



BHARAT HEAVY ELECTRICALS LIMITED

TRANSMISSION PROJECTS ENGINEERING MANAGEMENT

DOCUMENT No.	TB-394-316-125	Rev. No.	00		Prepared	Checked	Approved
TYPE OF DOC.	TECHNICAL SPECIFICATION			NAME	SK	SK	RS/DM
TITLE 220V/48V LEAD ACID TUBULAR BATTERY				SIGN			
				DATE	16.11.17	17.11.17	
				GROUP	TBEM	W.O. No	86009
CUSTOMER	Tamilnadu Transmission Corporation Limited (TANTRANSCO)						
PROJECTS	765/400kV AIS S/S Ariyalur						

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	Attachment: Check list for TE	01

Rev No.	Date	Altered	Checked	Approved	REVISION DETAILS			
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CHECKLIST FOR TECHNICAL EVALUATION

Along with the Technical Bids of the offers, the Bidder should submit this checklist confirming the inclusion of the enclosures as listed below. (Shall tick as ✓)

Sr No	Documents to be enclosed	Bidder to check & confirm
1	Copy of Unpriced BOQ as enclosed in the Technical Specification to confirm that bidder has quoted as per BOQ OF SECTION-1	
2.	Schedule of Technical Deviation format duly signed.	
3.	Supporting documents as asked in the Technical PQR.(As per cl. No. 4 of section -1 of technical specification)	
4.	Checklist of Technical parameters as per Section-5 duly filled and signed.	
5.	Compliance to Technical Specification	

NOTE:- If the Bidder fails to submit any of the documents as asked in the above check list, their bid is likely to be rejected / not evaluated.

The above checklist is verified for:-

NIT Ref No. :

Name of Equipment :

Name of Project :

Name of Bidder :

Signed with Seal of Bidder.

Date

SECTION – 1

SCOPE, SPECIFIC TECHNICAL REQUIREMENT AND QUANTITIES

1. SCOPE:

This technical specification covers the requirements of design, manufacture, testing at works, packing and dispatch of **220V and 48V DC Battery**.

This section covers the specific technical requirements, scope and quantities. The specific technical requirements for the above item as specified by the TANTRANSCO are given in Section-2A & 2B. The offered equipment shall also comply with the general technical requirements for the project as detailed under section-3 of this specification.

220V and 48V DC Battery is required for the following project:

Name of the Customer: **Tamilnadu Transmission Corporation Limited (TANTRANSCO)**

Name of the Project : **765/400kV AIS S/S Ariyalur**

This specification comprises of following sections:

Section-1: Scope, Specific Technical Requirements & Bill of Quantities

Section-2A: Technical specification of 220V Battery

Section-2B: Technical specification of 48V Battery

Section-3 : Project Details & General Technical Requirements

Section-4 : Guaranteed Technical Particulars

Section-5 : Technical Checklist

In case of any conflict between various sections, order of precedence shall be in the same order as listed above.

2. SPECIFIC TECHNICAL REQUIREMENTS:

For detailed equipment specification of 220V and 48V DC Battery, refer to Section - 2A and 2B respectively of the document.

Any accessory or tools and tackles listed in section-2A & 2B of the specification and not mentioned here in Section -1 is to be provided along with the Battery set.

Project: 765/400kV Ariyalur Substation
Customer: TANTRANSCO
Technical Specification: 220V/48V Lead Acid Tubular Battery

Bharat Heavy Electricals Limited
Doc. No. TB-394-316-125
Rev -00

3. BILL OF QUANTITIES :

Sl. No	DETAILS	Unit	Quantity
1.	220V, 535 Ampere Hour (AH) complete set with stand, insulators and terminal connectors, Electrolyte, Hydrometer Room Thermometer and Multi-meter (Tubular Lead Acid Battery with SAN Type Container)	Set	4
2.	48V, 1250 Ampere Hour (AH) complete set with stand, insulators and terminal connectors, Electrolyte, Hydrometer Room Thermometer and Multi-meter (Tubular Lead Acid Battery with SAN Type Container)	Set	2
3.	Battery accessories for four sets of 220V, 535 Ampere Hour (AH) Battery (Refer Annexure-A for list of accessories to be provided for each set of battery)	Lot	1
4.	Battery accessories for two sets of 48V, 1250 Ampere Hour (AH) Battery (Refer Annexure-A for list of accessories to be provided for each set of battery)	Lot	1
5.	Site testing for capacity and voltage during discharge on 1 set of 220V battery as per cl. No. 11 of section -2A	Lot	1
6.	Site testing for capacity and voltage during discharge on 1 set of 48V battery as per cl. No. 11 of section -2B	Lot	1

Note -1: Tap cell arrangement in Battery for boost charging shall be provided.

Note -2: All set of above battery should be accommodated in battery room of size 10m X10m. Battery layout shall be provided alongwith offer.

Note-3: Exact cable size for connection of battery terminal shall be provided during detailed engineering stage.

Note -4: For site testing Bidder will arrange all necessary equipment's including the variable resistor, tools , tackles and instruments for the tests.

4. TYPE TESTING

Bidder shall submit valid type test reports (As per relevant IEC/IS standard) for the tests carried out within last five years **from the date of opening of the tender** (i.e. 30.09.2016). The reports should have been conducted on identical or similar equipment/components to those offered. In case type test reports are more than 5 years old (from the date of opening of the tender **i.e. 30.09.2016**) or the reports of type tests are found to be technically unacceptable , the type test shall be conducted by the vendor without cost and delivery implication to BHEL. The type test if conducted shall be witnessed by BHEL/Customer.

5. TECHNICAL QUALIFYING REQUIREMENT

The manufacturer whose Batteries are offered should have designed, manufactured and supplied Lead Acid Tubular DC Batteries. These shall be operating satisfactorily for two years in power sector and/or industrial installations as on date of award of contract (i.e. 31.03.2017). The cell capacity shall be at least.

- a. 500 AH for 220 V Battery (Tubular type)
- b. 1250 AH for 48 V Battery (Tubular type)

Note – Bidder should quote for all type of Battery required in this tender alongwith accessories.

6. QUALITY PLAN

The contractor shall carry out contract works in accordance with sound quality management principles which shall include such as controls which are necessary to ensure full compliance to all requirements of the specification & applicable international standards. These quality management requirement shall apply to all activities during design, procurement, manufacturing, inspection, testing, packaging, shipping, inland transportation, storage, site erection & commissioning. Contractor shall submit detailed Quality Plan for BHEL / customer's approval within 1 week of P.O. placement.

Annexure-A

List of ACCESSORIES to be provided (for each set of Battery)

Sl. No.	Description	Qty.
A.	Hydrometer	1 No.
B.	Thermometer 0 to 100 degree centigrade with specific gravity correction scale-accuracy<0.5°C	1 No.
C.	Digital 3-0-3V Cell testing Voltmeter shall be provided with fine scales. Accuracy class shall be 0.5 or better and resistance not less than 1000 ohms	1 No.
D.	Wall mounting teak-wood for thermo-meters.	1 No.
E.	Plastic funnels	1 No.
F.	Rubber syphone	1 No.
G.	Stand insulators +5% extra.	1 Lot
H.	Cell insulators +5% extra	1 Lot
I.	Cell numbering tags with fixing arrangement.	1 Lot
J.	Teakwood, cable clamps with hardware.	1 Lot
K.	Ampere-hour meter (10 hour discharge rate) of 120 –300 AH range	1 No.
L.	Cell interconnectors (extra)	4 Nos.
M.	Fastners for the above	4 Nos.
N.	Junction box with suitable fuse arrangements of adequate rating to be mounted on the battery stands for terminating battery terminals.	1 No.
O.	Suitable wrenches for the Battery Terminals and bolts	1 set
P.	Cell lifting straps	1 No.
Q.	Digital multimeter of reputed make-(local makes will not be accepted)	1 No.
R.	Load bank of suitable rating with taps for testing for every 5 battery sets supplied	1 No.
S.	10% extra electrolyte	1 Lot

SECTION - 2A

220 V BATTERY & CHARGERS

TECHNICAL SPECIFICATION FOR LEAD ACID BATTERIES

- 1.0** The specification provides for the Design, manufacture, testing before despatch and delivery F.O.R.(Destination),Erection and commissioning of 220V/535Ah, Tubular type lead-acid stationary batteries in Transparent (SAN) container along with accessories as detailed below:

2.0 APPLICABLE STANDARDS (LATEST REVISION)

- 3.01
- | | |
|------------|--|
| IS-1885: | Electrical vocabulary, secondary cells and batteries |
| IS-1651: | Lead acid batteries with Tubular positive plates. |
| IS-1069: | Water for storage batteries |
| IS-266: | Sulphuric acid for storage batteries |
| IS-8320: | General requirements for methods of tests for lead-acid Storage batteries. |
| IS-6071: | Synthetic separator for lead acid batteries. |
| IEEE-485: | IEEE Recommended practice for sizing of large lead acid Storage batteries for generating stations and substations. |
| IEEE-484: | Recommended practice for design and installation of Storage batteries. |
| IEC 896-1: | Stationary Lead – acid Batteries. |

4.0 DESIGN AND CONSTRUCTIONAL FEATURES OF BATTERY.

4.01 Type

The battery shall be lead acid Tubular type **in Transparent SAN container**. Sealed Maintenance Free VRLA type/ Nickel Cadmium type batteries are not acceptable.

4.02 Positive Plates:

The plates shall be of first class material and workmanship and shall be free from blow-holes, cracks and other imperfections. The tubular positive plates shall consist of a suitable bar with spines cast of suitably alloyed lead to give adequate mechanical strength and minimum electrical resistance.

The tubular spines shall be cast of an alloy of Pb and Antimony with Antimony content not greater than 3% by weight. The casting shall be done using proper controlled procedure preferably using high pressure casting machine with an operating pressure not less than 90-100 Bars. Low antimony alloy (not greater than 3%) will ensure low water loss and a guaranteed topping up frequency of not more than once in 6 months. High pressure cast spines will ensure a long life and trouble-free operation.

Porous, acid resistant and oxidation resistant tubes shall be inserted one over each spine. After insertion, the tube shall be adequately filled and packed with active material (preferable through a rotary shaking machine) before their lower ends are closed by common plastic bar. The construction and material of tube shall be such as to reduce the loss of active material and shall be able to withstand normal internal stresses developed during service.

4.03 Negative Plates:

The negative plates shall be of flat pasted type. The pasting shall be done on an automated machine for better control of process parameters. It should have adequate mechanical strength and would be so designed that active material is maintained in intimate contact with the grid under normal working conditions throughout the life of the battery. Lead antimony alloy grid with maximum 3% antimony content or lead calcium alloy grid shall be used.

4.04 Separators:

The separators shall be microporous polyethylene envelope type to

avoid direct as well as side shorts. It should be acid resistant, chemically inert and should have excellent oxidation resistance and high degree of porosity to ensure minimum internal resistance. The average pore size shall be **less than 1 micron**. It should not exhibit any tendency to swell or shrink at temperature encountered during operation. Microporous synthetic separators shall conform to latest IS:6071. The internal resistance factor of the separators shall assure high discharge characteristics under all operating conditions. Proper arrangement to keep end plates in position shall be furnished by the bidder alongwith his offer.

Buffers/spring: Suitable buffers / springs shall be provided in the cells to keep the end plates in position. These shall have adequate length and strength.

4.05 Containers:

Containers shall preferably be made of **transparent SAN** (styrene acrylonitrile) **copolymer** giving excellent clarity, outstanding chemical resistance, rigidity and toughness with very high insulating qualities which eliminate the need for separate cell insulators. It shall have adequate mechanical strength to prevent bulging, cracking etc, during the life span of battery when operating under expected temperature range and due to action of static and dynamic loads and the action of electrolyte. These containers should enable the electrolyte level and the cell condition to be monitored at a glance. The containers shall conform to latest edition of applicable standards. A copy of the such standard in english shall be enclosed along with the offer. Battery containers shall be subjected to type, Routine and Acceptance Tests as per the requirements of applicable standards. The containers of the label attached firmly to the containers shall be marked with the information as per requirements of the above standard. The supplier's manufacturer's test certificates shall be submitted by the tenderer for the scrutiny of the purchaser.

4.06 Cell Lids:

It should be moulded from **opaque SAN** and sealed to the container. It should be easily removable if the need arises Terminal post shall be suitably sealed at the lid to prevent escape of acid spray, by means of rubber grommets, sealing compound or other suitable device. The positive and negative terminal posts shall be clearly and indelibly marked for easy identification.

- 4.07 Microporous Ceramic Vent Plugs: The vent plugs should be specially designed incorporating a microporous ceramic filter which effectively returns all acid spray to the cell, but allow free exit of oxygen and hydrogen which is generated at the end of boost charging. On removal, the plugs shall permit drawing of the electrolyte sample for servicing and of checking of the electrolyte level. The vent plug should preferably be flame retardant type to prevent any fire hazard in the battery room.

4.08 Connectors:

Connectors shall be of lead plated copper. The lead coating shall be adequate and tenacious. Minimum thickness of lead coating shall be **50 microns**. Connectors should be adequately designed to carry maximum duty cycle as specified and shall offer minimum resistance. The current

density for copper connectors shall not be more than 1.5 Amps/ Sq.mm. While considering the terminal voltage of the cell at the time of testing for discharge, the voltage drop due to inter-row and inter-cell connectors shall be considered. Connectors shall be adequately designed to withstand various stresses due to temperature changes, attack of acid and dynamic forces that could occur during the operation of the battery. Necessary transparent shrouds to cover all the inter row, inter cell and terminal connectors shall be provided. The cross section of cell connectors should not less than 75 sqmm for 220V.

4.09 Fasteners :Fasteners shall be of high tensile steel with lead coatings should be provided.

4.10 Electrolyte:

The electrolyte shall be battery grade sulphuric acid conforming to latest edition of relevant IS 266. The strength of the electrolyte in the cell during operation shall conform to the governing IS specification for the cell. Required quantity of electrolyte for the initial filling with 10% extra quantity shall be supplied in no-returnable non-degradable acid resistant strong plastic containers.

4.11 Water:

Water used in preparation of electrolyte and also to bring the level of electrolyte to the correct position during the course of operation or testing shall conform to the latest edition of IS-1069

4.12 Terminal Post:

Positive and negative terminal posts of the cells shall be clearly and unmistakably identifiable. Terminal posts shall be designed to accommodate external bolted connections conveniently and positively. All metal parts of the terminals shall be of lead coated type. Bolts, heads and nuts, except seal nuts, shall be hexagonal and shall be lead coated. Terminal posts shall be adequately fixed or removed. The junction between terminal posts and cover and between the cover and container shall be adequately sealed to prevent any seepage of the electrolyte. All terminals shall be provided with insulated covers.

The pole terminal should be of lead with a brass core insert, which shall increase the conductivity. The pole should have a double layered protection against crevice corrosion. The lead lining of the terminal should be protected against any contact with the electrolyte at the place where it emerges out of the cell interior through an injection moulded plastic encapsulation.

5.0 ACCESSORIES (for each set of Battery)

A	Hydrometer	1 Nos
B	Thermometer 0 to 100 degree centigrade with specific gravity correction scale-accuracy<0.5°C	1 No
C	Digital 3-0-3V Cell testing Voltmeter shall be provided with fine scales .Accuracy class shall be 0.5 or better and resistance not less than 1000 ohms	1 No.
D	wall mounting teak-wood for thermo-meters.	1No
E	plastic funnels	1No
F	rubber syphone	1No
G	Stand insulators +5% extra.	Lot
H	Cell insulators +5% extra.	Lot
I	Cell numbering tags with fixing arrangement.	Lot
J	Teakwood, cable clamps with hardware.	Lot
K	Ampere-hour meter[10 hour discharge rate] of 120 –300 AH range	1No
L	Cell interconnectors (extra)	4Nos
M	Fastners for the above	4Nos
n	Junction box with suitable fuse arrangements of adquate rating to be mounted on the battery stands for terminating battery terminals.	1No
O	Suitable wrenches for the Battery Terminals and bolts	1 set
P	Cell lifting straps	1 No
Q	Digital multimeter of repute make-(local makes will not be accepted)	1No

R	load bank of suitable rating with taps for testing for every 5 battery sets supplied	1No
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6.0 VOLTAGE :

The cell voltage shall not exceed 2.25 volts with a continuous low rate floating charge and shall not be less than 1.85 volts at the end of the emergency discharge.

7.0 OPERATION:

The D.C Battery shall be operated without an intentional ground. For indicating the incidence and degree of a ground fault on the D.C control circuitry, the mid point of the battery shall be earthed through an ammeter of high resistance. The high resistance shall be so proportional that the current flowing under the worst earth fault shall not exceed 250 mA.

It should be noted that, the 220V batteries are to be accommodated in the Battery Room and should operate satisfactorily over the entire range of ambient temperature of 0⁰ C to 50⁰ C and relative humidity of 95%.

8.0 General Requirements for Tests

Specific Gravity of Electrolyte:

The specific gravity of fully charged cells shall be adjusted to

1.200+/- 0.005 at 27 deg. C as per the requirement of IS 1651 (latest revision)

Temperature Correction:

The capacity of the cell shall be corrected to 27 deg. C using the

proper temperature correction factor pertaining to the type of the cell and the rate of discharge. The temperature correction should be made using factors supplied by the manufacturer but shall generally conform to some national or international standard for the similar type of cell.

Observations:

The observations, during any test shall be performed as specified in IS 1651 (latest revision)

8.1 Test for Capacity:

The cell shall be tested for its rated capacity output. The fundamental requirement shall be a discharge for 10 hours whilst discharge at other rates, may also be performed.

The capacity output, at the first discharge, corrected to 27 deg.

C shall not be less than 85% of the rated capacity of the cell. The cell shall reach 100% of its rated capacity within 5 charge – discharge cycles.

8.2 Test for Charging Efficiency:

Since the cells are expected to operate at various state of charge (SOC), the charging efficiencies at various depth for discharge needs to be measured and standardized for this application.

The cell appropriate for this application should have the following charging efficiencies:

80% SOC	80%
10% SOC	90%

8.3 Water loss:

The cell/ battery after being fully charged shall be kept on a float charge of 2.4 volts per cell at a temperature of 40 deg. C for 21 days at a stretch. The loss of water due to evaporation and self discharge shall not be more than 0.65 grams per Ah.

The battery shall reach an equilibrium state of charge within 72 hours of such charging. This shall be indicated by the float current after 72 hours of constant float. The float current shall not be more than 3 mA per Ah.

9.0 WOODEN STANDS:

The stand shall be double row double tier for 220V/535Ah Battery.

The stand shall be made of seasoned teakwood as per approval of the drawing. The proposed drawing for double row double tier for 220V/535Ah battery and may be enclosed along with the tender offer. The successful tenderer will be required to supply sufficient quantity of paint in separate containers for applying 3 coats for each stand with 110 cells for 220V/535Ah battery. Tamil Nadu Transmission Corporation Ltd will arrange to paint the stands after satisfying itself

that the stands are made of seasoned teakwood.

9.1 Marking:

Each cell shall be marked to meet the requirements of relevant Indian standards. In addition, each cell shall be legibly numbered serially to identify the cell during manufacture, testing, installation and operation of battery to identify after having assembled into battery bank in battery racks.

Following marking however, shall be provided.

- [i] Manufacturer's name, type and trade mark.
- [ii] Nominal voltage.
- [iii] AH capacity at 10 hours rate with specified end cell voltage.
- [iv] Cell number.
- [v] Upper and lower electrolyte level.
- [vi] Type of positive plate.
- [vii] Type of container.
- [viii] Date of manufacture [month and year] or [week and year].

A set of loose stickers shall be provided to mark the cells position in the assembled battery bank at site so that a cell removed for maintenance can be put back in original position.

10.0 TYPE TEST CERTIFICATE:

The type test certificates for 220V/535Ah battery (Attested xerox copies) as per latest ISS shall be furnished by the tenderer. The initial payment for the materials will be released only after approval of type test certificate from this office.

The bidder shall submit the test reports along with his offer for the following type tests, conducted on the offered samples as per relevant IS within

five years from the date of opening of the bid and test witnessed by any Government Department / Government undertaking..

- a Verification of constructional requirements.
- b Verification of dimensions.
- c Test for capacity.
- d Test for retention of charge.
- e Endurance Test.
- f Ampere-hour and watt-hour efficiency test.
- g Test for voltage during discharge.

If the type test report [s] does/do not meet the requirements

as per this specification, TANTRANSCO at its discretion may ask the supplier to conduct the above type tests [s] at the supplier's cost in the presence of TANTRANSCO's representative without any financial liability to TANTRANSCO.

Special Tests :

The bidder shall submit the test reports alongwith his offer for the following special tests, conducted on the offered samples as per relevant National Standard[s] within five years from the date of opening of the bid and test witnessed by any Government Department / Government undertaking, failing which the offer is liable for rejection.

11.0 ACCEPTANCE/ROUTINE TESTS:

All the acceptance and routine tests as stipulated in the relevant standards shall be carried out by the supplier in the presence of Corporation's representative. The Test Certificates submitted in triplicate for approval before despatch. Following acceptance tests shall be carried out in the presence of TANTRANSCO's officer.

- a) Verification of Dimensions
- b) Verification of marking and packing
- c) Test for capacity and
- d) Test for voltages during discharge & Ampere-hour and watt-hour efficiency test

Immediately after finalisation of the programme of acceptance/ routine tests the supplier shall give sufficient advance intimation at least 15 days in advance to the Corporation to enable to depute its representative for witnessing the tests.

The Purchaser may at his discretion undertake test for capacity and voltage during discharge after installation of the battery at site without any extra cost. The supplier shall arrange for all necessary equipments including the variable resistor, tools, tackles and instruments for the tests. If a battery fails to meet the guaranteed requirement, TANTRANSCO shall have the option of asking the supplier to replace the same within 15 [fifteen] days from the date of declaring the same to be insufficient/failed / not as per the specification [s].

12.0. FACTORY INSPECTION

During the course of manufacture, purchaser's representative shall have the right to expedite and or inspect the materials, workmanship, labour and the progress of manufacture of the equipment on order and may reject any material which is defective or unsuitable for the purpose intended or which is not in accordance with the specification. Supplier, upon demand by the purchaser or his representative, shall remedy or replace such defective or unsuitable material. Supplier shall provide all reasonable inspection facilities to purchaser's inspector. The supplier shall give notice of readiness so that the purchaser's representative may witness such final and acceptance tests before shipment. Purchaser's representative may at any time inspect and copy any or all test data. No material being furnished shall be shipped until factory inspection to the satisfaction of the purchaser and/or his representative had been made. Such inspection and approval shall not relieve the supplier from full responsibility for furnishing equipment, conforming to the requirements of the purchase order nor prejudice any claim, right or privilege which the purchaser may have, because of the use of defective or unsatisfactory equipment, should the inspection be waived by the purchaser, such waiver shall not relieve the supplier in any way from his contractual obligations. All tests required including repeated tests and inspections, that may be necessary owing to the failure to meet any tests specified shall be made at supplier's expense. If the equipment fails to pass the tests specified, purchaser shall have option to reject them. Additional tests shall be made to locate the failure and reconstruction. Testing shall be repeated to prove that the rebuild equipment meets the requirements in all respects.

13.0. DRAWINGS TO BE SUPPLIED ALONG WITH TENDER:

Tenderer shall submit along with the tender the following:

- i) General arrangement of cells and battery assembly.
- ii) General arrangement showing the inter-connections.
- iii) Graphics showing the performance of material
- iv) Drawing for the wooden stand.

- v) Instruction manuals for initial charging and subsequent charging.
 - vi) Pamphlets and technical literature giving detailed information of the batteries offered.
 - vii) The following characteristic curves, to be furnished alongwith the tender.
 - a. Battery discharge curves at various rates between one minute and 10 hour rate.
 - b. Curves showing the relation between the specific gravity and amount of charge in the battery for both charging and discharging conditions.
 - c. Curve of internal resistance at the end of various discharge rates
 - d. Curves showing the relation between cell voltage and charging current when charged at Finishing rate, High starting rate & Two step charging by starting and finishing rate.
- (No block diagrams are acceptable. Tenders are liable for rejection if details schematic drawings are not submitted).

The successful tenderers shall forward within 10 days of issue of purchase order four sets of the drawings for the purchaser's approval. Drawings which are satisfactory for approval on the first submission will be approved and one copy of the approved prints will be returned. The drawing not satisfactory for approval on the first submission will be returned to the supplier for re-submission. The print with such addition shall not be interpreted by the supplier to be approved as noted, unless specifically so noted above on approving signatures.

- a) Drawing showing cell dimension and assembly,
- b) General arrangement showing the inter connections,
- c) Drawing for the wooden stand,

Any shop work done prior to the approval of drawings shall be at the supplier's risk. Supplier shall make any change in the design which are considered necessary to make the equipment conform to the provisions and indent of the purchase order without any additional cost to the purchaser.

The supplier shall supply the purchaser within 15 days of receiving an approved print, one reproducible master print plus two prints of each of the approved drawings. In case the supplier resubmit a revision or change for approval, such resubmission shall be by four prints.

All drawings, part lists, assembly procedures etc., shall bear a readily identifiable number, drawing number etc., and each subsequent revision or addition to the drawing shall be identified by a revision number.

Checking and approval of the above documents by the purchaser is for the benefit of the purchaser and shall not relieve the supplier from full responsibility for ensuring correct interpretation of design, drawings and specifications or for the completeness and accuracy of the shop drawings and relevant specification.

Supplier shall record all deviations, corrections, omissions, changes, etc., occurring throughout the manufacturing, assembly and testing phases.

The Bidder shall also furnish one copy of bound manual along with each set of battery covering erection, commissioning, operation and maintenance instructions in English Language and all relevant information and drawings pertaining to the main equipment as well as auxiliary devices.

Approval of drawings by the Purchaser shall not relieve the supplier of any of his responsibility and liability for ensuring correctness and correct interpretation of the drawings for meeting the requirements of the latest revision of the applicable standards, rules and codes of practices.

The equipment shall conform in all respects to high standards of engineering, design, workmanship and latest revisions of relevant standards at the time of supply and Purchaser shall have the power to reject any material which, in his judgment, is not in full accordance therewith.

All drawings shall be in English Language and in Metric System of units.

The supplier shall also submit three sets of instruction manuals/leaflets/photographs.

SECTION - ~~2A~~ 2B

48 V BATTERY and CHARGERS

TECHNICAL SPECIFICATION FOR LEAD ACID BATTERIES

1.0 The specification provides for the Design, manufacture, testing before despatch and delivery F.O.R.(Destination),Erection and commissioning of 48V/1250 Ah, Tubular type lead-acid stationary batteries in Transparent (SAN) container along with accessories as detailed below:

2.0 APPLICABLE STANDARDS (LATEST REVISION)

- 3.01
- | | |
|------------|--|
| IS-1885: | Electrical vocabulary, secondary cells and batteries |
| IS-1651: | Lead acid batteries with Tubular positive plates. |
| IS-1069: | Water for storage batteries |
| IS-266: | Sulphuric acid for storage batteries |
| IS-8320: | General requirements for methods of tests for lead-acid Storage batteries. |
| IS-6071: | Synthetic separator for lead acid batteries. |
| IEEE-485: | IEEE Recommended practice for sizing of large lead acid Storage batteries for generating stations and substations. |
| IEEE-484: | Recommended practice for design and installation of Storage batteries. |
| IEC 896-1: | Stationary Lead – acid Batteries. |

4.0 DESIGN AND CONSTRUCTIONAL FEATURES OF BATTERY.

4.01 Type

The battery shall be lead acid Tubular type **in Transparent SAN container**. Sealed Maintenance Free VRLA type/ Nickel Cadmium type batteries are not acceptable.

4.02 Positive Plates:

The plates shall be of first class material and workmanship and shall be free from blow-holes, cracks and other imperfections. The tubular positive plates shall consist of a suitable bar with spines cast of suitably alloyed lead to give adequate mechanical strength and minimum electrical resistance.

The tubular spines shall be cast of an alloy of Pb and Antimony with Antimony content not greater than 3% by weight. The casting shall be done using proper controlled procedure preferably using high pressure casting machine with an operating pressure not less than 90-100 Bars. Low antimony alloy (not greater than 3%) will ensure low water loss and a guaranteed topping up frequency of not more than once in 6 months. High pressure cast spines will ensure a long life and trouble-free operation.

Porous, acid resistant and oxidation resistant tubes shall be inserted one over each spine. After insertion, the tube shall be adequately filled and packed with active material (preferable through a rotary shaking machine) before their lower ends are closed by common plastic bar. The construction and material of tube shall be such as to reduce the loss of active material and shall be able to withstand normal internal stresses developed during service.

4.03 Negative Plates:

The negative plates shall be of flat pasted type. The pasting shall be done on an automated machine for better control of process parameters. It should have adequate mechanical strength and would be so designed that active material is maintained in intimate contact with the grid under normal working conditions throughout the life of the battery. Lead antimony alloy grid with maximum 3% antimony content or lead calcium alloy grid shall be used.

4.04 Separators:

The separators shall be microporous polyethylene envelope type to

avoid direct as well as side shorts. It should be acid resistant, chemically inert and should have excellent oxidation resistance and high degree of porosity to ensure minimum internal resistance. The average pore size shall be **less than 1 micron**. It should not exhibit any tendency to swell or shrink at temperature encountered during operation. Micro porous synthetic separators shall conform to latest IS:6071. The internal resistance factor of the separators shall assure high discharge characteristics under all operating conditions. Proper arrangement to keep end plates in position shall be furnished by the bidder along with his offer.

Buffers/spring: Suitable buffers / springs shall be provided in the cells to keep the end plates in position. These shall have adequate length and strength.

4.05 Containers:

Containers shall preferably be made of **transparent SAN** (styrene acrylonitrile) **copolymer** giving excellent clarity, outstanding chemical resistance, rigidity and toughness with very high insulating qualities which eliminate the need for separate cell insulators. It shall have adequate mechanical strength to prevent bulging, cracking etc, during the life span of battery when operating under expected temperature range and due to action of static and dynamic loads and the action of electrolyte. These containers should enable the electrolyte level and the cell condition to be monitored at a glance. The containers shall conform to latest edition of applicable standards. A copy of such standard in English shall be enclosed along with the offer. Battery containers shall be subjected to type, Routine and Acceptance Tests as per the requirements of applicable standards. The containers of the label attached firmly to the containers shall be marked with the information as per requirements of the above standard. The supplier's manufacturer's test certificates shall be submitted by the tenderer for the scrutiny of the purchaser.

4.06 Cell Lids:

It should be moulded from **opaque SAN** and sealed to the container. It should be easily removable if the need arises Terminal post shall be suitably sealed at the lid to prevent escape of acid spray, by means of rubber grommets, sealing compound or other suitable device. The positive and negative terminal posts shall be clearly and indelibly marked for easy identification.

4.07 Microporous Ceramic Vent Plugs: The vent plugs should be specially designed incorporating a microporous ceramic filter which effectively returns all acid spray to the cell, but allow free exit of oxygen and hydrogen which is generated at the end of boost charging. On removal, the plugs shall permit drawing of the electrolyte sample for servicing and of checking of the electrolyte level. The vent plug should preferably be flame retardant type to prevent any fire hazard in the battery room.

4.08 Connectors:

Connectors shall be of lead plated copper. The lead coating shall be adequate and tenacious. Minimum thickness of lead coating shall be **50 microns**.

Connectors should be adequately designed to carry maximum duty cycle as specified and shall offer minimum resistance. The current density for copper connectors shall not be more than 1.5 Amps/ Sq.mm. While considering the terminal voltage of the cell at the time of testing for discharge, the voltage drop due to inter-row and inter-cell connectors shall be considered. Connectors shall be adequately designed to withstand various stresses due to temperature changes, attack of acid and dynamic forces that could occur during the operation of the battery. Necessary transparent shrouds to cover all the inter row, inter cell and terminal connectors shall be provided. The cross section of cell connectors should not less than 75 sqmm for 48V.

4.09 Fasteners :Fasteners shall be of high tensile steel with lead coatings should be provided.

4.10 Electrolyte:

The electrolyte shall be battery grade sulphuric acid conforming to latest edition of relevant IS 266. The strength of the electrolyte in the cell during operation shall conform to the governing IS specification for the cell. Required quantity of electrolyte for the initial filling with 10% extra quantity shall be supplied in no-returnable non-degradable acid resistant strong plastic containers.

4.11 Water:

Water used in preparation of electrolyte and also to bring the level of electrolyte to the correct position during the course of operation or testing shall conform to the latest edition of IS-1069

4.12 Terminal Post:

Positive and negative terminal posts of the cells shall be clearly and unmistakably identifiable. Terminal posts shall be designed to accommodate external bolted connections conveniently and positively. All metal parts of the terminals shall be of lead coated type. Bolts, heads and nuts, except seal nuts, shall be hexagonal and shall be lead coated. Terminal posts shall be adequately fixed or removed. The junction between terminal posts and cover and between the cover and container shall be adequately sealed to prevent any seepage of the electrolyte. All terminals shall be provided with insulated covers.

The pole terminal should be of lead with a brass core insert, which shall increase the conductivity. The pole should have a double layered protection against crevice corrosion. The lead lining of the terminal should be protected against any contact with the electrolyte at the place where it emerges out of the cell interior through an injection moulded plastic encapsulation.

5.0 ACCESSORIES (for each set of Battery)

A	Hydrometer	1 Nos
B	Thermometer 0 to 100 degree centigrade with specific gravity correction scale-accuracy<0.5°C	1 No
C	Digital 3-0-3V Cell testing Voltmeter shall be provided with fine scales .Accuracy class shall be 0.5 or better and resistance not less than 1000 ohms	1 No.
D	wall mounting teak-wood for thermo-meters.	1No
E	plastic funnels	1No
F	rubber syphone	1No
G	Stand insulators +5% extra.	Lot
H	Cell insulators +5% extra.	Lot
I	Cell numbering tags with fixing arrangement.	Lot
J	Teakwood, cable clamps with hardware.	Lot
K	Ampere-hour meter[10 hour discharge rate] of 120 –300 AH range	1No
L	Cell interconnectors (extra)	4Nos
M	Fastners for the above	4Nos
n	Junction box with suitable fuse arrangements of adquate rating to be mounted on the battery stands for terminating battery terminals.	1No
O	Suitable wrenches for the Battery Terminals and bolts	1 set
P	Cell lifting straps	1 No

Q	Digital multimeter of reputed make-(local makes will not be accepted)	1No
R	load bank of suitable rating with taps for testing for every 5 battery sets supplied	1No

6.0 VOLTAGE :

The cell voltage shall not exceed 2.25 volts with a continuous low rate floating charge and shall not be less than 1.85 volts at the end of the emergency discharge.

7.0 OPERATION:

The D.C Battery shall be operated without an intentional ground. For indicating the incidence and degree of a ground fault on the D.C control circuitry, the mid point of the battery shall be earthed through an ammeter of high resistance. The high resistance shall be so proportional that the current flowing under the worst earth fault shall not exceed 250 mA.

It should be noted that, the ~~220V~~^{48V} batteries are to be accommodated in the Battery Room and should operate satisfactorily over the entire range of ambient temperature of 0° C to 50° C and relative humidity of 95%.

8.0 General Requirements for Tests

Specific Gravity of Electrolyte:

The specific gravity of fully charged cells shall be adjusted to 1.200+/- 0.005 at 27 deg. C as per the requirement of IS 1651 (latest revision)

Temperature Correction:

The capacity of the cell shall be corrected to 27 deg. C using the proper temperature correction factor pertaining to the type of the cell and the rate of discharge. The temperature correction should be made using factors supplied by the manufacturer but shall generally conform to some national or international standard for the similar type of cell.

Observations:

The observations, during any test shall be performed as specified in IS 1651 (latest revision)

8.1 Test for Capacity:

The cell shall be tested for its rated capacity output. The fundamental requirement shall be a discharge for 10 hours whilst discharge at other rates, may also be performed.

The capacity output, at the first discharge, corrected to 27 deg.

C shall not be less than 85% of the rated capacity of the cell. The cell shall reach 100% of its rated capacity within 5 charge – discharge cycles.

8.2 Test for Charging Efficiency:

Since the cells are expected to operate at various state of charge (SOC), the charging efficiencies at various depth for discharge needs to be measured and standardized for this application.

The cell appropriate for this application should have the following charging efficiencies:

80% SOC	80%
10% SOC	90%

8.3 Water loss:

The cell/ battery after being fully charged shall be kept on a float charge of 2.4 volts per cell at a temperature of 40 deg. C for 21 days at a stretch. The loss of water due to evaporation and self discharge shall not be more than 0.65 grams per Ah.

The battery shall reach an equilibrium state of charge within 72 hours of such charging. This shall be indicated by the float current after 72 hours of constant float. The float current shall not be more than 3 mA per Ah.

9.0 WOODEN STANDS:

The stand shall be double row double tier for 48V/1250 Ah Battery.

The stand shall be made of seasoned teakwood as per approval of the drawing. The proposed drawing for double row double tier for 48V/1250 Ah battery and may be enclosed along with the tender offer. The successful tenderer will be required to supply sufficient quantity of paint in separate containers for applying 3 coats for each stand with 24 cells for 48V/1250 Ah battery. Tamil Nadu Transmission Corporation Ltd will arrange to paint the stands after satisfying itself that the stands are made of seasoned teakwood.

9.1 Marking:

Each cell shall be marked to meet the requirements of relevant Indian standards. In addition, each cell shall be legibly numbered serially to identify the cell during manufacture, testing, installation and operation of battery to identify after having assembled into battery bank in battery racks.

Following marking however, shall be provided.

- [i] Manufacturer's name, type and trade mark.
- [ii] Nominal voltage.
- [iii] AH capacity at 10 hours rate with specified end cell voltage.
- [iv] Cell number.
- [v] Upper and lower electrolyte level.
- [vi] Type of positive plate.
- [vii] Type of container.
- [viii] Date of manufacture [month and year] or [week and year].

A set of loose stickers shall be provided to mark the cells position in the assembled battery bank at site so that a cell removed for maintenance can be put back in original position.

10.0 TYPE TEST CERTIFICATE:

The type test certificates for 48V/1250 Ah battery (Attested xerox copies) as per latest ISS shall be furnished by the tenderer. The initial payment for the materials will be released only after approval of type test certificate from this office.

The bidder shall submit the test reports along with his offer for the following type tests, conducted on the offered samples as per relevant IS within five years from the date of opening of the bid and test witnessed by any Government Department / Government undertaking..

- h Verification of constructional requirements.
- i Verification of dimensions.
- j Test for capacity.
- k Test for retention of charge.
- l Endurance Test.
- m Ampere-hour and watt-hour efficiency test.
- n Test for voltage during discharge.

If the type test report [s] does/do not meet the requirements as per this specification, TANTRANSCO at its discretion may ask the supplier to conduct the above type tests [s] at the supplier's cost in the presence of TANTRANSCO's representative without any financial liability to TANTRANSCO.

Special Tests :

The bidder shall submit the test reports alongwith his offer for the following special tests, conducted on the offered samples as per relevant National Standard[s] within five years from the date of opening of the bid and test witnessed by any Government Department / Government undertaking, failing which the offer is liable for rejection.

11.0 ACCEPTANCE/ROUTINE TESTS:

All the acceptance and routine tests as stipulated in the relevant standards shall be carried out by the supplier in the presence of Corporation's representative. The Test Certificates submitted in triplicate for approval before despatch. Following acceptance tests shall be carried out in the presence of TANTRANSCO's officer.

- a) Verification of Dimensions

- b) Verification of marking and packing
- c) Test for capacity and
- d) Test for voltages during discharge & Ampere-hour and watt-hour efficiency test

Immediately after finalisation of the programme of acceptance/ routine tests the supplier shall give sufficient advance intimation at least 15 days in advance to the Corporation to enable to depute its representative for witnessing the tests.

The Purchaser may at his discretion undertake test for capacity and voltage during discharge after installation of the battery at site without any extra cost. The supplier shall arrange for all necessary equipments including the variable resistor, tools, tackles and instruments for the tests. If a battery fails to meet the guaranteed requirement, TANTRANSCO shall have the option of asking the supplier to replace the same within 15 [fifteen] days from the date of declaring the same to be insufficient/failed / not as per the specification [s].

12.0. FACTORY INSPECTION

During the course of manufacture, purchaser's representative shall have the right to expedite and or inspect the materials, workmanship, labour and the progress of manufacture of the equipment on order and may reject any material which is defective or unsuitable for the purpose intended or which is not in accordance with the specification. Supplier, upon demand by the purchaser or his representative, shall remedy or replace such defective or unsuitable material. Supplier shall provide all reasonable inspection facilities to purchaser's inspector. The supplier shall give notice of readiness so that the purchaser's representative may witness such final and acceptance tests before shipment. Purchaser's representative may at any time inspect and copy any or all test data. No material being furnished shall be shipped until factory inspection to the satisfaction of the purchaser and/or his representative had been made. Such inspection and approval shall not relieve the supplier from full responsibility for furnishing equipment, conforming to the requirements of the purchase order nor prejudice any claim, right or privilege which the purchaser may have, because of the use of defective or unsatisfactory equipment, should the inspection be waived by the purchaser, such waiver shall not relieve the supplier in any way from his contractual obligations. All tests required including repeated tests and inspections, that may be necessary owing to the failure to meet any tests specified shall be made at supplier's expense. If the equipment fails to pass the tests specified, purchaser shall have option to reject them. Additional tests shall be made to locate the failure and reconstruction. Testing shall be repeated to prove that the rebuild equipment meets the requirements in all respects.

13.0. DRAWINGS TO BE SUPPLIED ALONG WITH TENDER:

Tenderer shall submit along with the tender the following:

- i) General arrangement of cells and battery assembly.
 - ii) General arrangement showing the inter-connections.
 - iii) Graphics showing the performance of material
 - iv) Drawing for the wooden stand.
 - v) Instruction manuals for initial charging and subsequent charging.
 - vi) Pamphlets and technical literature giving detailed information of the batteries offered.
 - vii) The following characteristic curves, to be furnished alongwith the tender.
 - a. Battery discharge curves at various rates between one minute and 10 hour rate.
 - b. Curves showing the relation between the specific gravity and amount of charge in the battery for both charging and discharging conditions.
 - c. Curve of internal resistance at the end of various discharge rates
 - d. Curves showing the relation between cell voltage and charging current when charged at Finishing rate, High starting rate & Two step charging by starting and finishing rate.
- (No block diagrams are acceptable. Tenders are liable for rejection if details schematic drawings are not submitted).

The successful tenderers shall forward within 10 days of issue of purchase order four sets of the drawings for the purchaser's approval. Drawings which are satisfactory for approval on the first submission will be approved and one copy of the approved prints will be returned. The drawing not satisfactory for approval on the first submission will be returned to the supplier for re-submission.

SECTION – 3

GENERAL TECHNICAL REQUIREMENTS

3.0 FOREWORD

The provisions under this section are intended to supplement general requirements for the materials, equipment's and services covered under other sections.

3.1 PROJECT INFORMATION AND SYSTEM PARAMETERS

a) Customer : M/s Tamil Nadu Transmission Corporation Limited

b) Project Title : 765/400KV AIS SUB STATION AT ARIYALUR

c) Transport facilities : Road/Rail

Physical and other parameters:

3.1.1 Location of the substation

3.1.2 Nearest Railway station : Tindivanam
Railway : Southern Railway

3.1.3 Meteorological data

- | | |
|---|----------------|
| (i) Atmosphere | : Polluted |
| (ii) Maximum ambient temperature | : 50°C |
| (iii) Minimum ambient temperature | : 20°C |
| (iv) Maximum daily average ambient air temperature | : 45° C |
| (v) Maximum yearly average ambient air temperature | : 32° C |
| (vi) Maximum Humidity (%) | : 100% |
| (vii) Average thunder storm days per annum | : 50 |
| (viii) Average rainy days per annum | : 65 |
| (ix) Average annual rainfall (mm) | : 750 mm |
| (x) No. of months during which tropical monsoon condition prevail | : 3 |
| (xi) Maximum wind pressure | : 150 Kgf/Sqmm |
| (xii) Altitude above MSL | : <1000M |

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(xii) Basic Wind Speed

: 39 m/s (Zone -2)

However for design purpose, ambient temperature should be considered as 50° C and relative humidity as 100%.

3.1.4 System Parameter

SL No	Description of parameters	765kV System	400 kV System
1.	System operating Voltage	765kV	400k V
2.	Maximum operating voltage of the system(rms)	800kV	420k V
3.	Rated Frequency	50HZ	50H
4.	Number of Phases	3	3
5.	Rated Insulation Levels (i)Full wave impulse withstand voltage.(1.2 to 50 micro sec) (ii)Switching impulse withstand voltage(250/2500 micro sec) dry and wet. (iii) One minute power frequency dry withstand voltage (rms)frequency dry withstand voltage (rms)	2100kVp 1550kVp 830kV	1550kVp 1050kVp 630kV
6.	Corona extinction voltage	508kV	320kV
7.	Max. radio interference voltage for frequency between 0.5 MHz and 2 MHz at 508 kV rms for 765kV, and 266kV rms for 400kV system	2500 microvolts	1000 microvolts
8.	Minimum creepage distance (25mm/kV)	20000 mm	10500 mm
9.	Rated short circuit current for 1 sec. Duration	50kA	63kA
10.	System neutral earthing	Effectively earthed	Effectively earthed
11.	Seismic acceleration	0.3g horizontal	0.3g horizontal
12.	Plinth level of switchyard	300mm above FGL	300mm above FGL

3.1.5 AUXILIARY POWER SUPPLY:

Auxiliary electrical equipment's maintenance equipment's etc., shall be suitable for operation on the following supply system.

3 phase AC Supply	415V, 3 phase 4 wire 50 Hz, neutral grounded AC supply -10% to +10%, frequency +/- 5%
1 phase AC supply	240V, single phase, 50 Hz neutral grounded AC supply
DC supply	220, 2 wire DC supply + 10% to -15%, Ungrounded 48V, 2 wire DC supply , Positively earthed

3.2 GENERAL REQUIREMENT

3.2.0 ALL THE EQUIPMENTS / MATERIALS TO BE SUPPLIED SHOULD BE IN ACCORDANCE WITH RELEVANT LATEST / AMENDED IS/IEC, WHETHER IT HAS BEEN SPECIFICALLY MENTIONED IN THE SPECIFICATION OR NOT.

3.2.1 The bidder shall also furnish drawings for the following:

All EQUIPMENTS and type of clamps, fittings hardware's, insulators, bus bar . These designs / drawing shall be got approved by the purchaser before commencing the manufacture / construction / erection and are to be as per latest IS /IEC.

3.2.2 GENERAL:

The bidder shall be fully responsible for providing all equipment, materials system and services specified or otherwise which are required to complete the construction and successful commissioning of the substation in all respects.

Any other items not specifically mentioned in the specification but which are required for erection of materials/equipment under the scope of work, testing and commissioning are deemed to be included in the scope of the specification unless specifically excluded.

All items shall be supplied as per schedule and as specified in the relevant Indian standard of latest revision. The Technical specification of the main materials/equipment is furnished. The Technical specification contained herein for the materials are for the guidance of the tenderer.

The bidders are requested to procure the equipment's/materials/component only from reputed /qualified manufacturer as per Technical requirement stipulated in Section - I of Technical specifications. Approval of make of item shall be taken up by vendor from TANTRANSCO himself.

3.3 SPECIFIC REQUIREMENT

The bidder shall furnish make/manufacturer, catalogues, engineering data, technical information, design documents, drawings etc., fully in conformity with the technical specification and get approval from competent authority before commencement of any work.

All steel materials, other than materials for earthing should be of galvanized if not specified.

3.4 STANDARD:

The works covered by the specification shall be designed, engineered, manufactured, built, tested and commissioned in accordance with the Acts, Rules, Laws and Regulations of India.

The equipment to be furnished under this specification shall conform to latest issue with all amendments (as on the date of bid opening) of standards specified in each section.

The Bidder shall note that standards mentioned in the specification are not mutually exclusive or complete in themselves, but intended to compliment each other.

The Bidder shall also note that list of standards presented in this specification is not complete. Whenever necessary the list of standards shall be considered in conjunction with specific IS/IEC. When the specific requirements stipulated in the specifications exceed or differ than those required by the applicable standards, the stipulation of the specification shall take precedence.

3.5 TYPE TEST:

The Type Test for all the equipments/materials used for this project should have been conducted in any approved Government/Govt. recognized laboratories conforming to latest IS/IEC. The above type test certificates should accompany the drawings of the materials equipments, duly signed under seal by the Institution, who have issued the type test certificate. The above type test should have been conducted not earlier than Ten years , subject to no change in design as on the originally scheduled date of technical bid opening i.e. **30.09.2016**

In case the type tests were conducted earlier than 10 (ten) years prior to the originally scheduled date of bid opening, the contractor shall repeat these test (s) at no extra cost to the purchaser.

However, in case of instrument transformers, the following type tests should have been conducted within 5 (five) years prior to the originally scheduled date of bid opening.

- i) Lightning Impulse Test
- ii) Switching Impulse Test
- iii) Multiple Chopped Impulse Test (For CT)
- iv) Chopped Impulse Test (For CVT)

In case the test reports are of these tests (for instrument transformers) as mentioned above are conducted earlier than 5 (five) years prior to the originally scheduled date of bid opening, the contractor shall repeat these test(s) at no extra cost to the BHEL. The original type test certificates shall be furnished for verification on request.

TANTRANSCO/BHEL reserves the right to demand repetition of some or all the type tests in the presence of purchaser's representative at no extra cost.

Non furnishing of type test certificates by the tenderers, will be liable for rejection.

3.6 MATERIALS AND WORKMANSHIP:

All the materials shall be of the best class and capable of satisfactory operation in the tropics with humid atmosphere conditions. Unless otherwise specified, they shall conform to the requirements of the appropriate ISS/IEC. The workmanship shall be of the best grade and the entire construction in accordance with the best modern practice.

The equipment shall be designed to facilitate inspection and repairs and to ensure satisfactory operation under atmosphere condition prevailing at site and under such sudden variation of load and voltage as may be met with under working conditions in the system including those due to faulty synchronizing and short circuit within the rating of the apparatus.

The design shall incorporate every reasonable precaution and provision for the safety of all those concerned in the operation and maintenance of the equipment.

All the equipment's should operate without undue vibration and with the least practicable amount of noise.

3.7 **INSPECTION**:

The inspection may be carried out by the TANTRANSCO/BHEL at any stage of manufacture. The supplier shall grant free access to TANTRANSCO's/BHEL representative at a reasonable time when the work is in progress. The TANTRANSCO/BHEL shall have access at all times to the works and all other places of manufacture/fabrication, where the equipments are being manufactured/fabricated and the bidder shall provide TANTRANSCO's/BHEL representative all facilities for unrestricted inspection of the works, raw materials, manufacture of all the accessories and for conducting necessary tests.

Inspection and acceptance of any equipment under this specification by the TANTRANSCO/BHEL shall not relieve the supplier of his obligation of furnishing equipment in accordance with the specification and shall not prevent subsequent rejection if the equipment is found to be defective. The supplier shall keep the TANTRANSCO/BHEL informed in advance, about the manufacturing programme so that arrangement can be made for inspection.

The TANTRANSCO/BHEL, reserves the right to insist for witnessing the acceptance/routine testing of the bought out items. No material shall be dispatched from its point of manufacture unless the material has been satisfactorily inspected and tested.

The correct grade and quality of steel shall be used by the supplier. To ascertain quality of steel, the TANTRANSCO/BHEL may at his discretion get the material tested at an approved laboratory.

The bidder shall take an account the fabrication wastage while quoting the rates. The Employer will not accept any liability in connection with the wastage of steel during fabrication or otherwise. Steel shall be procured exclusively from the main producers. However, sections not rolled by main produces can be procured from reroller, provided rerolling of structural steel section is done from billets/ingots of tested quality. Rerolled sections are duly tested as per relevant standards. Supplier should obtain approval of list of primary producers of Steel and Zinc before Proto assembly.

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The BHEL/TANTRANSCO or his representative shall have the right to inspect and/or test the goods /works to confirm their conformity to the supplier. BHEL/TANTRANSCO shall notify the supplier in writing of the identity of any representatives authorized for these purposes.

The inspections and tests may be conducted on the premises of the supplier or his Sub vendor at the point of delivery and /or at the goods' final destination. Where tests are conducted in the premises of Supplier, all reasonable facility and assistance including access to drawings and production data shall be furnished at no charge to the BHEL.

Should any inspected or tested goods fail to conform to specifications, the BHEL/TANTRANSCO may reject them and the supplier shall either replace the rejected goods or make all alterations necessary to meet specification requirements free of cost to the BHEL/TANTRANSCO within one week of intimation.

The BHEL/TANTRANSCO's right to inspect, test and where necessary reject the goods after the goods; arrival at the site, shall in no way be limited or waived by reason of the goods having been previously inspected. Tested and passed by the BHEL/TANTRANSCO or his representative prior to the goods dispatch.

Not less than 15 (Fifteen) days advance intimation shall be given about the quantity of materials that will be ready for inspection by the officers of TANTRANSCO/ BHEL/Third agency authorized by the Corporation. The materials should not be dispatched without instruction from the Corporation.

3.8 GUARANTEE:

The supplier shall guarantee that the goods under the Contract are new, unused of the most recent or current models and incorporated all recent improvements in design and materials unless provided otherwise in the Contract. The supplier shall further guarantee that the goods supplied under this Contract shall have no defects arising from design, materials or workmanship, installation and erection, if that may develop under normal use of the supplied goods. The supplier shall also guarantee the performance of the works executed by him including the performance of all the materials/goods supplied by him.

BHEL shall promptly notify supplier in writing of any claims arising under guarantee in respect of goods. Upon receipt of such notice, the supplier shall, with all reasonable speed, repair or replace the defective works or parts thereof, free of cost at site. All the expenses towards transportation of defective parts to supplier's works and of repaired/replaced parts to site shall be borne by the Supplier.

If the Supplier, having been notified, fails to remedy the defects within 14 days, the BHEL will proceed to take such remedial action as may be necessary, at the supplier's risk and expenses. All expenses in this regard will be recovered from Supplier.

3.9 PRE COMMISSIONING TESTING (if applicable) :-

On completion of erection of equipment's and before charging each item of equipment's shall be thoroughly cleaned and inspected jointly by the TANTRANSCO and the BHEL for correctness and completeness of installation and acceptability for charging leading to initial pre commissioning test. The pre commissioning testing to be carried all equipment's in the presence of BHEL/ TANTRANSCO. Necessary tools, testing kits to be arranged by the Supplier.

3.10 DOCUMENTATION : All drawings shall conform to relevant international standards Organization (ISO) specification. All drawings shall be in ink and suitable for micro filming. All dimensions and data shall be in S.I. units.

3.11 PAINTING, GALVANISING:

All interiors and exteriors of all metal parts shall be thoroughly cleaned to remove all rust, scales, corrosion, greases or other adhering foreign matter and the surfaces treated by phosphating (e.g. seven tank phosphating sequences).

All metal surfaces exposed to atmosphere shall be given, in addition to the treatment, two primer coats of zinc chromate and two coats of epoxy paint with epoxy base thinner. All metal parts not accessible for painting shall be made of corrosion resisting material. All machine finished or bright surfaces shall be coated with a suitable preventive compound and suitably wrapped or otherwise protected. All paints shall be carefully selected to withstand tropical heat and extremes of weather within the limits specified. The paint shall not scale off or wrinkle or be removed by abrasion due to normal handling. All external paintings shall be as per shade **No.697/631 of IS-5.**

Paint inside the metallic housing shall be of anti condensation type and the paint on outside surfaces shall be suitable for outdoor installation.

All components shall be given adequate treatment of climate proofing as per **IS: 3202** so as to withstand corrosive and several service conditions.

All ferrous parts including all sizes of nuts, bolts, support channel structures, etc. as also the mechanism housing shall be hot dip galvanized conforming to latest version of IS : 2629 or epoxy painted. Spring washers shall be electro-galvanised.

All members of the structure members shall be hot dipped galvanised with a zinc coating of **610 gms. per square metre** . Galvanising shall be done after a work is completed, except that the nuts may be tapped or rerun after galvanization. The zinc coating shall be smooth, clean, of uniform thickness and free from defects. The preparation for galvanising itself shall not adversely affect the mechanical properties of the coated materials. The employer shall be at liberty to have the samples of zinc used, test checked in any laboratory at his own cost and reject the particular supply if it is below standard.

All galvanised material shall withstand test as per IS 2633-1972 or any other equivalent standard. The zinc used for galvanising fabricated material shall be of high grade Electrolytic zinc of 99.99% purity.

All nuts and pins shall be adequately locked. Nuts, bolts and pins used inside the transformer and tap-changer compartment where gaskets are not used shall be provided with spring washers or locknuts. Where galvanizing is specified, it shall be applied by the hot dipped process or by electro-galvanizing process and for all parts, other than steel wires, shall consist of a thickness of zinc coating equivalent to not less than 610gm of zinc per square meter of surface. The zinc coating shall be smooth, of uniform thickness and free from defects.

3.12 SURFACE FINISH

All interiors and exteriors of tanks, control cubicles and other metal parts shall be thoroughly cleaned to remove all rust, scales, corrosion, greases or other adhering foreign matter. All steel surfaces in contact with insulating oil as far as accessible, shall be painted with not less than two coats of heat resistant, oil insoluble, insulating paints.

All metal surfaces exposed to atmosphere shall be given two primer coats of zinc chromate and two coats of epoxy paint with epoxy base thinner. All metal parts not accessible for painting shall be made of corrosion resisting material. All machine finished or bright surfaces shall be coated with a suitable preventive compound and suitably wrapped or otherwise protected. All paints shall be carefully selected to withstand tropical heat and extremes of weather within the limit specified. The paint shall not scale off or wrinkle or be removed by abrasion due to normal handling.

3.13 PROTECTION

All coated surfaces shall be protected against abrasion, impact, discoloration and any other damages. All exposed threaded portions shall be suitably protected with either a metallic or a non-metallic protecting device. All ends of all valves, pipings and conduit equipment connections shall be properly sealed with suitable devices to protect them from damage.

All equipment accessories and wiring shall have fungus protection, involving special treatment of insulation and metal against fungus, insects and corrosion. The parts which are likely to get rusted, due to exposure to weather should also be properly treated and protected in a suitable manner. Screens of corrosion resistant material shall be furnished on all ventilating louvers to prevent entry of insects.

3.14 FUNGI-STATIC VARNISH

Besides the space heaters, special moisture and fungus resistant varnish shall be applied on the parts, which may be subjected or predisposed to the formation of fungi due to the presence or deposit of nutrient substances. The varnish shall not be applied to any surface of part where the treatment will interface with the operation or performance of the equipment. Such surfaces or parts shall be protected against the application to the varnish.

3.15 DEGREE OF PROTECTION

The supplier shall propose following Degree of protection for those equipment/Items for which the degree of protection has not been specified in the specification for the approval of BHEL/TANTRANSCO. The decision of BHEL/TANTRANSCO shall be final. The enclosures of the Control Cabinets, Junction boxes and Marshalling boxes panels etc to be installed shall be provided with degree of protection as detailed here under:

- a) Installed outdoor: IP-55
- b) Installed indoor in air conditioned area: IP-42
- c) Installed in covered area IP:52
- d) For LT switchgear (AC & DC distribution Boards): IP-54

The degree of protection shall be in accordance with IS:13947, (Part-1)/IEC-947(Part-1). Type test report/or degree of protection test on each type of the box shall be submitted for approval.

3.16 RATING PLATES, NAME PLATES AND LABELS :-

The equipment's shall be provided with a rating plate or plates marked with but not limited to following data whatever needs to that particular equipment's.

- (a) Manufacturer's name or trade mark.
- (b) Serial number and type design making it possible to get all relevant information from the manufacturer.
- (c) Year of manufacture.
- (d) Rated voltage
- (e) Rated insulation level.
- (f) Rated frequency
- (g) Rated Normal current.
- (h) Rated short circuit breaking current
- (i) First pole to clear factor
- (j) Rated duration of short circuit
- (k) Rated auxiliary D.C. supply voltage of closing and opening devices.
- (l) Rated pressure of SF6 gas for operation and interruption.
- (m) Rated out of phase breaking current.
- (n) Rated supply voltage of auxiliary circuit.
- (o) Rated supply frequency of auxiliary circuits.
- (p) Purchase Order Number and Date.

The rating plate shall be visible in position of normal service and installation.

The rating plate shall be weather proof and corrosion proof.

Type or serial number together with details of the loading conditions under which the item of the substation in question has designed to operate and such diagram plates as may be required by the BHEL/TANTRANSCO. The rating plate for each equipment shall be according to IEC requirements.

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Alternately two separate plates one with Hindi and other with English inscriptions may be provided. During approvals drawings of Rating/name plates/labels shall also be submitted.

3.17 EARTHING :

The operating mechanism housing, control cabinets, support structure etc. shall be provided with two separate earthing terminals suitable for bolted connection to 50x8mm mild steel flat to be provided for connection to station earth mat.

Circuit breakers, LA, Isolator, CVT, CT, BPI shall be provided with two grounding pads suitable for connection to galvanized steel flat of Size 75X12 mm. Control panels, Relay panel, outdoor marshalling boxes, Junction boxes, Lighting panels and distribution board shall be provided with two grounding pads, for connection to galvanized steel flat. The two pads shall be provided, one each at the middle of the two opposite sides of the bottom frame of the equipment. Earthing of hinged door shall be done by using a separate earth wire.

3.18 TERMINAL BLOCKS AND WIRING

Control and instrument leads from the switchboards or from other equipment will be brought to terminal boxes or control cabinets in conduits. All Inter-phase and external connections to equipment or to control cubicles will be made through terminal blocks.

Terminal blocks shall be 1100 V grade and have continuous rating to carry the maximum expected current on the terminals. Those shall be of moulded piece complete with insulated barriers stud type terminals, washers, nuts and lock nuts. Screw clamp, overall insulated, insertion type, rail mounted terminals can be used in place of stud type terminals. But preferably the terminal blocks shall be non-disconnecting stud type equivalent to Elmex type CATM4, Phoenix cage clamp type of Wedge or equivalent. The Insulating material of terminal block shall be nylon 6.6 which shall be free of halogens, fluorocarbons etc.

Terminal block for current transformer and voltage transformer secondary leads shall be provided with test links and isolating facilities. The current transformer secondary leads shall also be provided with short circuiting and earthing facilities.

The terminal shall be that maximum contact area is achieved when a cable is terminated. The terminal shall have a locking characteristic to prevent cable from escaping from the terminal clamp unless it is done intentionally. The conducting part in contact with cable shall preferably be tinned or silver plated however Nickel plated copper or zinc plated steel shall also be acceptable. The terminal blocks shall be of extensible design. The terminal blocks shall have locking arrangement to prevent its escape from the mounting rails.

The terminal blocks shall be fully enclosed with removable covers of transparent, non-deteriorating type plastic material. Insulating barriers shall be provided between the terminal blocks. These barriers shall not hinder the operator from carrying out the wiring without removing the barriers.

Unless otherwise specified terminal blocks shall be suitable for connecting the following conductors on

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each side.

All circuits except CT circuits :	Minimum of 2 nos. of 2.5 sq.mm.copper flexible.
All CT circuits :	Minimum of 4 nos. of 2.5 sq.mm, copper flexible.

The arrangements shall be in such a manner so that it is possible to safely connect or disconnect terminals on live circuits and replace fuse links when the cabinet is live. At least 20 % spare terminals shall be provided on each panel/cubicle/box and these spare terminals shall be uniformly distributed on all terminals rows.

There shall be a minimum clearance of 250mm between the first bottom row of terminal block and the associated cable gland plate. Also the clearance between two rows of terminal blocks shall be a minimum of 150 mm. The Supplier shall furnish all wire, conduits and terminals for the necessary inter-phase electrical connection (where applicable) as well as between phases and common terminal boxes or control cabinets.

All input and output terminals of each control cubicle shall be tested for surge withstand capability in accordance with the relevant IEC Publications, in both longitudinal and transverse modes. The supplier shall also provide all necessary filtering, surge protection, interface relays and any other measures necessary to achieve an impulse withstand level at the cable interfaces of the equipment.

TB sizes for incoming power supply shall be informed/confirmed during drawing approval stage.

3.19 CONTROL CABINETS, JUNCTION BOXES, TERMINALS BOXES AND MARSHALLING BOXES FOR OUTDOOR EQUIPMENTS

All types of boxes, cabinets etc. shall generally conform to and be tested in accordance with IS-5039, IS-8623 or IEC-439, as applicable and the clause given below.

Control cabinet, Junction boxes, Marshalling boxes & Terminal boxes shall be made of sheet steel. Sheet steel used shall be at least 2.0 mm thick cold rolled or 2.5 mm hot rolled. The box shall be properly braced to prevent wobbling. There shall be sufficient reinforcement to provide level surfaces, resistance to vibrations and rigidity during transportation and installation. Cabinet/boxes shall be free standing floor mounting type, wall mounting type or pedestal mounting type as per requirements.

Cabinet /boxes shall be provided with double hinged doors with padlocking arrangements. The distance between two hinges shall be adequate to ensure uniform sealing pressure against atmosphere. The quality of gaskets shall be such that it does not get damaged/cracked during the operation of the equipment.

All door, removable covers and plates shall be gasketed all around with suitably profiled Neoprene /EPDM gaskets. The gasket shall be tested in accordance with approved quality plan. The quality of gasket shall be such that it does not get damaged /cracked during the years of the equipment or its major overhaul whichever is earlier. All gasketed surfaces shall be smooth, straight and reinforced if necessary

to minimize distortion and to make a tight seal. Ventilating Louvers, if provided, shall have screen and filters. The screen shall be fine wire mesh made of brass.

All boxes/cabinets shall be designed for the entry of cables from bottom by means of weather proof and dust-proof connections. Boxes and cabinets shall be designed with generous clearances to avoid interference between the wiring entering from below and any terminal blocks or accessories mounted within the box or cabinet. Suitable cable gland plate projecting at least 150 mm above from the base of the Marshalling Kiosk/box shall be provided for this purpose along with the proper blanking plates. Necessary number of cable glands shall be supplied and fitted on this gland. The gland shall project at least 25mm above gland plate to prevent entry of moisture in cable crutch. Gland plate shall have provision for some future glands to be provided later, if required.

3.20 SPACE HEATERS

The heater shall be suitable for continuous operation at 240 V AC supply voltage and shall be provided with on – off switch and fuse shall be provided for heater.

One or more adequately rated, thermostatically connected heaters shall be supplied to prevent condensation in any compartment.

3.21 DELIVERY OF GOODS AND DOCUMENTS RELATED THERETO:

Delivery of goods shall be made by the supplier in accordance with the terms specified by the BHEL in its schedule of requirements.

3.22 INCIDENTAL SERVICES:

The Supplier is required to provide any or all the services broadly outlined in the Technical specification. Any other minor incidental service related to the scope of work like providing necessary assistance whether specifically mentioned or not must be carried out by the Supplier at his own cost. All tools, Tackles Plant etc., required for completion of above works shall be brought by the Supplier.

3.23 DISCREPANCIES BETWEEN DRAWING AND SPECIFICATION:

Should there be any discrepancy between the specifications and/or schedule of prices and/or drawings or any inconsistency, error or omission in either of them, reference must be made to the BHEL/TANTRANSCO for an explanation and the Supplier will be held responsible for any errors that may occur in the work through neglect of this precaution. The explanation of the BHEL/TANTRANSCO shall be final and binding on the Supplier.

3.24 LIST OF DRAWINGS AND DOCUMENTS :

The drawings for the equipments provided by the TANTRANSCO shall be followed strictly by the bidder while designing. For the rest of the equipments, the design is in the scope of the bidder and the

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same got approved by the TANTRANSCO.

The bidder shall furnish One sets of relevant descriptive and illustrative published literature pamphlets and the following drawings/documents for preliminary study along with the offer.

- (i) General outline drawings showing dimensions and shipping weights, quantity of insulating media , etc.
- (ii) Sectional views showing the general constructional features of the circuit breaker including operating mechanism, arcing chambers, contacts with lifting dimensions for maintenance.
- (iii) Schematic diagrams of breaker offered for control supervision and re- closing.
- (iv) Structural drawing, design calculations and loading data for support structures.
- (v) Foundation drilling plan and loading data for foundation design.
- (vi) The Type Test Reports
- (vii) Bill of materials shall be furnished along with drawings.

The supplier shall, within 1 weeks of placement of order submit Six sets of final version of all the above drawings for BHEL/TANTRANSCO's approval. The TANTRANSCO shall communicate its comments/approval on the drawings to the supplier within reasonable period. The Supplier shall, if necessary, modify the drawings and resubmit four copies of the modified drawings for TANTRANSCO's approval within two weeks from the date of comments.. However the drawing approval does not absolve the supplier from complying with the terms of the specification.

The following should be supplied to each consignee circle along with the initial supply of equipment's ordered.

- 1) Five copies of printed and bound volumes of operation, maintenance and erection manual in English along with the copies of approved drawings and type test reports etc.
- 2) Three sets of manuals detailed in item (1) shall be supplied to the TANTRANSCO/BHEL with in one week from the date of approval of drawings.
- 3) The spares for the Equipment's ordered under the scope of the Contract should also be supplied to the consignee circle along with initial supply of the breakers.
- 4) It should be noted that if the above conditions are not fulfilled the initial payment will not be released.

3.25 QUALITY ASSURANCE PLAN :

The bidder shall invariably furnish following information along with his offer. (i) Statement giving list of important raw materials including but not limited to:

- (a) Contact material
- (b) Insulation
- (c) Porcelain
- (d) Sealing material
- (e) Contactor, limit switches, etc. in control cabinet.

Name of sub-supplier for the raw materials, list of standards according to which the raw materials are tested, list of test normally carried out on raw materials in presence of bidder's representative,

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copies of test certificates.

- (ii) Information and copies of test certificates as in
- (i) above in respect of bought out accessories.
- (iii) List of areas in manufacturing process, where such inspections are normally carried out for quality control and details of such tests and inspections.
- (iv) Special features provided in the equipment to make it maintenance free.
- (v) List of testing equipment available with the Bidder for final testing of breakers vis-à-vis, the type, special, acceptance and routine tests specified in the relevant standards. These limitations shall be very clearly brought out in the relevant schedule i.e. schedule of deviations from specified test requirements.

The supplier shall submit following information to the TANTRANSCO.

- 1) List of raw materials as well bought out accessories and the names of sub-suppliers selected from those furnished along with offer.
- 2) Type test certificates of the raw material and bought out accessories.
- 3) Quality assurance plan (QAP) withhold points for TANTRANSCO inspection. The quality assurance plan and hold point shall be discussed between the employer and supplier before the QAP is finalized.

The supplier shall submit the routine test certificates of bought out items and raw material, at the time of routine testing of the fully assembled breaker.

3.26 **TEMPERATURE RISE :**

The maximum temperature attained by any part of the equipment when in service at site under continuous full load conditions and exposed to the direct rays of the sun shall not exceed 30 deg. Cover an ambient of 50 deg. C limits specified in relevant IEC. When the standard specify the limit of temperature rise these shall be exceeded when corrected for the difference between ambient temperature at site and that specified in the approved specifications. No material shall be dispatched from its point of manufacture unless the material has been satisfactorily inspected and tested.

3.27 **FITTINGS AND ACCESSORIES :**

Following is a partial list of some of the major fittings and accessories to be furnished by contractor as an integral part of the equipment.

Operation mechanism housing complete with :

- (a) Locking arrangement.
- (b) Heaters equipped with automatic thermostatic control and control switch.
- (c) Cable glands.
- (d) Local/Remote change over switch.
- (e) Operation Counter.
- (f) Terminal Blocks.
- (g) Control switches to cut off control power supply.
- (h) MCCBs/MCBs are required with permanent identification marks for protection of D.C. circuits and A.C. circuits.
- (i) Two earthing terminals.

3.28 PACKING AND FORWARDING:

The equipment shall be packed in crates suitable for vertical/horizontal Transport, as the case may be and suitable to withstand handling transport and outdoor storage during transit. The supplier shall be responsible for any damage to the equipment during transit due to improper and inadequate packing and handling. The easily damageable material shall be carefully packed and marked with the appropriate caution symbols. Wherever necessary, proper arrangement for lifting, such as lifting hooks etc., shall be provided. Any material found short inside the packing cases shall be supplied by supplier without any extra cost.

The supplier shall provide such packing of the goods as is required to prevent their damage or deterioration during transit to their final destination as indicated in the Contract. The packing shall be sufficient to withstand, without limitation, rough handling during transit to their final destination as indicated in the Contract and exposure to extreme temperatures, salt and precipitation etc., during transport and open storage. Packing case size and weights shall be taken into consideration wherever appropriate, the remoteness of the 'goods' final destination and absence of heavy mechanized handling facilities, at all points in transit.

The packing, marking and documentation within and outside the package shall comply strictly with such special requirements as shall be expressly provided for in the Contract or in any subsequent instructions issued by BHEL.

3.29 SPECIFICATION FOR NITRYL BUTYL RUBBER

The gaskets are to be used in tanks exposed to Transformer mineral oil/SF6 at about 110° C.

1. Hardness should be Shore A 70 ± 5 .
2. Tensile Strength should be min. 10.8N/sq.mm (Minimum)
3. Elongation strength should be 270% (Minimum)

3.30 APPROVAL PROCEDURE

The scheduled dates for the submission of drawings as well as for, any data/information to be furnished by the Employer would be as per the following schedule. The supplier shall also submit required no. of copies as mentioned in this specification of all drawings/design documents/test reports for approval by the BHEL/TANTRANSCO. The following schedule shall be followed generally for approval.

i.	First Submission	7 days after LOI/PO
ii.	Approval/comments/by employer on Initial submission	Reasonable time
iii.	Resubmission	Within 7 days (whenever from date of comments required) Including both ways postal time.
iv.	Approval or comments	Within 2 weeks of receipt of resubmission.
v.	Furnishing of distribution copies	2 weeks from the date of last approval.

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Note: The supplier may please note that all resubmissions must incorporate, all comments given in the submission by the BHEL/TANTRANSCO failing which the submission of documents is likely to be returned. Every revision shall be a revision number, date and subject, in a revision block provided in the drawing, clearly marking the changes incorporated.

The title block of drawings shall contain the following information incorporated in all contract drawings. Please refer below mention Title block for Submission of Documents.

Title Block

Customer	M/s Tamil Nadu Transmission Corporation Limited
Project:	765/400KV Air Insulated substation Ariyalur
Contractor	BHEL

3.31 DOCUMENTS TO BE SUBMITTED ALONGWITH OFFER

Drawings, GTP ,Type Test Reports and List of Past Supplies. Drawings & Documents

submitted at the time of offer shall be subject to review at contract stage.

3.31 DOCUMENTATION SCHEDULE

Following Documentation schedule to be followed per project.

S. No.	DESCRIPTION	TENDER STAGE	CONTRACT STAGE FOR APPROVAL	FINAL DOCUMENTATION	
				Prints	CDs
1	Drawings and Data Sheets	1	7	10	5
2	Drawings "As Built "	-	-	10	
3	Type Test Reports	1	7	10	
4	Erection Manuals	-	7	10	
5	Operation and Maintenance Manuals	-	7	10	
6	Manufacturing Quality Plan	-	7	10	
7	Field Quality Plan	-	7	10	
8	Inspection Test Reports	-	7	10	

Note: Drawings will also be submitted in CD/DVD in Latest AUTOCAD-2004 or Later version or any other CAD package along with conversion files for all major items. Final Documentation shall be submitted in bound volumes with details of Customer & Project etc. written on top.

SECTION-4 GUARANTEED TECHNICAL PARTICULARS

Sl. No.	ITEM DESCRIPTION	UNIT	220V	48V
1	Manufacturer's name			
3	Type of battery			
4	Manufacturer's catalogue reference			
5	Guaranteed Ah Capacity of battery at 27° C at 10 hour discharge rate with end of discharge voltage 1.9V per cell.	Ah		
6	Nominal voltage rating	V/cell		
7	Short circuit current for a short circuit at battery terminals	kA		
8	Duration for which battery can withstand short circuit current			
9	Cells: 1. No. of cells per battery 2. Type of the cell 3. Cell designation 4. Material of container 5. Overall dimensions of each cell 6. Sediment space (mm) 7. Net dry weight 8. Weight of cell with electrolyte 9. Recommended maximum period of storage before the first charge 10. Recommended cell centre to centre distance (mm)			
10	Inter cell connector: i) Material of connector ii) Type of insulation if provided			
11	Plates: i) No. of positive plates per cell ii) Type of positive plate iii) Type of negative plate			
12	Separator i) Type ii) Material			
13	Electrolyte i) Amount of electrolyte for first filling ii) Sp. gr. of electrolyte at 27 °C. - at the time of first filling - at the end of full charge - at the end of discharge at 10-h rate iii) Maximum electrolyte temperature	Litre		
14	Total shipping weight of electrolyte for one battery unit.	Kg		

15	Total shipping weight of one battery unit (without electrolyte)	Kg		
16	Racks i) No. of racks per battery ii) No. of cells per rack iii) Material and finish of rack Paint shade Alkali / acid resistant coating detail			
17	Recommended boost charging current	A		
18	Recommended boost charging voltage	V/cell		
19	Recommended float charge voltage	V/cell		
20	Float charging trickle current	A		
21	Recommended equalize charge rate - Current - Voltage per cell - Duration for equalize charging - Frequency of equalize charging	A V/cell		
22	Internal resistance of each cell Fully charged condition Fully discharged condition			
23	Recommended air changes per hour			
24	Battery Charge-Discharge Curves Enclosed	Yes / No		
25	Applicable Standards	IEC		

-- x x --

SECTION - 5

CHECK LIST FOR 220V/48V LEAD ACID TUBULAR BATTERY

Put a tick mark (✓) on 'YES' if the specified requirement is met, or put a tick mark on 'NO', if the specified requirement is not met and give comments in the "Remarks" column.

Sl. No.	Parameters	220 V	48V	YES/NO	Remarks
1.	Type of battery	Lead Acid tubular		YES/NO	
2.	Container of battery	Transparent SAN		YES/NO	
3.	Connector of battery	Lead plated copper		YES/NO	
4.	Stand of battery	Teakwood		YES/NO	
5.	Separator	Microporous Polyethylene envelop type		YES/NO	
6.	Total cells of battery bank	110nos.	24nos.		
7.	Capacity of cells	535AH	1250AH		
8.	Tap cell arrangement during boost charging	Provided		YES/NO	
9.	As per cl. No. 3 of section -1 , Accessories to be provided for each set of battery	Provided		YES/NO	
10.	Whether OGA drawing enclosed	Enclosed		YES/NO	
11.	Battery room layout enclosed	Enclosed		YES/NO	
12.	Bidder to comply requirements as per Technical Specification	Complied		YES/NO	
13.	Bidder will be responsible of getting approval from customer	Yes		YES/NO	
14.	All valid Type test reports as per clause no. 4 of section -1 available as on 30.09.16	Yes, available		YES/NO	
15.	Conduction of type test (if any)	Free of cost		YES/NO	

Date:
Place:
Phone:
Fax:
E-mail:
Mobile:
Website: