Fabrication and machining of stator, rotor, terminal box | Y | Y | | | Y | | | | Y | | | | | |
| Wound stator | Y | Y | | | | | Y | Y | | | | | | |
| Wound exciter | Y | Y | | | | | Y | Y | | | | | | |
| Rotor complete | Y | Y | | | | | Y | | | | | | Y | Y |
| Exciter, Stator, Rotor, Terminal box | Y | Y | | | | | Y | | | | | | | |
| Accessories, RTD, BTD, CT, AVR. Brushes, Diodes, Space heater, antifriction, bearing, cable glands, lugs, gaskets etc. | Y | Y | Y | | | | | | | | | | | |
| Alternator (IS:4722) | Y | Y | Y | | | | Y | | | | | | | |

Y =Test applicable Y1 = for HT Machines only

Note: MQP shall be submitted by the manufacturer comprising the tests/checks as stipulated in the matrix/table attached for the specific item/component by the respective manufacturer.

| 1.6.14.2 Alternator | (Table 2/2) | | | |
|---|---|---|---|---|
| Items/ Components | Tests/ Checks | | | |
| | All tests as per IS:4722 | Vibration | Over speed | Tan delta, shaft voltage and polarization index |
| Plates for stator frame, end shield, spider etc. | | | | |
| Shaft | | | | |
| Magnetic Material | | | | |
| Rotor copper/ aluminum | | | | |
| Stator copper | | | | |
| SC Ring | | | | |
| Insulating material | | | | |
| Tubes for cooler | | | | |
| Sleeve bearing | | | | |
| Stator/ Rotor, Exciter coils | | | | |
| Castings, stator frame, terminal box and bearing housing etc. | | | | |
| Fabrication and machining of stator, rotor, terminal box | | | | |
| Wound stator | | | | |
| Wound exciter | | | | |
| Rotor complete | | | | |
| Exciter, Stator, Rotor, Terminal box | | | | |
| Accessories, RTD, BTD, CT, AVR. Brushes, Diodes, Space heater, antifriction, bearing, cable glands, lugs, gaskets etc. | | | | |
| Alternator (IS:4722) | Y | Y | Y | Y1 |

Y =Test applicable Y1 = for HT Machines only

Note: MQP shall be submitted by the manufacturer comprising the tests/checks as stipulated in the matrix/table attached for the specific item/component by the respective manufacturer.

**1.6.14.3 Final assembly**

| Items/ Components | Tests/ Checks | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Material test | Dimension | WPS, PQR, Welding | NDT, DP or MPI, UT | Check completeness | Hydraulic, Leak, Pressure test | Functional test | All Routine test as per Specification /IS | No load test for one hour of the DG set assembly | Clearances and alignment |
| Base frame | Y | Y | Y | Y | Y | | | | | |
| Fuel tank | Y | Y | Y | Y | Y | Y | | | | |
| Battery (IS:1691) | | | | | | | | Y | | |
| Battery charger | | | | | | | | Y | | |
| Control panel | | | | | | | | Y | | |
| Assembled DG set | | Y | | | Y | | Y | Y | Y | Y |

Y =Test applicable

Note: MQP shall be submitted by the manufacturer comprising the tests/checks as stipulated in the matrix/table attached for the specific item/component by the respective manufacturer.

**1.6.14.4 Type test (Category-II)**

All DG sets and accessories supplied shall be of type tested quality.

Type test reports for the following shall be submitted for purchaser's approval :

a) Measurement of resistance and air gap
b) Phase sequence test
c) Regulation test
d) Measurement of open circuit and short circuit characteristics
e) Efficiency test
f) Temperature rise test
g) Momentary overload test
h) Over speed test
i) High Voltage test
j) Insulation resistance test (both before and after high voltage test)
k) Noise level as per IS:12065

l) Vibration as per IS:12075
m) Determination of deviation of voltage waveform from sinusoidal
n) Degree of protection test on control panel for IP-52

**1.6.14.5 Site Tests**

The following minimum tests/ checks shall be conducted at site. Any other tests/ checksas per the manufacturer's recommendation shall also be carried out

a) Visual Test

b) Electrical Tests

i) Calibration of instruments, relays etc.
ii) Primary and secondary injections tests of protective devices.
iii) Function, interlock test of control panel
iv) Insulation resistance measurement of power and control circuits.

c) Mechanical Tests

i) Trial run of engine
ii) Governor testing
iii) Over speed trip test
iv) Load pick up and load rejection tests
v) Load test and temperature rise measurement of engine and alternator
vi) Fuel consumption test

| 1.6.15 Electro Static Precipitator (ESP) – Electrical | | | | |
|---|---|---|---|---|
| **1.6.15.1 General** | | | | |
| Items/ Components | **Tests/ Checks** | | | |
| | Visual | Make, Type, Rating etc. | Final Inspection as per IS/ IEC /BS | Remarks |
| TR Set | Y | Y | | Refer table for TR |
| ESP insulator (IEC 168/ 273, IS 2544) | Y | Y | Y | ESP insulators shall be additionally subjected to high temperature test on sample basis as per mutually agreed upon procedure. |
| Electrostatic Precipitation Management System | Y | Y | | Refer table for annunciation, control, PLC Panel |
| Microprocessor based rapper controller | Y | Y | | Refer table for annunciation, control, PLCPanel |
| Disconnecting switch (IS 13947) | Y | Y | Y | |
| Heaters ( IS 4159/ BS 6351) | Y | Y | Y | |

| 1.6.15.2 Transformer Rectifier (TR) Set | | | | | | | | | | | | | (Table 1/2) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Items/ Components | Tests/ Checks | | | | | | | | | | | | |
| | Visual | Dimensional and physical | Make, Type, Rating | Mechanical, chemical Properties | Electrical | Electronics | Welding | NDT | Pretreatment of tank | Painting | All tests as per IS2026 | All tests as per IEC-146 | |
| Thyristor | Y | Y | Y | | | Y | | | | | | Y | |
| Contactor | Y | Y | Y | | Y | | | | | | | | |
| Switch Fuse Unit | Y | Y | Y | | Y | | | | | | | | |
| HRC Fuse | Y | Y | Y | | Y | | | | | | | | |
| Current Transformer | Y | Y | Y | | Y | | | | | | | | |
| Overvoltage Protector | Y | Y | Y | | Y | | | | | | | | |
| Measuring Instruments | Y | Y | Y | | Y | | | | | | | | |
| Control Transformer | Y | Y | Y | | Y | | | | | | | | |
| Bushings | Y | Y | Y | | Y | | | | | | | | |
| Dial Thermometer | Y | Y | Y | | Y | | | | | | | | |
| Resistor wire wound | Y | Y | Y | | Y | | | | | | | | |
| Sudden Pressure Relay | Y | Y | Y | | Y | | | | | | | | |
| PVC insulated copper wire (ISI Marked) | Y | Y | Y | | Y | | | | | | | | |
| Terminal Block | Y | Y | Y | | Y | | | | | | | | |
| Gasket | Y | Y | Y | Y | | | | | | | | | |
| Electrolytic copper | Y | Y | Y | Y | | | | | | | | | |
| Capacitor, Resistor | Y | Y | Y | Y | Y | Y | | | | | | | |
| PCB | Y | Y | Y | | Y | | | | | | | | |
| Insulated conductor | Y | Y | Y | Y | Y | | | | | | | | |
| Laminations | Y | Y | Y | Y | Y | | | | | | | | |
| Press board, paper | Y | Y | Y | Y | Y | | | | | | | | |
| Insulating oil (Silicon) | Y | | Y | Y | Y | | | | | | | | |

| 1.6.15.2 Transformer Rectifier (TR) Set | | | | | | | | | | | | (Table 2/2) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Items/ Components | Tests/ Checks | | | | | | | | | | | |
| | Visual | Dimensional and physical | Make, Type, Rating | Mechanical, Chemical Properties | Electrical | Electronics | Welding | NDT | Pretreatment of tank | Painting | All tests as per IS2026 | All tests as per IEC-146 |
| Radiator | Y | Y | Y | Y | | | | Y | | | | |
| Transformer Tank | Y | Y | Y | Y | | | Y | Y | | Y | | |
| Panel Fabrication | Y | Y | Y | Y | | | Y | | Y | Y | | |
| Electronic Cards | Y | Y | Y | | Y | Y | | | | | | |
| Linear Reactor, Choke | Y | Y | Y | Y | Y | | | | | | | |
| Transformer Assembly | Y | Y | | Y | Y | | | | | | | |
| Control Panel | Y | Y | Y | Y | Y | Y | | | | Y | | |
| HV, TR Set | Y | Y | Y | | Y | Y | | | | Y | Y | |
| ESP Controller (Separate QP) | Y | Y | Y | | Y | Y | Y | | Y | | Y | |

**1.6.15.3 Annunciation, Control, PLC Panel**

| Items/ Components | Tests/ Checks | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Visual | GA, BOM ,Lay out of components | Dimensions, General physical inspection | Paint shade, thickness, adhesion | Component Rating, Make, Type | Wiring | IR and HV | Review of TC for instruments | Accessibility of devices | Illumination | Functional check for control element , | Test as per IEC:1131 * | Routine and acceptance tests as per IS 8623 |
| Annunciation, Control, PLC Panel | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y |
| | | | | | | | | | | | | | |

**Notes**

| | |
|---|---|
| 1) | Detailed procedure of Burn-in and Elevated temperature test shall be as per Quality Assurance Programme |
| 2) | (*) Applicable for PLC |
| 3) | MQP shall be submitted by the manufacturer comprising the tests/checks as stipulated in the matrix/table attached for the specific item/component by the respective manufacturer. |

| 1.6.15.4 VFD Module | | | | |
|---|---|---|---|---|
| Attributes/ Characteristics / Items/ Components/ Sub-system assembly | Visual & Dimensional checks | Make / Type/ Rating etc. | Final Inspection as per IS/ IEC | Remarks |
| HT Breaker (IEC-56) | Y | Y | Y | |
| DC Reactor | Y | Y | | For details refer table for DC Reactor |
| Transformer | Y | Y | Y | For details refer table for Transformer |
| Motor | Y | Y | Y | For details refer separate table for Motor |
| VFD Panel | Y | Y | Y | For details refer table for VFD Panel |

Note:

1) This is an indicative list of tests/checks. The manufacture is to furnish a detailed Quality Plan indicating the practices & Procedure followed along with relevant supporting documents during QP finalization

2) Make of all major Bought-out Items will be subject to purchaser's approval.

3) Note: MQP shall be submitted by the manufacturer comprising the tests/checks as stipulated in the matrix/table attached for the specific item/component by the respective manufacturer.

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# ANNEXURE D

# QUALITY ASSURANCE PLAN OF MAJOR EQUIPMENTS USED IN DISTRIBUTION SYSTEM

# Quality Assurance Plan

The Utility shall be solely responsible & accountable for assuring quality in the project works. Utility shall formulate a detailed Comprehensive Quality Assurance (QA) plan for the works to be carried out with an objective to create quality infrastructure works. The QA Plan shall be an integral part of the contract agreement with the contractor/ equipment supplier and erection agency as the case may be, in case of turnkey/ partial turnkey or departmental execution of works. Utility has to ensure that the quality of materials/ equipment supplied at site and execution of works carried out at field is in accordance to Quality Assurance Plan/ Guaranteed Technical Particulars GTP) and Technical specifications/ Approved Drawings/ Data Sheets etc.

The Utility, through Contractor/ Project Monitoring Agency (PMA)/ Third Party appointed by Utility, shall strictly ensure Quality Assurance checks during the day to day course of project execution, and ensure the quality of material and equipment as per Quality Plan/ Approved Drawings/ Technical Specifications/ Data sheet/ GTP/ applicable national & international standards etc.

The Utility should ensure that Quality Assurance Plan should be prepared keeping in view the following:

- All equipment/ materials shall comply with the relevant Indian Standard/ International Standards, if Indian Standards are not available.
- All Type Tests, Routine tests & Acceptance tests shall be as per relevant IS.
- Pre-Dispatch Inspection at factory site shall be limited to Power Transformers only. The Power transformers, of all capacities of primary voltage level of 33kV and below, shall be subjected to Pre-Dispatch Inspection at factory site. The details are at Annexure-I.
- Random sampling of material/ equipment from field site/ stores shall be taken up for testing at NABL accredited labs (3rd Party or Utility owned). The minimum sample size for the material/ equipment shall be as specified in Annexure – II of these guidelines.
- The Utility / Contractor (*to be specified in tender document*) shall be responsible for safe handling, packing and transportation of the sealed sample material up to the identified testing laboratory and back to field site/ store. However, in the event the Utility requests to test the material/ equipment after it has been commissioned at site, all applicable costs shall be borne by the Utility.
- The choice of lot and random sampling shall be done by the Utility in the presence of the manufacturer/ supplier, the Contractor and any third party, if applicable.

- Utility shall endeavor to pick the random samples from a lot within ten (10) days of receipt of such lot at the field site/ stores and send it for testing, failing which such lot shall be treated as accepted by the Utility. Further, it should be ensured that testing reports are made available within 2 weeks of submission of samples. However, during the period of random sampling and testing, the installation and commissioning of material/ equipment at the field site may continue.
- In case, the NABL lab test report for random sample from field site/ stores are found significantly mismatched with Routine Test report submitted by manufacturer/ supplier, the entire lot of materials/ equipment supplied by the defaulting manufacturer/ supplier shall be rejected whether supplied materials/ equipment is lying in site stores, in transit or under erection, testing & commissioning or has already been commissioned. All costs related to removal of such rejected materials/ equipment and replacement with new materials/ equipment shall be borne by Contractor/ Manufacturer/ Supplier without any cost implication to the Utility.
- Applicable norms for failure rate of equipment/ material supplied by vendors should be prescribed in the tender documents in case of turnkey/ partial turnkey/ departmental execution of works. Non adherence to such norms should cause black listing of such vendors.
- Further, a system of reporting should be put in place by the Utility to monitor failure rates of key equipment. Suppliers/ vendors/ contractors whose equipment have failed (repeatedly in last 2-3 years with a failure rate of more than 10%) and their promoters shall be blacklisted for a period of 5 years from participating in future tenders for similar works
- All coordination activities including reporting etc. should be through an IT based solution rather than deploying manpower for this purpose.
- The cost of quality monitoring may be optimized including the manpower cost for coordination activities.

**TYPE TEST & ROUTINE TESTS:**

All the Type Tests & Routine Tests shall be carried out as per Indian Standards.

**SITE ACCEPTANCE TEST:**

Random sampling of following material/ equipment shall be picked from field site/stores for testing at third party NABL accredited laboratory. Minimum sample size shall be as specified in Annexure-II:

1. Distribution Transformer
2. Ring Main Unit
3. CT/PT Unit (Outdoor) & Metering Cubicle (Indoor)
4. Circuit Breaker
5. Insulators
6. Cables
7. Control & Relay Panel
8. Overhead Conductor
9. Energy Meter
10. Poles
11. Capacitor
12. Distribution Box

The Utility may add any other important material in the above list. The site acceptance tests shall be as per approved Drawings/ Technical Specifications/ Data sheet/ GTP/QA Plan and applicable national & international standard.

In case of power transformer, after installation and commissioning at site, the power transformers shall be further tested to demonstrate satisfactory operation at full load/ as per field requirements, for minimum duration of 5 days without any breakdown or fault. If the power transformer fails within such duration, the same shall be replaced by the manufacturer/ bidder/ supplier without any additional cost to the Utility.

**PRE-COMMISSIONING TESTS**

On completion of erection of the equipment and before charging, each item of the equipment shall be thoroughly cleaned and then inspected jointly by the Utility and the contractor for correctness and completeness of installation and acceptability for charging, leading to initial pre- commissioning tests at Site. The list of pre-commissioning tests to be performed should be included in the Contractor's quality assurance programme.

**COMMISSIONING TESTS**

The contractor will use all required instrumentation and control equipment during commissioning tests and such measuring equipment and devices should be duly calibrated as far as practicable. The tests will be conducted at the specified load points and as near the specified cycle condition as practicable. The contractor will apply proper corrections in calculation, to take into account conditions, which do not correspond to the specified conditions. Any special equipment, tools and tackles required for the successful completion of the Commissioning tests shall also be provided by the contractor.

The specific tests to be conducted on equipment should be included in the technical specifications. However, where the pre-commissioning tests have not been specified specifically, they shall be as per relevant IS code of practice or as mutually agreed. The Contractor shall also be responsible for ensuring compliance to all statutory requirements for commissioning and successful operation of the system.

**FIELD QUALITY PLAN**

The Utility should prepare a separate Field Quality Plan (FQP) for civil, electrical, mechanical etc. works supported with drawings which shall be approved by their competent authority and may be uploaded at web portal. The contractor should adhere to FQP while carrying out physical works. The Utility should also prepare a comprehensive FQP for testing & commissioning of Grid Substations, Distribution transformer Substation, 33 KV, 11 KV line, LT line etc. The system should be energized only after performing all tests as described in the FQP and after clearance from Electrical Inspector. Proper records in this regard, including tests on earth resistance, insulation resistance of 11 kV line & Distribution Transformer etc. shall be maintained, jointly signed by Utility and contractor. All the quality assurance checks conducted in the field should be documented properly and signed by the quality engineer of the contractor & Utility and shall be kept for future reference. These documents shall be maintained by the Utility in proper order and shall be made available at site for verification during inspection.

**QUALITY ASSURANCE PROGRAMME OF THE BIDDER/ CONTRACTOR**

To ensure that the equipment and services under the scope of the tender, whether manufactured or performed within the Contractor's Works or at his Sub-contractor's premises or at the Utility site or at any other place of work, are in accordance with the specifications/ tender conditions, the Contractor shall adopt a suitable 'Quality Assurance Programme'. Such programme shall be broadly outlined by the contractor and finalized after discussions with the Utility before the award of the contract. The detailed programme shall be submitted by the contractor after the award of contract and acceptance by the Utility.

A Quality Assurance Programme of the contractor shall generally cover the following:

- Organization structure of the Contractor for management and implementation of the proposed quality assurance program
- Documentation control system
- Qualification data for bidder's key personnel
- The procedure for purchases of materials, parts components and selection of sub- Contractor's services including vendor analysis.
- System for shop manufacturing and site erection controls including process controls and fabrication and assembly control
- Control of non-conforming items and system for corrective actions
- Test procedure for field activities
- Control of calibration and testing of measuring instruments and field activities
- System for indication and appraisal of field inspection status
- System for quality audits
- System for authorizing release of manufactured product
- System for maintenance of records
- System for handling storage and delivery
- A manufacturing quality plan detailing out the specific quality control measures and procedures adopted for controlling the quality characteristics relevant to each item of equipment furnished and/ or services rendered.
- A Field quality Plan covering field activities

The Utility or his duly authorized representative like PMA reserves the right to carry out quality audit and quality surveillance of the system and procedure of the Contractor/ his vendor's quality management and control activities.

The Contractor would be required to submit all the Quality Assurance documents as stipulated in the Quality Plan. The contractor shall supply the materials/ equipment of type & design which has already been Type Tested. Contractor/ Manufacturer shall provide copy of such tests at the time of bidding and also at site in support of type-tested materials supplied under the contract.

The Utility should share their Quality Assurance Plan/ Field Quality Plan (FQP) with the Contractor. The schedule for submission/ approval of document as per QAP/ FQP shall be finalized before placement of the contract, keeping in view the overall project schedule. The Contractor shall be responsible for any time delay, misinterpretation, error and conflict during design, manufacturing, testing and erection of the Works resulting from non- compliance with the requirements of the approved Specification.

**Annexure-I**

**QUALITY ASSURANCE PLAN FOR STAGE INSPECTION-I OF POWER TRANSFORMER**
**(33 kV & 22 kV level)**

| S No. | Particulars | As offered | As observed | Deviation and Remarks |
|---|---|---|---|---|
| (A) | Inspection of Core :<br>(I) Core Material<br>1) Manufacturer's characteristic certificate in respect of grade of lamination used. (Please furnish test certificate) | | | |
| | 2) Thickness of core lamination | | | |
| | 3) Remarks regarding Rusting and smoothness of core. | | | |
| | (II) Core Construction : | | | |
| | (1) Core Diameter (mm)/Maximum step width (mm) | | | |
| | (2) Total cross sectional area of core | | | |
| | (3) Effective cross sectional area of core | | | |
| | (4) Whether top yoke is cut for LV connection. | | | |
| | (5) If yes, at 4 above, whether Reinforcement is done. | | | |
| | (6) Core length (leg center to leg center) | | | |
| | (7) Window height. | | | |
| | (8) Core height | | | |
| | (9) Core weight ~~only~~ including channel weight.<br>(Channel weight can be taken separately)<br>Tolerance as agreed in GTP | | | |
| (B) | INSPECTION OF WINDING | | | |
| | (I) Winding material | | | |
| | (1) Material used for | | | |
| | a) HV winding | | | |
| | b) LV winding | | | |
| | (2) Grade of material for | | | |

| | | | | |
|---|---|---|---|---|
| | a) HV winding | | | |

| | | | | |
|---|---|---|---|---|
| | b) LV winding | | | |
| | (3) Test certificate of manufacturer (enclosed copy) for winding material of: | | | |
| | a) HV | | | |
| | b) LV | | | |
| | (II) Construction Details<br>1) Size of Cross sectional area of conductor for : | | | |
| | a) HV winding | | | |
| | b) LV winding | | | |
| | 2) Type of insulation for conductor of : | | | |
| | a) HV winding | | | |
| | b) LV winding | | | |
| | 3) Diameter of coils in: | | | |
| | a) LV winding | | | |
| | a) Internal Diameter (mm) / Inner dimensions | | | |
| | ii) Outer diameter (mm) / Outer dimensions | | | |
| | b) HV winding | | | |
| | a) Internal diameter (mm)/Inner dimensions | | | |
| | ii) Outer diameter (mm)/Outer dimensions | | | |
| | 4) Current density of winding material used for: | | | |
| | a) HV | | | |
| | b) LV | | | |
| | 5) Total No. of turns | | | |
| | a) HV coils | | | |
| | b) LV coils | | | |
| | 6) Total weight of coils of | | | |
| | a) LV winding (Kg) | | | |
| | b) HV winding (Kg) | | | |
| (C) | INSULATION MATERIALS | | | |

| | | | | |
|---|---|---|---|---|
| | (I) DPC Paper Insulation | | | |
| | a) Type of Paper (Dotted Kraft or Diamond Dotted Kraft) | | | |
| | b) Make | | | |
| | c) Thickness (mm) | | | |
| | d) DPC laying direction | | | |
| | e) Percentage Overlapping | | | |
| | II) Interlayer Insulation | | | |
| | a) Type of Paper | | | |
| | b) Make | | | |
| | c) Thickness (mm) | | | |
| | III) Between HV and LV winding | | | |
| | a) Type of Paper | | | |
| | i. Make | | | |
| | ii. Thickness (mm) (all size) | | | |
| | b) Type of Pressboards | | | |
| | i. Make | | | |
| | ii. Thickness (mm) (all size) | | | |
| | IV) Between core and LV | | | |
| | Type of Paper | | | |
| | i. Make | | | |
| | ii. Thickness (mm) (all size) | | | |
| | Type of Pressboards | | | |
| | i. Make | | | |
| | ii. Thickness (mm) (all size) | | | |
| | V) Material used for top and bottom yoke and insulation | | | |
| | a) Type of Material | | | |
| | i. Make | | | |
| | ii.Thickness (mm) (all size) | | | |

| | | | | |
|---|---|---|---|---|
| | VI) Material used for Spanner, wedge and Axial for insulation | | | |
| | a) Type of Material | | | |
| | i. Make | | | |
| | ii. Thickness (mm) (all size) | | | |
| | iii. Visual condition( i.e free from dust, burr, damage and sharp edges) | | | |
| | VII) Test certificate of manufacturer (enclose copy for all type of papers and pressboard used) | | | |
| (D) | TANK : | | | |
| | (I) Construction Details: | | | |
| | 1) Shape | | | |
| | 2) Thickness of side wall (mm) | | | |
| | 3) Thickness of top and bottom plate (mm) | | | |
| | 4) Provision of sloping top cover | | | |
| | 5) Tank internal dimensions (mm) | | | |
| | a) Length X Width | | | |
| | b) Height | | | |
| | (II) General Details : | | | |
| | 1) Inside painted by oil corrosion resistant paint (please specify which type of coating done) | | | |
| | 2) Provision of lifting lugs. | | | |
| | a) Numbers | | | |
| | b) Reinforcement done by welding all side of Lug | | | |
| | 3) Provision of air release plug | | | |
| | 4) Provision of hot dip galvanized GI Nuts Bolts with 1no. plain and 1no. spring washer. | | | |
| | 5) Deformation of side wall of tank when subject to: | | | |
| | a) Vacuum of (-) 0.7 Kg/sq.cm for 30 minutes. | | | |
| | b) Pressure of 0.8 Kg/sq.cm. for 30 minutes. | | | |
| (E) | TERMINALS: | | | |
| | 1) Material whether of Brass Rods | | | |
| | a) HV | | | |

| | | | | |
|---|---|---|---|---|
| | b) LV | | | |
| | 2) Size (dia. In mm ) | | | |
| | a) HV | | | |
| | b) LV | | | |
| (F) | BUSHINGS – Two part | | | |
| | 1) Whether HV & LV bushings mounted as per drawing. | | | |
| | a) HV- Top Inclined | | | |
| | b) LV – Side | | | |
| | 2) Bushing Clearance: (mm) | | | |
| | a) LV to Earth | | | |
| | b) HV to Earth | | | |
| | 3) Bushing are two part and inner part shall be sealed and external part is replaceable without affecting sealing and need of opening of top cover. | | | |
| (G) | TANK BASE: | | | |
| | 1) Whether tank base is welded folded upwards, as Specified in specification. | | | |
| (H) | OIL: | | | |
| | 1) Name of supplier | | | |
| | 2) Breakdown voltage of oil: (kV) | | | |
| | a) Filled in tanked transformer | | | |
| | b) In storage tank (to be tested by Inspecting officer) | | | |
| | 3) Supplier's test certificate (enclose copy) | | | |
| (I) | ENGRAVING: | | | |
| | 1) Engraving of Sl. No. and name of firm and YoM. | | | |
| | a) On bottom of clamping channel of core-coil assembly. | | | |
| | b) On Body of tank (on Yellow base with Black paint) | | | |
| (J) | NAME PLATE DETAILS: | | | |
| | Whether Name Plate is as per approved drawing | | | |
| (K) | COLOUR OF TRANSFORMER | | | |
| | 1) Tank body (Inner side) | | | |
| | 2) Tank body (Outer side) | | | |

**QUALITY ASSURANCE PLAN FOR STAGE INSPECTION- II OF POWER TRANSFORMER (33 kV & 22 kV level)**

| S. No. | Name of test | Specified value(Range) | Test Result | Pass/Fail |
|---|---|---|---|---|
| 1 | Visual inspection for material used, it's finish and workmanship | Free from cracks, nicks, protrusion and other visible defects. | | |
| 2 | Physical Verification of complete CCA with all fittings including insulation used, packing used, Bus bars, Flats, Channels etc. | GTP Values | | |
| 3 | Clearances and Dimension measurements. | GTP Values | | |
| 4 | Physical Verification Leads positions | GTP Values | | |
| 5 | Ratio Measurement at all Taps | GTP Values | | |
| 6 | Magnetic Balance Test | GTP Values | | |
| 7 | 2KV/Isolation Test for one minute | Should Withstand | | |

**QUALITY ASSURANCE PLAN FOR FINAL INSPECTION OF POWER TRANSFORMERS (33 kV & 22 kV level)**

| S. No. | Name of test | Specified value(Range) | Test Result | Pass/Fail |
|---|---|---|---|---|
| 1 | Visual inspection for material, finish and workmanship | Free from cracks, nicks, protrusion and other visible defects. | | |
| 2 | Physical Verification of complete Transformer with all assembly including test rollers, radiators, cable boxes etc. and Checking of weights, Dimensions. | Approved GTP Values | | |
| 3 | Measurement of Winding Resistance | Approved GTP Values | | |
| 4 | Measurement of voltage ratio and phase displacement | Approved GTP Values | | |
| 5 | Verification of vector group relationship | DYn11 | | |
| 6 | Measurement of short-circuit impedance and Load Loss. | Approved GTP Values | | |

| | | | | |
|---|---|---|---|---|
| 7 | Measurement of No-Load Loss and Current (Losses at 90, 100 and 110% of rated voltage). | Approved GTP Values | | |
| 8 | Measurement of insulation resistance. | Approved GTP Values | | |
| 9 | Dielectric Test | GTP Values | | |
| 10 | Test on ON-Load Tap Changer | GTP Values | | |
| 11 | Zero-Phase sequence Measurement | Approved GTP Values | | |
| 12 | Oil Pressure/leakage test on completely assembled transformer at 0.35kg/sq.cm for 8 hrs. | Should withstand | | |
| 13 | Bushing shall be tested for Capacitance and Power factor and shall meet the manufacture's requirement. | GTP | | |
| 14 | All CTs and resistance of image coil for winding temperature indicator shall be | GTP | | |
| | checked for ratio test, polarity and knee point voltage test | | | |
| 15 | Determination of Capacitances and dissipation factor winding-to-earth and between windings. | GTP | | |
| 16 | Magnetic balance test | GTP | | |
| 17 | Measurement of Magnetizing current at low voltage | | | |
| 18 | Voltage Regulation at rated load and at unit, 0.9, 0.8 lagging power factor | GTP | | |
| 19 | Measurement of Acoustic Noise Level | GTP | | |
| 20 | Measurement of the power taken by the fans | GTP | | |
| 21 | Functional tests on auxiliary equipment:<br>i. Test on OTI and WTI<br>ii. High Voltage test on insulation test for Auxiliary Wiring. | GTP | | |

| | | | | |
|---|---|---|---|---|
| 22 | Test on Oil filled in Transformer<br>i. Dielectric Strength of Oil<br>ii. Water Content.<br>iii. Dielectric Dissipation factor (tan delta at 90° C.<br>iv. Resistivity | GTP | | |
| 23 | Temperature rise test | GTP | | |
| 24 | Short Circuit withstand test | Should withstand | | |
| 25 | Lightning Impulse voltage test with chopped wave. | GTP | | |

**Annexure-II**

**SAMPLE SIZE FOR RANDOM SAMPLING OF MATERIAL/ EQUIPMENT**

Sample size for random sampling of material/ equipment to be picked from field site/ stores for testing at third party NABL accredited laboratory:

1. Distribution Transformer: 5% of each Lot
2. Ring Main Unit: 5% of each Lot
3. CT/PT Unit (Outdoor) & Metering Cubicle (Indoor): 5% of each Lot
4. Circuit Breaker: 5% of each Lot
5. Insulators: 1% of each Lot
6. Cables/ABC: 1 sample (as per applicable standard) from each Lot (Lot limited to 25 Drums)
7. Control & Relay Panel: 5% of each Lot
8. Overhead Conductor: 1 sample (as per applicable standard) from each Lot (Lot limited to 25 Drums)
9. Energy Meter: 1% or 32 meters per Lot whichever is lower
10. Poles: 1% of each Lot
11. Capacitor: 5% of each Lot
12. Distribution Box: 1% or 32 nos. per Lot whichever is lower.