BHARAT HEAVY ELECTRICALS LIMITED

TRANSMISSION BUSINESS ENGINEERING MANAGEMENT

NEW DELHI

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				GROUP	TBEM		
				W.O. No	83003/83006		
CUSTOMER	TAMIL NADU TRANSMISSION CORPORATION LIMITED						
PROJECT	400/110 KV Substation at Thappagundu & 400/230-110 KV Substation at Anikadavu						

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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 390kV, 216kV & 96kV Surge Arresters complete in all respects and including all fittings and accessories required for efficient and trouble-free operation.

This section covers the scope and quantities of 390kV, 216kV & 96kV Surge Arresters. The offered equipment shall also comply with the General Technical Requirements for the project as detailed under section-3 of this specification. For environmental conditions, refer Section-3 carefully.

The specification comprise of following sections:

Section-1: Scope, specific technical requirements & Bill of Quantities.
Section-2: Equipment specifications
Section-3: General technical requirements for all equipments under the project.
Section-4: Guaranteed Technical Particulars (to be filled at contract stage)
Section-5: Checklist (to be filled during tender stage.)

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

The equipment is required for the following projects:

Name of the Customer : M/s Tamil Nadu Transmission Corporation Limited
Name of the Project : 400/110kV Substation at Thappagundu
400/230-110 KV Substation at Anikadavu

2. SPECIFIC TECHNICAL REQUIREMENTS

As per Section-2.

3. BILL OF QUANTITIES

As per Annexure-1.

4. TYPE TESTING

The Type Test for offered 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 five (05) years as on the date of technical bid opening, which is 05/4/13 for Anikadavu & 10/4/13 for Thappagundu substations.

The Copies of type test certificates shall be furnished for verification at contract stage.

In Case the type test reports are more than 5 years old (from the date of Technical bid opening or the reports are found to be technically unacceptable, type tests shall be conducted by the vendor without cost & delivery implication to BHEL.

5. TECHNICAL QUALIFYING REQUIREMENT

The qualified manufacturer should have manufactured, Type tested and supplied at least 50% of the required quantity (for each project) of the surge Arrester (of the same voltage level as offered and short Circuit Rating of at least 40kA for 3s for 420kV and 40kA for 3s for 245kV & 132kV) to Electricity Boards/Power Utilities in India in any one year during the last five years as on 05/4/13 for Anikadavu & 10/4/13 for Thappagundu substations. The same should have been in satisfactory operation for a minimum period of two years as on date 05/4/13 for Anikadavu & 10/4/13 for Thappagundu substations.

Further the qualified manufacturer should have type tested the Surge Arrester from Government / Government recognized laboratories confirming to IS/IEC only.

6. INSPECTION & TESTING

All the equipments shall be inspected prior to dispatch in line with relevant IS, approved GTP/ drawing and technical specification, BHEL/ customer approved QAP.

Annexure-1

Bill of Quantities

A. 400/110kV Thappagundu Substation

A.1 390kV Surge Arresters

S. No.	PI Description	Detailed Technical Description	Unit	Quantity
1	390 KV Lightning arrester	390 KV Surge arrester ,station type, discharge class 3, heavy duty outdoor self supporting, single pole assembly, gapless, Zinc oxide type, with accessories	No.	21

A.2 110kV Surge Arresters

S. No.	PI Description	Detailed Technical Description	Unit	Quantity
1	110 KV Lightning arrester	96 KV surge arrester, station type, discharge class 3, heavy duty outdoor self supporting, single pole assembly, gapless, Zinc oxide type, with accessories	No.	12

B. 400/230-110kV Anikadavu Substation

B.1 390kV Surge Arresters

S. No.	PI Description	Detailed Technical Description	Unit	Quantity
1	390 KV Lightning arrester	390 KV surge arrester , station type, discharge class 3, heavy duty outdoor self supporting, single pole assembly, gapless, Zinc oxide type, with accessories	No.	27
2	**Mandatory Spare:** 390 KV Lightning arrester	**Mandatory Spare:** 390 KV surge arrester , station type, discharge class 3, heavy duty outdoor self supporting, single pole assembly, gapless, Zinc oxide type, with accessories	No.	2

B.2 230kV Surge Arrester

S. No.	PI Description	Detailed Technical Description	Unit	Quantity
1	230 KV Lightning arrester	216KV surge arrester, station type, discharge class 3, heavy duty outdoor self supporting, single pole assembly, gapless, Zinc oxide type, with accessories	No	9

B.3 110kV Surge Arresters

S. No.	PI Description	Detailed Technical Description	Unit	Quantity
1	110 KV Lightning arrester	96 KV surge arrester, station type, discharge class 3, heavy duty outdoor self supporting, single pole assembly, gapless, Zinc oxide type, with accessories	No	6

Surge Arrester shall be completed with following accessories:

a. Insulating Base
b. Grading Ring/Corona Ring (if Required)
c. Pressure relieving arrangements at both ends of each stack.
d. Surge monitor (For surge counter no auxiliary supply or battery shall be required for operation of counter. Readings of millimeter and counter shall be visible through inspection glass pane.)
e. Insulated stranded Copper cable of suitable size from insulating base to monitor shall be supplied in single length considering individual lengths as following:
    I. 5m for 420kV
    II. 3.5m for 230kV
    III. 2.5m for 110kV

    Please note that connecting lead, lugs and accessories shall be provided with each surge arrester.
f. Earth clamp and line top Terminal Plate with stainless steel Bolts & Nuts.
g. Terminal Clamps Suitable for
    I. Single moose ACSR conductor for 110kV surge arrestor
    II. 3" Al Tube, Twin moose ACSR conductor for 230kV surge arrestor.
    III. 4" Al Tube, Twin moose ACSR conductor for 390kV surge arrestor

    Sub-conductor spacing for 420kV/230kV/110kV shall be 450mm/225mm/225mm respectively.
h. Hardware required for :
    I. Inter-Unit Connection Within Arrester
    II. Connecting the Arrester to substation structure(Substation Structure in BHEL-Scope)
i. Any other requirements as stated in this Specification alongwith other standard accessories, which are not specifically mentioned but are usually provided with surge arrester of such type and rating for efficient and trouble-free operation.

SECTION – 2

EQUIPMENT SPECIFICATIONS

1.0 GENERAL:

1.1 The surge arrester shall conform to IEC: 60099- 4 except to the extent modified in the specification.

1.2 Arresters shall be of hermetically sealed units, self supporting construction, suitable for mounting on tubular / Lattice support structures to be supplied by the BHEL.

1.3 The surge Arresters shall be designed for use in the geographic and metrological conditions.

2.0 DUTY REQUIREMENTS:

a) The surge arresters shall be of heavy duty station class and gapless type without any series or shunt gaps.

b) The surge arresters shall be capable of discharging over voltages occurring during switching of unloaded transformers, reactors and long lines.

c) 390 KV class surge arresters shall be capable of discharging of server re-energisation switching surges on a 400 KV, 450 KM long line with surge impedance of 300 ohms and capacitance of 11986 Micro Farads/km and over voltage factor of 2.3 p.u

d) 390 KV class arrester shall be capable of discharging energy equivalent to class 3 of IEC for a 420 KV system on two successive operations followed immediately by 50 Hz energisation with a sequential voltage profile as specified below:

705 kVp for 3 peaks
508 kVp for 0.1 sec
565 kVp for 1 second
550 kVp for 10 seconds

e) 216/96 KV class arresters shall be capable for discharging energy equivalent to class 3 of IEC for 230/110 KV system on two successive operations

f) The surge arresters shall be suitable for withstanding short circuit forces of 63kA for 1s/40kA for 3s/40kA for 3s for 420kV/230kV/110kV system respectively.

g) The reference current of the arresters shall be high enough to eliminate the influence of grading and stray capacitance on the measured reference voltage.

h) The surge arresters are being provided to protect the following equipment whose insulation levels are indicated in the table given below:-

Equipment to be protected	Lightning impulse (kVp) for 420 kV system	Switching surge (kVp) for 420 kV system	Lightning impulse (kVp) for 230 kV system	Lightning impulse (kVp) for 145 kV system
Power transformer	±1300	±1050	±950	±550
Instrument Transformer	±1425	±1050	±1050	±650
Reactor	±1300	±1050	-	-
CB/Isolator Phase to ground	±1425	±1050	±1050	±650
Across open contacts	±1425 (-/+240)	±900 (-/+345)	±1200	±750

i) The duty cycle of CB installed in 420/230/110KV System of the purchaser shall be O-0.3 sec min-CO – 3 min -CO. The surge Arrester shall be suitable for such circuit breaker duties in the system.

3.0 CONSTRUCTIONAL FEATURES:

The features and constructional details of surge arresters shall be in accordance with requirement stipulated hereunder:

a) The surge arresters shall be of station type, discharge class 3, heavy duty outdoor self supporting, construction for suitable for mounting tubular support structures single pole assembly, gapless, Zinc oxide type surge arresters for 420/230/110 KV solidly grounded neutral system. Each equipment shall be supplied with grading ring, insulating base, pressure relieving arrangements at both ends of each stack, surge monitor, copper cable of suitable size from insulating base to monitor, earth clamp and line top terminal plate with stainless steel bolts and nuts. The suitable base channels and mounting tubular/lattice support structure for the arresters to be supplied.

b) All metallic parts shall be hot dip galvanized. The color of porcelain insulators

shall be glazed brown

c) The surge monitor shall consist of a milli-ammeter with operating alarm and danger zones for measuring the leakage current and a five digit surge counter to register the number of surges. The housing of the surge arresters shall conform to IP 67.

d) The non-linear blocks shall be of sintered metal oxide material. These shall be provided in such a way as to obtain robust construction, with excellent mechanical and electrical properties even after repeated operations.

e) The surge arresters shall be fitted with pressure relief devices suitable for preventing shattering of porcelain housing and providing path for flow of rated fault currents in the event of arrester failure. Details shall be furnished in the bids along with quality checks.

f) The arresters shall not fail due to arrester porcelain contamination.

g) Seals shall be provided in such a way that these are always effectively maintained even when discharging rated lightning current

h) Outer insulator shall be porcelain conforming to requirements. Terminal connectors shall conform to requirements stipulated in the specification.

i) Porcelain housing shall be so co-ordinate that external flashover will not occur due to application of any impulse or switching surge voltage up to the maximum design value for arrester.

j) The end fittings shall be made of corrosion proof material and preferably be nonmagnetic.

k) The name plate shall conform to the requirement of IEC incorporating the year of manufacture.

l) The heat treatment cycle details along with necessary quality checks used for individual blocks along with insulation layer formed across each block are to be furnished. Metalizing coating thickness for reduced resistance between adjacent discs is to be furnished with additional information schedule of bid proposal sheets along with procedure for checking the same. Details of thermal stability test for uniform distribution of current on individual disc is to be furnished.

m) The manufacturer will submit data for rejection rate of ZnO blocks during manufacturing/operation for the past three years.

n) The supplier of surge arrester must be a manufacturer of Zinc/ Metal oxide blocks to have control over quality and avoid spurious blocks. The type test on surge arresters is valid only if supplied surge arresters use same make of blocks on which type test is done. If blocks utilized differentially than used in type tested surge arresters then type test is not valid. The details of blocks in GTP should match what is used in Type testing.

o) The sealing arrangement of the surge arrester steaks shall be done incorporating grooved flanges with the O-rings/elliptical cross section gaskets of Neoprene or Butyl rubber.

4.0 FITTINGS AND ACCESSORIES:

a) 390/216/96 KV Arresters shall be complete with insulating base having provision for bolting to flat surface of structure.

b) Self contained discharge counters, suitably enclosed for outdoor use and requiring no auxiliary or battery supply for operation shall be provided for each single pole unit along with necessary connection. Suitable leakage current meters should also be supplied within the same enclosure. The reading of milli-ammeter and counters shall be visible through an inspection glass panel. The terminals shall be robust and of adequate size and shall be so located that incoming and outgoing connections are made with minimum possible bends. The design of the surge monitor shall be such that it is possible to tilt the surge monitor downwards by an angle up to 45 deg from horizontal plane.

c) Surge monitor consisting of discharge counters and milliammeters should be suitable to be mounted on support structure of the arrester and should be tested for IP67 degree of protection. The standard supporting structure for surge arrester should be provided with a mounting pad, for fixing the surge monitor. The surge monitor should be suitable for mounting on this standard mounting pad. Also all nuts, bolts, washers etc., required for fixing the surge monitor shall have to be supplied by the Vendor.

d) Grading/ Corona ring shall be provided on each complete arresters units as required. The Vendor shall supply suitable terminal connectors. The arrangement for surge monitor enclosure fixing to the structure shall be at its rear/bottom. Connection between the surge arrester base and surge monitor shall be through an insulated stranded copper cable. The cable shall be terminated at rear/bottom side of the surge monitor. The gaskets of the surge monitors shall be of Neoprene, Butyl or equivalent material.

Following length of cable for different rating of surge arresters shall be used:

1. 420kV – 5m
2. 230kV – 3.5m
3. 110kV – 2.5m

5.0 TESTS:

5.1 The surge arresters should have been type tested as per IEC/IS and shall be subjected to routine and acceptance tests in accordance with IEC document. In the switching surge operating duty test, the samples shall be pre-heated to 70 degree C, (instead of 60°C as given in IEC) prior to application of long duration surges for contamination test procedures obtained in ANSI: 062-11-1987 may be followed until IEC brings out alternate procedure for the same.

The test reports of the type test and the following additional type tests shall be furnished.

i) Radio interference voltage test.

ii) Seismic withstand test.

iii) Contamination test.

iv) Temporary over voltage withstands test procedure to be mutually agreed. Each metal oxide block surge arrester shall be tested for the guaranteed specific energy capability in addition to the routine/acceptance test as per IEC: 60099-4.

5.2 **(a) Acceptance Tests:**

1. Measurement of power frequency reference voltage of the arrester units.
2. Lightning Impulse Residual voltage on arrester units.
3. Internal Ionization or partial Discharge test.

(b) Special Acceptance Test:

1. Thermal stability test on three sections.
2. Aging & Energy Capability test on block (procedure to be mutually agreed).
3. Watt loss tests.

(c) Routine Tests:

1. Sealing test: Water dip test at 1.5 m depth from top of surge arresters for 30minutes shall be performed during assembly of surge arrester stacks

(followed by other routine tests, i/e/ P.D Measurement, Reference Voltage, Residual Voltage & IR measurement).

2. Measurement of reference Voltage.
3. Residual voltage test of arrester unit.
4. Internal Ionization test or partial discharge test.
5. Vertically check on completely assembled surge arrester as a sample test on each lot.
6. Pressure relief test

(d) Test on surge Monitors:

The surge monitors shall also be connected in series with the test specimens during residual voltage and current impulse with stand tests to verify efficacy of the same. Additional routine/functional tests with one 100A and 10 kA current impulse, (8/20 micro sec.) shall also be performed on the surge monitor.

Surge monitors shall be routinely tested for water dip test at 1.5 m for 30 minutes. No water vapors shall be visible on the monitor glass.

(e) Test on Insulators:

All routine tests shall be conducted on the hollow column insulators as per IEC – 233.The following additional tests shall be carried out on 420KV insulators:

i) Ultrasonic test as a routine test.
ii) Pressure test as a routine test.
iii) Bending load test in 4 directions at 50% specified bending load as a routine test.
iv) Bending load test in 4 directions at 100% specified bending load as a sample test on each lot.
v) Burst Pressure test as a sample test on each lot.

6.0 TECHNICAL PARAMETERS:

A. 390 KV CLASS SURGE ARRESTER

Sl.No	DESCRIPTION	
1	Rated arrester voltage	390 KV

2	i) Nominal Discharge current ii) Discharge current at which Insulation co-ordination will be Done	10KA of 8/20 microsecond wave 20 kA of 8/20 Microsecond wave
3	Minimum discharge capability	8kJ/kV or corresponding to clause – 2.0(d) Referred to rated arrester Voltage and at Minimum discharge characteristics whichever is higher
4	Continuous operating voltage at 50°C	303 kV rms.
5	i) Min. Switching surge residual Voltage (1kA) ii) Max. Switching surge residual Voltage (1kA)	730 kVp 780 kVp
6	Max. residual voltage at i) 10 kA nominal discharge current ii) 20 kA nominal discharge current iii) Steep fronted wave residual voltage at 10 kA	 900 kVp 975 kVp 1050 kVp
7	Max steep current impulse residual voltage at 10 kA	650 kVp
8	Long duration discharge class	3
9	High current short duration test Value (4/10 micro second wave	100 kAp
10	Current for pressure relief test	63kA rms
11	Low current long duration test value (2000 micro sec)	As per IEC
12	Prospective symmetrical Fault current	40kA (rms) for 0.2 Sec.
13	Pressure relief class	A

B. 216 KV CLASS LIGHTNING ARRESTERS

Sl.No	DESCRIPTION	
1	Rated arrester voltage	216 KV
2	Nominal Discharge current	10KA of 8/20 microsecond wave

3	Minimum discharge capability	5Kj/kV (referred to rated arrester voltage corresponding to minimum discharge characteristics.
4	Continuous operating voltage at 50°C	168 kV rms.
5	Max. Switching surge residual Voltage (1kA	500 kVp
6	Max. residual voltage at i) 5kA ii) 10 kA nominal discharge current	560 kVp 600 kVp
7	Max steep current impulse residual voltage at 10 kA	650 kVp
8	Long duration discharge class	3
9	High current short duration test Value (4/10 micro second wave	100 kAp
10	Current for pressure relief test	40kA rms
11	Low current long duration test value (2000 micro sec)	As per IEC
12	Pressure relief class	A

C. 96 KV CLASS LIGHTNING ARRESTERS

S.No	DESCRIPTION	
1.	Rated arrester voltage	96KV
2.	Nominal Discharge current	10KA of 8/20 microsecond wave
3.	Minimum discharge capability	5Kj/kV (referred to rated arrester voltage corresponding to minimum discharge characteristics.
4.	Continuous operating voltage at 50°C	81 kVrms.
5.	Max. Switching surge residual Voltage (1kA)	217kVp
6.	Max. residual voltage at i) 5kA ii) 10 kA nominal discharge current	256 kVp 272 kVp
ii)	Long duration discharge class	3
iii)	High current short duration test Value (4/10 micro second wave	100 kVp

iv)	Current for pressure relief test	40kA rms
v)	Low current long duration test value (2000 micro sec)	As per IEC
vi)	Pressure relief class	A

7.0 TESTS AND TEST CERTIFICATES :

7.1 Manufacturers test certificates in respect of all materials as specified in IEC 99-4 and IS 3070 Part I to III of latest issue and other tests as mentioned elsewhere in the specification shall be supplied in triplicate.

7.2 In addition to the above tests, the purchaser reserves the right of carrying out at site such tests as he may decide upon. Such additional tests shall be carried out at the purchasers expense.

7.3 The entire equipment shall after erection be run for one year under normal operating conditions. Any defects discovered during this period shall be rectified free of all charge. The equipments should be set properly and demonstrated to function correctly.

7.4 Test certificates furnishing the results of Routine tests as per appropriate Indian Standard Specification should be forwarded for, the equipment, before despatching the materials. The equipments will be rejected, if the test results are not satisfactory.

7.5 The Board reserves the right to have the Acceptance tests as specified in relevant IS/IEC of latest issue, carried out on the arresters to be supplied against this contract.

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SECTION – 3

GENERAL TECHNICAL REQUIREMENTS

3.0 Foreword

The provision under this section is intended to supplement general requirements for the materials, equipment 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 : 400/110 KV Substation at Thappagundu & 400/230/110 KV Substation at Anikadavu
c) Transport facilities : Road/Rail
d) Site location : THAPPAGUNDU IN THENI DISTRICT, MADURAI REGION & ANIKADAVU IN TIRUPPUR DISTRICT, COIMBATORE REGION

The following system parameters shall prevail:

Nominal system voltage	**400 kV**	**230kV**	**110 kV**
Highest system voltage	420 kV	245kV	132 kV
Frequency	50 Hz	50 Hz	50 Hz
Minimum creepage	25mm/kV	25mm/kV	25mm/kV
System Earthing	Effectively Earthed	Effectively Earthed	Effectively Earthed

SITE CONDITIONS

3.1.1 Ambient Temperature
a) Ambient air temp. (max.) : 50 deg C
B) Max Temp. for design : : 50 deg C
b) Ambient air temp. (min.) : 20 deg C
c) Max, Daily average ambient air temp. : 45 deg C
d) Max. yearly average ambient air temp. : 32 deg C

3.1.2 Max. humidity : 100% Max.

3.1.3 Average thunder storm days per annum : 50

3.1.4 Average rainy days per annum : 90

3.1.5 Average Annual rainfall : 1000 mm

3.1.6 No. of months during which tropical monsoon condition prevail: 5
3.1.7 Max, wind Pressure : 150kg/sqmm
3.1.8 Max wind speed : 39m/s
3.1.8 Altitude above MSL : 1000 m

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

AUXILIARY POWER SUPPLY

3 phase AC Supply	415V, 3 phase 4 wire 50 Hz, neutral grounded AC supply -15% to +10%
1 phase AC supply	240V, single phase, 50 Hz neutral grounded AC supply
DC supply	220, 2 wire DC supply + 10% to –15% 48V, 2 wire DC supply

3.2 GENERAL REQUIREMENT

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

3.2.1 The supplier shall also furnish drawings for the following:

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

3.2.1 GENERAL:

3.2.1.1 The bidders 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.

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

3.2.1.3 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/equipments is furnished. The Technical specification contained herein for the materials are for the guidance of the tenderer.

3.2.1.4 The Tenderers are requested to procure the equipments/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

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

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

3.4 SPECIFIC TECHNICAL REQUIREMENTS: / Drawing submission

The successful bidder shall submit all drawings and documents as per clause no. 3.29 along with the list of drawings within 7 days after placement of order to BHEL.

3.5 STANDARD:

The goods supplied under this contract shall conform to the standards mentioned in the Technical Specifications and when no applicable standard is mentioned, to the standard specified by the Institution of Central / State Government or internationally recognized Institutions shall be applicable and such standards shall be the latest issued by the concerned institution.

3.6 TEST CERTIFICATE:

Copies of all test certificates relating to material to be procured by the Supplier for the works shall be forwarded to BHEL.

3.7 Inspection clause :

3.7.1 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.

3.7.2 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:

3.8.1 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.

3.8.2 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.

3.8.3 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 equipments and before charging each item of equipments 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 equipments in the presence of Board Engineers. Necessary tools, testing kits are to be arranged by the Supplier.

3.10 PACKING:

3.10.1 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.

3.10.2 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.

3.11 COLOUR SCHEME AND CODES FOR PIPE SERVICE/PANELS

The supplier shall propose a color scheme for those equipment/Items for which the colour scheme has not been specified in the specification for the approval of BHEL/TANTRANSCO. The decision of BHEL/TANTRANSCO shall be final. The scheme shall include:

Finishing colour of Indoor equipment

Finishing colour of Outdoor equipment.

Finish colour of all cubicles.
Finishing colour of various auxiliary system equipment including piping

Finishing colour of various building items.
All the steel works shall be thoroughly cleaned of rust , scale , oil , grease, dirt and scarf by pickling , emulsion cleaning , etc. The sheet steel shall be phosphated /oven dried and then painted with two coats of zinc rich primer paints . After application of the primer, two coats of finished synthetic enamel paint shall be applied. The colour of the finished coats inside shall be glossy white and exterior of the treated sheet steel shall be shade 631 of IS 5 /RAL 7032 for all switchboard /MCC/distribution board , control panels etc.
Sufficient quantities of touch paint shall be furnished for application at site. All the indoor cubicles shall be the same as exterior surface and for other miscellaneous items, colour scheme will be approved by the BHEL/TANTRANSCO.

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 GALVANIZING

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 610 gm of zinc per square metre of surface.The zinc coating shall be smooth, of uniform thickness and free from defects.

3.16 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.

3.17 RATING PLATES, NAME PLATES AND LABELS

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.

Alternately two separate plates one with Hindi and other with English inscriptions may be provided.

During approvals drawings of Rating/name plates/lables shall also be submitted.

3.18 EARTHING

Circuit breakers, LA, Isolator, CVT, CT, BPI shall be provided with two grounding pads suitable for connection to galvanized steel flat. 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.

3.19 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 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 drwawing approval stage.

TBs should be suitable for cable sizes all cable sizes.

3.20 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 3.0 mm thick cold rolled or 3 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 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 atleast 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 atleast 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

3.21 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.

3.22 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.

3.23 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.

3.24 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.

3.25 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 Employer. 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.

Note: The supplier may please note that all resubmissions must incorporate, all comments given in the submission by the Employer 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 enclosed sheet for details of Title block.

3.26 TITLE BLOCK

Following Title Blocks to be used in drawings at the time of drawing approvals

For Thappagundu

Customer	M/s Tamil Nadu Transmission Corporation Limited

Project:	400/110 KV Substation at Thappagundu
Contractor	BHEL

For Anikadavu

Customer	M/s Tamil Nadu Transmission Corporation Limited
Project:	400/230-110 KV Substation at Anikadavu
Contractor	BHEL

3.27 DOCUMENTS TO BE SUBMITTED ALONGWITH OFFER

1) Drawings
2) Guaranteed Technical Particulars
3) Type Test Reports
4) List of Part Supplies with rating

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

3.28 DOCUMENTATION SCHEDULE

Following Documentation schedule to be followed per project.

S. No.	DESCRIPTION	TENDER STAGE	CONTRACT STAGE FOR APPROVAL	FINAL DOCUMENTATION	
			Prints	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.

APPENDIX-A

SCHEDULE OF TECHNICAL DEVIATION

The following are the deviations/variations/exceptions from the specification:

SECTION	CLAUSE NO. / PAGE NO.	STATEMENT OF DEVIATION / VARIATIONS / EXCEPTIONS

In case, this schedule is not submitted, it will be presumed that the equipment /material to be supplied under this contract is deemed to be in compliance with the specification.

If there is NIL deviation, even then the format to be filled as **NIL DEVIATION**

Note: Continuation sheets of like size and format may be used as per the Bidder's Requirement and shall be annexed to this schedule.

Place

Date

Signature of the authorized representative of

Bidder's name …….

Designation …….

Company seal …….

APPENDIX-B

BIDDER'S UNDERTAKING FOR TYPE TEST REPORTS

Bidder shall take type test report, MQP, and drawing approval from TANTRANSCO without any commercial / delivery implication to BHEL. In case type test reports are not acceptable to customer due to any technical reason, the same shall be conducted free of cost.

Place Signature of the authorized representative of

Bidder 'name----------

Date

Designation----------

Company seal ----------

390/216/96 KV LIGHTNING ARRESTERS

Sl. No.	Description	390/216/96 KV LIGHTNING ARRESTERS
01	Maker's Name and place of manufacture	
02	a)Type of Construction b)Type of Mounting c)Model	
03	a)Rated Voltage KV (rms) b)Reference voltage KV (rms)	
04	Maximum continuous Operating Voltage KV (rms)	
05	Nominal Discharge Current (8/20 microsecond wave) KA	
06	Min. Discharge capability	
07	Rated Frequency	
08	a) IR at MCOV b) IC at MCOV	
09	a) Reference current, mA b) Reference volt at reference current	
10	Max. residual voltage in KV (Peak) 8/20 microsecond wave a) at 5000 amps. b) at 10000 amps. c) at 20000 amps. d) Max. partial discharge (Pico coulombs)	
11	Max.Switching Impulse Residual Voltage (KVp)	
12	Max. Steep Current Impulse RDV (KVp)	
13	Impulse High Current short duration discharge Amps. (4/10 microsecond wave) KA	
14	T.O.V. (KVP) a) 0.1 second b) 1.0 second c) 10.0 second d) 100.0 second	

Sl. No.	Description	390/216/96 KV LIGHTNING ARRESTERS
15	Insulation withstand a) Lightning IMP (Dry) (KVp) b) Power frequency with stand Voltage KV (rms) Dry/Wet c) Switching Impulse Wet (KVp)	
16	Pressure Relief Class	
17	PR Relief Class KA (RMS)	
18	Long Duration Current impulse Test a) Current Peak Amps. b) Virtual Duration Micro Sec.	
19	a) Leakage current at normal voltage b) Leakage current at max. operating voltage.	
20	Arrester percentage rating	
21	Dimensions of the arresters a) Max. Dia of Porcelain b) Max. Height of Porcelain	
22	a) Material of valve b) Details of sealing c) Description of Pressure Relief system d) No. of units per arrester	
23	Creepage distance mm	
24	Minimum clearance a) Between phases mm b) Between phase to earth	
25	Size of grounding terminal	
26	Size of the line terminal	
27	Diameter of the grading ring	
28	Min. space required for 3 phase installation	
29	Max. Cantilever Strength of the arrester KGM.	
30	Overall weight of one single phase stack (Approx.) Kgs.	
31	Weight of complete arrester (Approx.) Kgs.	
32	Nett weight of each arrester (Approx.) Kgs.	

SECTION – 5

Check List

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

1. TECHNICAL REQUIREMENTS (FOR SURGE ARRESTER)

S. No.	PARTICULARS	Unit	390 kV	YES/ NO	216kV	YES/ NO	96 kV	YES/ NO	Remarks
1.	Designation	-	Heavy duty, Station class						
2.	Application	-	Protection of transformer/ Reactor/Circuit Breaker/Isolator						
3.	Type	-	Zinc Oxide, Gapless						
4.	Installation	-	Outdoor						
5.	Arrester Rated Voltage	kV	390		216		96		
6.	Max. Cont. Operating Voltage (MCOV) at 50°C	kVrms	303		168		81		
7.	Rated Frequency	Hz	50						
8.	Rated nominal discharge current for 8/20 μs wave	kA	10						
9.	Discharge Current at which insulation co-ordination is done for 8/20 ms wave	KA	20		-		-		

10	Minimum discharge capability	kJ/kV	8kJ/kV or corresponding to clause – 2.0(d) Referred to rated arrester Voltage and at Minimum discharge characteristics whichever is higher		5Kj/kV (referred to rated arrester voltage corresponding to minimum discharge characteristics.)		5Kj/kV (referred to rated arrester voltage corresponding to minimum discharge characteristics.)		
11	Min. switching residual voltage (1 kA)	kVp	730		-		-		
12	Max. switching residual voltage (1 kA)	kVp	780		500		217		
13	Max. Residual Voltage for 8/20 µs at:								
	a) 5 kA	kVp	-		560		256		
	b) 10 kA	kVp	900		600		272		
	c) 20 kA	kVp	975		-		-		
	d) Steep fronted wave residual voltage at 10kA	kVp	1050		-		-		
14	Max. Steep current impulse residual voltage at 10kA	kVp	650		650		-		
15	Impulse withstand Voltage of arrester housing (1.2/50 ms wave) Dry and wet	kV_p	±1425		±1200		±650		

16	Switching impulse withstand Voltage of arrester housing (1.2/50 μs wave) Dry and wet	kV_p	±1050		-		-		
17	Long duration discharge class		3		3		3		
18	High Current short duration test value (4/10micro second wave)	kVp	100		100		100		
19	Current for pressure relief test	kA_{rms}	63		40		40		
20	Low current long duration test value (2000 micro sec)		as per IEC		as per IEC		as per IEC		
21	Prospective symmetrical fault current	kA	40kA(rms) for 0.2 sec		-		-		
22	Pressure relief class		Class A		Class A		Class A		
23	RIV at specified power frequency voltage	μV	as per IEC		as per IEC		as per IEC		
24	Partial discharge at 1.05 MCOV	pC	As per IEC		as per IEC		as per IEC		
25	All metallic parts are hot dip galvanized		Yes		Yes		Yes		
26	Color of porcelain insulators shall be glazed brown.		Yes		Yes		Yes		
27	Surge arresters shall be capable of protecting the equipment as given in section 2.		Yes		Yes		Yes		
28	Parts/ Accessories to be included in supplies with SA as mentioned below but not limited to it.								

i)	Surge Monitor(consisting of milliammeter with operating alarm and danger zones for measuring the leakage current and a five digit surge counter to register the number of surges		Included		Included		Included		
ii)	Insulating base		Included		Included		Included		
iii)	Corona ring (if applicable)								
iv)	Pressure relieving Arrangement at both ends of each stack		Included		Included		Included		
v)	Terminal clamp included in scope		4" Al. Tube, Twin Moose ACSR conductor		3" Al. Tube, Twin Moose ACSR conductor		Single Moose ACSR conductor		
vi)	Hardware required for inter-unit connection and to connect the surge arrester to structure		Included		Included		Included		
vii)	Insulated interconnecting stranded cable between arrester base and surge monitor. (cables for all SA at a station supplied in single length)		5m for each SA		3.5m for each SA		2.5m for each SA		

2. TYPE TESTS

Whether Type test reports of the tests conducted (not more than 5 years earlier as per clause no.4 of section-1) on similar material submitted with offer. **YES/NO**

Whether Type test reports are as per relevant IEC and Clause No. 5

and 7 of section-2 attached here	**YES/NO**
If type test report submitted, indicate report number and date.	**YES/NO**
If the valid type tests reports are not available with the bidder then the type test, as per relevant IEC and Clause No. 5 and 7 of section-2, shall be conducted by the bidder free of cost.	**YES/NO**