सत्यमेव जयते

Guidelines for Model Quality Assurance Plan (MQAP) for major equipment of Power sector

भारत सरकार

Government of India

विद्युत मंत्रालय

Ministry of Power

केन्द्रीय विद्युत प्राधिकरण

Central Electricity Authority

INDEX

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 despatched from the manufacturer's works before the same is accepted, subsequent to pre-despatch final inspection including verification of records of all previous tests/ inspections by Purchaser's authorised representative and duly authorised for despatch. However, the purchaser may

waive-off inspection depending upon the requirement.

(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.

APPENDIX

CEA OM DATED 01/11/2021 REGARDING CONSTITUTION OF COMMITTEE FOR STANDARDIZATION OF TEST PROTOCOLS FOR ELECTRO-MECHANICAL EQUIPMENT IN POWER SECTOR

File No.CEA-HY-17-145/1/2018-HETD Division

भारत सरकार/Government of India
विद्युत मंत्रालय/Ministry of Power
केंद्रीय विद्युत प्राधिकरण/Central Electricity Authority
जल विद्युत अभियांत्रिकी एवं प्रौद्योगिकी विकास प्रभाग
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No. 10/3/HE&TD/2021/ **Date:**01.10.2021

OFFICIAL MEMORANDUM

Subject: Constitution of Committee for Standardization of Test Protocols for Electro-Mechanical equipment in Power Sector-reg.

As Hon'ble Union Minister of Power has desired to standardize Test Protocols for Electro-Mechanical equipment in Power Sector, a Committee is hereby constituted consisting of the following members:

1.	Member (GO&D & Hydro),CEA	Chairman
2.	Chief Engineer (TE&TD), CEA	Member
3.	Chief Engineer (PSE&TD), CEA	Member
4.	Chief Engineer (DPT), CEA	Member
5.	Chief Engineer (RTD), CEA	Member
6.	Representative of CPRI	Member
7.	Representative of NTPC	Member
8.	Representative of PGCIL	Member
9.	Representative of NHPC	Member
10.	Representative of BHEL	Member
11.	Representative of SECI	Member
12.	Representative of DISCOM	Member
13.	Chief Engineer (HE&TD), CEA	Member & Convener

Further, the Committee may co-opt any other member, if required.

The **Terms of Reference (ToR)** of the Committee shall be as given below:

1) Standardization of Type Tests, Routine Tests, Field Acceptance Tests, etc.
2) The possibility of using CEA Regulations as part of Test Protocols.
3) Incorporation of outcome at Sl. No. 1 in CEA Regulations for making it enforceable.
4) Any other issue/ agenda with the consensus of the Committee.

The Committee shall submit a Report within 01 week from the date of receipt of this order.

This issues with the approval of the Competent Authority.

01/11/21

(Sonam Srivastava)
Asstt. Director

File No.CEA-HY-17-145/1/2018-HETD Division

To :

1. Chairman, CEA
2. Member (GO&D and Hydro), CEA
3. Chairman & Managing Director, NTPC Limited, NTPC Bhawan, SCOPE Complex, Institutional Area, Lodhi Road, New Delhi – 110003 – with a request to nominate a representative of NTPC (not below the rank of ED/GM)
4. Chairman & Managing Director, PGCIL, Power Grid Corporate Office, Saudamini, Plot No.2, Sector 29, Near IFFCO Chowk, Gurgaon (Haryana) – 122001 – with a request to nominate a representative of PGCIL (not below the rank of ED/GM)
5. Chairman & Managing Director, NHPC Ltd., NHPC Office Complex, Sector-33, Faridabad – 121003 (Haryana) – with a request to nominate a representative of NHPC (not below the rank of ED/GM)
6. Managing Director, SECI, 6th Floor, Plate-B, NBCC Office Block Tower-2, East Kidwai Nagar, Kidwai Nagar, New Delhi, Delhi 110023– with a request to nominate a representative of SECI (not below the rank of ED/GM)
7. Chairman & Managing Director, Bharat Heavy Electricals Limited, BHEL HOUSE, Siri Fort, New Delhi-110049 – with a request to nominate a representative of BHEL (not below the rank of ED/GM)
8. Chief Engineer (TE&TD), CEA
9. Chief Engineer (DPT), CEA - with a request to co-opt a representative from any DISCOM
10. Chief Engineer (PSE&TD), CEA
11. Chief Engineer (RTD), CEA - with a request to co-opt members from RE Sector (not below the rank of ED/GM)
12. Chief Engineer (HE&TD), CEA
13. DG, CPRI, Central Power Research Institute, Prof.Sir C.V.Raman Road,Post Box No: 8066, SadaShiva Nagar (p.o), Bengaluru, 560080

ANNEXURE A

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

INDEX

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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	-

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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	-

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	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	-

(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	-

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			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	-

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(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	-

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			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**								

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(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

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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		Manufacturer's Standard			P	V
(e)	Glaze flow	Physical	As per Customer's requirement/ Manufacturers 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

(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

			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	**<u>Cutting & Grinding</u>**								
(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

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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							

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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	-

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 / Consignment/ each type clay/ As per customer				P	V	-
(b)	Appearance of Fired sample	Physical					P	V	-
(c)	Sieve Residue on 38 microns	Physical					P	V	-

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(d)	Moisture of Extrusion	Physical	requirement/ Manufacturer's standard	Technical Specifications/ Manufacturer's Standard	Technical Specifications/ Manufacturer's Standard		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/ Manufacturer's standard				P	V	-	
(b)	Sieve Residue (63 microns)	Physical					P	V	-	

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				Technical Specifications/ Manufacturer's Standard	Technical Specifications/ Manufacturer's Standard				
(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	-
2.4	**Dolomite**								

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(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	-	
(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 (As Cast)**									
(a)	Visual Inspection	Physical	100%	Technical Spec./ Approved Drawings	Technical Spec./ Approved Drawings		P	V	-	
(b)	Dimensional Check	Physical	2/lot / As per customer requirement/	Approved Drg	Technical Spec./ Approved Drawings		P	V	-	

			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	-	

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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	-	

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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**									

(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**									

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(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	

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(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	

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(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	

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(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	

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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	

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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

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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	

			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	-

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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** L.O.I at 1000^{O}C Al_2O_3 Fe_2O_3 TiO_2	Chemical			15.0%Max. 30.0%Min. 2.0%Max. 2.0%Max. 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. 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** L.O.I at 1000^{O}C Al_2O_3 Fe_2O_3 TiO_2	Chemical	One sample in every six month / As per Customer requirement/ Manufacturer's Standard		13% Max. 23% Min. 2.5% Max. 3% Max. / 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

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(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** Fe_2O_3 CaO MgO	Chemical			0.2% Max. 28% Min. 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** L.O.I at $1000^{O}C$ SiO_2 Fe_2O_3 CaO MgO	Chemical			6.0% Max. 58% Min. 1% Max. 5% Max. 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

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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** L.O.I at $1000^{O}C$ MnO_2 Acid Insolubles	Chemical			7% Max, 80% Min. 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

(d)	**Chemical Analysis** L.O.I at 1000^{O}C Cr_2O_3	Chemical			3% Max. 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** ZrO_2 SiO_2	Chemical			25 to 40 % 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

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/cm² 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)**								
(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/	Plant Standard			-	P	V
	Silica Body				15 to 25%/As per plant standard		-	P	V

	Alumina Body		Manufacturer's Standard		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 Customer requirement/ Manufacturer's Standard	Plant Standard	No Lamination Crack		-	P	V
(b)	Moisture Content	Physical			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

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4.07	**Drying of Green Ware**								
(a)	Temp. Control	Physical	Once each Shift	Plant Standard	40ºC to 120ºC/As per plant standard		-	P	V
(b)	Moisture Content	Physical	Once each Shift		< 1.0%/As per plant standard		-	P	V
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

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(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	-
(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. rated EMS/ As per Technical Specification	CMTC	P	V	-
(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 T.S - 55 kg/mm². (min) upto 120KN, 71 kg/mm². (min)- 160-210KN %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	-

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(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)**								
(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.	CMTC	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		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-	CMTC	P	V	-

					10%,(Min) / As per Tech. Specs.				
(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	-
(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	-
(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 Technical Specifications		P	V	-
(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**								

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(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			P	W
(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.	EM-Format		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

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(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
(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

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(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
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

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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	-
1.4	Chemical Composition	Chemical	1 Sample / lot	Manufacturer Plant Specn./ As per specn / IS 733	Si : 0.3 - 0.7 % Fe : 0.6 % max Cu : 0.1 % max Mn : 0.3 % max	Component Mfg's TC	P	V	-

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					Mg : 0.4 - 0.9 % Zn : 0.2 % max Ti : 0.2 % max Cr : 0.1 % max Balance - aluminium					
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 % Fe : 0.6 % max Cu : 0.1 % max Mn : 0.3 % max Mg : 0.4 - 1.0 % Zn : 01 % max Ti : 0.2 % max Cr : 0.25 % max 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	Min. 27.5 Kg / mm2	Component Mfg's TC	P	V	-	

				per specn / IS 617/ IS 1285						
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 Deg C for 24 hrs		P	V	-	
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	-	

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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 / Third Party Report	P	V	-	
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	P	V	-	

						TC				
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	Manufacturer	Component	P	V	-	

				Plant Drawing	Plant Drawing/ Compliance to Plant Drg	Mfg's TC / Eqpt. Mfg's TC				
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 TC	P	V	-	
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 Washers	Physical	One sample / lot	Approved Drawing / As per specn.	Approved Drawing / As per specn.	Component Mfr's TC / Eqpt. Mfg's TC	P	V	-	
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	IS - 2633, 2629, 4759 As per	Component Mfr's TC	P	V	-	

				specn./	specn.					
	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	-	
				.	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**									

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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	

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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 (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%			Eqpt. Mfg's TC	-	P	W	
3.0	Measurement of rated	Electrical	100%			Eqpt. Mfg's TC	-	P	W	

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	inductance of the main coil			IEC - 60353 / IS 8792/ IS 8793/ As per specn	IEC - 60353 / IS 8792/ IS 8793/ As per specn					
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	
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	-

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	Dimension	physical	1 No/Lot	IEC 61462/ Tech. Specn./ Mfr Drg	IEC 61462/ Tech. Specn./ Mfr Drg	CMTC	P	V	-
	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	-

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h	Interfacial Tension	Test	01 sample/lot			CMTC	P	V	-
i	Total Sulpher Content	Test	01 sample/lot			CMTC	P	V	-
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	-

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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	-

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. ≥ 5mm 610g/m² < 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	-

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	100%	IS 16227	IS 16227	EMTR	-	P	V
b	Accuracy	Electrical					-	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%			EMTR	-	P	V

d	Verification of Accuracy Class	Electrical	100%	IS 16227	IS 16227	EMTR	-	P	V
e	Polarity Marking & Verification of Core Sequence	Electrical	100%			EMTR	-	P	V
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				EMTR	-	P	V

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e	Tan delta	Electrical	One sample/lot	As per IEC 60296/IS 335	As per IEC 60296/IS 335	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	100%	Tech. Specs / IS16227/ IEC61869	Tech. Specs / IS16227/ IEC61869	Log Sheet	-	P	V
f	Resistance ,Knee point voltage ,Exciting Current measurement on special protection (Class PS) cores.	Electrical					-	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				Log Sheet	-	P	V

k	I.R. Measurement Between primary & secondary (Earth)	Electrical	100%		Min 7000 M Ohms./mfg std	Log Sheet	-	P	V
l	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 90^0C 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	10 %	Tech. Specs / IS16227/ IEC61869	Tech. Specs / IS16227/ IEC61869	Test Report	-	P	W
i	Interturn over voltage test (all cores will be tested separately)	Electrical					-	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
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 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	-

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.			

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				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 Smoothnes s (Visual Check)	Visual	100% on each Coil	IS : 5484 & Tech.Specificatio n 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)								

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

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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

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**								

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	(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		-	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**								

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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

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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

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			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

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

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

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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

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			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

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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

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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 Ambient Temperature at the time of measurement Length of the cable drum under measurement Actual Value of the IR measured in Mohm			-	P	W
b	Individual Core to armour								

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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

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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 • Concentricity • 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	-

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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	-	

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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	-	
6.3	Tensile test & elongation	Mechanical	1 sample per			CM's TC	P	V	-	

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			batch							
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 holes, surface finish	Visual	100%	Manufacturer's Plant Standard	Manufacturer's Plant Standard					
10.2	Chemical analysis	Chemical	1 sample per			CM's TC	P	V	-	

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			batch							
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							
13	**Trip & Close coils**									
13.1	Coil resistance	Electrical	100%	Manufacturer's	Manufacturer's	Routine test certificate	P	V	-	

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13.2	HV test 2kv for 1 minute	Electrical	100%	Plant Standard	Plant Standard	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 & lockout	Electrical	100%	-	-	Routine Test Record	-	P	V	
17.3	HV Test at 2 KV for one minute	Electrical	100%	-	-	Routine Test Record	-	P	V	

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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	-	
23	**Base frame & structure**									
23.1	Visual check	Visual	100%	Drawing	No damages		P	V	-	

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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**									
25.1	Visual inspection & other tests	Visual	100%	Plant drawings	Certificate of conformance	Certificate of conformance	P	V/P	-/V	

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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 Internal Document	No damages	CM's TC	P	V	-	
29.2	HV Test (1kV for 1 minute) (pin to ground)	Electrical	100%	Manufacturer Internal	Manufacturer Internal	CM's TC	P	V	-	

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				Document	Document					
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 62271-100	Routine test certificate	Routine test certificate	-	P	V	
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) b) c) d) e)	At 100% V & 110%V : 5-Closing,5-Opening At 70% V 5-Opening At 85% V 5-Closing At 100%V 5-CO & 1O-C-O At 50% voltage for opening.	Electrical	100%	IEC-62271-100 & Specification	IEC-62271-100 & Specification	Routine Test Record	-	P	W	
35.2 a)	Measurement of speed & time (Curves to be	-do-	100%			-do-	-	P	W	

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	maintained by operational analyser)									
b)	At 100%V Opening Operation 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 resistance of the main circuit		100%			- do-	-	P	W	
35.9	Design and visual checks		100%			- do-	-	P	W	
35.6	**ELECTRICAL**									

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	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 i) Control Circuit 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 applicable)**									
37.1	Controlled switching equipment validation tests									
a)	Tests with PSD & CB, 1.	Electrical	100%	As per	As per	Routine test	-	P	W	

	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.			specification	specification	record				
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.

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

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 IS 513 for CRCA & IS 1079 for HR	IS513 / IS 1079 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**								

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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**								

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5.1	**EARTH BUS BAR** Dimension al conformity Hardness & surface defects	Visual / Measureme nt	One sample per lot	IS 1897 / IS 613	IS 1897 / IS 613	CMTC	P	V	-
5.2	**FASTENERS- (**Bolts/Nuts/Washers) Dimensional conformity 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** (Door Switch, Space Heater, Thermostats, 3 Pin Socket with Switch, Fluorescent/ Incandescent Lamp LED Lamp) Position of component assembly Type & Quantity of components assembled 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)** 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	-

	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 BOM/ GTP	Project specific approved BOM/ GTP	CMTC	P	V	-

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	functional) Functional Test HV Test 2 kV for 1min.	Dimensional conformity / Functional Electrical							
14	**EVENT LOGGER** Functional Test 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	-

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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/C M- 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	-

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17	**PROTECTION RELAYS(Conventional/Numerical) GE - Imported 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 manual, as a part of integrated	Tech. specification, GTP, BOM, and Approved drawings , software manual, as a part of integrated	EM TC	-	P	V

				test / software manual	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
21	MICOM S1 AGILE /ENERVISTA/ DS AGILE/AVIEW SOFTWARES								
21.1	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									
1	**Auxiliary relays**								
1.1	Functional and calibration check,	Electrical/ Visual	100%	Tech. Specification Approved	Tech. Specification Approved	EM TC	-	P	V

	High voltage test			Drg/BOM, GTP	Drg/BOM, GTP				
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, Software loading & Measurement	Functional	100%	Tech. specification , GTP, BOM, and Approved drawings	Tech. specification , GTP, BOM, and Approved drawings	RTR	-	P	V
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 Test Certificates.	verification	100%			EMTC / VTC	P	V	W

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 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
2.2	Continuity Check	Functional	100%			EMTC / VTC	P	V	W
2.3	Check for earthing continuity between each apparatus and	Functional	100%			EMTC / VTC	P	V	W

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	earth bus by continuity tester								
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 protocolSimulator - All trip commands (for TC1 & TC2 of CB) of main protection relays to	Electrical/ Functional	100%			EM TC	-	P	V

	be checked up to panel terminal block as per the PSL & Scheme. - Auto reclosure scheme checks to include : Block logic including 3- phase trip, priority closing in case of Main & Tie CB. 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 Subatation Automation System)**								
4.1	Check all IEDs loaded with Settings received from Customer and	Visual / Functiona l	100%			EM TC	-	P	V

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	the Approved PSL Logic. - Verification of DR signal standardisation as per approved DR list. - Verification of SAS Alarm /Events signals as per standard List.			Appd drg, GTP, Internal Check list, Approved PSL Logic .	Appd drg, GTP, Internal Check list, Approved PSL Logic .				
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
C-5	**FINAL ACCEPTANCE TESTS**								
5.1	Visual Check for -Basic assembly and Mimic Diagram/ Dimensional	Visual Dimensional conformity	100%	Appd drg, BOM, GTP, Tech. spec/ Internal drawing/ RTR Approved	Appd drg, BOM, GTP, Tech. spec/ Internal drawing/ RTR	EM - TC	-	P	W

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	Conformity/ finish and workmanship / door alignment / dust proofing	tests		PSL Logic .	Approved PSL Logic .				
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 PSL Logic .	Tech. spec/ Internal drawing/ RTR ,Settings provided by Customer & Approved PSL Logic .	EM TC	-	P	W
5.5	Visual inspection for paint shade, paint thickness, surface finish, adhesion	Visual / Measurement	100%			EM TC	-	P	W
5.6	Check for availability of Spare Digital Inputs & outputs as per specification	Visual	100%			EM TC	-	P	W
5.7	Check for availability of spare terminals in each panel	Visual	100%			EM TC	-	P	W

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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 communication checked as per approved scheme	Visual	100%			EM TC	-	P	W
5.14	Operational check- For protection relays, meters etc.	Visual check & Measurement/ Electrical -	100%	Appd drg, BOM, GTP, Tech. spec/ Internal drawing/ RTR	Appd drg, BOM, GTP, Tech. spec/ Internal drawing/ RTR	EM - TC	-	P	W

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		Functional checks							
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 supervision) -Metering (Synchro Check, Measurement Accuracy) -Gateway communication using protocol Simulator	Visual & Electrical	100%			EM - TC	-	P	W

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5.18	The complete integration check for Communication, relay configuration, parameterization, with interfacing of necessary software/ hardwares. 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, Transformer-protn & all non numerical relays)	Appd drg, GTP, Tech. spec/ Internal drawing/ RTR	EM - TC	-	P	W
C-7	Disturbance Recorder (Stand alone funtional)	Visual check & Measurement & Dimensional conformity /funtional	100%			EM - TC	-	P	W
C-8	Event Logger	Visual check & Measurement & Dimensional conformity /funtional	100%			EM- TC	-	P	W

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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 switch(Part of panel testing)	Electrical - Functional checks	100%	Appd Specification .GTP & drg/	Appd Specification.GTP & drg/	EM - TC	-	P	W
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	Appd Specification.GTP & drg/	EM - TC	-	P	W

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				checklist : Bay controller					
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 used Project specific)	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
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	Functional	100%	Approved SAS BOM & Tech. Specification / approved	Approved SAS BOM & Tech. Specification / approved	EM - TC	-	P	W

	Information availability for telecontrol centre Device control			FAT Procedure	FATProcedure				
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 -LED Indication. - Operation of Electromechanical relays (if any) -Accuracy check - Relay configuration & setting	Visual & Electrical	100%	Appd drg / BOM,GTP	Appd drg / BOM,GTP	EM - TC	-	P	W
12.2	Enegy meter	Visual & Electrical	100%	As per IS 14697 & IEC 62053/62052/ As per MQP of component	As per IS 14697 & IEC 62053/62052/ As per MQP of component	EM/CM - T	-	P	W

				Manufacturer/ Tech. Specification and GTP	Manufacturer/ Tech. Specification and GTP				
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 testing)	Electrical_ Functional Checks	100%				-	P	W
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			Tech specification	Tech specification	EM TC	-	P	W

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		Functional	100%	, GTP, BOM, and Approved drawings	, GTP, BOM, and Approved drawings				
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 a) Time synchronization Equipment Test b) System time Synchronization Check	Visual & Electrical	100%	Tech. specn/ GTP, Approved drgs., Approved FAT Procedure	Tech. specn/ GTP, Approved drgs., Approved FAT Procedure	EM TC	-	P	W
14.2	SAS Functional Test a) Digital Input/ Output b) Software Interlock Logic Display c) Synchronization Check d) Auto Reclosure Check	Visual & Electrical	100%			EM TC	-	P	W
14.3	HMI / Server Functional Test a) Event & Alarm	Visual & Electrical	100%			EM TC	-	P	W

	management b) Trends & Reports c) OWS Memory & Disk utilization d) HMI Server Redundency Check								
14.4	Substation SAS server / Gateway functional test a) Communication of server / Client with Bay Level devices b) Data retrieval of Master Digital c) Data retrieval of Analog Inputs d) SAS Server/ Gateway redundancy check.	Visual & Electrical	100%			EM TC	-	P	W
14.5	EWS Test a) Setting and Configuring of IED's b) Retrieval of Disturbance file from IED's 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

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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	-

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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	-

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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	**Galvanizing**								
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	**Rubber 'O' Ring**								
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	-

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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	Measure	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)**								

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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	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	Measur e	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

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

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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

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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

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	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

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i	Power frequency Withstand test for one minute (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 90^0C 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
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

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	-

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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 Serial No.		-	P	V	
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		P	V	-	

					maintained at NO & NC					
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					
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				

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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	-	
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				

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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	-	
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	-	

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d.	Ageing	Mechnical	1 sample/lot	Manufacturer std			P	V	-	
e	Dimension		1 sample/lot				P	V	-	
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. /Apprd. Drgs	Make & Product Code No	CMTC				
a.	Visual(Make & Type)	Visual	100%	IS 13947 Part 5 & 3	No damage		-	P	V	
b.	High Voltage Test	H V	10%		2 KV , 1min		P	V	-	

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		Tester								
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 tester		P	V	-	
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		P	V	-	

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					410W C(E250 C) as per IS 2062					
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	-	
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	

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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 6mm thick)	Chemical analysis	1sample/lot		360		P	V	-	
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	-	

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h.	Chemical Composition (in weight %)	Chemical analysis	1sample/lot		IS 5082-1998 IS 1608-2005		P	V	-	
1.19	COPPER RODS PROFILES / FLATS / PIPES	Mechanical/ Chemical/ Electrical	IS 613 / IS 191 / I S 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(ELECTR OLYTIC 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 Machine	ONE SAMPLE		15 % Min		P	V	-	
h.	Bend test -180 degree	fixure	ONE SAMPLE		no crack		P	V	-	

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	(for flats)									
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	
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	

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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	Mechanical/	5%		As per 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	

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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	
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		-	P	V	

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						CMTC				
b.	Dimensional	Dimensional	5 % of lot of each size	do	do		P/-	V/P	-/W	
c.	Chemical	Chemical	1 sample per lot of each size	do	do		P	V	-	
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	Chemical	One Sample /	Component	Component	CMTC	P	V	-	

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	Report	Analysis	Batch	Manufacturer specification	Manufacturer specification					
	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	
2.2	EARTH SWITCH					EM Records				

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	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	-	
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									

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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 Silver & Free Cynide	As per Manufacturer practice		P	V	-	
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										

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

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 / Electrical	One Set of each type (kV) per Lot / LOA / Project One Set of randomly Selected Sample with higher rating of Current and earthswitches per inspection lot	IEC 62271-102/ Tech. Specn. /Apprd. Drgs./Apprd. Tech. Data Sheet	IEC 62271-102/ Tech. Specn. /Apprd. Drgs./Apprd. Tech. Data Sheet no removal of silver coating in contact area(MS/ES)	EM Test Reports	-	P	W	
	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	Electrical/		do	do	EM Test Reports	-	P	W	

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	(Mech.) Operation& Interlocks (elect & Mech).	Mechanical								
	iv. Vertically Alignment Check & Clearance Check	Electrical/ Mechanical		do	do	EM Test Reports	-	P	W	
	v. General Assembly Dimensional Check & Aux. Switch and Limit Switch Operation.	Electrical/ Mechanical		do	do	EM Test Reports	-	P	W	
	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		100%	Tech. Specn./Apprd.	Tech. Specn./Apprd.		-	P	-	

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	Items as per Contract			Drgs.	Drgs.				
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	-

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

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	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
k)	All routine test (Electrical & Mech) as per IEC 61462 as applicable	Electrical	100%			CMTC/ EMTC	P	V/P	-/V
3	**Aluminium Castings**								

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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**								
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	-

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

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	-
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			CMTC	P	V	-
b)	Tensile strength after aging for 48hrs	Mechanical	2 Samples/lot			CMTC	P	V	-

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c)	Flextural strength after aging for 48hrs	Mechanical	2 Samples/lot	Manufacturer's Plant Standard/IS 4832	Manufacturer's Plant Standard/IS 4832	CMTC	P	V	-
d)	Bonding strength after aging for 48hrs	Mechanical	2 Samples/lot			CMTC	P	V	-
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	-
9	**Sheet Metal Pressed Components**								

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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**								
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	-

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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	-
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**								

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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 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/E MTC	P/-	V/P	-/W
c	Antimony Tri Oxide	Chemical	50 gms / batch			CMTC/E MTC	P/-	V/P	-/W
d	Cobalt Oxide	Chemical	50 gms / batch			CMTC/E MTC	P/-	V/P	-/W
e	Chromium Oxide	Chemical	50 gms / batch			CMTC/E MTC	P/-	V/P	-/W
f	Manganese Dioxide	Chemical	50 gms / batch			CMTC/E MTC	P/-	V/P	-/W
g	Silicone Dioxide	Chemical	50 gms / batch			CMTC/E MTC	P/-	V/P	-/W
h	PVA	Chemical	50 gms / batch			CMTC/E MTC	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	-

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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 Standard/DRG/ Tech. Spec.	IEC 60099-4/Manufacturer's Plant Standard/DRG/ Tech. Spec.	EMTC	P/-	V/P	-/W
b)	Verification of Dimensions	Dimensional	5 Sample/Lot			EMTC	P/-	V/P	-/W
c)	Energy Handling Capability test	Electircal	100%			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

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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 GTP/Mfr's Plant Std.	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	-
c)	Verification of Dimensions	Dimensional	2 Samples/Lot		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	-

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

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	-
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 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 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 GTP/As per Spec	< 10 pC	EMTC	P	V	W

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d)	Thermal Stability Test on ZnO blocks	Electrical	1 Samples per Lot	IEC 99 - 4/ /appvd GTP/As per Spec	IEC 99 - 4	EMTC	P	V	W
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
(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

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

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

S. No.	Components / Operations & Description of Test	Type of check	Quantum of Check / Sampling with basis	Reference document for Testing	Acceptance Norms	Category of responsibility		
						Sub-Vendor	Manufacturer	Customer
A	**Raw Material & Components**							
1.	Winding Conductor (PICC)/ (CTC)/ Lead wires	(a) Visual & Dimensional check of Conductor: Thickness & width of bare conductor, thickness of paper, surface covering, no. of conductors, finish of conductor and finish of PICC/CTC	One sample per type per lot	IS 1897 IS 13730 As per approved drawing	Bare conductor: Width(mm) Tolerance (in ± mm) Up to 3.15 - 0.03 3.16 to 6.30 - 0.05 6.31 to 12.5 - 0.07 12.51 to 16 - 0.10 > 16 - 0.13 Thickness (mm) Tolerance (in ±mm) For Width (mm) (2-16) (16-40) 0.8 to 3.15 - 0.03 0.05 3.15 to 6.30 - 0.05 0.07 6.30 to 10 - 0.07 0.09 Insulated conductor:	P	V	W/V

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

					Paper Covering Tolerance (%) thickness (mm) 0.25 to 0.5 - 10 Over 0.5 to 1.3 - 7.5 Over 1.3 - 5			
		(b) Resistivity at 20 deg.C		IS 13730	For annealed conductor: 0.01727 ohm/mm^2/m (max) For half hard conductor: 0.01777 ohm-mm^2/m (max)	P	V	W/V
		(c) Insulation test for bunched conductor/between strands of CTC (if applicable)		IS 13730	Maximum Charging current 1A at 250V AC/ 500V DC for 1 minute.	P	V	W/V
		(d) Elongation test for annealed conductors (if applicable)		IS 7404 IS 13730	Thickness (mm) elongation % Up to 2.5 30 (min.) >2.5-5.6 32 (min.)	P	V	-
		(e) Proof strength of work hardened conductor		IS 7404 IS 13730	As per design requirement	P	V	-

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		(f) Radius of corner of bare conductor		IS 7404 IS 13730	Thickness (mm) Corner Radius (mm) Up to 1.0 - 0.50 x nominal thickness 1.01 to 1.60 - 0.50 1.61 to 2.24 - 0.65 2.25 to 3.55 - 0.80 3.56 to 5.60 - 1.00 (Tolerance ±25%)	P	V	V
		(g) Copper purity		As per plant standard	OEM Standard	V	V	V
		(h) Oxygen Content		As per plant standard	OEM Standard	V	V	V
		(i) Epoxy Bonding Strength (Bonded CTC)		As per plant standard	As per plant standard	P	V	V
2.	Kraft Insulating Paper (for covering of PICC/CTC)	(a) Visual check & Measurement of Thickness	One sample per type per lot	IEC 60554-3-1 IEC 60554-3-5 IEC 60554-2, Methods of Test	Paper to be smooth, unglazed surface, free from dust particles and no surface defect Thickness tolerance within specified value ±10%	P	V	--
		(b) Density			Nominal value ±0.05 gm/cm^3			
		(c) Substance (grammage)			Thickness(µm) Sub(g/m^2) 50 40 65 52 75 60			

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					90 72 Tolerance: For material ≤45 g/m^2 ±10% For material >45 g/ m^2 ±5%			
		(d) Moisture Content			8 % max			
		(e) Tensile Index (Machine Direction)			93 NM/gm (min)			
		(f) Tensile Index (Cross-machine Direction)			34 NM/gm (min)			
		(g) Elongation at Break (MD)			As per IEC 60554-3-1			
		(h) Elongation at Break (CD)			As per IEC 60554-3-1			
		(i) Electric Strength in Air			As per IEC 60554-3-1			
		(j) Ash Content			1 % max			
		(k) PH of Aqueous extract			6 to 8			
		(l) Conductivity of Aqueous extract			10 mS/m (max)			
		(m) Air Permeability			0.5 to 1.0 µm/Pa.s			
		(n) Tear Index (MD)			5 mN m^2/g (min)			
		(o) Tear Index (CD)			6 mN m^2/g (min)			
		(p) Water Absorption (Klemn Method)			10 %			
		(q) Heat Stability i) Reduction of Degree of Polymerization ii) Reduction of Bursting Strength iii) Increase of Conductivity of Aqueous extract.			Type test report			

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		(r) DP Value			As per IEC 60554/Manufacturer's std. practice			
		(s) Storage Period			As per Manufacturer's std. practice			
		(t) Storage in controlled Environment			As per Manufacturer's std. practice			
3.	Thermally upgraded Paper/Aramid Paper (if applicable)	Manufacturer's std. practice			As per Manufacturer's std. practice			
4.	(i) CRGO Mother coil / Laminations	Check following documents (a) Invoice of Supplier (b) Mill's Test certificate (c) Packing List (d) Bill of Lading (e) Bill of Entry (f) manufacturer's identification slip/unique numbering of prime CRGO coil	Each Lot (100% of coils)	IS 3024 IS 649 IEC 60404 ASTM 4343	As per approved design	P	V	V
		Check points:						
		(a) Visual check, check for coil width & thickness from nameplate	10% of coils		Visually defect free, as per design requirement			
		(b) Cutting Burr	One sample per lot		Less than 20 micron burr/ As per IS/ mutual agreement while ordering			

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		(c) Bend / Ductility test			As per IS 649/IS 3024 Completion of one 160° bend without fracture			
		(d) Surface insulation resistivity check			Average value: 10 Ω cm^2 (min.) Individual value: 05 Ω cm^2 (min.)			
		(e) Accelerated Aging test (type test)			4% (max.) increase in measured specific total loss			
		(f) Test on stacking factor			As per table no. 4 of IS 3024			
		(g) Test for specific Watt loss test	One sample from offered lot	IS 3024	As per table no. 2 of IS 3024	--	P	V
		(h) Magnetic Polarisation		IS 3024	As per appropriate tables of IS 3024	--	P	V
		(i) Grade of CRGO		Approved drawing/ Document	Approved Drawing/Document/ Manufacturer standard	P	V	V
		(j) Permeability at 800 A/m		Test Method IS 3024/ IS 649		P	V	V
		(k) Compliance to Quality Control Order of DHI		IS 3024		P	V	V
	(ii) Core Cheese (Packets) Applicable only for Reactors	(a) Visual Check	100%	Drawing/ Specifications	No damages	P	P	V
		(b) Surface flatness check – Mechanical			Drawing/Specifications			
		(c) Placement of Ceramic Spacers -Measurement						
		(d) Total Height & Diameter						
5.	Pre-compressed	(a) Visual & dimensional check, thickness, width and length	One sample of each size (thickness) per	IEC 60641-3-1 IEC60763-3-1	No surface defects	P	V	V

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	Press Board/ Laminated pre-compressed pressboard	(b) Apparent Density (g/cm^3)	lot of pressboard	IEC 60641-2, IEC60763-2 Methods of Test	Up to 1.6 mm TK - 1.0-1.2 >1.6-3 mm - 1.1-1.25 >3-3.6 mm - 1.15-1.30 >6-8 mm - 1.2-1.3			
		(c) Compressibility in air (C) (in %)			Up to 1.6 TK - 10 % >1.6-3 mm - 7.5 % >3-3.6 mm - 5 % >6-8 mm - 4 %			
		(d) Reversible part Compressibility in air (C_{rev}) (in %)			Up to 1.6 TK - 45 %; >1.6-3 mm - 50 % >3-3.6 mm - 50 %; >6-8 mm - 50 %			
		(e) Oil Absorption			Up to 1.6 mm TK - 11 min > 1.6-3 mm - 9 min > 3 - 3.6 mm - 7 min > 6-8 mm - 7 min			
		(f) Moisture Content			6% max. / As per relevant std. & Manufacturer's std. practice			
		(g) Shrinkage in air (MD, CD & PD)			MD - 0.5 % max, CD- 0.7 % max, Thick – 5 % max			
		(h) pH of aqueous extract			6-9 for solid boards			
		(i) Conductivity of aqueous extract			Up to 1.6 - 5 max (mS/m) > 1.6-3 mm- 6 max, > 3-3.6 mm - 8 max			

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					> 6-8 mm TK - 8-10 max			
		(j) Dielectric Strength in Air			Up to 1.6 - 12 kV/ mm > 1.6-3 mm - 11 kV/mm > 3-3.6 mm - 10 kV / mm > 6-8 mm TK - 9 kV/mm			
		(k) Dielectric Strength in Oil			Up to 1.6 - 40 kV/ mm > 1.6-3 mm - 35 kV/mm > 3-3.6 mm - 30 kV / mm > 6-8 mm TK - 30 kV/mm			
		(l) Ash Content (%)			1 % maximum			
		(m)Elongation (MD, CD)			MD CD Up to 1.6 - 3 % 4 % >1.6-3 mm - 3 % 4 % >3-3.6 mm - 3 % 4 % >6-8 mm TK - 3 % 4 %			
		(n) Tensile strength (MD, CD)			As per relevant std./ Manufacturer's std. practice			

		(o) Internal Ply Bond strength (for laminated pre compressed boards) • Dried (tested at 23°C) • Dried (tested at 120°C retention) • Oil impregnated (tested at 23°C) • Aged for 1 week at 120°C in oil (tested at 23°C retention)			As per relevant std./ Manufacturer's std. practice			
		(p) Flexural strength (MD, CD) (for Laminated pre compressed Boards) (MPa)			As per relevant std./ Manufacturer's std. practice			
		(q) Contamination Dielectric Liquids (for laminated pre compressed press boards) • Neutralization value (mg KOH/g) • Sludge content (mg/l) • Dissipation factor			As per relevant std./ Manufacturer's std. practice			
6.	Perma-wood	(a) Visual & dimensional check, thickness, width & length	One sample of each size per lot	IS 3513 IS 1708 IS 1736 IS 1998 IEC 61061 Approved document	Shall be free from surface defect	P	V	V
		(b) Density			0.8 to 1.3 gm/cc			
		(c) Moisture content			IS 3513/IS 1708			
		(d) Oil Absorption at 90 °C			Min 5%			
		(e) Dielectric Strength at 90 °C			Min 60 KV			
		(f) Tensile strength			Min for LD - 700 KV /cm^2			

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		(g) Compressive strength test			Min for LD - 1400 KV /cm^2			
		(h) Shear strength age-wise			Min for LD - 450 KV /cm^2			
		(i) Thickness			Thickness (mm) Tolerance (±mm) 10 to 25 - 1.2 26 to 50 - 1.4 51 to 150 - 2.0			
		(j) Shrinkage (MD, CD)			IEC 61061/Plant standard			
		(k) pH Value						
		(l) Breakdown voltage, parallel to the laminations						
7.	Porcelain Bushings (Hollow)	(a) Visual & dimensional check.	10% Sample per lot As per IS/ IEC	IS 3347 IS 8603 IEC 60137	As per approved drawing, IS 3347/IS 8603	P	V	V
		(b) Power frequency voltage withstand test			As per IS 3347/IS 8603/ IEC 60137			
8.	Polyester Resin Impregnated Glass Fiber Tape	(a) Visual Check	One sample per lot per size	IS 15208	Free from visual defect	P	V	--
		(b) Verification of shelf life			To be used within self-life period not to be used after expiry of period			
		(c) Dimensional Check • Thickness • Width			• 0.25 to 0.35 mm (± 0.07) / as per manufacturer's design • 20 to 50 mm (± 2)			

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		(d) Tensile Strength			200 N/mm (min)			
		(e) Resin Content			27 (± 3%)			
		(f) Softening point of resin			Max 200 °C			
		(g) Storage Condition			As per cl. 15.3 of IS 15208			
		(h) Elongation			4% (Max)			
9.	Lacquer (in case it is used)	Manufacturer's std. practice			As per Manufacturer's std. practice	P	V	--
10.	Condenser Bushing (OIP/RIP/RIS)	**Routine Test**	100%	IEC 60137				
		(a) Visual and Dimensional check			No visible damage	P	W	W
		(b) Lightening impulse withstand test (if applicable)			As per IEC 60137			
		(c) Measurement of dielectric dissipation factor and capacitance at room temperature			Tan Delta - 0.5%		P	V
		(d) Dry power frequency voltage withstand test			As per approved GTP	P	W	V
		(e) Measurement of Partial Discharge (PD)			As per IEC - No flash-over/ puncture		W	V
		(f) Pressure Test (for OIP condenser bushing)			No leakage	P	W	V
		(g) Test tap insulation test			As per IEC 60137			
		(h) Tightness test			No leakage	P	W	V

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		(i) Creepage distance			As per approved GTP	P	W	W
		(j) Test of oil before carrying out routine test on bushing (for OIP bushing) • BDV • Water content • Tan delta at 90°C • IFT at 27°C			• BDV: Min 70 kV • Water content: Max 5 ppm • Tan Delta at 90ºC Max:0.0025 • IFT at 27ºC: Min 0.04 N/m	P	W	V
		Method & Positioning of Storage			As per bushing manufacturer's guideline		P	--
11.	Buchholz Relay	**Routine test**	100%	IS 3637		P	W	V
		(a) Type & make			As per approved drawing			
		(b) Porosity			No leakage			
		(c) High voltage			2 KV for 1 min. withstand			
		(d) Insulation resistance			Minimum 10 MΩ by 500 V DC megger			
		(e) Element test			No leakage at 1.75 Kg /cm^2 oil pressure for 15 mins			
		(f) Gas volume test at 5° ascending towards conservator			GOR - 1: 90 to 165 CC GOR - 2: 175 to 225 CC GOR - 3: 200 to 300 CC			
		(g) Loss of oil & Surge test			GOR - 1: 70 to 130 CC GOR - 2: 75 to 140 CC GOR - 3: 90 to 160 CC			
12.	Bimetallic Terminal Connector	**Routine test**	100%	IS 5561		P	W	V
		(a) Dimensional			As per approved drawing			
		(b) Visual check			Free form defects			
		(c) Tensile strength			As per type test report			
		(d) Resistance			As per type test report			

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		(e) Galvanizing test (if required)			As per type test report			
13.	Marshalling Box/ Cooler Control Cabinet	(a) Dimensional & Visual check (workmanship, clearances, ferruling, labeling, accessories, earthing terminals, mounting/ lifting details, 20% spare TBs etc.)	100%	Approved drawing and specification	As per approved drawing	P	P/W	W/V
		(b) Verification of paint shade, thickness & adhesion			As per approved drawing			
		(c) All Functional Check at max & min rated operating voltage, electrical control operations, alarms, interlocks and sequential operations			As per approved drawing			
		(d) BOM check for Component type, make & rating			As per approved drawing			
		(e) DOP check by thin paper insertion method			As per technical specification			
		(f) Degree of Protection (IP Class) verification			As per type test report / approved drawing			
		(g) Check for sealing gasket (EPDM rubber for outdoor/ neoprene rubber for indoor)			Free form defects			
		Routine test						
		a. HV test at 2kV (for 1 min) for auxiliary winding			1 min withstand			
		b. Verification of wiring and its routing			Firm and aesthetic			

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		c. IR test at 500 V for 1 min			1 min withstand			
14.	Remote Tap Changer Control Panel (if applicable)	(a) Dimension & Visual Check	100%	Approved drawing and specification	As per approved drawing	P	P/W	W/V
		(b) 2kV test for Auxiliary wiring			1 min withstand			
		(c) Paint shade & Thickness			As per approved drawing			
		(d) Wiring routing check			Firm and aesthetic			
		(e) Functional Check			As per approved drawing			
		(f) Verification of BOQ			As per approved drawing			
15.	Air cell (Flexi Air Separator)	Make, Visual check of surface finish of complete air cell & Dimensions	100%	IS 3400	No surface defects. As per approved drawing	P	W	V
		Routine test						
		(a) Pressure test at 0.105 Kg /cm^2 (10Kpa) for 24 hrs			No leakage for 24 hours	P	W	V
		(b) 10 times inflation and deflation test at 0.105 Kg /cm^2			No deformation	P	W	V
		Type tests on basic fabric i. Oil side coating compound ii. Air side inner/outer coating iii. Rubber coating (inner/outer) iv. Coated fabric	One sample per lot of raw material		Tensile strength & elongation at break: ISO 1421 Tear resistance: ISO 4674-1 Coating adhesion: ISO 2411 Gas permeability: ISO 7229	P	W	V
16.	Roller Assembly	(a) Visual & Dimensions.	One sample per lot	IS 5517 IS 2004 IS 28 IS 2026	Free from surface defect	P	V	--
		(b) Mechanical Properties & Chemical	One sample per melt/heat		For shaft as per MS EN8, BS 970-1			

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		composition of raw material used for shaft & roller forging	treatment batch		For roller wheel of cast iron IS 210 For roller wheel of Cast steel IS 1030			
17.	Oil & Winding Temperature Indicator	(a) Type & make	100%	--	As per approved drawing	P	P/W	V
		(b) Accuracy			± 1.5% of FSD			
		(c) HV test at 2kV for 1 min between all terminals & earth			Withstand for 1 min			
		(d) Switch contact operation test			Operation within ± 2.5° C of setting			
		(e) Contact Rating			As per Manufacturer's std.			
18.	Pressure Relief Device	(a) Type & Make	100%	As per specification	As per approved drawing & free from defect	P	P/W	W/V
		(b) Air Pressure Test			Operate at Specified pressure ± 0.07 kg/cm^2			
		(c) Liquid Pressure Test			Satisfactory operation at pressure release			
		(d) Switch/contact testing			No leakage for 24 hrs			
		(e) Leakage test at 75% operating pressure			2 kV withstand for 1 min			
		(f) HV test			As per Manufacturer's std.			
		(g) Functional test/Calibration						
		(h) Contact Rating						
19.	Magnetic Oil Level Gauge (MOG)	(a) Type & make	100%	--	As per approved drawing & free from defect	P	P/W	W/V
		(b) Dial Calibration for level			Check pointer position for Max, Min and center level (within tolerance as per specifications)			

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		(c) 2kV HV test for 1 min between all terminal & earth			Withstand for 1 minute			
		(d) Leak test with air for 6 Hours			No leakage at 4 kg/cm^2			
		(e) Switch/contact operation test			Operate at Min level indication			
		(f) Contact Rating			As per Manufacturer's std.			
20.	Valves (Gate, Globe & Butterfly)	(a) Type, make & visual check for material of valve body, gate wedge, spindle and gland	100%	IS 778	As per approved drawing & no visible defect	P	W	V
		(b) Dimension check						
		(c) For Gate & Globe Valve: (i) Body test at 1.5 MPa (2 minutes) (ii) Seat test at 1.0 MPa (2 minutes) (iii) Seepage test at 2 kg/cm^2 for 12 hrs.			No leakage			
		(d) For Butterfly valve: (i) Pressure test through body and spindle (ii) Pressure test for diaphragm (iii) Oil seepage test (oil 105± 5 ^{o}C, pressure of 1.5 kg/cm^2 for 24 hrs.)			(i) No leakage at 5 kg/cm^2 for 10 minutes (ii) Max 6 drops/min at 1.5 kg/cm^2 (iii) No leak in body and spindle Max 6 drops/min through disc			
21.	Transformer Oil	Routine Test	100%	IS: 335 IEC 60296 IS 6855	As per technical specification	P	W	W
22.	Tank, Tank-cover, Turret,	(a) Visual check of welding joints including earthing	100% One per design	CBIP	Free from defect	P	W	V

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	Conservator & Accessories	connection, matching of tank with cover& Dimensional check after final welding		Manual on Transformer 2013				
		(b) Visual Check for a fit up for butt welds on tank walls, base & cover			Check for proper welding			
		(c) DP test on Butt welds after fit up & load bearing welds (lifting logs, bollards, jacking pads)			Check for proper welding			
		(d) Air leakage test on assembled tank with turrets & on conservator			No leakage			
		(e) Visual check of paint shade, paint film thickness (inside & outside) & film adhesion, primer application			Paint thickness Outside: 155 micron Inside: 30 micron No peel-off Or As per approved drawing			
		(f) WPS (Weld procedure specification) approval			Details to be furnished As per Specification/ASME Sec IX			
		(g) PQR (Process Qualification Record)			Details to be furnished As per Specification/ASME Sec IX			
		(h) Welders Qualification			Details to be furnished As per	P	W	V

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					Specification/ASME Sec IX			
		(i) UT (Ultrasonic test) of tank MS Plate of thickness >12mm.			Details to be furnished As per Specification/ASME Sec IX			
		(j) RT (Radiography test) of butt weld in bottom plate of tank after fit up (if any)			Details to be furnished As per Specification/ASME Sec IX			
		(k) Verification of PWHT (Post weld heat treatment)			Details to be furnished As per Specification/ASME Sec IX			
		(l) Surface cleaning by Shot/sand blasting			Details to be furnished as per Specification			
		(m)Tank - i. Pressure test (PT) ii. Vacuum test (VT) iii. Adhesion test iv. Visual Inspection inside transformer tank before PT & VT test			i. Withstand-Twice the normal head of oil or normal head+ 35 KN/m^2 whichever is lower, maintained at base of bank for 8 hrs. ii. Withstand- 3.33 KN/ m^2 for 1 hr. iii. Details to be furnished as per manufacturer's standard. iv. Inputs required as per specification	P	W	V
		(n) Chemical composition & mechanical property of steel		IS 2062 BS 4360	As per relevant standards	P	W	V

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

		(for tank, tank-cover, conservator, turrets and accessories)						
23.	Radiators	(a) Chemical composition & mechanical property of raw material	100%	BS EN 50216-1 IS513 Manufcaturer's drawing	As per relevant standards	P	W	W/V
		(b) DP test on lifting lugs welds			No welding defect			
		(c) Surface cleaning of header support and bracing details by sand/shot blasting			Free from surface defect			
		(d) Air pressure test on elements			As per relevant standards /CBIP			
		(e) Dimensional check after final welding			As per approved drawing			
		(f) Air pressure test on radiator assembly by water dipping method			2 kg/cm^2 for 30 minutes - no leakage			
		(g) Visual check of paint shade, paint film thickness & film adhesion			As per tech spec, coating thickness more than 70 micron			
		(h) WPS (Weld Procedure Specification) approval			Details to be furnished, if applicable as per Specification/ASME Sec IX			
		(i) PQR (Process Qualification Record)			Details to be furnished, if applicable as per Specification/ASME Sec IX			
		(j) Welders Qualification			As applicable As per Specification/ ASME Sec IX			

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24.	OLTC (as applicable)	(a) HV test on Auxiliary circuit (2kV for 1min).	100%	IS 8468 IEC 60214	To Withstand for 1 min	P	P/W	V
		(b) Operational test of complete OLTC including functional check of driving mechanism			Satisfactory operation			
		(c) Pressure test on diverter switch oil compartment			No leakage at 10 Psi for 1 hour			
		(d) Mechanical Operation test of diverter switch (endurance test)			No defect after 5000 operations			
		(e) Mechanical test of tap selector motor drive			500 satisfactory operations between extreme taps			
		(f) Sequence test			Switching time within permissible limit			
		(g) Visual & Dimensional check			Free from defects, dimensions as per drawing			
		(h) Operational test on Surge relay			Satisfactory working of trip & reset			
		(i) Milli volt drop/contact resistance measurement after Mechanical test.			As per standard			
		(j) Condition of Silver plating on contacts			Good condition			
		(k) Measurement of Tan delta			To be provided (value to be used for benchmark) as per manufacturer's standard			
		(l) Helium Test (barrier board leakage test)- For externally mounted OLTC			To be provided as per manufacturer's standard			

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25.	Digital RTCC Relay/ Automatic Voltage Regulating Relay (AVR) (if applicable)	(a) Check of Binary input and output signal along with HMI display nomenclature	100%		as per specification/manufacturer's standard			
		(b) Check availability of spare binary input and output terminal						
		(c) Check communication interface						
		(d) Test for complete function include tap position indication, raise and lower command execution						
26.	Cooling Fans & motor	(a) Type, Make & visual check	100%	IS 2312	As per approved drawing, no visual damage/ defect	P	W	V
		(b) Power consumption, rating test			As per approved drawing			
		(c) HV test (3kV Power frequency withstand test for 1 min)			Should withstand			
		(d) Insulation resistance value			2 MΩ (minimum) with 500 V DC megger			
27.	Nitrile Rubber Gasket	(a) Visual check	1 sample/ Lot	ISO 7619-1 ISO 815 ISO 37 ISO 3865 IS 11149	Free from cracks and pin holes	P	W	V
		(b) Dimensions			Within tolerance			
		(c) Shore Hardness			70 ± 5 IRHD			
		(d) Tensile Strength			12.5 N/mm2 min			
		(e) Compression set test			35% (max) at 70 ± 1° C			
		(f) Elongation at break			250% min			

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		(g) Accelerated aging in air (at 100 ± 2° C for 72 hours)			Change in harness: ±15 IRHD Tensile strength change: 20% (max) Elongation change: max +10%/ -25%			
		(h) Accelerated aging in oil (at 100 ± 2° C for 72 hours)			Change in hardness: ±8 IRHD Tensile strength change: 35% (max) Volume change: +20%/ -8%			
		(i) Time period between manufacturing of gasket and its use			To be used within self-life period, not to be used after expiry period			
28.	EPDM Gasket for Marshalling Box	(a) Visual Check	1 sample/ Lot	IS 11149	Free from cracks & pinholes	P	W	V
		(b) Dimensional check (Thickness & Width)			Within tolerance			
		(c) Tensile Strength			As per IS 11149			
		(d) Elongation at break			As per IS 11149			
		(e) Shore Hardness check as per DIN-53505			As per IS 11149			
		(f) Compression test (in air) as per DIN, ISO 815			As per IS 11149			
29.	Bushing CT	Dimensions (Visual check for ID/OD, thickness)	100%	IS 16227 IEC 61869-2	As per approved drawing			
		Routine test						
		(a) Verification of terminal marking & polarity			As per IS 16227/ IEC 61869-2			
		(b) Overvoltage inter-turn test			Rated current withstand for 1 min			

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		(c) Determination of error			As per IS 16227/ IEC 61869-2			
		(d) HV Test (Dry power frequency withstand test on secondary winding)			3 kV AC for 1 min withstand			
		(e) Accuracy Ratio			As per IS 16227/ IEC 61869-2			
		(f) Secondary winding resistance for PS/PX class			As per IS 16227/ IEC 61869-2			
		(g) Knee point voltage & excitation current for PS/PX class						
30.	Oil circulating pump (as applicable)	(a) Visual check	100%	IS 9137	no visual damage/ defect	P	P/W	V
		(b) No load running test (rpm, input power and current) (c)			Satisfactory performance & no load losses within limit			
		(d) HV test (2kV power frequency withstand voltage test for 1 min)			Should withstand			
		(e) Oil pressure test on pumps at 5kg/cm^2 for 30 min			No leakage			
		(f) Locked rotor test			Satisfactory operation of protection			
31.	Oil flow Indicator (as applicable)	(a) Type, Make & Visual check (b) Dial & Calibration (c) Contact Rating (d) Dielectric Test between terminals and earth	100%	--	(a) As per standard document, no visual damage/defect (b) As per standard document (c) As per standard document	P	P/W	V

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

		(e) Leak test at 7 kg/cm2 for 2 min (f) Alarm & trip operation check (g) Full flow check			(d) Shall withstand 2 kV for 1 min (e) No leak			
32.	Power/Control Cable	Review of Supplier's TC for physical & electrical tests as per specification/drawing.	Random	--	As per standard document	P	P	V
33.	Silica Gel Breather	(a) Dimension, Type and model check (b) Check of healthiness & colour of Silica gel (c) Pressure test by blanking oil cup end	100%	-	(a) Within tolerance, Type and model as per drg (b) No visible defect, Gel colour is blue/Orange (c) No leak at 0.35 kg/cm^2 (for 30 Min)	P	W	-
34.	Drum for insulating oil	(a) Visual check of inside cleanliness and outside coat	100%	IS 1783 –1	As per specifications/ IS 1783-1			
		(b) Dimensional check (thickness, height & diameter)						
		(c) Leakage test on drum						
		(d) Drop test						
		(e) Hydraulic test						

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 a) Runner b) Stay Rings c) Discharge Ring d) Spiral Casing e) Head Cover f) Bottom Ring g) Turbine Shaft h) Turbine Shaft seal i) Servo Motor j) Turbine Guide Bearing k) Labyrinth l) Injector (Nozzle Assembly) m) Guide Apparatus n) Digital Governing System
2)	Generator a) Rotor b) Stator c) Generator Shaft d) Generator Bracket 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 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 ii. Variable-Frequency Drive (VFD)
10)	Current Limiting Reactors
11)	Generator Circuit Breaker

12)	Phase Reversal Disconnecting Switch
13)	i. Dynamic Braking cubicle 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:

11)	Generator Circuit Breaker	B-171-B-174
12)	Phase Reversal Disconnecting Switch	B-175-B-178
13)	i. Dynamic Braking cubicle ii. Starting Switch	B-179-B-181 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.	**मद/घटक एवं विशेषता**	**जाँच की**	**जाँच की**	**संदर्भ दस्तावेज़ / स्वीकृति**	**रिकॉर्ड**	**निरीक्षण एजेंसी (INSP.**	**टिप्पणी**

सं. SR. NO.	ITEM /COMPONENTS & CHARACTERISTICS	प्रकृति NATURE OF CHECKS	मात्रा QUANTUM OF CHECKS	मानदंड REFERENCE DOCUMENTS/ ACCEPTANCE NORMS	प्रारूप RECORD FORMAT	AGENCY)			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	Measurem	100%	-do-	IR	3/2	-	1	TC

	Assembly	ent							
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**			
			EMPLOY		**(VENDORS Q.C. DEPT. OR**				

			ER (QA&I DEPT.)		**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	Measurem	100%	-do-	IR	3/2	-	1	RR

	Surface	ent							
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 (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	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	Sample	-do-	IR	3/2	-	1	TC

		Test	per Lot						
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	Measurem ent	100%	-do-	IR	3/2	-	1	RR
2.3	Machining								
a)	Dimensions & Surface Finish Check	Visual / Measurem ent	100%	-do-	IR	3/2	-	1	TC
3	**Final Inspection before HP-HVOF Coating**								
3.1	Dimensional Check & Surface finish	Measurem ent	Critical Dim.	-do-	IR	3/2	-	1	TC
3.2	Profile Checking with Template (Top, Middle & Bottom)	Measurem ent	100%	-do-	IR	3/2	-	1	TC
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
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) : Servomotor				**विक्रेता (VENDOR) :**			
				एनआईटी/ क्रय आदेश संदर्भ (NIT/P.O. REFERENCE) :			
क्र.	**मद/घटक एवं विशेषता ITEM /COMPONENTS &**	**जाँच की प्रकृति NATURE OF**	**जाँच की**	**संदर्भ दस्तावेज़ /**	**रिकॉर्ड**	**निरीक्षण एजेंसी (INSP. AGENCY)**	**टिप्पणी REMAR**

सं. SR. NO.	CHARACTERISTICS	CHECKS	मात्रा QUANTUM OF CHECKS	स्वीकृति मानदंड REFERENCE DOCUMENTS/ ACCEPTANCE NORMS	प्रारूप RECORD FORMAT	प्रदर्शन Perform	गवाह Witness	सत्यापन Verify	KS
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	-do-	-do-	-do-	JIR	3/2	1	-	CHP

	Pressure								
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'.								
	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**	**रिकॉर्ड प्रारूप RECORD FORM**	**निरीक्षण एजेंसी (INSP. AGENCY)**			**टिप्पणी REMARKS**
						प्रदर्शन Perform	**गवाह Witness**	**सत्यापन Verif**	

				NORMS	**AT**			**y**	
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
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	-do-	-do-	JIR	3/2	1	-	CHP

		applicable)							
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	Measurem	100%	-do-	IR	3/2	-	1	RR

	Labyrinth after machining	ent							
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
Not	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-								

e:	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		-do-	-do-	IR	3/2	-	1	TC

	Segment / Shell (Bearing Pad)								
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		**(VENDORS Q.C. DEPT. OR REPRESENTATIVE)**				

			DEPT.)		

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. 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	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	UT, MPI, DPT	100%	-do-	JIR	3/2	1	-	CHP

	Defects	(as applicable)							
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/Equival	TC	3/2	-	1	TC

				ent					
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
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.								

			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	Measure ment	- 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/ Measure ment	- do-	-do-	TC	3/2	-	1	TC
2	**Painting**	Visual/ Measure ment	- do-	-do-	TC	3/2	-	1	TC
Not e:	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)**				

कार्य स्थल गुणवत्ता योजना (FIELD QUALITY PLAN) :									
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**								
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
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.								
	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	Measurement /Visual	100%	-do-	TC/TR	3/2	1	-	TC/TR

	Spiral case.								
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" .								
	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) :	
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	Visual	100%	-do-	TC/TR	3/2	1	-	TC/TR

	sequence at full output: normal stop, emergency stop due to mechanical fault, emergency stop due to electrical fault.								
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 ,	Measurement	-do-	-do-	TC	3/2	-	1	TC for core

	height etc)								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**			
	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 Test	Mechanical	-do-	-do-	TC	3/2	-	1	TC
iii)	Breakdown Voltage Test at	Electrical	-do-	-do-	TC	3/2	-	1	TC

	Room & elevated temp.								
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	Measure ment	Sample	Tech spec./ Appd Drg./ IS/IEC/Equivalent Standard	TC	3/2	-	1	TC
ii)	Tensile Strength	Mechanic al	-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	Measure ment/ 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
Not e:	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" .								
	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**	**रेकॉर्ड फ़ारमैट RECORD FORMA**	**निरीक्षण एजैंसी Inspecting Agency**			**टिप्पणी Remarks**
						प्रदर्शन PERFOR	गवाह WITNES	सत्यापन VERIF	

				NORMS	**T**	M	S	Y	
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 sector	Electrical	-do-	-do-	TC	3/2	-	1	TC
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)								
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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 एजैंसी Inspecting Agency**			**टिप्पणी Remarks**
						प्रदर्शन PERFORM	गवाह WITNESS	सत्यापन 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**								
i)	Dimensions of Rotor Fan : i) Radial ii) Axial	Measurement	-do-	Tech spec./ Appd Drg./ IS/IEC/Equivalent Standard	JIR / TC	3/2 / 3/2	1 / -	- / 1	i) Radial - CHP 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)**				

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.	**मद/घटक एवं विशेषता**	**जाँच की प्रकृति NATURE OF**	**जाँच की मात्रा QUANTUM**	**संदर्भ दस्तावेज़ / स्वीकृति मानदंड**	**रेकॉर्ड फ़ारमैट**	**निरीक्षण एजैंसी Inspecting Agency**		**टिप्पणी Remar**

S.N.	ITEM/ COMPONENT & CHARACTERISTICS	CHECKS	OF CHECKS	REFERENCE DOCUMENT/ ACCEPTANCE NORMS	RECORD FORMAT	प्रदर्शन PERFORM	गवाह WITNESS	सत्यापन VERIFY	ks
	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/Elect (as applicable)	Sample	-do-	TC	3/2	-	1	TC
3	**Pole coils**								
A	**Raw material (Copper)**								
i)	Material Properties	Chem/Mech/Elect	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	JIR	3/2	1	-	CHP

				Standard					
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)								
	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 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 (as applicable)	100%	Tech spec./ Appd Drg./ IS/IEC/Equivalent Standard	TC	3/2	-	1	TC
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" .								
	Signature					**Signature & Seal**			
	EMPLOYER (QA&I DEPT.)				**(VENDORS Q.C. DEPT. OR REPRESENTATIVE)**				

परियोजना (PROJECT) :				**ग्राहक (CLIENT):**					
उपष्कर का नाम (NAME OF EQUIPMENT) : Generator Shaft (Top & bottom)				**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**								
	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	-do-	-do-	-do-	JIR	3/2	1	-	CHP

	Shaft with Thrust Collar Assembly (if applicable)								
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
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)**				

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
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)								
	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 Bearing Pads (Thrust, Upper & Lower Guide Bearing Pads)				**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 (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
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 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 एजैंसी 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

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" .								
	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 (Shaft Coupling Bolts)				**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)	**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" .								
	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 (Disc, Collar, Springs etc)				**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	**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
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" .								
	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 (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 Remark
						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
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	Measurement	-do-	-do-	JIR	3/2	1	-	CHP

	assembly								
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 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" .								
	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 (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 एजैंसी 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
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" .								
	Signature					**Signature & Seal**			
	EMPLOYER (QA&I DEPT.)				**(VENDORS Q.C. DEPT. OR REPRESENTATIVE)**				

<u>कार्य स्थल गुणवत्ता योजना (FIELD QUALITY PLAN) :</u>

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
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 polarization factor.	-do-	-do-	-do-	TC/TR	3/2	1	-	TC/TR
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
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,	-do-	-do-	-do-	TC/TR	3/2	1	-	TC/TR

	including at 110 % of rated unit load.								
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
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.								
	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
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	-do-	Appd. Drg. / Tech. Spec. /	TC	3/2	-	1	TC

		(As applicable)		IS/IEC/Equivalent					
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
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**			
			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**	**संदर्भ दस्तावेज़ / स्वीकृति मानदंड REFERENCE DOCUMENTS/**	**रिकॉर्ड प्रारूप RECORD**	**निरीक्षण एजेंसी (INSP. AGENCY)**			**टिप्पणी REMARKS**
						प्रदर्शन Perfor	**गवाह Witnes**	**सत्यापन**	

			CHECKS	ACCEPTANCE NORMS	FORMAT	m	s	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
10.2	NDT of weld joints	UT,DPT, MPI	100%	-do-	TC	3/2	-	1	TC

		(As applicable)							
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
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. CHP*-Test shall be conducted at site in presence of Power Station representative.

			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
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.								
			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/Equival					
1.1	**Pump**								

				ent					
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	Measurem ent	- 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/ Measurem ent	- do-	-do-	TC	3/2	-	1	TC
2	**Painting**		- do-	-do-	TC	3/2	-	1	TC
Not e:	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.								
			Signatur			**Signature & Seal**			

			e			
			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
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'.								
	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)**				

5) (i) STATIC EXCITATION SYSTEM FOR SYNCHRONOUS MACHINES

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
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	Measure ment/ 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**								
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/ Measure	100%	Tech spec./ Appd Drg./	JIR	3/2	1		CHP

		ment		IS/IEC/Equivalent Standard					
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

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**	-do-	On 01	-do-	JIR	3/2	1	-	CHP

	(Heat Run)		unit						
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 applicable)**	Visual	100%	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) : Excitation System				**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)	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	-do-	-do-	-do-	TC/TR	3/2	1	-	TC/TR

	supplies								
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 ii) Functional checking of commands to Excitation equipment, operation and status for control room commands iii) Excitation equipment status & alarm indications at control room and local. iv) Checking alarms, trip conditions and Sequence of Events.	Functional	-do-	Tech spec./ Appd Drg./ IS/IEC/Equivalent Standard/ Scheme	TC/TR	3/2	1	-	TC/TR
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)
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)	Functiona l	-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)**				

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	JIR	P	W	CHP	

				above'					
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	
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	Electrical	100%		JIR	P	W	RR	

	resistance of power circuit								
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	
1.2.1.13	Operation of converter with reduced voltage	Electrical	100%		JIR	P	W	RR	
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	Electrical	100%	'IS/ IEC/	JIR	P	W	CHP	

	loss and current			equivalent or above'					
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	
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	
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	TC	3/2	-	1	TC

				Standard					
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	-do-	-do-	-do-	JIR	3/2	1	-	CHP

	withstand test (IVW)								
	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.								
	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: (a) Eccentric running of moving parts. (b) Alignment of shafts. (c) Fauling of moving components. (d) Any un-usual noise. (e) Presence of lubricant at desired surfaces. (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. specs./ IS/IEC/Equivalent					
8.1	Make, Type & Capacity	Visual	100%		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	Measurement	-do-	-do-	JIR	3/2	1	-	CHP
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. 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	**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.								
			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) : Oil Handling System				**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	**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	100%	-do-	TC/TR	3/2	1	-	TC/TR

		Test							
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	
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	'IS/ IEC/ equivalent or	JIR	P	W	CHP	

			Converter	above'					
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	
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			**(VENDORS Q.C. DEPT. OR REPRESENTATIVE)**					

	DEPT.)				

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)**				

<u>कार्य स्थल गुणवत्ता योजना (FIELD QUALITY PLAN) :</u>

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.	**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 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	JIR	3-2	1	-	CHP

				above'					
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			Supplier report					
1	General aspect / Dimensional control / Tesile test ("T" punch)	Mechanical	100%		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	Mechanic	100%		TC	P	RR	-	

	diagram	al							
	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	TC	2/3	-	1	TC

				Standard					
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./	TC	2/3	-	1	TC

				IS/IEC/Equivalent Standard					
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	JIR	2/3	1	-	CHP

				Standard					
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)**			

<u>कार्य स्थल गुणवत्ता योजना (FIELD QUALITY PLAN) :</u>

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./	TC/TR	3/2	1	-	TC/TR

				IS/IEC/Equivalent Standard					
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 δ) 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)**				

<u>कार्य स्थल गुणवत्ता योजना (FIELD QUALITY PLAN) :</u>									
परियोजना (PROJECT) :				**ग्राहक (CLIENT):**					
उपष्कर का नाम (NAME OF EQUIPMENT) : Bushing				**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)	**<u>General Checks</u>**								
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 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:

1.1.1. 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 non destructive testing as detailed against relevant equipment shall meet the requirement of ASTM section 3 Vol. 3.03 or equivalent BIS standard.

1.1.1.1. Drum

i) Each plate shall be subjected to a 100 % normal and shear ultrasonic at the millto meet the minimum requirements of BS: 5996 grade LC3/ 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, exceptfor forgings, shall be subjected to MPE.

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% radiographic test (RT) before stress relieving.

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

ix) All butt welds shall be subjected to 100% ultrasonic test and magnetic particle examination after stress relieving.

x) All full penetration welds shall be subjected to ultrasonic examination after stress relief.

xi) After stress relieving, all welds shall be examined by magnetic particle examination (MPE) methods depending on size and accessibility.

xii) Complete drum shall be subjected to hydraulic pressure test and all compensating pads shall be pneumatically tested.

1.1.1.2. 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) All butt welds shall be subjected to MPE and radiographic examination before stress relieving.

iii) All full penetration nozzle and attachment welds shall be subjected to UT prior to stress relieving.

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

v) Non-load bearing welds shall be examined by MPE 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.

1.1.1.3. 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 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.

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 and UT. Wherever the code/standard/process specifies random sampling, the same shall be minimum 20%. All fillet welds (including fins if any) shall be subjected to MPE or dye penetration test (DPT).

v) Tubes and fabricated panels, coils shall be subjected to hydraulic pressure test excluding water wall panels and loose tubes but including burner panels, reheaters, superheaters and economizers.

1.1.1.4. Integral piping, valves and fittings

i) All pipe lengths shall be subjected to 100 % ultrasonic examination as per ASME E213 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 forged fittings shall be checked by UT and formed fittings shall be checkedby MPE.

iv) All pressure parts shall be 100 % UT tested. All welded, cast alloy steel and carbon steel fittings for use above 71 bar design conditions shall be 100 % RT tested. However, wherever the code/standard/process specifies random sampling, the same shall be minimum 20%.

v) All bent pipes shall be checked for ovality and thinning by UT on first off lot andon random samples for subsequent pieces. Outer surface of bends shall be subjected to MPE or DPT.

vi) 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.

vii) All butt welds shall be subjected to UT or RT and MPE. 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 %.

viii) All butt welds in alloy steel piping of P91, X20 and X 22 shall be checked for RTor 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 > 400^0C and/ or pressure exceeding 71 bar

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

b) Temperature > 175^0C upto 400^0C and/or pressure exceeding 17 bar and upto 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 upto 100NB.
- 100% MPE.

c) All other pipes not covered above shall be subjected to 100% MPE or DPT in case of under ground 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.

1.1.1.5. 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) 100% UT of stem dia 500mm or more.

iv) 100% UT of body & bonnet for valves 1500 class or above. 100% MPE for 600 class and above.

xiii) 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 of fillet joints (in case of cast valves).

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

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

vii) 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.

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

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

Table 1: NDT requirements for pressure retaining components of valves

Valve size NB in mm	**ANSI Class upto 300**	**ANSI Class above 300 upto 600**	**ANSI Class above 600 below 900**	**ANSI Class 900 and above but below 4500**
Less than 50	Visual	Visual	Visual	MPE (for special class valves)
50 & above but below 100	Visual	Visual	MPE (for special class valves)	MPE and RT on 10%of valves on 100% area
100 & above but less than 300	Visual	MPE	MPE and RT on 10% of valves on change of section and weld ends	MPE and RT on 100% area
300 and above	MPE	MPE	MPE and RT on change of sections and weld ends	MPE and RT on 100% area

Note:

i. For body and bonnet forgings, UT with MPE may be adopted in place of RT.

ii. For austenitic steel, MPE may be replaced by DPT.

1.1.1.6. 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.

1.1.1.7. 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.

1.1.1.8. 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.

1.1.2. Boiler water circulation pumps

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

ii) All forging and castings shall be subjected to 100% UT or RT and MPE or DPT 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 1.5 times the design pressure.

v) Each pump shall be subjected to performance test at the manufacturer's works under 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 temperature and 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) Overspeed 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.

1.1.3. 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 despatch 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.

1.1.4. Soot Blowers

i) Butt weld between nozzle and lance tube shall be subjected to 100 % radiography tests.

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

a) Smooth operation

b) Long tube travel, closing and opening time.

c) Current drawn.

1.1.5. 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 BS 848, Part-1.

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.

1.1.6. 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 body casing and separator of the mill shall be tested by RT and MPE. All other welds shall be tested by MPE or DPT for acceptance.

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.

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 atleast one mill complete with all major components at shop.

viii) All rotating components shall be dynamically balanced.

1.1.7. Coal Feeders

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

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.

1.1.8. 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 upto 25mm, 100% MPE shall be carried out 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.

iv) Ceiling girders, columns, ducts hoppers and tunnels shall be trial assembled and match marked prior to dispatch/erection. At least two consecutive girders alongwith cross member shall be assembled at a time.

v) Drum sling rods

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

b) Welds shall be examined by UT 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.

vi) 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.

1.1.9. Electro- Static Precipitators (ESPs)

1.2.3.3 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

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.

1.2.3.4 ESP structure

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

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

iii) Radiographic examination shall be performed on butt welds as per AWS D1.1. 100% radiography on tension flange (bottom flange) welds and spot radiography on all joints in compression flange (top flange) of all beams and columns shall be carried out. The minimum length of welds for spot radiography and acceptance criterion shall be as per AWS D 1.1.

iv) Edge preparation for field welding shall be examined by MPI.

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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

1.2.1.1. 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 alongwith 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.

1.2.1.2. 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.

1.2.1.3. 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 overspeed.

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:

a) Ultrasonic examination with normal and angular probes of the weld to ensure complete coverage and freedom from harmful defects.

b) Run out of rotor before and after welding.

c) MPE on finish welds.

d) Hardness survey on the welds.

e) Stress relieve annealing.

f) Test reports of filler material used.

g) 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 overspeed 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 overspeed test shall be carried out during which the rotor shall withstand an overspeed 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 overspeed test, vibration measurement and analysis shall also be carried out.

v) After blading and again after overspeed 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 overspeed test.

vii) Lock blade lift after the overspeed test shall be checked and record for same shall be maintained.

1.2.1.4. 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.

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.

v) Dye penetrant test shall be made on the erosion shield and blade joint in manufacture prior to fitting to the wheel and after overspeed 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 rivetting 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 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.

1.2.1.5. Diaphragms

i) Welded and fabricated diaphragms

a) Concentricity checks shall be carried out on final machined diaphragms to ensure that there are no negative overlaps between guide and moving blades.

b) 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.

1.2.1.6. 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.

1.2.1.7. 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 50 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.

1.2.1.8. **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.

1.2.1.9. Bolts and nuts for pressure retaining enclosures and rotor couplings

i) Bar stock for bolts shall be subject to 100% UT.

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.

1.2.1.10. **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.

1.2.1.11. Inspection of completed turbine

i) HP and IP 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 overspeed 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.

k) Pre- dispatch inspections including clearance check for transportation device.

ii) LP Turbines

For the LP turbine, the following minimum checks/ measurements shall becarried out on the assembled turbine at the manufacturer's works:

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 non destructive 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.

ii) All butt welds shall be subjected to 100% RT.

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 overspeed test at 120% of rated speed for 5 minutes.

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 hydrotest, 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 centrifuge, 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 of 10% of butt welds (including T-joints) shall be carried out. However, for vacuum containing welds, RT on atleast 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 method before dispatch.

vii) 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.

viii) 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.

ix) Dimensional check including tube hole diameter, ligament pitch etc. shall be carried out.

x) 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.

xi) Tube to tube sheet weld joints shall be subject to 100% DP test.

xii) Water fill test on shell side of condenser shall be carried out. No leakage shall be permitted.

xiii) Water fill test of standpipe, Flash tank etc. shall be carried out. No leakage shall be permitted.

xiv) Hydraulic test of tube side of condenser shall be carried out. No leakage shall be

permitted.

xv) 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.

1.3.4 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 incl 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.

d) All weldments shall be given suitable heat treatment.

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.

c) Fillet welds shall be checked by 100% MPE or DPT.

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

- 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.

- 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.

- Thermal shock test shall be carried out on one pump with measurements taken on all critical areas such as barrel, discharge branch, casing cover, casing cover stud.

- Dry running withstand capability shall be demonstrated and establishedon one pump. The pump shall be capable of accepting complete loss of water and must be capable of being shut down in a controlled manner and brought down to rest after being tripped from design conditionwith simultaneous closure of suction valve. Coasting down time check to be done.

- Visual cavitation test on one first stage production impeller shall be carried out to demonstrate absence of cavitation at design speed in coldwater. The test shall establish the cavitation characteristic to confirm that the cavity length under dynamically scaled site conditions corresponding to design point shall not exceed an acceptable size. This test shall be carried out at 25%, 50%, 80%, 100% and 125% of design flow.

f) Strip down test

Complete strip down of one feed pump which undergoes NPSH test, dry run test, thermal shock test etc. 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) + 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

- 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.

- Dry run withstand capability shall be demonstrated and established on one pump.

g) 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) + 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) + 3% of design head (for ≥ 152.4 m)

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.

The results of the

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 50mm),

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

1.5.1.1.15.VII 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 50mm.

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.

- 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.

v) 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 or hydraulic tests and UT or RT on longitudinal welds.

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.

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.

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 pipings 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 pipings).

xvii) All other pipes not covered above (except oil piping) shall be subjected 100% MPE or DPT in case of under ground 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 and 10% DP Test. For Jacking oil lines 100% RT 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.

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:

a) Valve size < 50 NB
- Visual examination for rating below ANSI Class 900
- MPE for rating above ANSI Class above 900

b) Valve size ≥ 50 NB and < 100 NB
- Visual examination for rating upto ANSI Class 600
- MPE for rating above ANSI Class above 600 and below 900
- 100% MPE and 100% RT on 10% of valves for rating above ANSI Class above 900 and below 4500

c) Valve size ≥ 100 NB and < 300 NB
- Visual examination for rating upto ANSI Class 300
- MPE for rating above ANSI Class above 300 and below 600
- 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
- 100% MPE and 100% RT on valves for rating above ANSI Class 900 and below 4500

d) Valve size ≥ 300 NB
- MPE for rating upto ANSI Class 600
- 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

- 100% MPE and 100% RT on valves for rating above ANSI Class 900 and below Class 4500

In the above NDTs, MPE may be replaced by DPT for austenitic steels.

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. Type tests for discharge co-efficient and pressure drop co-efficient, shall be carried out. In case the type tests have been carried out in the past and documents generated, the same shall be furnished to the purchaser for approval.

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.

d) 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 andclosing 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 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) One hanger 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 fibre blankets and block insulation, testing shall be carried out as per IS: 15402.

f) Type tests except 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 aluminium 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 ≥ 50 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 standard.

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 per batch of rubber mix such as hardness, adhesion, spark test, bleed test and flex test on diaphragm, type test for diaphragm for 50,000 cycles.

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 shall be carried out on plate material for body and disc.

b) Machined surfaces of casing, disc and shaft shall be subjected to MPE or DPT.

c) Butt welds of thickness above 30mm on body and disc shall be subject to 100% RT alongwith and post weld heat treatment for stress relieving.

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) Dry cycle test (spring cycle test) for one lakh cycles shall be carried out as a type test.

b) Machined surfaces of casing, disc and shaft shall be subjected to MPE or DPT.

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 fibre 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%.

viii) 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, 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:

a)	Butt welds in tension	: 100% RT and 100% DPT
b)	Butt welds in compression	: 10% RT and 100% DPT
c)	Butt weld in rope drum	: 100% RT and 100% DPT
d)	Fillet welds	: 10% DPT (random)

1.4.8.4 Forgings

i) All forgings (wheel, gears, pinions, axles, hooks and hook trunion) greater than or equal to 50mm 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, cross travel 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 and backlash. 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.

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.

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.

ii) Tubes for heat exchangers/ vessels and interconnecting pipes shall be tested as per the requirement of relevant code/standard.

iii) All welding shall be performed as per approved Welding Procedure Specification and IBR qualified procedure and welders.

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.

v) RT on butt weld joints of heat exchangers/ vessels shall be carried out as per the requirement of design code/approved drawing.

vi) DPT on Root run after back gouging and on finished welds shall be carried out.

vii) 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 50mm) 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.

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 50mm) 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 50mm) 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.

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

iii) 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 50mm), 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 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.

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.

iii) 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**

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). 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.

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. 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. **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 - 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.

a) **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.

b) **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 aeging, 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

c) **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.

d) **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 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.

e) **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.

f) **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

g) **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.

h) **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 - UT/RT and MPI/DPT.

c) Fillet Welds 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.

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 lub 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 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 trunion) greater than or equal to 50mm 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 50mm) 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.

Piping Valves and fillings- Refer clause 1.5.1.10.3

1.5.1.1.11 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

iii) Manufacturer's standard test certificate or guarantee certificate shall be submitted for split and window air conditioners.

1.5.1.1.12 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.

1.5.1.1.13 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: shop tests**

a) For Pipes, Fittings, Valves and specialties, requirements are indicated separately.

b) Deluge Valves and Spray 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 1.5.1.1.14.

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).

- Gl Pipes

  Welding on Gl Pipes in general shall not be done. Welding of Gl 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.

1.5.1.1.14 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.

1.5.1.1.15 Low Pressure Piping, Valves and Fittings etc.

I. **Pipes, fittings**

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.

II. **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 ≥ 50 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 standard.

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.

vii) 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 per batch of rubber mix such as hardness, adhesion, spark test, bleed test and flex test on diaphragm, type test for diaphragm for 50,000 cycles.

viii) 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.

ix) Fabricated butterfly valves:

a. UT shall be carried out on plate material for body and disc.

b. Machined surfaces of casing, disc and shaft shall be subjected to MPE or DPT.

c. Butt welds of thickness above 30mm on body and disc shall be subject to 100% RT along with and post weld heat treatment for stress relieving.

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.

x) Dual plate check valves:

a. Dry cycle test (spring cycle test) for one lakh cycles shall be carried out as a type test.

b. Machined surfaces of casing, disc and shaft shall be subjected to MPE or DPT.

III. **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) Adhesion test

b) Measurement of thickness

c) Shore hardness test

d) Visual examination and spark test at 5 kV/mm of thickness

e) Bleeding resistance test (as applicable) with keeping the sample in 33% HCl, 48% NaOH and DM water for 72 hours.

f) Bleeding test and ozone resistance test shall be done on rubber material.

ii) Dimensional check shall be carried out as per relevant code/ approved drawing.

IV. **Coating and wrapping of pipes**

Spark 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.

V. **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 and ozone resistance test as per ASTM D- 380.

ii) Fabric strength of synthetic fibre 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 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%.

viii) Life cycle test and burst test shall be carried out on bellows of each type, design and size.

VI. **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.

VII. **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 50mm), 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.

VIII. **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.

IX. **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.

X. **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 50mm 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

1.5.1.1.16 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) One hanger 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.

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 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 trunion) greater than or equal to 50mm 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 50mm) 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 fillings- Refer clause 1.5.2.1.9 (IV).

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: shop tests**

a) For Pipes, Fittings, Valves and specialties, requirements are indicated separately.

b) Deluge Valves and Spray 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 1.5.2.1.10 (IV).

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).

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.

a) **Pipes, fittings**

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.

b) **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 ≥ 50 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. Valves shall be offered for hydro test in unpainted condition. 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 standard.

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) Anti-corrosive protection shall be tested as per applicable code.

ix) Gate, globe and swing check valves

- Machined surfaces of castings and butt welds shall be subjected to MPE or DPT.
- Blue matching, wear travel for gates, valves, pneumatic seat leakage, reduced pressure test for check valves shall be done as per relevant standard.

x) Diaphragm valves

- Seat leakage test for actuator operated valves, shall be done with by closing the valves with actuator.
- Tests on rubber parts per batch of rubber mix such as hardness, adhesion, spark test, bleed test and flex test on diaphragm, type test for diaphragm for 50,000 cycles.

xi) Cast butterfly valves

- Machined surfaces of casing, disc and shaft shall be subjected to MPE or DPT.

- Hydraulic test of body, seat and disc-strength shall be carried out in accordance with governing design standard. 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) Fabricated butterfly valves:

- UT as per ASTM A-435 shall be carried out on plate material for body and disc for plate thickness 25mm and above.
- Machined surfaces of casing, disc and shaft shall be subjected to MPE or DPT.
- Butt welds of thickness above 30mm on body and disc shall be subject to 100% RT along with and post weld heat treatment for stress relieving.
- Hydraulic test of body, seat and disc-strength shall be carried out in accordance with governing design standard. 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.

xiii) Dual plate check valves:

- Dry cycle test (spring cycle test) for one lakh cycles shall be carried out as a type test. If dry cycle test has been carried out earlier for same material & diameter, test report shall be submitted for review of the purchaser.
- Machined surfaces of casing, disc and shaft shall be subjected to MPE or DPT.

c) **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:

- Adhesion test
- Measurement of thickness
- Shore hardness test
- Visual examination and spark test at 5 kV/mm of thickness
- The report of bleeding resistance test and ozone resistance test carried out on rubber material shall be furnished.

ii) Dimensional check shall be carried out as per relevant code/ approved drawing.

d) **Coating and wrapping of pipes**

Spark 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-10221/ IS 15337 as applicable.

e) **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 and ozone resistance test as per ASTM D- 380.

ii) Fabric strength of synthetic fibre 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 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%.

viii) Life cycle test and burst test shall be carried out on bellows of each type, design and size.

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 50mm), 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 50mm 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 trunion)

a) All forgings greater than or equal to 50 mm diameter or thickness shall be subjected to ultrasonic testing.

b) DPT/MPI shall be done after hardfacing 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.

NOTE: 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 weldingshall 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 upto the tip of the last stages of blades of LP cylinder.

vii) 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.

REFERENCE QUALITY PLAN

SL NO	COMPONENT & OPERATION	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK		Reference Document	Acceptance Noprms	Format Of Records	Agency			Remarks
					M	C/U				M	C	U	
1.0	**Steam Generator –**												
1.1	**Pressure Parts**												
1.0	**RAW MATERIAL INSPECTION**												
1.1	Drums Plates	Chemical properties	Critical	Normal and shear ultrasonic at the mill	100 %		minimum requirements of BS: 5996 grade LC3/ ASTM or equivalent standards	MTC	√	P	V	V	See Note 3
		Mechanical properties	Critical	Mech. Tests			Elevated temp. tensile test on plate material		√	P	V	V	
		Mechanical properties	Critical	Mech. Tests	100% along edges and area adjacent to cut-outs		Magnetic particle examination (MPE)						
1.2	Headers	Mechanical properties	Critical	Mech. Tests	25% of lot		i) Ultrasonic Test ii)Transverse test on headers (greater than 8") iii) Flattening test on pipe from one end	MTC	√	P	V	V	
1.3	Tubes & Tube Elements	Mechanical properties	Critical	Ultrasonic Test			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
1.3.1		Mechanical properties	Critical	Ultrasonic method	100% (on first off lot and random checks on subsequent pieces)		For ovality and thinning						
1.3.2	All tubes, stubs, panels, coils	Mechanical properties	Critical	a) Steel ball test b) Sponge passage.			Checking for clearance and for cleanliness by sponge passage.						

1.4	Integral Piping, Valves and Fitting	Mechanical properties	Critical	MECH. TESTS			MTC	√	P	V	V	
1.4.1	Pipe lengths	Mechanical properties	Critical	Ultrasonic Test or hydraulic tests and UT or RT on longitudinal welds at the tube mill.		As per ASMEE213 or equivalent, with longitudinal calibration notch of depth 5% of wall thickness (0.3mm minimum and 1.5mm maximum)	Test Report	√	P	V	V	
1.4.2	Mother pipes	Mechanical properties	Critical	Ultrasonic Test		As per ASMEE 213 or equivalent with longitudinal calibration notch of depth 5% of wall thickness (0.3mm minimum and 1.5mm maximum).	Test Report	√	P	V	V	
1.4.3	Forged fittings	Mechanical properties	Critical	Ultrasonic Test			Test Report	√	P	V	V	
1.5	Valves	Chemical properties	Critical	Chemical analysis			MTC	√	P	V	V	
1.6	Compensating Pads	Mechanical properties	Critical	Mech. Tests				√	P	V	V	
2.0	**IN PROCESS INSPECTION**											
2.1	Drum Plates	Dimesional	Major	Measure	100%	MANUFACTURING DRAWING	IR		P	-	-	
2.1.1		Visual	Major	Visual	100%	MANUFACTURING DRAWING			P	-	-	
2.1.2	Forged connections	NDT	Critical	Ultrasonic testing on Plates before machining	100%		UT REPORT	√	P	V	V	
2.1.3	Connecting pieces (machined)	NDT	Critical	Mech. Tests	Internal dia > 100mm & above	Magnetic particle examination (MPE) except for forging						
2.1.4	a) Butt welds	NDT	Critical	Radiographic	100%	Before Stress relief	RT					

				test (RT)			REPORT					
	b) Butt welds	NDT	Critical	Ultrasonic testing & MPE	100%	After stress relieving in the furnace of the entire drum	UT REPORT					
2.1.5	Full penetration welds	NDT	Critical	Ultrasonic testing & MPE	100%	After stress relief	UT REPORT					
2.2	Headers											
2.2.1	Butt welds	NDT	Critical	a) Radiographic test (RT) b) Magnetic particle examination (MPE)	100%	Before Stress relief	RT REPORT					
2.2.2	Full penetration nozzle & attachment welds	NDT	Critical	Ultrasonic testing & MPE	100%	Before stress relief	UT REPORT					
2.3	Tubes and Tube Elements	NDT	Critical	MPI	100%			√	P	V	V	
2.3.1	Butt Welds	NDT	Critical	RT and UT	100% (in case of random sampling – min. 20%)	Finished Butt Welds	UT & RT REPORT					
2.3.2	Fillet welds (including fins if any)	NDT	Critical	MPE or dye penetration test (DPT)	100%							
2.4	Integral Piping, Valves and Fitting	NDT	Critical	MPI	100%			√	P	V	V	
2.4.1	Butt Welds	NDT	Critical	RT and UT & MPE	100% (in case of random sampling – min. 20%)	Finished Butt Welds. For weld on alloy steel piping, UT or RT shall be done after stress relieving.	UT & RT REPORT	√	P	V	V	
2.4.2	Butt Welds	NDT	Critical	RT or UT & MPE	100%	All butt welds in alloy steel piping of P91, X20 and X 22 after stress relieving (SR). UT shall be of digital recordable type.	UT & RT REPORT	√	P	V	V	

2.4.3	All Weld joints	NDT	Critical	Hardness	100% (Alloy steel piping of P91, X20 and X 22) (3% hardness on welds of other alloy steel piping.)	For preheating and post weld heat treatment (PWHT) induction heating shall be deployed. However, PWHT can be done in furnace also.		√	P	V	V	
2.4.4	HP Piping	NDT	Critical	Examination of welds	100%	As per relevant design/ manufacturing codes.						See Note 5
2.4.5	Any other pipe not covered	NDT	Critical	MPE/ DPT/ RT	100% / 10%	100% MPE or DPT for under ground pipes and 10% MPE or DPT for piping above the ground. RT for 10% of butt welds of underground piping	Test Reports	√	P	V	V	See Note 6
2.5	Valves	NDT	Critical	MPI	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 b) MPE	100% 100%	a) 1500 class or above b) 600 class or abovr		√	P	V	V	
2.6	Compensating Pads											
3.0	**FINAL INSPECTION**											
3.1	Drum	Hydraulic Pressure Test	Major	Measure	100%		TYPE TEST REPORT	√	P	V	V	See Note 8
3.1.1	Compensating Pads	Pneumatic test	Major	Measure	100%		TYPE TEST REPORT	√	P	V	V	See Note 9
3.2	Complete closed end headers	Hydraulic Pressure Test	Major	Measure	100%		TYPE TEST REPORT	√	P	V	V	See Note 8
3.3	Tubes and fabricated	Hydraulic Pressure Test	Major	Measure	100%		TYPE TEST	√	P	V	V	See Note 8

	panels, coils						REPORT					
3.4	Valves	a) Hydraulic Pressure Test and b) Seat leak test	Major	Measure	100%	a) ANSI 16.34 or IBR b) As per applicable standards or codes	TYPE TEST REPORT	√	P	V	V	See Note 8
3.5	Non pressure bearing attachments	NDT	Major	UT/ MPE	100%	UT and MPE for Load bearing welds after stress relieving. MPE for Non load bearing welds after stress relief.		√	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 specifiedspecification, 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 > 400^0C and/ or pressure exceeding 71 bar • 100% RT or UT on butt welds and full penetration branch welds. • 100% MPE. b) Temperature > 175^0C upto 400^0C and/or pressure exceeding 17 bar andupto 71 bar • 100% RT or UT on butt welds and full penetration branch welds forpipe diameter more than 100NB. • 10% RT or UT on butt welds and full penetration branch welds forpipe diameter upto 100NB. • 100% MPE.
6.	100% MPE or DPT for under ground pipes and 10% MPE or DPT for above ground piping. RT for 10% of butt welds of underground piping.

7.

Valve sizeNB in mm	ANSI Class upto300	ANSI Classabove 300 upto 600	ANSI Classabove 600 below 900	ANSI Class 900 and above but below 4500
Less than 50	Visual	Visual	Visual	MPE (for special class valves)
50 & above but below 100	Visual	Visual	MPE (for special class valves)	MPE and RT on10% of valves on 100% area
100 & above but less than 300	Visual	MPE	MPE and RTon 10% of valves on change of section and weld ends	MPE and RT on100% area
300 and above	MPE	MPE	MPE and RTon change ofsections and weld ends	MPE and RT on100% area

8. 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.
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.
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

9. 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.

10. Chemical requirements:
For T91:
C- 0.08-0.12 wt%, Cr - 8.5wt% min , P-0.015 wt% max, S- 0.005 wt% max, Sl-0.20-0.40 wt%, Nl – 0.2 wt% max , Al-0.02 wt% max, N-0.035-0.070 wt%, Cu-0.1 wt% max, As-0.010 wt% max, Sn-0.010 wt% max, Sb-0.003 wt% max, Pb-0.001 wt% max, C+N >0.12 wt%, As+Sn+Sb+Pb <0.015 wt%; N/AI ratio - 4 min.

For T92:
C- 0.08-0.12 wt% min, S – 0.005 wt% max, Si – 0.20 wt% max, Cb – 0.04 – 0.07 wt%, B – 0.001-0.004 wt%, N – 0.035-0.060 wt%, Ni – 0.2 wt% max Al – 0.02 wt% max, Cu – 0.1 wt% max, As – 0.010 wt% max, Sn – 0.010 wt% max, Sb – 0.003 wt% max, Pb – 0.001 wt% max
C+N >0.12 wt%, As+Sn+Sb <0.015 wt%

11.	For supercritical units, (i) The design of all pressure parts (tubes, headers, separators, vessels etc.) shall meet the requirements of Indian Boiler Regulations (IBR). (ii) Design pressure of the steam generator pressure parts shall be at least 1.05 times the maximum operating pressure, or as required by IBR/other international codes, whichever is higher. (iii) The thickness of the pressure parts (steam and water tubes/headers, separators, pressure vessels etc.) shall be calculated using IBR formulae/factor of safety etc. (and not as per codes/formulae acceptable to IBR). Minimum tube thickness at the bends in no case shall be less than the minimum required tube thickness for the straight tubes. (iv) The working fluid temperature to be considered for design of boiler tubes, headers, separators and other pressure parts upto first stage of attemperation, shall be as maximum predicted/ expected fluid temperature in these pressure parts plus margins as per IBR.

1.2 Boiler water circulation pumps

1.0 RAW MATERIAL INSPECTION												
1.1	casing	NDT	Critical	High Temp. check	100%	Apart from mandatory and supplementary check of material specification.	MTC	√	P	V	V	
1.2	shaft	Mechanical properties	Critical	MECH. TESTS	100%	Apart from mandatory and supplementarycheck of material specification.	MTC	√	P	V	V	
1.3	impeller	Mechanical properties	Critical	MECH. TESTS	100%	Apart from mandatory and supplementarycheck of material specification.	MTC	√	P	V	V	
2.0	**IN PROCESS INSPECTION**											
2.1	Forging and Casting	Mechanical properties	Critical	UT or RT and MPE or DPT	100%		MTC	√	P	V	V	
2.2	Butt welds on pressure parts of heat exchanger for these pumps	NDT	Critical	UT or RT and MPE or DPT	100%	All other welds shall be tested with MPE or DPT.	MTC	√	P	V	V	
3.0	**FINAL INSPECTION**											
3.1	Boiler water circulation pumps	a) Hydraulic Test	Major	Mech. Tests	100%	The pump casing to be tested to minimum of 150% of the design pressure	TYPE TEST REPORT	√	P	V	V	
		b) Performance	Critical	Measure	100%	At manufacturer's worksunder as near actual site conditions as possible.		√	P	W	W	
3.2		NPSH test, Temp. rise test, under voltage test, function of pump at operating temp. & pressure and hot standstill & start test	Critical	Measure	One no.	If already done on the same model will not be repeated.						Documents will be submitted for review and approval of the purchaser
1.3 Air Preheaters, Steam Coil Air Pre-Heater and Fuel Oil Heaters												
1.0	**IN PROCESS INSPECTION**											
1.1	Forged shafts like stub shaft, main rotor forging, housing hub	MECHANICAL PROPERTIES	Critical	UT at mill MPE	100%	Magnetic particle examination after machining.		√	P	W	W	
1.2	Critical welds of rotor	MECHANICAL	Critical	Radiography	100%			√	P	W	W	

	post	PROPERTIES										
2.0	**FINAL INSPECTION**											
2.1	Heating coils	Hydraulic pressure test	Critical	Measure	100%	As per applicable standard		√	P	W	W	
2.2	All pipes, valves, steam traps and mountings	hydraulic test	Critical	Measure	100%	As called for under IBR, BS or other approved codes.		√	P	W	W	
1.4 Soot Blowers												
1.0	**IN PROCESS INSPECTION**											
1.1	Soot blowers : Butt weld between nozzle and lance tube	MECHANICAL PROPERTIES	Critical	Radiography	100%			√	P	W	W	
2.0	**FINAL INSPECTION**											
2.1	Soot blowers	Operational checks	Critical	Measure	100%	For Long tube travel, closing and opening time and current drawn		√	P	W	W	
1.5 ID, FD and PA fans												
1.0	**IN PROCESS INSPECTION**											
1.1	Rotor components	Mechanical properties	Critical	UT at mill MPE	100%	Magnetic particle examination after machining.		√	P	W	W	
1.2	Butt welds in Rotor components	NDT	Major	UT/ MPE	100%	UT for Butt welds All welds MPE after stress relief.		√	P	W	W	
2.0	**FINAL INSPECTION**											
2.1	Hydraulic coupling of ID fan	Operational checks	Critical	Measure	One fan assembly	String test for coupling to check temperature rise, smooth operation, vibration and noise level						Dry run test to be carried out during string test.
1.6 Coal Mills, Pulverised Coal Piping and Burners												
1.0	**RAW MATERIAL INSPECTION**											
1.1	Shaft, coupling, gears and pinions, top and bottom races and other rotating components	Mechanical properties	Critical	UT and MPE or DPT	100%	MPE or DPT to check surface soundness.	MTC	√	P	V	V	
1.2	Wear resistant parts	A) Mechanical properties	Critical	UT or RT	100%	To check surface soundness after heat treatment						
		b) Chemical Properties	Critical	Measure	100%	For chemical composition and hardness						
		c) Chemical Properties	Critical	Measure	100%	For ceramic materials for various properties including hardness, density,						

						wear rate						
2.0	**IN PROCESS INSPECTION**											
	Butt welds in body casing and separator of mill	NDT	Major	RT/ MPE/ DPT	100%	RT for Butt welds All welds MPE or DPT		√	P	W	W	
3.0	**FINAL INSPECTION**											
3.1	Gearboxes	Operational checks	Critical	Measure	100%	Check rise in oil temperature, noise level and vibration.		√	P	W	W	Check for leak tightness of gear case also to be done.
3.2	Burner Assembly	NDT	Critical	Measure	100%	Operational checks		√	P	W	W	
3.3	Trial assembly of mill	NDT	Critical	Measure	Atleast one no.	Operational checks		√	P	W	W	
1.7 Coal Feeders												
1.0	**IN PROCESS INSPECTION**											
1.1	Welds in the casing and pulley fabrication	NDT	Major	MPE	100%			√	P	W	W	
2.0	**FINAL INSPECTION**											
	Feeder casing	NDT	Major	Measure	100%	Leak tightness check, endurance test for load		√	P	W	W	
1.8 Boiler structure, ducts, hoppers, dampers etc.												
1.0	**RAW MATERIAL INSPECTION**											
	Plates of tension and compression flanges and connection material and plates above 40mm thickness	Mechanical properties	Critical	UT	100%			√	P	W	W	
2.0	**IN PROCESS INSPECTION**											
2.1	Butt and fillet welds for built up plate girders	Mechanical properties	Critical	MPE	100%	Visual check in accordance with AWS D.1.1		√	P	W	W	
2.2	Butt welds in body casing and separator of mill	NDT	Major	a. RT/ UT b. MPE c. MPE/ DPT	a. 100% b. 100% c. 10%	a. RT or UT for Butt welds of thickness 32mm and above b. For thickness below 32mm and upto 25mm c. For thickness below 25mm		√	P	W	W	
2.3	Drum sling rods	NDT	Major	UT/ MPE	100%	• UT for sling rod • All welds UT & MPE after stress relief.		√	P	W	W	

3.0	**FINAL INSPECTION**											
	Dampers	Operational checks	Critical	MEASURE	One no. each type and size offered	Gas tight dampers for shop leakage test to demonstrate the guaranteed tightness		√	P	W	W	In case such type test is already done, reports of the same to be submitted for review
1.9 Electro- Static Precipitators (ESPs)												
1.0	**IN PROCESS INSPECTION**											
1.1	All welds in ESP structure	Mechanical properties	Critical	MPE	100%	Visual check in accordance with AWS D.1.1		√	P	W	W	
1.2	Butt and fillet welds for built up plate columns	Mechanical properties	Critical	MPE	100%	Visual check in accordance with AWS D.1.1		√	P	W	W	
1.3	Butt welds	Mechanical properties	Critical	Radiography	100%	Visual check in accordance with AWS D.1.1		√	P	W	W	
1.4	Tension flange (bottom flange) welds of all beams & columns	Mechanical properties	Critical	Radiography	100%	The minimum length of welds for spot radiography and acceptance criterion shall be as per AWS D 1.1		√	P	W	W	Spot radiography on all joints in compression flange (top flange)
2.0	**FINAL INSPECTION**											
2.1	Discharge & collecting electrodes	Work test (for the wire type electrodes)	Major	Measure	100%	• Chemical and tensile test • Metallographic • Surface purity from chloride ions • Spring back and surface finish after coiling (applicable to helical discharge electrodes		√	P	W	W	
2.2	Collecting electrodes and rigid discharges electrode	Work tests	Major	Measure	100%	• Chemical and mechanical properties • Profile and straightness • Cupping test for deep drawn sheets		√	P	W	W	
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.											

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	Test pieces of the material and condition of the casting	NDT	Critical	Determination of the properties of material	100%		MTC	√	P	V	V	
1.2	Casting material	Mechanical properties	Critical	Properties of material	100%	• Requirements of creep and rupture for long exposure of the component/ equipment to high temperatures and pressures. • Mechanical properties, chemical composition, and microstructure.	MTC	√	P	V	V	In case of new or non established vendors, creep data shall be made available by the contractor
2.0	**IN PROCESS INSPECTION**											
2.1	Casting	Mechanical properties	Critical	MPE	100%	On the entire inner and outer surfaces	MTC	√	P	V	V	After heat treatment
2.2	Casting	Mechanical properties	Critical	UT or RT	100%	Examination for internal flaws	MTC	√	P	V	V	After heat treatment
2.2	Welds of stub pipes and transition pieces to the main body of an enclosure	NDT	Critical	RT and MPE or DPT RT/UT/MPE of finished welds	100%		MTC	√	P	V	V	After stress relieving
3.0	**FINAL INSPECTION**											
3.1	Cast enclosure	Hydraulic Test	Major	MECH. TESTS	100%	Based on establishedpractice of manufacturer	TYPE TEST REPORT	√	P	V	V	

2.2 Steam Turbine - Low pressure (LP) enclosures (fabricated)												
1.0	**RAW MATERIAL INSPECTION**											
1.1	Test pieces of plate material	NDT	Critical	Mechanical and chemical	100%	Determination of the mechanical and chemical properties of material	MTC	√	P	V	V	
1.2		Mechanical properties	Critical	UT	100%	Examination for internal flaws	MTC	√	P	V	V	
2.0	**IN PROCESS INSPECTION**											
2.1	Welds of an enclosure	NDT	Critical	RT and MPE or DPT RT/UT/MPE of finished welds	100%		MTC	√	P	V	V	See Note 3
3.0	**FINAL INSPECTION**											
2.1	Fabricated enclosure	Hydraulic Test	Major	MECH. TESTS	100%	Based on establishedpractice of manufacturer	TYPE TEST REPORT	√	P	V	V	After stress relieving
2.3 Turbine rotors - FORGING and COMPLETE ROTOR												
1.0	**RAW MATERIAL INSPECTION**											
1.1	Forging material	Mechanical properties	Critical	UT	100%	Examination for internal flaws	MTC	√	P	V	V	
1.2		Mechanical properties	Critical	Properties of material	100%	• Requirements of creep and rupture for long exposure of the component/ equipment to high temperatures and pressures. • Mechanical properties, chemical composition, and microstructure.	MTC	√	P	V	V	In case of new or non established vendors, creep data shall be made available by the contractor
2.0	**IN PROCESS INSPECTION**											
2.1	Rotor Welds	NDT	Critical	RT and MPE or DPT	100%	• Ultrasonic examination with normal and angular probes	MTC	√	P	V	V	

				RT/UT/MPE of finished welds		of the weld • Run out of rotor before and after welding • MPE on finish welds • Hardness survey on the welds • Stress relieve annealing						
3.0	**FINAL INSPECTION**											
3.1	HP and IP rotor forgings	NDT	Critical	Measure	100%	Thermal stability tests		√	P	W	W	Thermal stability of the rotors in service and at overspeed
3.2	Each Rotor	NDT	Critical	MPE	100%	On journal areas						After final machining and before gashing on other areas
3.3	Complete Rotor	NDT	Critical	MPE	100%	• Axial & radial run-outs before and after blading and after overspeed tests. • dynamically balancing at rated speed • An overspeed test – to withstand overspeed of 120% for five continuous minutes or 125% for two continuous minutes. • Vibration tests to determine natural frequencies in various vibration modes to ensure that the ranges are outside operating frequencies		√	P	W	W	See Note 4
	2.4 Turbine rotors – STATOR AND ROTOR BLADES AND SHROUD BANDS											
1.0	**RAW MATERIAL INSPECTION**											

1.1	Material	Mechanical properties	Critical	Measure	100%	Examination for internal flaws. 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.	MTC	√	P	V	V	
1.2	Each bar stock	Mechanical properties	Critical	Properties of material	100%	Mechanical properties, chemical composition, and microstructure.	MTC	√	P	V	V	
1.3	Each bar stock	Mechanical properties	Critical	UT	100%	Examination for internal flaws - for machining blades	MTC	√	P	V	V	
2.0	**IN PROCESS INSPECTION**											
2.1	Erosion shield and blade joint	Mechanical properties	Critical	Radiography	100%	• Visual check • Dye penetrant test		√	P	W	W	Shall be done prior to fitting to the wheel and after overspeed tests
2.2	Shroud bands after punching and after rivetting	Mechanical properties	Critical	DPT	100%	To ensure freedom from harmful surface defects		√	P	W	W	
3.0	**FINAL INSPECTION**											
3.1	Moving blades of over 225mm active length	Mechanical properties	Critical	Moment weighed	100%	Assembled on shaft in a prescribed sequence to ensure optimum balancing of rotor						
3.2	LP turbine blades	Mechanical properties	Critical	To determine Natural frequencies	100%	Before mounting on rotors to ensure that the same are outside operating frequency range						
3.3	Cast blades (if provided)	Chemical analysis and mechanical properties	Critical	MPE/ RT	100%	• Per heat/ heat treatment batch • MPE on rough machined and finish machined blade • RT on blades						See Note 5
	2.5 Diaphragms											
1.0	**IN PROCESS INSPECTION**											
1.1	Welded and fabricated	Mechanical properties	Critical	UT/ MPE	10%/ 100%	For inaccessible areas, DPT shall be carried out in place of	MTC	√	P	V	V	

	diaphragms					MPE						
1.2	Cast, forged and machined diaphragms	Mechanical properties	Critical	UT/ MPE	100%	The side walls shall be checked by MPE or DPT	MTC	√	P	V	V	
2.0	**FINAL INSPECTION**											
2.1	Colour matching of all the diaphragms	Mechanical properties	Critical		100%	By putting two halves together and feeler gauge tightness check shall be carried out						
	2.6 Exhaust hood											
1.0	**IN PROCESS INSPECTION**											
1.1	Castings	Chemical analysis and mechanical properties	Critical		100%	• As per relevant standard						
1.2	Butt welds of Fabricated construction (if provided)	Mechanical properties	Critical	RT/ DPT	10%/ 100%		MTC	√	P	V	V	
2.0	**FINAL INSPECTION**											
2.1	Finished hood	Pressure test	Critical	MEASURE	100%	As per applicable standard		√	P	W	W	
2.2	Exhaust hood parting planes	Blue matching	Critical	MEASURE	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	Test pieces of valve bodies, bonnets, valve disc and seat, and valve spindle	Mechanical properties	Critical	Properties of material	100%	• Requirements of creep and rupture for long exposure of the component/ equipment to high temperatures and pressures. • Mechanical properties, chemical composition, and microstructure.	MTC	√	P	V	V	In case of new or non established vendors, creep data shall be made available by the contractor
2.0	**IN PROCESS INSPECTION**											
2.1	Stellited and nitrided areas of components and	Mechanical properties	Critical	Radiography	100%	• Visual check • Dye penetrant test		√	P	W	W	

	on stellite components in the finish ground or honed condition											
2.2	Valve body and bonnet castings or forgings	Mechanical properties	Critical	RT/ UT MPE	100%	Body and bonnet shall also be subjected to 100% MPE on entire surface		√	P	W	W	
2.3	All pressure containing welds in body and bonnet	Mechanical properties	Critical	RT/ UT MPE	100%							
2.4	Bar stock of 50 mm and above size for valve stem	Mechanical properties	Critical	UT MPE/ DPT	100%	Finish machined stem shall be subjected to MPE or DPT						
3.0	**FINAL INSPECTION**											
3.1	Each valve body and bonnet	Pressure test	Critical	Measure	100%	As per applicable standard		√	P	W	W	At min.1.5 times the max. working pressure after applying temp. corrections for min. 30 minutes
3.2	All the actuating cylinders and servomotors	Operational checks	Critical	Measure	100%	Performance tested to check functional requirements						
3.3	Valve operators and actuators	Operational checks	Critical	Measure	100%	Performance tested to check functional requirements like trip closing and opening time, valve lift and hysterisis						
2.8	**Cast and forged steel components**											
1.0	**FINAL INSPECTION**											
	LP casing- in case of cast	Chemical analysis and mechanical	Critical	Measure	100%	Results of tests conducted to determine mechanical						Including other items

	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	properties				properties, chemical analysis, metallurgical/ metallographic examination, and heat treatment procedures recommended and actually followed shall be recorded on certificates						which are not specifically covered elsewhere
2.9 Bolts and nuts for pressure retaining enclosures and rotor couplings												
1.0	**FINAL INSPECTION**											
1.1	Bar stock for bolts	MECHANICAL PROPERTIES	Critical	UT	100%			√	P	W	W	
1.2	Finish machined bolts	MECHANICAL PROPERTIES	Critical	MPE or DPT	100%	To detect surface defects		√	P	W	W	
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	100%	As per applicable standard (at min.1.5 times the max. working pressure after applying temp. corrections)		√	P	W	W	
1.2	All the main assemblies and sub-assemblies	Mechanical properties	Critical	Measure	100%	Functional test		√	P	W	W	
1.3	All control equipment	Mechanical properties	Critical	Measure	100%	Rig testing		√	P	W	W	If it is not possible to test it on the steam turbine light run
1.4	Nitrided stellite	Mechanical	Critical	Radiography	100%	• Visual check		√	P	W	W	

	components in the finish ground	properties				• Hardness check • Dye penetrant test						
2.11 Inspection of completed turbine												
2.11.1 HP and IP turbines												
1.0	**FINAL INSPECTION**											
1.1	Complete turbine	Mechanical properties	Critical	Measure	100%	Various checks and measurement: • Clearance between shaft seal casing and shaftseal ring • clearance in anti- rotational device in shaft seal casing joint • axial and radial alignments of inner and outer casings • for radial and axial blade clearances in blading section • for axial and radial clearances in shaft seal • min. axial clearances and min. radial clearances in completely assembled steam turbine • alignment of overspeed governor • axial distances for shroud bands for casings						
1.2	Steam turbine control and emergency control equipment	No load running test	Critical	Measure	100%	including functional tests						as per manufacturer's standard practice
1.3	Pre- dispatch inspections	Mechanical properties	Critical	Measure	100%	including clearance check for transportation device						
2.11.2 LP turbines												
1.1	Complete turbine	Mechanical properties	Critical	Measure	100%	Various checks and measurement: • radial and axial blade clearance in blading section						

						• min. axial clearances and min. radial clearances in completely assembled steam turbine • alignment of stationary blade carriers •						
1.2	Steam turbine control and emergency control equipment	No load running test	Critical	Measure	100%	including functional tests						as per manufacturer's standard practice
1.3	Pre- dispatch inspections	Mechanical properties	Critical	Measure	100%	including clearance check for transportation device						
2.12.2 Integral Auxiliaries of Steam Turbine												
1.0	**IN PROCESS INSPECTION - Bearing pedestals, housings and bearings**											
1.1	Pedestals	Mechanical properties	Critical	Measure	100%	Leakage test						
1.2	Butt Welds (for fabricated pedestals and housing)	NDT	Critical	RT or UT	10%	Other welds MPE						after stress relieving
1.3	Bearing shell	NDT	Critical	RT or UT	100%							
2.0	**FINAL INSPECTION**											
2.1	Bearing oil inlet piping and jacking oil piping	Hydraulic Test	Major	MECH. TESTS	100%	Based on establishedpractice of manufacturer	TYPE TEST REPORT	√	P	V	V	
2.12.3 Lubricating oil, jacking oil and control oil systems												
	2.12.3.1 Pumps											
1.0	**IN PROCESS INSPECTION - Bearing pedestals, housings and bearings**											
1.1	Main oil pump shaft	NDT	Critical	UT	100%	Butt welds RT or UT						
1.2	Pump impeller	NDT	Critical	MPE or DPT	100%							
1.2.1		Overspeed	Critical		100%	test at 120% of rated speed for 5 minutes						
1.3	Pump casing	Hydraulic pressure test	Major	Mech. Tests	100%	At 2 times the working pressure or 1.5 times the pump shut off	TYPE TEST					

						head whichever is higher	REPORT					
2.0	**FINAL INSPECTION**											
2.1	Pumps	PERFORMANCE	Critical	Measure	100%	At the manufacturer's works under as near actual site conditions as possible. Test shall include check for vibration and noise levels also		√	P	W	W	
2.2	Coolers and lubricating oil tanks	Pressure test	Critical	Measure	100%	The twin oil coolers shall be tested on both tube side and shell side. After hydro test, the coolers shall be suitably dried		√	P	W	W	
2.3	Atmospheric tanks	Performance (leakage test)	Critical	Measure	100%	By water fill test for atleast 12 hrs						
2.4	Oil purifiers :											
2.4.1	All pressure parts	Hydraulic Pressure test	Critical	Measure	100%							
2.4.2	Complete purifier	Performance	Critical	Measure	100%	At manufacturer's works for capacity, mechanical running, sequential operation and interlocks, moisture content, vapour tightness, vibration, noise level, quality improvements etc						See Note 6
	2.13 Steam Condenser											
	2.13.1 Condenser											
1.0	**IN PROCESS INSPECTION**											
1.1	Plates	Mechanical properties	Critical	Mech. Tests	100%	Ultrasonic Test	MTC	√	P	V	V	
1.2	Tubes	Mechanical properties	Critical	Mech. Tests	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
1.3	Forgings of the nozzles	Mechanical properties	Critical	Mech. Tests	100%	UT and MPE						
1.4	Butt welds (including T-joints)	Mechanical properties	Critical	RT/ DPT	10%/ 100%	For vacuum containing welds, RT on atleast 10% of each butt weld shall be carried out.	MTC	√	P	V	V	Nozzle welds shall be subject to 100% MPE or DPT.
1.5	Welds (of fabricated flanges)	Mechanical properties	Critical	RT/ UT/ MPE	100%	MPE to ensure freedom from internal and surface defects	MTC	√	P	V	V	
1.6	Tube to tube sheet weld joints	Mechanical properties	Critical	DP	100%		MTC	√	P	V	V	
2.0	**FINAL INSPECTION**											
2.1	Tube side of condenser	Hydraulic Pressure test	Critical	Measure	100%	No leakage shall be permitted						
2.2	shell side of condenser	Water fill test	Critical	Measure	100%	No leakage shall be permitted						
2.3	Standpipe, Flash tank etc.	Water fill test	Critical	Measure	100%	No leakage shall be permitted						
2.4	Compensating pads (RF pads)	Pneumatical test	Critical	Measure	100%							
	2.13.2 Condenser air evacuation system - Vacuum pumps											
1.0	**FINAL INSPECTION**											
1.1	Pump casings	Hydraulic testing	Critical	Measure	100%	As per applicable standard (at 1.21.5 times the shut off pressure or twice the maximum operating pressure, whichever is higher)		√	P	W	W	
1.2	Heat exchangers	Hydro test	Critical	Measure	100%	On both tube side and shell side		√	P	W	W	After, the heat exchangers shall be suitably dried
1.3	Complete unit	Operation and performance testing	Critical	Measure	Atleast One no.	with saturated air conditions at condenser design vacuum point as well as vacuum pump design						The test shall be conducted

						point with total minimum three points						with the respective motors to be supplied
	2.13.3 Feed water heaters, drain coolers, gland steam condenser and deaerator - Heaters, drain coolers and gland steam condensers and Deaerator											
1.0	**IN PROCESS INSPECTION**											
1.1	Plates	Mechanical properties	Critical	Mech. Tests	100%	Ultrasonic Test	MTC	√	P	V	V	
1.2	Cladded plates	Mechanical properties	Critical	Mech. Tests	100%	Ultrasonic Test for ovality of holes, ligaments, surface finish etc	MTC	√	P	V	V	
1.3	Tubes (U-tubes)	Mechanical properties	Critical	Mech. Tests	100%	Eddy current test and 100% hydraulic test						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
1.4	Forgings of the nozzles	Mechanical properties	Critical	Mech. Tests	100%	UT and MPE						
1.5	Tube sheets	Mechanical properties	Critical	Mech. Tests	100%							
1.6	Tube to tube sheet weld joints	Mechanical properties	Critical	DP	100%		MTC	√	P	V	V	
2.0	**FINAL INSPECTION**											
2.1	Heat exchangers	Hydro test	Critical	Measure	100%	On both tube side and shell side		√	P	W	W	After, the heat exchangers shall be suitably dried and

												nitrogen capped
2.2	Complete unit	Operation and performance testing	Critical	Measure	Atleast One no.	with working-fluid using hydraulic and pneumatic method						
	2.13.4 Boiler Feed Pumps - Main pump											
	2.13.4.1 Main pump											
1.0	**IN PROCESS INSPECTION**											
1.1	Barrel casing, casing cover, suction & discharge branches, shaft, ring sections, and wearing rings	Mechanical properties	Critical	Mech. Tests	100%	Ultrasonic Test	MTC	√	P	V	V	
1.2	Suction branch, impellers and diffusers	Mechanical properties	Critical	Mech. Tests	100%	RT	MTC	√	P	V	V	
2.0	**FINAL INSPECTION**											
2.1	On barrel casing, discharge cover, and suction and discharge branches	Hydraulic testing	Critical	Measure	100%			√	P	W	W	
2.2	Complete unit	Operation and performance testing	Critical	Measure	100%	• Performance testing as per Hydraulic Institute Standards (HIS) to determine its characteristic curve at design speed and to ensure compliance with design requirements • Vibration to be measured in transverse, horizontal and vertical direction at all measuring points • Noise Level as per HIS. • Strip down test		√	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
	2.13.4.2 Booster pump											

1.0	**IN PROCESS INSPECTION**											
1.1	Shaft and wearing rings	MECHANICAL PROPERTIES	Critical	Ultrasonic Test	100%	MECH. TESTS	MTC	√	P	V	V	
1.2	On machined components	MECHANICAL PROPERTIES	Critical	DPT	100%	After final machining	MTC	√	P	V	V	
2.0	**FINAL INSPECTION**											
2.1	On pump casing	Hydraulic testing	Critical	Measure	100%	at 1.5 times the shut off pressure or 2 times the working pressure whichever is higher		√	P	W	W	
2.2	Impeller and completed rotor assembly	dynamic balancing test	Critical	Measure	100%	Rotor assembly shall be subjected to run out test also		√	P	W	W	
2.2	Complete unit	Operation and performance testing	Critical	Measure	100%	• Performance testing as per Hydraulic Institute Standards (HIS) to determine its characteristic curve at design speed and to ensure compliance with design requirements • Vibration to be measured in transverse, horizontal and vertical direction at all measuring points • Noise Level as per HIS. • Strip down test		√	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	**IN PROCESS INSPECTION**											
1.1	Gears, pinions, wheels and shafts rings	Mechanical properties	Critical	UT/ DPT/ MPE	100%	MECH. TESTS	MTC	√	P	V	V	
2.0	**FINAL INSPECTION**											
2.1	Assembled rotating component	Dynamic balancing test	Critical	Measure	100%			√	P	W	W	
2.2	Gear box	Full load speed and back to back locked rotor torque test	Critical	Measure	Atleast One no.			√	P	W	W	

	2.13.5 Condensate Extraction Pumps (CEPs)											
	2.13.5.1 Pump											
1.0	**IN PROCESS INSPECTION**											
1.1	Pump shaft	Mechanical properties	Critical	Ultrasonic Test	100%	MECH. TESTS	MTC	√	P	V	V	
1.2	Butt welds on fabricated components of thickness more than 10 mm	Mechanical properties	Critical	RT	10%		MTC	√	P	V	V	
1.3	Welds on Casing, suction bell, shaft, impeller and fabricated components	Mechanical properties	Critical	DPT	100%	MECH. TESTS	MTC	√	P	V	V	
2.0	**FINAL INSPECTION**											
2.1	On pump casing and pressure containing fabricated parts	Hydraulic testing	Critical	Measure	100%	at 1.5 times the shut off pressure or 2 times the working pressure whichever is higher		√	P	W	W	
2.2	Individual Impeller and completed rotor assembly	dynamic balancing test	Critical	Measure	100%	Rotor assembly shall be subjected to run out test also		√	P	W	W	
2.3	Complete unit	Operation and performance testing	Critical	Measure	100%	• Performance testing as per Hydraulic Institute Standards (HIS) to determine its characteristic curve at design speed and to ensure compliance with design requirements • Vibration to be measured in transverse, horizontal and vertical direction at all measuring points • Noise Level as per HIS. • Strip down test		√	P	W	W	Tests shall be carried out using cold soften quality water

	2.13.6 Condensate Polishing Unit (CPU)											
	2.13.6.1 CPU service vessels											
1.0	**IN PROCESS INSPECTION**											
1.1	Plates	Mechanical properties	Critical	Mech. Tests	100%	Ultrasonic Test	MTC	√	P	V	V	
1.2	Finished and formed dished ends and hemi heads	Mechanical properties	Critical	DP/ MPE	100%	Knuckle portion shall be checked by 100% MPE or DP test	MTC	√	P	V	V	
1.3	Butt welds full penetration joints and nozzle welds	Mechanical properties	Critical	RT & MPE or DPT	100%		MTC	√	P	V	V	
1.4	Rubber lining	Mechanical properties	Critical	Tests as per IS-4682 part-I	100%	• Tensile & Elongation, Specific Gravity, Ash content • Adhesion test • Shore hardness test • Ozone resistance test: (50 PPHM) / 40° C / 20 % Strain /70 Hrs • Water Absorption Test,		√	P	V	V	Water Absorption Test, After ageing test & Compression Set test
2.0	**FINAL INSPECTION**											
2.1	Fabricated vessel	Hydraulic testing	Critical	Measure	100%	at 1.5 times the working pressure		√	P	W	W	before the rubber lining and at the working pressure after the rubber lining
	2.13.6.2 Acid/ alkali handling tanks											
1.0	**IN PROCESS INSPECTION**											
1.1	Plates	Mechanical properties	Critical	Mech. Tests	100%	Ultrasonic Test	MTC	√	P	V	V	
1.2	Butt welds full penetration joints and nozzle welds	Mechanical properties	Critical	RT & MPE or DPT	100%		MTC	√	P	V	V	
1.3	Rubber lining	Mechanical	Critical	Tests as per	100%	Same as for CPU vessels given		√	P	V	V	

		properties		IS-4682 pt-I		above						
2.0	**FINAL INSPECTION**											
2.1	Fabricated tank	Leakage testing	Critical	Measure	100%			√	P	W	W	
	2.13.6.3 Dosing pumps/ metering pumps											
1.0	**IN PROCESS INSPECTION**											
1.1	Material	Chemical Properties	Critical	Measure	100%	For chemical composition and hardness						
1.2	Screw set, shaft and machined surfaces of casing and impellers.	Mechanical properties	Critical	MPE or DPT	100%	Also shaft (diameter greater than or equal to 50mm)	MTC	√	P	V	V	
2.0	**FINAL INSPECTION**											
2.1	Pump casing	Hydraulic testing	Critical	Measure	100%	at 1.5 times the shut off pressure or 2 times the working pressure whichever is higher		√	P	W	W	
2.2	Complete unit	Operation and performance testing	Critical	Measure	100%	Performance testing as per Hydraulic Institute Standards (HIS) to determine its characteristic curve at design speed and to ensure compliance with design requirements		√	P	W	W	
	2.13.7 Condenser On-Line Tube Cleaning System											
	2.13.7.1 Ball recirculation pump											
1.0	**FINAL INSPECTION**											
1.1	Pump casing	Hydraulic testing	Critical	Measure	100%	at 1.5 times the shut off head or 2 times the working pressure whichever is higher		√	P	W	W	
1.2	Complete pump	Performance test	Critical	Measure	100%	including functional tests						as per manufacturer's standard practice
	2.13.7.2 Ball sorter/ fabricated body (housing)											
1.0	**FINAL INSPECTION**											
1.1	Body	Hydraulic testing	Critical	Measure	100%	at 1.5 times the shut off head or 2 times the working pressure		√	P	W	W	

						whichever is higher						
1.2	Ball sorter assembly	Performance test	Critical	Measure	100%	including functional tests						as per manufacturer's standard practice
	2.13.7.3 Coating/ lining											
1.0	**FINAL INSPECTION**											
1.1	Rubber lining	Mechanical properties	Critical	Tests as per IS-4682 part-I	100%	• Tensile & Elongation, Specific Gravity, Ash content • Adhesion test • Shore hardness test • Ozone resistance test: (50 PPHM) / 40° C / 20 % Strain /70 Hrs • Water Absorption Test,		√	P	V	V	Water Absorption Test, After ageing test & Compression Set test
	2.13.7.4 Debris Filter											
1.0	**FINAL INSPECTION**											
1.1	Body, strainer mesh and other components	Chemical Properties	Critical	Measure	100%	For chemical composition and hardness						
1.2	Body	Hydraulic testing	Critical	Measure	100%	at 1.5 times the shut off head or 2 times the working pressure whichever is higher		√	P	W	W	
1.3	Filter assembly	Performance test	Critical	Measure	100%	including functional tests						as per manufacturer's standard practice

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	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												
4	• Run out examination shall be carried out at blade shrouds also • In case, bidder's practice is different,the same shall be furnished for purchaser's approval. During overspeed test, vibration measurement and analysis shall also be carried out • 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 overspeed test • Lock blade lift after the overspeed 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: • 100% RT and 100% MPE on blades • 100% hardness testing. • Mechanical testing and metallurgical testing. • 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												
	4. HIGH PRESSURE PIPING, VALVES, THERMAL INSULATION AND MISCELLANEOUS SYSTEMS/ EQUIPMENT												
	4.1 High pressure Piping and Fitting												
1.0	**IN PROCESS INSPECTION**												
1.1	All pipe lengths	Mechanical properties	Critical	Ultrasonic Test	100%	MECH. TESTS	MTC	√	P	V	V		
1.2	longitudinal welds	Mechanical properties	Critical	UT or hydraulic tests and UT or RT	100%	MECH. TESTS	MTC	√	P	V	V		
1.3	All mother pipes used for fittings	Mechanical properties	Critical	hydraulic test or an ultrasonic test	100%	MECH. TESTS	MTC	√	P	V	V		
1.4	All alloy and carbon steel pipes	Mechanical properties	Critical	Ultrasonic Test	100%	for pipe thickness ≥ 3.6 mm and 100% eddy current test for thickness < 3.6 mm	MTC	√	P	V	V		
1.5	Pipe bends (cold/ hot formed)	Mechanical properties	Critical	Ultrasonic Test or other acceptable methods	100%	Thickness to be checked for high pressure applications							
1.6	Welds	NDT	Critical	Examination	100%	As per relevant design/						See Note 3	

				of welds		manufacturing codes.						
1.7	Finished welding for alloy steel piping, BFP discharge piping, MS piping, HRH piping, CRH piping and associated pipings	NDT	Critical	Examination of welds	100%							See Note 4
1.8	Finished welding for Carbon Steel Class- I piping	NDT	Critical	Examination of welds	100%	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)						See Note 5
1.9	Finished welding for carbon steel class- I piping	NDT	Critical	Examination of welds	100%	Having design temperature ≤ 218deg C or design pressure for steam ≤ 17.6 kg/ cm^2 (g) or design pressure for feedwater ≤ 24.6 kg/cm^2 (g)						See Note 6 & 7
2.0	**FINAL INSPECTION**											
2.1	Alloy steel pipes (SA 335, P11, P22, & P91)	Mechanical properties	Critical		25% per lot	shall be subject to the following tests : • Transverse tension test on pipes from one end for pipe size 200 mm and above • Flattening test on pipe from one end						
2.2	Oil piping	NDT	Critical	Examination of welds	100%							See Note 8
2.3	Rubber lined pipes	Mechanical properties	Critical	Tests as per IS-4682 part-I	100%	• Tensile & Elongation, Specific Gravity, Ash content • Adhesion test • Shore hardness test • Ozone resistance test: (50 PPHM) / 40° C / 20 % Strain /70 Hrs • Water Absorption Test,		√	P	V	V	Water Absorption Test, After ageing test & Compression Set test
	4.2 Power Cycle Valves											

	4.2.1 Valves other than extraction line valves and butterfly valve											
1.0	**IN PROCESS INSPECTION**											
1.1	Pressure retaining parts of valves	NDT	Critical	Examination of welds	100%							See Note 9
2.0	**FINAL INSPECTION**											
2.1	Body	• Hydraulic testing • Seat leak test	Critical	Measure	100%	as per ANSI 16.34		√	P	W	W	
2.2	Fully assembled valve	Functional testing	Critical	Measure	100%	Performance test : • Valve travel, closing and opening time • Current drawn by actuators						Springs for safety valves shall be tested for spring rate
	4.2.2 Extraction line Valves											
1.0	**FINAL INSPECTION**											
1.1	On each valve	Hydraulic testing	Critical	Measure	100%	• To check body and bonnet strength • Seat leakage and back seat leakage test (wherever applicable) • Air seat leakage test		√	P	W	W	Minimum test requirements of pressure shall be as per ANSI B 16.34
1.2	On each valve	Performance test	Critical	Measure	100%	including functional tests						as per manufacturer's standard practice
	4.2.3 Butterfly Valve											
1.0	**RAW MATERIAL INSPECTION**											
1.1	Plates for body, disc and flanges (for fabricated valves)	Mechanical properties	Critical	UT	100%			√	P	W	W	
2.0	**IN PROCESS INSPECTION**											
2.1	Austenitic stainless steel	Mechanical properties	Critical	IGC (inter-granular	100%	For sea water application valves		√	P	W	W	

	welds			corrosion) test								
2.2	Shafts, seat rings etc	Mechanical properties	Critical	Dye Penetration test	100%			√	P	W	W	
2.3	Rubber seal	Mechanical properties	Critical	tensile, elongation and hardness test for vulcanising	Sample from lot	Hydraulic stability test (Bleed Resistance) and ozone crack resistance tests		√	P	W	W	
3.0	**FINAL INSPECTION**											
3.1	On each valve	Hydraulic testing	Critical	As per AWWA-C504/ BS-5155	100%	• To check body and bonnet strength • Air seat leakage test		√	P	W	W	
3.2	Disc Strength test	Hydro (Forward and Backward)	Critical	as per EN 12266-1	100%			√	P	W	W	
3.3	On each valve with actuator	Performance test	Critical	Measure	100%	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 : • Closing and opening time • Operation of tripping switch and position indicator						See Note 10
	4.2.4 Metallic expansion bellow											
1.0	**IN PROCESS INSPECTION**											
1.1	Longitudinal butt weld on bellow	Mechanical properties	Critical	MPE or DPT	100%	Before forming and after forming	MTC	√	P	V	V	
1.2	Welds	Mechanical properties	Critical	MPE or DPT	100%	Butt welds shall be subject to 100% RT	MTC	√	P	V	V	
2.0	**FINAL INSPECTION**											
2.1	On each pipe and expansion bellow	Hydraulic testing	Critical	Measure	100%			√	P	W	W	
2.2	On prototype/ expansion bellow	Performance test	Critical	Life cycle test, meridional yield rupture	On prototype	As per Sec. D clause 3.2 of standards of Expansion Joint Manufacturer Association (EJMA)		√	P	W	W	

				test and squirm test								
	4.2.5 Hangers and Support											
1.0	**IN PROCESS INSPECTION**											
1.1	Welds	Mechanical properties	Critical	• UT • MPE	100%	• Butt welds of thickness 32mm and above • Butt welds of thickness less than 32mm & Fillet welds	MTC	√	P	V	V	
1.2	Turn-buckle, pipe clamps and hangers of thickness greater than 25mm	Mechanical properties	Critical	MPE/ DPT	100%	On bent portions	MTC	√	P	V	V	
2.0	**FINAL INSPECTION**											
2.1	Completed springs	Performance test	Critical	MEASURE	100%	sagging test and load versus deflection test		√	P	W	W	For diameter more than 25mm, MPE shall also be carried out
	4.2.6 Thermal insulation, refractory, lagging and cladding											
	4.2.6.1 Thermal insulation											
1.0	**FINAL INSPECTION**											
1.1	Resin bonded mineral wool insulation	Performance test	Critical	Measure	100%	As per IS: 8183		√	P	W	W	
1.2	Resin bonded rock wool insulation	Performance test	Critical	Measure	100%	As per IS: 9842		√	P	W	W	
1.3	Sprayed mineral wool	Performance test	Critical	Measure	100%	As per IS: 9724		√	P	W	W	
1.4	Ceramic fibre blankets and block insulation	Performance test	Critical	Measure	100%	as per IS: 15402		√	P	W	W	
	4.2.6.2 Refractory											
1.0	**FINAL INSPECTION**											
1.1	Fire bricks or	Performance test	Critical	Measure	100%	Castable refractory shall have		√	P	W	W	As per

	castable refractory					proper identification, supplier name, customer name, batch no., date, material name and net weight in kg with proper instructions for handling						manufacturer's standard
	4.2.6.3 lagging and cladding											
1.0	**FINAL INSPECTION**											
1.1	Aluminium sheeting	Performance test	Critical	Measure	All insulation to be protected by means of an outer covering	ASTM B-209-1060 temper H14	MTC	√	P	V	V	
	4.3 Low Pressure Piping, Valves and Fittings etc.											
	4.3.1 Pipes, fittings and mitre bends											
1.0	**IN PROCESS INSPECTION**											
1.1	Welds of pipes and fittings	Mechanical properties	Critical	Dye penetration test	100%	Including welds of rolled and welded pipes	MTC	√	P	V	V	
	4.3.2 Valves											
1.0	**RAW MATERIAL INSPECTION**											
1.1	Shaft/ spindle of size ≥ 50 mm diameter	Mechanical properties	Critical	• UT • 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**											
2.1	All valves	Hydraulic testing	Critical	Measure	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	
	4.3.3 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 pt-I	100%	• Tensile & Elongation, Specific Gravity, Ash content • Adhesion test • Shore hardness test • Ozone resistance test: (50 PPHM) / 40° C / 20 % Strain /70 Hrs • Water Absorption Test,		√	P	V	V	Water Absorption Test, After ageing test & Compression Set test
	4.3.4 Coating and wrapping of pipes												
1.0	**FINAL INSPECTION**												
1.1	Primer and enameled and coal tar tapes	Performance test	Critical	Spark test, adhesion test and material test	100%	As per AWWA-C-203-91/ IS 15557/ IS 10221 as applicable	MTC	√	P	V	V	
	4.3.5 Rubber expansion joints												
1.0	**FINAL INSPECTION**												
1.1	Rubber compound test slab after valcanising	Performance test	Critical	Tensile strength, elongation and shore hardness	Sample from lot	Also hydro stability test as per ASTM D-3137, ozone resistance test as per ASTM D-380 and kerosene dip test	MTC	√	P	V	V	
1.2	Fabric strength of synthetic fibre for reinforcement	Performance test	Critical	•rubber to fabric adhesion •rubber to metal adhesion	Sample from lot	• As per IS: 3400 or ASTM D-413 • As per IS 3100 or ASTM D-429		√	P	V	V	

1.3	Expansion joints in assembled condition	Performance test	Critical	vacuum test	100%	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		√	P	V	V	
	4.4 Equipment Cooling Water (ECW) System											
	4.4.1 Primary side and secondary side pumps											
1.0	**FINAL INSPECTION**											
1.1	Pump casing and pressure containing fabricated parts	Hydraulic testing	Critical	Measure	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	Critical	Measure	100%	• Performance testing as per Hydraulic Institute Standards (HIS) to determine its characteristic curve at design speed and to ensure compliance with design requirements • Vibration to be measured in transverse, horizontal and vertical direction at all measuring points • Noise Level as per HIS. • Strip down test		√	P	W	W	Other tests shall also be conducted in line with details given above for other pumps
	4.4.2 Plate heat exchangers											
1.0	**RAW MATERIAL INSPECTION**											
1.1	Material used for cover plates, heat exchange plates and tie rods	NDT	Critical	Mechanical and chemical	On one per heat basis	Determination of the mechanical and chemical properties of material	MTC	√	P	V	V	For gasket, ageing test, shrinkage test and hardness to be carried out
1.2	Plates	Mechanical properties	Critical	UT	100%	With thickness 25 mm or above		√	P	W	W	
1.3	Welds	Mechanical	Critical	DPT	10% of the lot of	In case of any defects, entire lot	MTC	√	P	V	V	

		properties			heat exchanger plates	shall be tested and only defect free plates shall be accepted						
2.0	**FINAL INSPECTION**											
2.1	Each heat exchanger	Hydraulic testing	Critical	Measure	100%	at 1.5 times the shut off head or 2 times the working pressure whichever is higher		√	P	W	W	
	4.4.3 Auto clean filters											
1.0	**FINAL INSPECTION**											
1.1	The body	Hydraulic testing	Critical	Measure	100%	at 1.5 times the shut off head or 2 times the working pressure whichever is higher		√	P	W	W	
1.2	Complete filter assembly	Performance test	Critical	Pressure drop, flow and particle size tests	100%			√	P	V	V	
	4.5 EOT Cranes and Hoists											
	4.5.1 Hooks											
1.0	**FINAL INSPECTION**											
1.1	Hooks	Performance test	Critical	All tests including proof load test	100%	as per relevant IS		√	P	V	V	MPE or DPT shall be done after proof load test
	4.5.2 Girders, end carriage, crab, gear-box and rope drum											
1.0	**RAW MATERIAL INSPECTION**											
1.1	Plates for girders, end carriage, crab, gear-box and rope drum	Mechanical properties	Critical	UT	100%	With thickness 25 mm or above		√	P	W	W	
2.0	**IN PROCESS INSPECTION**											
	Butt Welds in tension, compression and rope drum	NDT	Critical	RT and DPT	100%	Fillet welds : 10% DPT (random)	MTC	√	P	V	V	
	4.5.3 Forgings											
1.0	**RAW MATERIAL INSPECTION**											

1.1	All forgings (wheel, gears, pinions, axles, hooks and hook trunion)	Mechanical properties	Critical	UT	100%	more than or equal to 50mm diameter or thickness		√	P	W	W	DPT or MPE shall be done after hard facing and machining
	4.5.4 Final testing											
1.0	Assembled cranes	Performance test	Critical	All tests for deflection, load, overload, hoisting motion, cross travel etc	100%	As per IS-3177		√	P	V	V	
2.0	Electric hoists & Chain pulley	Performance test	Critical	All tests	100%	Hoists as per IS-3938 Chain pulley blocks as per IS-3832		√	P	V	V	
3.0	Elevators	Performance test	Critical	Breaking load test	100%	All other tests as per relevant standard for steel wire rope		√	P	V	V	
	4.6 Air Conditioning System											
	4.6.1 Refrigerant compressor (reciprocating/ screw/ centrifugal)											
1.0	**FINAL INSPECTION**											
1.1	Castings for cylinder block, crank case and casings	Operation and performance testing	Critical	Hydraulic/ pneumatic test	100%			√	P	V	V	
1.2	Oil pump for reciprocating compressor			Capacity test				√	P	V	V	
	Assembled compressor :											
1.3	Compressors and chilling units	Performance testing	Critical	No load air run (free run) test	100%	to check FAD (free air delivery), noise, vibration and temperature rise of bearing and body		√	P	V	V	
1.4	Reciprocating compressor	Performance testing	Critical	Hydraulic/ leakage test	100%			√	P	V	V	
1.5	Compressors	Performance testing	Critical	Functional run test	100%	Also capacity control (for part load performance) check		√	P	V	V	

	4.6.2 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	
	4.6.3 Vapour absorption machine (VAM)											
1.0	**FINAL INSPECTION**											
1.1	Complete assembled unit	Operation and performance testing	Critical	Capacity (TR) and steam consumption		rated conditions and part load conditions		√	P	V	V	All the controls shall be tested for proper functioning during the above test
	4.6.4 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, power consumption, noise and vibration		√	P	V	V	
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	
	4.6.5 Cooling tower											
1.0	**FINAL INSPECTION**											
	Assembled Cooling towers	Operation and performance testing	Critical	As per IS	One per type	Free 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

	4.7 Vacuum Pump											
1.0	**RAW MATERIAL INSPECTION**											
1.1	Pump components	Chemical, Physical properties & Hardness	Critical	UT of forgings like shaft, couplers etc.		Review of MTC						
1.2	Separator	Mechanical properties	Critical	RT	10%	Review of MTC						
		• Chemical, Physical properties Hydraulic test	Critical			Review of MTC						
1.3	Heat Exchanger	Chemical, Physical properties	Critical	Eddy current/ UT		Review of MTC						
		Hydraulic test of tube side & shell side										
1.4	Gear Box	Performance test	Critical			Review of MTC						No load condition, backlash, no. of gear train etc.
1.5	Valves	Performance test	Critical			Review of MTC – MoC & Leak test						MoC - Materials of construction
1.6	Instruments	Performance test	Critical	Calibration & Accuracy (except for switch) & Repeatability		Review of MTC for Pressure gauge, Temp. gauge, Pressure switch, Flow meter etc.						
2.0	IN PROCESS INSPECTION											
2.1	Rotor	Mechanical properties	Critical	DPT	Visual	Of machined portion						
		• Dynamic Balancing Run out check	Critical	Gr.6.3 or better		Measurement						
3.0	FINAL											

	INSPECTION											
	Pump Assembly	Major dimensions	Critical		Measurement	Review of MTC						
		Hydrostatic test	Critical		Visual, Measurement	Review of MTC						
		Performance test	Critical		Measurement	(HEI Standard)						
		Noise level check, Vibration check, Bearing temp. rise check	Critical		Measurement	Review of MTC						
	4.8 Oxidation Blower											
1.0	**RAW MATERIAL INSPECTION**											
1.1	Body/ casing, End plate/ Cover, Rotor	Chemical, Physical properties & Hardness	Critical			Review of MTC						
1.2	Shaft	Chemical, Physical properties	Critical			Review of MTC						
		Mechanical properties	Critical	UT	NDT	Review of report for dia >40mm						
1.3	Timing gears	Chemical, Physical properties	Critical			Review of MTC						
		Hardness	Critical			Review of Hardness report						
		Mechanical properties	Critical	UT after proof machining	NDT	Review of NDT report						
1.4	Base frame, Pipe & fitting, Foundation bolts	Chemical, Physical properties	Critical			Review of MTC						
1.5	Coupling/ Gear box,Valves, Filter, Silencer, Bearings etc.	Functional & Performance check	Critical			Review of MTC						
1.6	Actuators	Functional & Performance check	Critical			Review of MTC						
2.0	IN PROCESS INSPECTION											
2.1	Body/ Casing	Hydro test			Visual and Measurement							

2.2	Shaft, Gears, End plate after machining	Mechanical properties Surface defects	Critical	DPT	100%	• of machined portion Visual and Measurement						
2.3	Rotor assembly (shaft with lobe)	Mechanical properties	Critical		Dynamic balancing	Measurement						
3.0	FINAL INSPECTION											
	Complete blower assembly with motor	Performance Run	Critical		• Overall major dimensions • Free air delivery • Head Power • Efficiency, speed • Discharge Pressure & temp. • Noise & Vibration • Oil temp. rise test	Visual and Measurement						

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	However, as a minimum, the following requirements shall be met (except for oil piping) :
	• 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
	• 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:
	  • pipe diameter > 100 NB100% RT or UT and 100% MPE
	  • pipe diameter ≤ 100 NB10% RT or UT and 100 % MPE
	• In addition to above, statutory requirement, wherever applicable, shall also becomplied with

4	• Butt welds 100% RT and 100% MT or DPT • Welds for nozzle, branch 100% RT and 100% MT or DPT connections of size > 100NB • Welds for all other attachments 100% MT or DPT • Removal of weld defects 100% MT or DPT

5.	i) Butt welds: pipe size > 100 NB — 100% RT and 100% MPE or DPT pipe size ≤ 100 NB — 10% RT and 10% MPE or DPT j) Welds for nozzle, branch and thickness > 19 mm — 100% RT and 100% MPE or DPTconnections of size > 100NB k) Welds for all other attachments — 10% MPE or DPT l) Removal of weld defects/weld repair — 100% MPE or DPT
6.	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 — 10% MPE or DPTconnections/ attachments 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 under ground piping and 10% MPE or DPT in case of over ground 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. b) Fillet welds with load transfer shall be subjected to 100% MPE or DPT andfillet welds without load transfer shall be subjected to 10% MPE or DPT
9.	a) Valve size < 50 NB • Visual examination for rating below ANSI Class 900 • MPE for rating above ANSI Class above 900 b) Valve size ≥ 50 NB and < 100 NB • Visual examination for rating upto ANSI Class 600 • MPE for rating above ANSI Class above 600 and below 900 • 100% MPE and 100% RT on 10% of valves for rating above ANSI Class above 900 and below 4500 c) Valve size ≥ 100 NB and < 300 NB • Visual examination for rating upto ANSI Class 300 • MPE for rating above ANSI Class above 300 and below 600 • 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 • 100% MPE and 100% RT on valves for rating above ANSI Class 900 and below 4500 d) Valve size ≥ 300 NB • MPE for rating upto ANSI Class 600 • 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 • 100% MPE and 100% RT on valves for rating above ANSI Class 900 and below Class 4500 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

1.6 ELECTRICAL SYSTEMS

i) Quality Plan

The indicative list of various tests/ checks for various equipment/ items is given below. The bidder shall draw his own quality plans in line with these requirements, his standard practices and requirements of standards/ codes and implement such programme after approval by the purchaser.

ii) Process checks

Under the 'Process checks', tests which are required to be conducted at worksduring various stages of manufacturing have been listed.

iii) Type tests

Type tests have been divided into following two categories:

(a) Category-I

The contractor shall carry out type tests listed under Category -I for the respective equipment. The charges for each of these type tests shall be indicated separately and the same shall be considered for the evaluation of the bids. The owner reserves the right to waive conducting of any or all of the specified type tests on submission of type test report conducted on similar equipment during lastfive (5) years, in which case the type test charges shall not be payable for thetype tests which are waived. The type test charges shall be paid only for thetest(s) actually conducted successfully under this contract. The Contractor shall supply the equipment to the site only after receiving MDCC (Material Dispatch Clearance Certificate) from the Owner. Without receiving consent / MDCC from Owner, Supply of the equipment at site shall not be considered.

(b) Category-II

The contractor shall only submit the reports of the type tests listed under Category -II for the respective equipment which should have been carried out within last five (5) years from the date of bid opening. These reports should befor the tests conducted on the equipment similar to those proposed to be supplied under this contract and the test(s) should have been either conducted at an independent laboratory or should have been witnessed by a client. In case the contractor is not able to submit report of the type test(s) conducted within lastfive years from the date of bid opening, or in case the type test report(s) are not found to be meeting the specification requirements, the contractor shall conduct all such tests under this contract free of cost and submit the reports for approval.

iv) Site Tests

Some site tests have also been identified below which shall be carried out by the contractor. The site tests as per the manufacturer's practice, other than those

specified herein, shall also be conducted by the bidder :-

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	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 pressure application	Insulation test of core tension bolt and core bar	Functional check of ventilation ducts	Hot spot by infra red camera, ELCID	Location of temperature detectors	Iron loss at rated flux density
Core assembly (additional checks for generator)	Y	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	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	Y1	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
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 = 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				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 (Table 4/4) (additional checks for exciter)

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.

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.
vi) Stator- NFT test
vii) Open circuit and short circuit tests
viii) Measurement of temperature rise at the rated load
ix) Performance capability of the machine
x) Line charging capacity
xi) 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.
xii) Rotor-IR, Winding resistance, Impedance & RSO test
xiii) 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 Busducts and Neutral Grounding equipment

1.6.2.1 Generator Isolated Phase Busduct (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

Trial assembly set-up shall include 3-phase straight run, 90^0 bend, set of flexible connection of each type, metallic bellow on enclosure, CTs mounted in position (asapplicable), bolted link and necessary inspection covers.

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											

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 (the set up shall include 3 phase straight run, 90^0 bend, set of flexible connection of each type, metallic bellow on enclosure, CT's mounted in position, (as applicable), bolted link, and necessary inspection covers. Milli-volt drop across bolted flexible joint shall be measured

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)

a) 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

b) 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) **Please refer QAP for transformer**

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 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										

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
- Water tightness test on outdoor portion of bus-duct
- 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

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												

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) Capacitance & tan Delta test
iv) Enclosure IP Degree test
v) Measurement of zero phase sequence impedance
vi) Measurement of the harmonics of no load current
vii) Temperature rise
viii) Lightning impulse voltage test on all the three limbs as per Cl. 13 of IS:2026Part-III,1981

1.6.5.3.2 Additional Type tests (Category-I)

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:

i) Check for proper packing and preservation of accessories like radiators, bushings, explosion vent, dehydrating breather, Buchholz relay, conservator etc.

ii) Check for proper provision of bracing to arrest the movement of core and winding assembly inside the tank.

iii) 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.

iv) 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.
v) Noise level measurement
vi) Measurement of zero phase sequence impedance
vii) Measurement of the harmonics of no load current
viii) Temperature rise
ix) Lightning impulse voltage test on all the three limbs as per Clause 13 of IS:2026 Part-III,1981

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 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.																	

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

- 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).

- 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).

1.6.6.1.2 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.

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														

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														

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/ 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 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 Busduct

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														

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														

1.6.8.2 415V Busduct

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															

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
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) Cable Drum Rewinding	Y								Y	Y	Y	Y	Y	
Wooden drum (IS:10418)/ Steel drum		Y												

Y =Test applicable

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) 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.

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												

1.6.9.2 1.1 kV PVC and XLPE CABLES	(Table 2/2)			
	Tests/ Checks			
Item/ Components/ Sub-system	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 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.			

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 Cable Drum Rewinding	Y	Y						Y	Y	Y	Y
Wooden drum(IS:10418)/ Steel drum		Y									
Y =Test applicable											

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.

1.6.9.4 Type tests (Category-I)

The type tests on one drum out of every ten (10) drums or less 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 $27^{o}C$ and $1x10^{11}$ ohm-cm at $70^{o}C$.

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 250^0C. 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^{o}C (room temperature, 50^{o}C, 100^0C, 150^0C and 200^0C) plotted on a graph and than extrapolated. The minimum temperature index shall be 250^{o}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

a) Insulation resistance test

b) 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														

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.

iii) 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

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										

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				

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 50^0C 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													

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.
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 50^0C 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 50^0C. 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

iv) Insulation resistance test
v) Automatic voltage regulator operation
vi) Load limiter operation.
vii) 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).
viii) 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 tests as per relevant standards
Protective relays (IS:3231/ 8686)	Y				Y	Y	Y			Y		Y		Y
Auxiliary relays (IS:3231/ 8686)	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
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
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														

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.

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.

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 10%	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											

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															

1.6.14.2 Alternator	**(Table 2/2)**			
Items/ Components	**Tests/ Checks**			
	All tests as per IS:4722	Vibration	Overspeed	Tan delta, shaft voltage and polarization index
Plates for stator frame, end shield, spider etc.				
Shaft				
Magnetic Material				
Rotor copper/ aluminium				
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				

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										

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) Overspeed 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) Overspeed trip test
iv) Load pick up and load rejection tests
v) Load test and temperature rise measurement of engine and alternator

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

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		For details refer table for Transformer
Motor	Y	Y		For details refer separate table for Motor
VFD Panel	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 alongwith relevant supporting documents during QP finalization

2) Make of all major Bought-out Items will be subject to purchaser's approval.

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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 under the project with an objective to create quality infrastructure works. The QA and Inspection Plan shall be integral part of the contract agreement with the contractor or equipments 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/equipments 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 & Contractor shall strictly ensure Quality Assurance checks during the day to day course of project execution, including pre-dispatch inspections of all materials as per Manufacturing Quality Plan/ Approved Drawings / Technical Specifications/ Datasheet/ GTP/applicable national & international standards etc.

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 this 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.

Vendor approval: It is a Good Practice that all the materials to be procured for project works shall be purchased from the authorized vendors approved by the Quality Assurance Department of Utility. Approved vendors list should be uploaded periodically on the utility web portal. New vendors/suppliers may be approved by the utility, provided capability of manufacturer's is assessed suitably by visiting the factory premises and checking the testing facility available before accepting it as approved vendor.

Material/Equipment Inspection: The important materials should be inspected at manufacturer premises before dispatch. The Following materials/equipments may be inspected for pre-dispatch inspection at manufacture premises

1. Power Transformer,
2. Distribution Transformer
3. Ring Main Unit
4. CT/PT Unit (Outdoor) & Metering Cubicle (Indoor)
5. Circuit Breaker,
6. Insulators,
7. Cables
8. Conductor
9. Control & Relay Panel,
10. Overhead Conductor/ ABC
11. Energy Meter
12. Poles
13. Insulators
14. Capacitor
15. Distribution Box

The utility may add the important material in the above list. At least one sample from each type of the above materials/ equipments should be inspected by the Utility representative. The inspection/testing/witnessing of acceptance tests shall be as per approved Drawings/Technical

Specifications/Datasheet/GTP/QA Plan and applicable national & international standard.

Sampling from field: Any material, as deemed fit/as per utility practice may be picked from site/store for testing at test laboratory chosen by inspecting official.

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 ofthe contractor shall generally cover the following:

- Organization structure of the Contractor for management and implementation of the proposed quality assuranceprogram
- 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, source inspection, incoming raw material inspection, verification of material purchases etc.
- System for shop manufacturing and site erection controls including process controls and fabrication andassembly control
- Control of non-conforming items and system for corrective actions
- Inspection and test procedure both for manufacture and field activities
- Control of calibration and testing of measuring instruments and field activities

- System for indication and appraisal of 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 forcontrolling the quality characteristics relevant to each item of equipment furnished and/or services rendered.
- A Field quality Plan covering field activities

The manufacturing & Field quality Plans shall be mutually discussed and approved by the Utility after incorporating necessary corrections by the Contractor as may be required. The Utility or his duly authorized representative 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 at the time of Utility Inspection of equipment/material. The contractor shall supply the materials of type & design which has already been Type Tested. Contractor 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.

To ensure that the proposed systems conform to the specific provisions and general intent of the Specification, the Contractor shall submit documentation describing the systems to the Utility for review and approval. The contractor shall obtain approval of Utility for the relevant document at each stage before proceeding for manufacturing, system development, factory testing, site testing, training etc. The schedule forsubmission/approval of each document shall be finalised during the discussions before placement of the contract, this schedule shall be in line to 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.

The Contractor shall submit to the Utility all documents in accordance with an approved schedule of submissions and shall submit any further information (in the form of drawings, documents, manuals, literature, reports etc.) when asked by the Utility while commenting /approving any drawings/documents etc.

PRE- DISPATH INSPECTION

Pre-dispatch inspection shall be performed on various materials at manufacturer's work place for which contractor shall be required to raise requisition giving at least sufficient time (say 10 days). Depending on requirement, inspection shall be witnessed by representatives of Utility. The contractor shall ensure that pre-dispatch inspection for materials are intimated only when the material is completely ready for inspection. On due date of inspection, if it is found that materials are not ready in required quantities or the inspection could not be carried out due to non-availability of requisite calibrated certificate of instruments with manufacturer, closing of works on scheduled date of inspection, non-availability of sufficient testing/material handling staff at manufacturer works etc, all expenditures incurred on deployment of various inspecting officials along with some specified fine may be imposed on the agency and re-inspection may be carried out on expense of contractor. 2nd such situation at same manufacturer/supplier may result in rejection of name of manufacturer from list of approved vendors/sub-vendors. In case sub-standard materials (old component, re-cycled materials, re-used core material, re-used transformer coil material etc) offered for inspection and are noticed during the inspection, materials shall be rejected and approval of sub-vendor may also be cancelled for all future projects.

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.

Quality Assurance Plan (QAP) for major equipments: Quality Assurance Plan shall be as per applicable Indian Standards. In case of non-availabiltiy of Indian Standards, QAP shall be as per the Utiltiy Specifications/GTP:

QUALITY ASSURANCE PLAN FOR STAGE INSPECTION-I OF POWER TRANSFORMER (33 kV, 22kV)

S No.	Particulars	As offered	As observed	Deviation and Remarks
(A)	Inspection of Core : (I) Core Material 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)			
	(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			
(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 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)			
	ii) Outer diameter (mm)			
	b) HV winding			
	a) Internal diameter (mm)			
	ii) Outer diameter (mm)			
	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, 22kV)

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, 22kV)

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: i. Test on OTI and WTI ii. High Voltage test on insulation test for Auxiliary Wiring.	GTP		
22	Test on Oil filled in Transformer i. Dielectric Strength of Oil ii. Water Content. iii. Dielectric Dissipation factor (tan delta at 90° C. iv. Resistivity	GTP		
23	Temperature rise test	GTP		
24	Short Circuit withstand test	Should withstand		
25	Lightning Impulse voltage test with chopped wave.	GTP		

QUALITY ASSURANCE PLAN FOR STAGE INSPECTION OF DISTRIBUTION TRANSFORMER

S No.	Particulars	As offered	As observed	Deviation and Remarks
(A)	**Inspection of Core :**			
	(I) Core Material			
	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.			
	4. Whether laminations used for top and bottom yoke are in one piece.			
	5. Core Losses			
	(II) Core Construction :			
	(1) No. of steps			
	(2) Dimension of steps			

As offered :

Step No.	1	2	3	4	5	6	7	8	9	10	11	12
W mm												
T mm												

As found :

Step No.	1	2	3	4	5	6	7	8	9	10	11	12
W mm												
T mm												

	(3) Core Diameter (mm)			
	(4) Total cross sectional area of core			
	(5) Effective cross sectional area of core			
	(6) Whether top yoke is cut for LV connection.			
	(7) If yes, at 6 above, whether Reinforcement is done.			
	(8) Core length (leg center to leg center)			
	(9) Window height.			
	(10) Core height			
	(11) Core weight only			
(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 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 wire used for delta formation (mm)			
	4. Diameter of coils in:			

	a) LV winding			
	i) Internal Diameter (mm)			
	ii) Outer diameter (mm)			
	b) HV winding			
	j) Internal Diameter (mm)			
	ii) Outer diameter (mm)			
	5. Current density of winding material used for:			
	a) HV			
	b) LV			
	6. Whether neutral formation on top.			
	7. HV coils / Phase			
	a) Number			
	b) Turns/coil			
	c) Total turns			
	8. LV coils /Phase			
	a) Number			
	b) Turns / coil			
	c) Total turns			
	9. Total weight of coils of			
	a) LV winding (Kg)			
	b) HV winding (Kg)			
	10) Winding is free from metallic/non-metallic dust, burr and deformations under DPC paper.			
	a) HV Winding			
	b) LV Winding			
(C)	**INSULATION MATERIALS**			
	(II) 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			
	VIII) Interlayer Insulation			
	a) Type of Paper			
	2. Make			
	3. Thickness (mm)			
	II) 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)			
	III) Between core and LV			
	Type of Paper			
	i. Make			
	ii. Thickness (mm) (all size)			
	Type of Pressboards			
	i. Make			
	ii. Thickness (mm) (all size)			
	IV) Material used for top and bottom yoke and insulation			
	a) Type of Material			
	i. Make			
	ii.Thickness (mm) (all size)			
	V) 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)			
	VI) Test certificate of manufacturer (enclose copy for all type of papers and pressboard used)			
(D)	**CLEARANCES: (mm)**			
	(I) Related to core and winding			
	1) LV to core (radial)			
	2) Between HV and LV (Radial)			
	3) (i) Phase to phase between HV conductor			
	(ii) Whether two nos. press board each of minimum 1mm thick provided to cover the tie rods.			
	4) Thickness of duct between HV and LV coil mm			
	(II) Between core – coil assembly and tank:			
	1) Between winding and body			
	a) Tank length wise			
	b) Tank breadth wise			
(E)	**TANK :**			
	(III) Construction Details:			
	1) Rectangular shape			
	2) Thickness of side wall (mm)			
	3) Thickness of top and bottom plate (mm)			
	4) Provision of sloping top cover towards HV bushing.			
	5) Tank internal dimensions (mm)			
	a) Length			
	b) Breadth			
	c) Height			
	d) On HV side			
	e) On LV side			
	(IV) General Details :			
	1) Inside painted by oil corrosion resistant paint (please specify which type of coating done)			

	2)Gasket between top cover and tank			
	a) Material			
	i) Thickness (mm)			
	ii) Jointing over laps (mm)			
	3)Provision of lifting lugs:			
	c) Numbers			
	d) Either reinforced by welded plates edge wise below the lug up to re-enforcing angle of the tank done.			
	6) Pulling lug of MS plate			
	a) Nos.			
	b) Thickness (mm)			
	c) Whether provided on breadth side or length side			
	4) Provision of air release plug			
	5) Provision of hot dip galvanized GI Nuts Bolts with 1no. plain and 1no. spring washer.			
	6) Deformation length wise side wall of tank when subject to			
	a)Vacuum test as per the relevant IS/ GTP.			
	b)Pressure test as per relevant IS/GTP.			
(F)	**RADIATORS:**			
	1)Fin radiators as per GTP/ relevant standard.			
	a) Dimension of each fin (L × B × T)			
	b) Fins per radiator			
	c) Total No. of radiators bank			
	2) Verification of manufacturer's test certificate regarding Heat dissipation (excluding Top and Bottom) in w/sq.m			
	3) Verification of position of radiator with respect to bushing.			
(G)	**CONSERVATOR**			
	1) Dimensions (L ×D) (in mm.)			
	2) Volume (m3)			
	3) Inside dia. of conservator tank pipe (mm)			
	4) Whether conservator outlet pipe is projected approx. 20 mm inside the conservator tank.			

	5) Whether arrangement made so that oil does not fall on active parts.			
	6) Whether die cast metal oil level gauge indicator having three positions at (-5^0C , 30^0C and 98^0C)			
	7) Whether drain plug & filling hole with cover provided			
	8) Inner side of the conservator Tank painted with -			
(H)	**BREATHER:**			
	1) Whether UV protected seamless acrylic body breather for silica gel provided.			
	2) Make			
	3) Capacity			
(I)	**TERMINALS:**			
	3) Material whether of Brass Rods/Tinned Copper.			
	a) HV			
	b) LV			
	c) Size (dia. In mm)			
	d) HV			
	e) LV			
	f) Whether SRBP tube / insulated paper used for formation of Delta on HV.			
(J)	**BUSHINGS**			
	4) Whether HV bushings mounted on top cover/ side walls.			
	a) HV			
	b) LV			
	c) Whether arrangement for studs for fitting of HV Bushing are in diamond shape (so that arcing horns are placed vertically).)			
	d) Position of mounting of LV bushings			
	e) Bushing Clearance: (mm)			
	a) LV to Earth			
	b) HV to Earth			
	c) Between LV bushings			
	d) Between HV bushings			

(K)	**TANK BASE CHANNEL/ ROLLERS:**			
	2) Size of channel (mm)			
	3) Whether channels welded across the length of the tank			
(L)	**OIL:**			
	a. Type of oil and Name of supplier			
	b. Breakdown voltage of oil: (kV)			
	c. Filled in tanked transformer			
	d. In storage tank (to be tested by Inspecting officer).			
	e. Supplier's test certificate (enclose copy)			
(M)	**ENGRAVING:**			
	Engraving of Sl. No. and name of firm.			
	a) On bottom of clamping channel of core-coil assembly.			
	b) On Top cover of tank			
(N)	**NAME PLATE DETAILS:** Whether Name Plate is as per approved drawing			
(O)	**COLOUR OF TRANSFORMER**			
	b. Tank body with			
	c. Conservator with			

Note: Type Test, Routine Test, Any special test shall be conducted as per the relevant IS i.e. IS 1180

ACCEPTANCE TESTS TO BE CARRIED OUT

S No.	PARTICULARS	Specified Value	Reference documents	Test Results	Pass/Fail
1.	Visual and Physical verification	GTP/Drawing	GTP/Drawing		
2.	Ratio Test		IS 2026 (Part 1) cl. 16.3		
3	Vector Group & Polarity check		IS 2026 (Part 1) cl.16.3		
4.	No load loss measurement	GTP value	IS 2026 (Part 1) cl.16.5		
5.	Max. Load loss measurement (watt) at 50% loading at 75ºC	GTP value	IS 2026 (Part 1) cl.16.4		
	Max. Load loss measurement (watt) at 100% loading at 75ºC Note – Calculation sheet to be attached along with	GTP value			
6.	Winding Resistance :	GTP Value	IS 2026 (Part 1) 16.2.1 & 16.2.3		
	H.V. (in Ohms) Resistance at 75 deg.C (Calculated)				
	L.V. (in Ohms) Resistance at 75 deg.C (Calculated)				
7.	Insulation resistance (M ohm) HV-LV HV-E LV-E		IS 2026 (Part 1) cl.16.6		
8.	a) Separate source Voltage withstand test voltage:		IS 2026 (Part 3) cl.10		
	HV	28 kV for 60 secs.			
	LV	3 kV for 60 secs.			

9.	Induced over-voltage withstand test at double voltage and double frequency	100 Hz, 866 volts for 60 seconds.	IS 2026 (Part 3) cl.11		
10.	No load current at	GTP values	IS 2026 (Part 1) cl.16.5		
	90% volts				
	100% volts				
	112.5% volts				
11.	Neutral current measurement (A)	within 2% of the Full load current			
12.	Percentage Impedance at 75 deg.C (Please furnish calculation sheet)	GTP/TPDDL Specification	IS 2026 (Part 1) cl.16.4		
13.	Transformer oil test (Break down voltage)	>60KV per 2.5mm for one minute			
14.	Oil leakage test (0.35Kg/sq.cm)	Should Withstand for one hour	IS 1180 (Part 1) clause 21.5.1.3		
15.	Pressure test		IS 1180 (Part 1) cl. 21.5.1.2		
16.	Temperature Rise test (Over ambient temperature)	top oil – 35^0 top oil – 40^0	IS 2026 (Part 2) Clause no.4		
17.	Verification of Bushing clearance HV/LV (mm) a) Phase to Phase b) Phase to Earth	GTP			
18.	Paint Thickness test /Cross Adhesion Test	GTP/Utility Specification	IS1180 part 1 clause no. 21.4.d		
19.	Engraving on Name plate, Guarantee plate and Tank body	GTP	GTP		
20.	Copy of calibration certificates of testing equipment be enclosed.	100% testing equipment			
21.	Verification of tightening torque w.r.t torque chart.	GTP	Approved torque chart		
22.	Raw Material sourcing and consumption documents verification in offered lot		As per acceptance clause in the specification		

23	CT- OEM Test reports if applicable	RTC			
24	Breather test reports for air pressure (Type test of OEM from NABL lab)				
25	Breather mounting fixing on conservator with Teflon tape				
26	CT mounting without touching bus bar				
27	Operation of Auxiliary contacts NONC operation test of various accessories like PRV, OTI, float switch etc. as applicable.				
28	Checking of CT terminal Ferruling S1 & S2 for all phases, in Auxiliary box.	As per Approved Drawing	As per Approved Drawing		

QUALITY ASSURANCE PLAN FOR 11 kV ABC CABLE

A	**Material/Part**	**Acceptance Criteria**
1	Conductor	The cable conductors shall be of round, stranded and compacted aluminium of nominal cross sectional area as per requirement.
2	Conductor Screen	The conductors screen shall be of extruded semi-conducting cross linked polyethylene compound of thickness not less than 0.5 mm.
3	Insulation	The Insulation screen shall be as per IS:7098 (Part II).
4	Insulation Screen	The Insulation screen shall comprise extruded semi-conducting compound and/or semi- conducting tape. Thickness of the screen shall be not less than 0.6 mm.
5	Outer Sheath	The outer sheath shall be black polyethylene. The nominal thickness of sheath shall be 1.8mm and it shall conform to the technical requirements of ST-3 of EIC-502.
6	Messenger (Neutral Conductor)	The bare messenger wire shall be of required size, aluminium alloy, generally conforming to IS:398 (Part IV) – 1979 and shall be suitably compacted to have smooth round surface to avoid damage to the outer insulating sheath of single-core phase cables twisted around the messenger. There shall be no joints in any wire of the stranded messenger conductor except those made in the base rod or wire before finally drawing.
7	Packing	Cables shall be supplied in returnable wooden drums conforming to IS: 10418. The standard length of the bunched cable in each drum shall be 1000 meters (+/-) 10%. Other lengths may be acceptable subject to the approval of employer/purchaser.
8	Marking	The Cable drum shall carry the information as per the requirements of IS: 7098 (Part-II). However, exact details of marking/embossing, color of outer sheath etc. Will be as per the detailed purchase order. Suitable identification

		marks shall be given on the outer sheath to clearly distinguish three phases of the bunched cable.

Acceptance Test:

Name of Test	**Referred documents**
a) Tensile Test	As per the utility specifications/GTP
b) Wrapping Test	As per the utility specifications/GTP
c) Conductor resistance test	As per the utility specifications/GTP
d) Test for thickness of insulation and sheath	As per the utility specifications/GTP
e) Hot set test for insulation	As per the utility specifications/GTP
f) Tensile strength and elongation at break test for insulation and sheath	As per the utility specifications/GTP
g) Partial discharge test	As per the utility specifications/GTP
h) High voltage test	As per the utility specifications/GTP
i) Insulation resistance (volume resistivity) test	As per the utility specifications/GTP

QUALITY ASSURANCE PLAN FOR LT ABC CABLE

Name of test	**Referred documents**	**Test (Pass or Fail)**
Tensile test (for phase/street light conductor)	As per IS10810.	
Wrapping test (for phase/street light conductor)	As per IS10810	
Breaking load test for messenger conductor	As per IS10810	
Elongation test for messenger conductor	As per IS10810	
Conductor resistance test	As per IS10810	
Test for thickness of insulation	As per IS10810	
Tensile strength and elongation at break test	As per IS10810	
Hot set test for XLPE insulation	As per IS10810	
Insulation resistance test	As per IS10810	
High voltage test	As per IS10810	
Carbon black content	As per IS10810	
Any other	As per the utility	

QUALITY ASSURANCE PLAN FOR 11kV XLPE CABLE

A RAW MATERIAL		CHARACTERISTICS	REFERENCE
1	Aluminium/Copper Rod	a) Tensile strength	As per the utility specifications / GTP
		b) Resistivity	As per the utility specifications / GTP
		c) Diameter	As per the utility specifications / GTP
		d) Chemical composition	As per the utility specifications / GTP
		e) Surface finish	As per the utility specifications / GTP
2	PVC Compound	a) Tensile Strength	As per the utility specifications / GTP
		b) Elongation at break	As per the utility specifications / GTP
		c) Thermal stability	As per the utility specifications / GTP
3	**TR-XLPE** Compound (Borealis/Dow chemical/ Hanwa)	a) Packing	As per the utility specifications / GTP
		b) Tensile Strength	As per the utility specifications / GTP
		c) Elongation at break	As per the utility specifications / GTP
		d) Hot set test	As per the utility specifications / GTP
		e) Volume Resistivity	As per the utility specifications / GTP
		f) Cure Curve (Max. Torque)	As per the utility specifications / GTP
		g) Density	As per the utility specifications / GTP
4	Semi-conducting Compound (Borealis/Dow chemical/ Hanwa)	a) Packing	As per the utility specifications / GTP
		b) Volume Resistivity	As per the utility specifications / GTP
		c) Tensile Strength	As per the utility specifications / GTP
		d) Elongation at break	As per the utility specifications / GTP
		e) Cure Curve (Max. Torque)	As per the utility specifications / GTP
		f) Density	As per the utility specifications / GTP
5	Copper tape	a) Thickness & width	As per the utility specifications / GTP
		b) Tensile Strength	As per the utility specifications / GTP
		c) Elongation at break	As per the utility specifications / GTP
		d) Resistivity	As per the utility specifications / GTP
6.		a) Dimensions	As per the utility specifications / GTP

	Armour wires/strips (Galvanised steel)	b) Surface condition/finish	As per the utility specifications / GTP
		c) Tensile Strength	As per the utility specifications / GTP
		d) Elongation at break	As per the utility specifications / GTP
		e) Torsion test for round wire	As per the utility specifications / GTP
		f) Wrapping test	As per the utility specifications / GTP
		g) Mass of zinc coating	As per the utility specifications / GTP
		h) Uniformity of zinc coating	As per the utility specifications / GTP
		i) Adhesion test	As per the utility specifications / GTP
		j) Resistivity test	As per the utility specifications / GTP
7	Water Swellable tape	a) Dimensions	As per the utility specifications / GTP
		b) Swelling height	As per the utility specifications / GTP
		c) Resistivity	As per the utility specifications / GTP
		d) Weight	As per the utility specifications / GTP
8	Steel Drum	a) Dimension	As per the utility specifications / GTP
		b) Finish & workman ship	As per the utility specifications / GTP
9	Cable Pulling eye	a) Dimensions & Material	As per the utility specifications / GTP
		b) Finish & workman ship	As per the utility specifications / GTP
		c) Tension test on pulling eye	As per the utility specifications / GTP
10	Binder tape	a) Dimensions & material	As per the utility specifications / GTP
11	Polypropylene filler	a) Size	As per the utility specifications / GTP
12	Heat shrinkable end cap	a) Bore diameter	As per the utility specifications / GTP
		b) Length of end cap	As per the utility specifications / GTP
B. PROCESS INSPECTION			
1	Wire Drawing	a) Diameter	As designed
		b) Surface finish	Smooth and Free from defects
		c) Tensile test (for Al)	IS: 8130/84

		d) Elongation test (for Cu)	IS: 8130/84
		e) Wrapping test (for Al)	IS: 8130/84
2	Stranding	a) No. of wires/strands	As designed
		b) Lay length & Lay direction	As designed
		c) Dia of conductor	As designed
		d) Surface finish	Smooth and Free from defects
3	Core extrusion (Conductor screen, Insulation & insulation screen)	a) Compound Make/Grade	
		b) Thickness of insulation & extruded S.C. layers	As per design
		c) Surface finish	Smooth and Free from defects
		d) Printing on outer semi- conducting layer	Do not heat, freely strippable
		e) Tensile Strength	IS 7098/II/2011
		f) Elongation at break	IS 7098/II/2011
		g) Hot set test	IS 7098/II/2011
		g1) Ovality of core	Tech. Data Sheet
		h) Eccentricity of insulation	Tech. Data Sheet
		i) Core diameter	Tech. Data Sheet
		j) Void & contamination test for insulation (Silicon Oil test)	Tech. Data Sheet
		k) Wafer boil test for extruded semi-conducting layers	As per BIS
4	Taping - water Swellable semi-conducting	a) Dimensions	Tech. Data Sheet
		b) Tape Application (Overlap)	Tech. Data Sheet
5	Taping - Copper tape	a) Width & Thickness of tape	Tech. Data Sheet
		b) Number of tapes	Tech. Data Sheet
		c) Tape application (Overlap)	Tech. Data Sheet
6	Laying up	a) Identification of cores	Tech. Data Sheet
		b) Direction of lay, core Sequence & Lay length	IS 7098/II/2011
		c) Application of binder tape	Tech. Data Sheet

		d) Shape of laid up assembly	Reasonably Circular
7	Inner sheath	a) Material & type	Tech. Data Sheet
		b) Thickness	Tech. Data Sheet
		c) Surface finish	Smooth and free from defects
		d) Colour of inner sheath	Tech. Data Sheet
8	Armouring	a) Dimension of armour wires/strips	Tech. Data Sheet
		b) No. of armour strip/wire	Tech. Data Sheet
		c) Armour coverage	IS 7098/II/2011
		d) Direction of lay	IS 7098/II/2011
		e) Lay length/Gear setting	
		f) Surface finish	Smooth and free from defects
9	Outer sheath/Rewinding	a) Material & type	Tech. Data Sheet
		b) Anti rodent & termite additives	Tech. Data Sheet
		b) Thickness	As per the utility specifications / GTP
		c) Overall diameter	As per the utility specifications / GTP
		d) Surface finish & colour of sheath	Smooth and free from defects
		e) Cable length verification	Tech. Data Sheet
		f) Marking	Tech. Data Sheet
C FINAL INSPECTION			
1	Routine tests	a) High Voltage	IS 7098/II/2011
		b) Conductor Resistance	IS 8130/84
		c) Partial Discharge	IS 7098/II/2011
		d) Impulse	
		e) Armour Coverage	
		f) Physical Dimensions	
		g) Freely Strippable insulation screen (Strippability Test)	Factory Standard
2	Stage Inspection	Wire Drawing	Tech. Data Sheet
		Extrusion process	Tech. Data Sheet

		Raw maerial inspection at factory	Tech. Data Sheet
		Wrapping of Aluminium	Tech. Data Sheet
		Tensile test for Aluminium	Tech. Data Sheet
3	Acceptance tests	a) Annealing test for copper	IS 8130/84
		b) Tensile test for aluminium	IS 8130/84
		c) Wrapping test for aluminium	IS 8130/84
		d) Conductor resistance test	IS 8130/84
		e) Test for thickness of insulation & sheath	IS 7098/II/2011 & Tech. Data sheet
		f) Hot set test for insulation	IS 7098/II/2011
		g) Tensile strength & Elongation at break of insulation & outer sheath	IS 7098/II/2011 & IS 5831/84
		h) Partial discharge test	IS 7098/II/2011
		i) High voltage test	IS 7098/II/2011
		j) Insulation resistance (Volume resistivity) test	IS 7098/II/2011
		k) Tests for dimension of armour wires/strips	IS 3975, IS 10810 Pt. 36 & Tech. Data sheet
		l) Test for anti termite & anti rodent property of outer sheath	Tech. Data Sheet
		m) Rewinding of cable on drum	To check cable appearance, drum appearance, cable winding, packing, embossing/printing/sequential marking
		n) Void & contamination test for insulation (Silicon Oil test)	Tech. Data Sheet
		o) Wafer boil test for extruded semi-conducting layers	Tech. Data Sheet
		p) Freely Strippable insulation screen	Factory Standard

		q) Water Penetration test (WPT) on core (i.e.Logitudinal Water Blocking Test)	Tech. Data Sheet
		r) Armour coverage	Tech. Data Sheet
		s) Ovality	Tech. Data Sheet
		t) Eccentricity	Tech. Data Sheet
		u) Mass & uniformity & zinc coating on armour	Tech. Data Sheet
		v) Resistivity of Strip armour	Tech. Data Sheet
		w) Swelling height of water swellable tape	Tech. Data Sheet
		x) Cable pulling eye strength test on one sample	Tech. Data Sheet
		y) Flammability test	As per IS- 78098/II/2011
		z)Impulse withstand test	IS 7098/II/2011
		z1) Ageing & Water absorption test(Gravimetric) on Insulation & Outer sheath	IS 5831/84
		z2) Heating Cycle with Potential	Tech. Data Sheet
		z3) Raw Material Verification in all aspects	Tech. Data Sheet
4	Type tests at vendor's works	a) Tests on conductor	Tech. Data Sheet
		i) Annealing test for copper	IS 8130/84
		ii) Tensile test for aluminium	IS 8130/84
		iii) Wrapping test for aluminium	IS 8130/84
		iv) Conductor resistance test	IS 8130/84
		b) Tests for armouring wires/strips	Tech. Data Sheet
		i) Dimensions of wire/strip	IS 3975, IS 10810 Pt. 36 and Tech. Data Sheet
		ii) Tensile strength & Elongation at break	IS 3975
		iii) Torsion test for wire	IS 3975

		iv) Winding test for strip	IS 3975
		v) Uniformity of zinc coating	IS 3975
		vi) Mass of zinc coating	IS 3975
		vii) Resistivity of wire/strip	IS 3975
		c) Test for thickness of insulation & sheath	IS 7098/II/2011 & Tech. Data sheet
		d) Physical tests for insulation	
		i) Tensile strength & Elongation test	IS 7098/II/2011
		ii) Ageing in air oven	IS 7098/II/2011
		iii) Hot set test	IS 7098/II/2011
		iv) Shrinkage test	IS 7098/II/2011
		v) Water absorption (gravimetric)	IS 7098/II/2011
		e) Physical tests for outer sheath	
		i) Tensile strength & Elongation test at break	IS 5831/84
		ii) Ageing in air oven	IS 5831/84
		iii) Shrinkage test	IS 5831/84
		iv) Hot deformation test	IS 5831/84
		v) Loss of mass in air oven	IS 5831/84
		v) Heat shock test	IS 5831/84
		vi) Thermal stability test	IS 5831/84
		f) Electrical tests in sequence	
		i) Partial discharge test	IS 7098/II/2011
		ii) Bending test	IS 7098/II/2011
		iii) Partial discharge test	IS 7098/II/2011
		iv) Dielectric power factor as a function of voltage	IS 7098/II/2011
		v) Dielectric power factor as a function of temperature	IS 7098/II/2011
		vi) Heating cycle test	IS 7098/II/2011
		vii) Dielectric power factor as a function of voltage	IS 7098/II/2011
		viii) Partial discharge test	IS 7098/II/2011
		ix) Impulse withstand test	IS 7098/II/2011

		x) High voltage test	IS 7098/II/2011
		g) Insulation resistance (Volume resistivity test)	IS 7098/II/2011
		h) Flammability test	IS 7098/II/2011
D	**PACKING & MARKING**		
1	Packing & Marking	a) Cable end sealing	IS 7098/II/2011/ and as per agreement
		b) Pulling eye at leading end	As per agreement
		b) Stencilling/Marking on drum	IS 7098(Part 2):2011/ and as per agreement

QUALITY ASSURANCE PLAN FOR 11 KV RING MAIN UNITS (3WAY, 4WAY & 5WAY) WITH ALL ACCESSORIES (BREAKER, CONTROL CUBICLE, WIRING, MOTOR, SPRING, INSULATORS, EARTHING PROVISION ETC.)

ROUTINE TEST /ACCEPTANCE TEST

Sl. No.	Test	Reference
1	Dimensional & Visual Checks	GTP/ Utility Specifications
2	PF withstand voltage test on LBS and CB combined with switches closed position	GTP/ Utility Specifications
3	HV withstand test across isolator distance with opened contact of VCB	GTP/ Utility Specifications
4	Voltage Indication Tests	GTP/ Utility Specifications
5	Measurement of contact resistance on LBS & CB combined with closed switch condition	GTP/ Utility Specifications
6	Operational & Interlock Tests	GTP/ Utility Specifications
7	Leak Detection Test at bushing terminals after RMU assembly	GTP/ Utility Specifications
8	HV withstand test	GTP/ Utility Specifications
9	Insulation resistance test	GTP/ Utility Specifications
10	Routine Tests as per IS / IEC	GTP/ Utility Specifications
11	Compatibility & data integration check after operations, alarms and reset check	GTP/ Utility Specifications
12	Relay testing should be done with primary injection kit on installed relay	GTP/ Utility Specifications

RAW MATERIAL SCRUTINY BASED ON TEST CERTIFICATES /VISUAL INSPECTION

Sl. No.	Component	Attribute	Applicable Procedure
1	Main Tank	Visual & dimensional /Material Grade/Outer Surface cleaning & galvanization/welding	As per Utility specifications
2	SF6 Tank	Visual & dimensional /Material Grade/Surface cleaning & galvanization/welding	As per Utility specifications
3	Support Structure & Front Cover	Visual & dimensional /Material Grade/Surface cleaning & galvanization/mimic diagram	As per Utility specifications
4	Load Break Switch	Rating/type/appearance/finish/Routine Test Confirmation/Functional check/compatibility for Remote or SCADA operation	As per Utility specifications
5	Circuit Breaker Assembly	Material grade/Physical check/functionality of coils, motor, auxiliary switch, wiring, gear box, spring charging	As per Utility specifications
6	Vacuum Interrupter	Visual & Dimensional check/Material grade/	As per Utility specifications
7	Current Transformers for CB Compartment	Material grade/Physical check/Routine Test Confirmation	As per Utility specifications
8	Relay	Material grade/Functional check/Routine Test Confirmation	As per Utility specifications
9	Bushings & Cable Termination	Visual & Dimensional check/Material grade/locking provision in cable compartment	As per Utility specifications
10	Earthing	Visual Inspection/Earth busbar material grade/dimension/connection	As per Utility specifications
11	Fault Passage Indicator	Visual,Dimensional & Functional check/provision of SCADA output contact	As per Utility specifications
12	Voltage indicator lamps and Phase Comparators	Visual,Dimensional & Functional check/Material Grade	As per Utility specifications
13	Remote Control of the RMU & other requirements	Visual,Dimensional & Functional check/Material Grade (for Motorized, Non-motorized & Smart RMU	As per Utility specifications
14	Cable Boot for Cable Termination	Visual inspection	As per Utility specifications

15	Paint	Visual Inspection/Paint shade	As per Utility specifications
16	Control wiring	Material grade/functionality check	As per Utility specifications
17	Complete switchgear	Material grade/Physical check	As per Utility specifications

QUALITY ASSURANCE PLAN FOR SMART METERS

Item Requirement	Characteristics	Acceptance Criteria
Meter Body	Physical Appearance	Smooth, Clean , free from Grease
	Grade of Material	Fire retardant, Self Extinguishing, UV stabilized , recyclable and anti oxidation properties
	Flammability requirement	As per utility
	Materials	
	a) Base:	As per the utility.
	b) Cover:	As per the utility.
	Thickness, Min.	As per the utility.
Terminals and Terminal Block	Physical Appearance	Smooth, Clean , free from Grease
	Grade of Material	Fire retardant, Self Extinguishing, UV stabilized , recyclable and anti oxidation properties
	a) Terminal Block material	As per the utility.
	Depth of Terminal Hole	As per the utility.
	Internal Diameter of Terminal Hole	As per the utility.
	Clearance between adjacent terminals	As per IS 16444
	Terminal Cover:	As per GTP
	Material withstand temperature for terminal block	As per the utility / GTP /IS
	Material pressure withstand for terminal block	As per the utility / GTP/IS.
PCB	Glass epoxy, fire resistance grade.	As per relevant standards/ Technical specification
Battery		As per relevant standards/ Technical specification
Microcontroller and RTC having separate battery backup		As per relevant standards/ Technical specification
Optical port		As per relevant standards/ Technical specification

Memory chip		As per relevant standards/ Technical specification
Display modules		As per relevant standards/ Technical specification
Electronic components		As per relevant standards/ Technical specification
Measurement/ computing chips		As per relevant standards/ Technical specification
Communication Module		As per relevant standards/ Technical specification
Load Switch		As per relevant standards/ Technical specification

Note: Type Test, Routine Test, & Acceptance Test shall be conducted as per the relevant IS