BHARAT HEAVY ELECTRICALS LIMITED
TRANSMISSION PROJECTS ENGINEERING MANAGEMENT

DOCUMENT No.	TB-394-316-107	Rev. No.	00		Prepared	Checked	Approved
TYPE OF DOC.	TECHNICAL SPECIFICATION			NAME	VP	SK	RS/DM
TITLE				SIGN			
624 kV Surge Arresters				DATE	07.06.17	08.06.17	10.06.17
				GROUP	TBEM	W.O. No	86009
CUSTOMER	Tamilnadu Transmission Corporation Limited (TANTRANSCO)						
PROJECTS	765/400kV AIS S/S Ariyalur						

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Rev No.	Date	Altered	Checked	Approved	REVISION DETAILS			
				Distribution	*TBMM*	*TBQM*	*TBCM*	*TBTS*
				Copies	-	-	01	-

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.(Annexure-A)	
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 .....

ANNEXURE- A

TECHNICAL REQUIREMENT

Name of Project: - 765/400kV AIS S/S ARIYALUR **Name Of Item** : - 624kV Surge Arresters

Sr. No	Technical Requirement	Supporting documents	Reference of attached documents
1.	The manufacturer(s) whose 765kV Surge Arrester(s) are offered, should have designed, manufactured, type tested (as per IEC/IS) with the specified energy capability and supplied 715kV or above class Surge Arresters, which are in satisfactory operation* for at least two (2) years as on the date of award of contract (i.e.31.03.2017). OR	1 .Bidder to Provide Compliance/Confirmation of fulfilling SL No.1 Technical Requirement. 2. Performance certificate /Letter /MOM etc. issued by end customer for Satisfactory operation 3. PO Copy 4. Inspection/ dispatch clearance 5. LR details 6. Commissioning Report/ Handing over Documents Etc.	
2.	765kV Surge Arresters may also be offered from the manufacturer, who have established production line in India and have manufactured & type tested (as per IEC/IS) 715kV or above voltage class Surge Arresters manufactured in their Indian works, which are in satisfactory operation* as on the date of award of contract(i.e.31.03.2017). In case the above Surge Arresters are not in satisfactory operation* for two (2) years as on the date of award of	1 .Bidder to Provide Compliance/Confirmation of fulfilling Sl. No.2 of Technical Requirement. 2. Performance certificate /Letter /MOM etc. issued by end customer for Satisfactory operation. 3. PO Copy Bidder	

TECHNICAL REQUIREMENT

	contract(i.e.31.03.2017), the contractor shall furnish performance guarantee for an amount of 10% of the ex-works cost of the Surge Arresters. This performance guarantee shall be in addition to the contract performance guarantee to be submitted by the contractor. The additional performance guarantee shall be for an extended period of two years. * Satisfactory operation means certificate issued by the Employer certifying the operation Without any adverse remark.	4. Inspection/ dispatch clearance Bidder 5. LR details Bidder 6. Commissioning Report/ Handing over document 7. Confirmation of Performance Guarantee of 10% of the ex-works of Cost of Surge Arresters. Etc.	

Signed with Seal of Bidder.

Date .....

SECTION I

SCOPE, SPECIFIC TECHNICAL REQUIREMENTS AND QUANTITIES.

1.0 SCOPE

This technical specification covers the requirements of design, manufacture, testing at works, packing and dispatch of 624kV Surge Arresters (**polymer/porcelain insulator is acceptable)** complete with all accessories like surge counter, insulating base, terminal connector , connecting lead and fixing hardware etc.

The specification comprise of following sections:

Section-1 : Scope, Specific Technical Requirements & Bill of Quantities
Section-2A: Amendment of Detailed Technical Requirement (Section-2B)
Section-2B: Detailed Technical Requirement - Equipment Specification
Section-3 : Project Details & General Technical Requirements
Section-4 : Guaranteed Technical Particulars
Section-5 : Checklist

In case of any conflict between various sections, order of precedence shall be in the same order as listed above and the same is to be considered as binding requirement.

1.1 624kV class surge arresters are required for the following Project

Customer : **Tamilnadu Transmission Corporation Limited (TANTRANSCO)**

Project : **765/400kV AIS S/S Ariyalur**

Refer Section-3 for Project Details and General Specifications.

2.1 SPECIFIC TECHNICAL REQUIREMENTS

800 kV class arrester shall be capable of discharging energy equivalent to class 5 of IEC for an 800 kV system on two successive operation followed immediately by 50 Hz energisation with a sequential voltage profile as specified below:

1000 kVp for 3 peaks

910 kVp for 0.1 Sec

885 kVp for 1 seconds

866 kVp for 10 seconds

2.2 Technical parameters

(a)	Rated arrester voltage	624 kV
(b)		
	i) Nominal discharge Current	20kA of 8/20 microsecond current wave.
	ii) Discharge current at which insulation co-ordination will be done.	20kA of 8/20 microsecond wave
(c)	Minimum discharge capability	13kJ/kV or Corresponding to clause -2.1 referred to Rated arrester Voltage and at minimum discharge Characteristics whichever is higher
(d)	Continuous operating voltage at 50 deg.C	490 kV (rms)
(e)	Max. Switching surge residual voltage	
	-at 1kA	1180 kVp
	-at 2KA	1220 kVp
(f)	Max. residual voltage at	
	i) 20kA nominal discharge current	1480 kVp
	ii) Max Steep current impulse residual voltage at 10 kA	1480 kVp
(g)	Long duration discharge	Class 5
(h)	High current short duration test value (4/10 micro second wave)	100 kAp
(i)	Current for pressure relief test	**50 kA rms**
(j)	Low current long duration test value	As per IEC.
(k)	Prospective symmetrical fault current	50kA (rms) for 0.2 Sec.
(l)	Pressure relief class	50kA

j) Cantilever strength of Polymer insulator (Min) **500kg**

k) **Surge counter should have " NO" Normally open Potential free contact which should be closed in case of surge.**

l) Creepage distance **25mm/kV (i.e. 20000mm)**

m) Mounting Structure **Lattice Type**

3.0 TECHNICAL REQUIREMENTS:

3.1 The manufacturer(s) whose 765kV Surge Arrester(s) are offered, should have designed, manufactured, type tested (as per IEC/IS) with the specified energy capability and supplied 715kV or above class Surge Arresters, which are in satisfactory operation* for at least two (2) years as on the date of award of contract(i.e.31.03.2017).

OR

3.2 765kV Surge Arresters may also be offered from the manufacturer, who have established production line in India and have manufactured & type tested (as per IEC/IS) 715kV or above voltage class Surge Arresters manufactured in their Indian works, which are in satisfactory operation* as on the date of award of contract(i.e.31.03.2017). In case the above Surge Arresters are not in satisfactory operation* for two (2) years as on the date of award of contract(i.e.31.03.2017), the contractor shall furnish performance guarantee for an amount of 10% of the ex-works cost of the Surge Arresters. This performance guarantee shall be in addition to the contract performance guarantee to be submitted by the contractor. The additional performance guarantee shall be for an extended period of two years.

* Satisfactory operation means certificate issued by the Employer certifying the operation Without any adverse remark.

4.0 BILL OF QUANTITIES

4.1 Main Item:-

S. No.	DESCRIPTION	Unit	Quantity
1.	624kV Surge arresters (single phase) complete with all accessories like corona ring terminal pad, surge counter, insulating base, connecting cable , fixing hardware etc.	Nos.	36
2.	624kV Surge arresters (single phase) ,Rigid Type terminal connector suitable for Quad Bull AAC conductor with Horizontal approach	Nos.	36

3.	Insulated connecting Cable between Lightning Arresters and Surge monitor (Single Length)	Mtr.	314

4.2 Mandatory Spare :-

S. No.	DESCRIPTION	Unit	Quantity
1.	624kV Surge arresters (single phase) complete with all accessories like corona ring terminal pad, surge counter, insulating base, connecting cable , fixing hardware etc.	No.	1
2.	624kV Surge arresters (single phase) ,Rigid Type terminal connector suitable for Quad Bull AAC conductor with Horizontal approach	No.	1
3.	Insulated connecting Cable between Lightning Arresters and Surge monitor (Single Length)	Mtr.	9

Note-1- Insulated connecting Cable between Lightning Arresters and Surge monitor shall be supplied in single length for all required surge arresters including main and spare items (i.e. Considering individual length of 8.7m for 624kV) . Please note that connecting lead, lugs and accessories shall be provided with each Lightning Arrester.
Note -2- Total quantity may vary up to ±25% at contract stage.
Note-3- Bidder to comply all tests as per clause no. 5 of section 2B of Technical Specification.
Note-4 - Refer Section 2B for details of terminal connector.

5.0 Further, a legally enforceable undertaking by the manufacturer shall be furnished during contract execution for guarantee quality, timely supply and performance of the 765 KV Surge arrester.

6.0 TYPE TESTS:

Bidder shall submit valid type test reports (As per relevant IEC/IS standard) for the tests carried out within last ten 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 10 years old (from the date of opening of the tender) 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.

7.0 SPECIAL TOOLS AND TACKLES :

Bidder shall supply all special tools and tackle free of cost which are specifically required for the Surge arresters and are proprietary in nature. List of such special tools and tackle should be clearly

listed along with the technical offer. Any special tool which is not listed in the list but required during the erection/testing/commissioning of surge arresters shall also be supplied free of cost by the supplier.

8.0 DEVIATIONS :

The bidder shall list all the deviation from the specification separately. Offers without specific deviation will be deemed to be totally in compliance with the specification and NO DEVIATION on any account will be entertained at a later date.

PACKAGE NAME 765/400KV AIS SUBSTATION AT ARIYALUR
CLIENT TANTRANSCO

SL.NO.	VOLUME/SECTION	LAUSE/DRAWING NO	BIDDER'S QUERY	Client's Reply
10	Technical specification, Section-6, Surge arrester,	Clause-3.0 (i)	As per the referred clause, porcelain housing is envisaged for surge arrester. However, for 624kV surge arresters, polymer housing is the most standard practice. On award of contract, necessary type test reports & credentials can be shared. We trust the same is acceptable in line with TANTRANSCO's acceptance of polymer housing for instrument transformers	In respect of 765KV,Polymer insulator can also be accepted only on submission of relevant type test certificates and successful performance certificate from the end user.
11	Amendment, Annexure-I,	Sl.no.30	Since 765kV strung buses are of Quad AAC Bull conductor, we interpret this line item to be read as "Bolted type single suspension fitting suitable for 765kV Quad AAC Bull"	Please refer Annexure-IB
12	Amendment, Annexure-I,	Sl.no.32	Since 400kV strung buses are of Quad Bersimis conductor, we interpret this line item to be read as "Bolted type single suspension fitting suitable for 400kV Quad Bersimis"	Please refer Annexure-IB
13	As per Electrical layout (/Ariyalur 765/400kV in kallakurchi E.D.C) is shown Firefighting pump house		As per the Electrical layout Drawing 765/400kV in kallakurchi E.D.C), FFPH Building is shown. As per the Norms we have to give Fire hydrant system surrounding the buildings & HVWS system for Transformer and MVWS system for cable gallery to be done. But the same is not reflected in BPS & Specification also not available. Please confirm. If it is required, please include a line item in BPS and also furnish the specification.	Pump house not required.
14	Amendment, Annexure-I		Annexure-II as referred in various clauses of amendments & clarifications are not received at our end. Kindly share the same.	Please refer prebid reply dated 16-09-16
			CIVIL QUERIES	
1	PreBid Query Reply, Page 25 of 99	Sl. No. 1 to 20	In the reply to the pre bid queries, it has been indicated to refer Annexure-III as response to most of the civil queries, but the Annexure III has not been furnished along with pre bid replies. Please furnish the same.	Please refer Annexure III A

Section 9A

winding of singlephase spare shunt reactors can be disconnected or connected to either of the three phase banks unless approved otherwise. All material like Bus post insulator, Aluminium tube, conductor, clamps & connectors, earthing materials, support structure, hardware etc required for neutral formation and connection with neutral CT and earthing of neutral shall be provided by contractor.

2.Reactor Oil

The insulating oil, to be used and supplied with the Reactor, shall be of EHV grade conforming to IS:335 of latest issue. No inhibitors shall be used in the oil.

V.SECTION 05(CURRENT TRANSFORMER):

1. Placement of secondary Core in one side in the design of CT: accepted for 765KV only provided the type test reports shall be submitted for the same design.
2. CT insulator: In respect of 765KV,Polymer insulator can also be accepted only on submission of relevant type test certificates and successful performance certificate from the end user.
3.Aluminium/copper primary winding accepted for 765KV CT only provided the type test results are submitted for the same design.

VI.SECTION 06(SURGE ARRESTORS):

1. LA insulator: In respect of 765KV,Polymer insulator can also be accepted only on submission of relevant type test certificates and successful performance certificate from the end user.

VII.SECTION 08(ISOLATORS):

1.Isolater Terminal Pads

a)As per specification for 400 KV isolators.

b)For 765KV isolators all current carrying parts shall be made from high conductivity electrolytic copper/aluminium.

2. For 800 & 420 KV AB Switches each phase shall be suitable for both manual & Electrical operation. Manual operation by individually and ganged electrically.

3.Isolater Blade/Arm: Shall be made from high conductivity electrolytic copper/ aluminium.

Section 2B

SECTION - [redacted]

SURGE ARRESTERS

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 contractor.

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

2.0 DUTY REQUIREMENTS:

a)The surge arrestors 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) 800 KV class surge arresters shall discharge severe re-energisation switching surges on line with surge impedance of 270 ohms and capacitance of 13000 Micro Farads/km.

d) 800 KV class surge arresters shall discharge energy equivalent to Class 5 of IEC on two successive operation followed immediately by 50Hz energisation with a sequential voltage profile as specified below:

1000kVp for 3 peaks

910kVp for 0.1 sec

885kVp for 1.0 sec

866kVp for 10 sec

e) 420 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

f) 420 KV class arrester shall be capable of discharging energy equivalent to class 4 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:

650 kVp for 3 peaks

575 kVp for 0.1 sec

550 kVp for 1 second

475 KVp for 10 seconds

g) The surge arresters shall be suitable for withstanding short circuit forces.

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

i) 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 800 kV system	Switching surge (kVp) for 800 kV system	Lightning impulse (kVp) for 420 kV system	Switching surge (kVp) for 420 kV system
Power transformer	±1950	±1550	±1300	±1050
Instrument Transformer	±2100	±1550	±1425	±1050
Reactor	±1950	±1550	±1300	±1050
CB/Isolator Phase to ground	±2100	±1550	±1425	±1050
Across open contacts	±2100 (-/+457)	±1140 (-/+653)	±1425 (-/+240)	±900 (-/+345)

j) The duty cycle of CB installed in 800/420KV 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 5 & 4, heavy duty outdoor self supporting, construction for suitable for mounting tubular support structures single pole assembly, gapless, Zinc oxide type surge arrestors for 765/400 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 strip/ flat 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 arrestors 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 arrestor shall conform to IP 67.

d) The non-linear blocks shall be of sintered metal oxide material.

e) These shall be provided in such a way as to obtain robust construction, with excellent mechanical and electrical properties even after repeated operations.

f) 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.

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

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

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

j) 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.

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

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

m) 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.

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

o) 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.

p) 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) 765/400 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 contractor.

d) Grading/ Corona ring shall be provided on each complete arrestor units as required. The contractor 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 a 2.0 m long insulated stranded 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.

5.0 TESTS:

5.1 The surge arresters should 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 beings 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 arresterunits.
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 & emerging Capability test on block (procedure to be mutually agreed).
3. Wattloss tests.

(c) Routine Tests:

1. Sealing test
2. Water dip test at 1.5 m depth from top of surge arrestor for 30 minutes 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).
3. Measurement of reference Voltage.
4. Residual voltage test of arrester unit.
5. Internal Ionization test or partial discharge test.
6. Vertically check on completely assembled surge arrester as a sample test on each lot.
7. 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. 800 KV CLASS SURGE ARRESTER TECHNICAL PARAMETERS

800 KV LIGHTNING ARRESTERS

Sl.No	DESCRIPTION	
1	Rated arrester voltage	624 KV
2	i) Nominal Discharge current ii) Discharge current at which Insulation co-ordination will be Done	20KA of 8/20 microsecond wave 20 kA of 8/20 Microsecond wave
3	Minimum discharge capability	13kJ/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	490 kV rms.

5	i) Max. Switching surge residual Voltage (1kA) ii) Max. Switching surge residual Voltage (2kA)	1180 kVp 1220 kVp
6	Max. residual voltage at 20 kA nominal discharge current	1480 kVp
7	Max steep current impulse residual voltage at 10 kA	1480 kVp
8	Long duration discharge class	Class 5
9	High current short duration test Value (4/10 micro second wave)	100 kVp
10	Current for pressure relief test	50kA rms
11	Low current long duration test value	As per IEC
12	Prospective symmetrical Fault current	50kA (rms) for 0.2 Sec.
13	Pressure relief class	50 kA

B)420 KV CLASS SURGE ARRESTER TECHNICAL PARAMETERS (NOT IN SCOPE)

420 KV LIGHTNING ARRESTERS

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	12kJ/kV or corresponding to clause – 2.0(f) 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	Class 4
9	High current short duration test Value (4/10 micro second wave	100 kVp
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	63kA (rms) for 0.2 Sec.
13	Pressure relief class	63kA

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 Corporation 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.

** ** **

POWER / TERMINAL CONNECTORS

1.0. SCOPE :

The Power Connectors are for use in outdoor sub-stations in TAMILNADU.

2.0. CODES AND STANDARDS :

2.1. The power connectors should conform to IS 5561-1970 for the latest issue.
2.2. All materials used shall conform to the relevant Indian Standards.
2.3. The Aluminium alloys used in the manufacture of the connectors shall conform to designation A6 of IS 617-1975.
2.4. Conductor the bimetallic connector made from Aluminium Alloy Wherever for connecting equipment terminal made of copper or brass to ACSR casting shall be provided with bimetallic Strip.
2.5.1. All bolts and nuts shall have hexagonal heads.
2.5.2. All Bolts and Nuts shall be of stainless steel conforming to ISS 1570-304 quality.

2.5.3 The design of clamp shall be to our approval. The details of current take off as required by us shall be detailed out in drawing and shall be submitted along with the bid. In respect of the terminal connectors following should be ensured:-

(a) The terminal connector should be made of A6 Aluminum Alloy and by pressure / gravity die cast only. Sand casted terminal connectors are not acceptable.
(b) All castings shall be free from blow holes, surface blisters, cracks and Cavities. All sharp edges should be rounded off.
(c) No part of clamp shall be less than 12 mm thick.
(d) The bimetallic strips / sleeve shall be 2 mm thick.
(e) All nuts, bolts & washers shall be of Hot Dip Galvanised mild steel.
(f) The conductor should be tightened by six bolts. Conductor hold length must not be less than 100 mm.
(g) The surface of clamps to be tightened by six bolts should be flat in shape so that it may be possible to open the nuts and bolts by normal flat spanners. Therefore, any type of groove in the clamp body for fixing of nuts should be avoided.
(h) The portion of clamp to hold the conductor should be flat and straight and not zig-zag in construction, at both the sides, so that holding of clamp by throttling action of current may be avoided.
(i) Space of at least 50% of diameter of nuts should be available after the hole at both the sides of conductor holding portion for better mechanical strength.
(j) All current carrying parts shall be designed and manufactured to have minimum contacts resistance.
(k) The clamp for Twin Moose ACSR Conductor shall be in three pieces so that each conductor may be tightened separately.
(l) Size of terminal connector for which the clamp is designed and also rated current under site conditions shall be embossed / punched on each part of clamps except hardware

(m)**All the power connecters should be corona free and type tested for RIV irrespective of voltage level**.

3.0. RATING :

3.1. The rated current of Power Connectors shall be generally 3000 A and for switch end clamps 3000 A.

3.2. The rated frequency of Power Connectors shall be 50 Hz.

3.3. The rated short time current shall be 63 KA (rms)/ 1 sec for 400KV system and 50.0. KA (rms) for 1 Second for765 KV system.
The rated Peak short circuit current shall be 2.5 times that of rated S.T.C.

4.0. REQUIREMENTS :

4.1. The power connectors surface shall be smooth and free from cavities, blow holes and such other defects which would be likely to cause them to be unsatisfactory in service also capable of preventing the built up of non conducting oxide.

4.2. The power connectors shall be so designed and proportioned that they are capable for safety withstanding stresses to which they may be subjected during erection, normal service, under short circuit and climate conditions and that the effects of vibration both on the conductor and the connector itself are minimized. They shall be designed, manufactured, and finished so as to avoid sharp radius of curvature, ridges and excrescences which might lead to localized pressure on or damage to the conductor in service.

4.3. Sufficient contact pressure should be maintained at the joint by the provision of required number of bolts or other fixing arrangements. But the contact pressure should not be so great so as to cause relaxation of the joint by cold flow. The joint should be such that the pressure is maintained within this range under all conditions of service. To avoid excessive local pressure, the contact pressure should be evenly distributed by the use of pressure plates, wharewashers or suitable saddles of adequate area and thickness.

4.4. The Power Connectors shall be so designed that the joints runs cooler than the associated Bus Bar.

4.5. The Power Connectors shall have short and as far as possible direct current paths.

4.6. The Power Connectors shall avoid crevices where moisture can accumulate or through which corrosive atmospheres can penetrate.

4.7. All the current carrying parts shall be designed and manufactured to have minimum contact resistance.

4.8. The thickness of any current carrying parts shall not be less than 16 mm.

4.9. The clamps and fitting shall be so designed that the post Insulators shall not be subjected to any abnormal stresses due to thermal change in conductor.

4.10. All the clamps and fittings shall be as short as possible.

4.11. Wherever possible there shall be two halves and no U Bolts shall be used.

5.0. **LIMITS OF TEMPERATURE RISE :**

5.1. The limits of temperature rise specified are based on the following reference ambient temperatures :

a) Maximum ambient air temperature : 45 Degree C
b) Maximum daily average ambient temp. : 35 Degree C
c) Maximum yearly ambient temperature : 30 Degree C

5.2 The temperature rise of Power Connectors above a reference ambient temperature 40 Degree C when carrying rated current shall not exceed 45 Degree C.

6.0. PROTECTION AGAINST CORROSION :

All parts of Power Connectors shall either be inherently resistant to atmospheric corrosion or be suitably protected against corrosion, both during storage and in service.

7.0. TESTS AND TEST CERTIFICATES :

TYPE TESTS :

7.1. Tenderers are requested to furnish copy of type test certificates for the material/equipment of their make in full shape as conforming to relevant IS/IEC Standards of latest issue obtained from a Government/ Government recognised Laboratory . The above type test certificates should accompany the drawings of the material/equipments, duly signed under seal by the Institution who have issued the type test certificate.

7.2. The above type test certificates shall be furnished and get them approved before offering of the inspection of first lot of materials/equipments at no extra cost to TANTRANSCO and no relaxation to TANTRANSCO's Delivery Clause will be given on this account.

7.3. The above type test should have been conducted not earlier than five years (5 years) as on the date of submission. Non submission of above type test certificates within the stipulated time will entail cancellation of Purchase Order without any further reference to the supplier.

7.4. The original type test certificates shall be furnished for verification on request Type Test conducted:

a) Tensile Test
b) Resistance Tests
c) Temperature Rise Test
d) Short Time Current Test
e) Dimensions Check
f) RIV Test & Corona Test for all power connectors in respective of voltage rating.

7.6 Acceptance Tests :

a) Tensile Test
b) Resistance Tests
c) Dimensions check
d) Galvanising Test wherever applicable

7.7 Routine Tests :

a) Visual Inspection and
b) Dimensional check.

8.0 INSPECTION :

The accredited representatives of the Purchaser shall have access to the contractor's works at any time during the working hours for the purpose of inspecting the manufacturing of materials and for testing and may select samples from the materials. The contractors shall provide facilities for the above.

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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

(xii) Basic Wind Speed : **47 m/s(Zone -4)**

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	400kV
2.	Maximum operating voltage of the system(rms)	800kV	420kV
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	500mm above FGL	500mm 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) asmentioned 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 rom 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 .

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.

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

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

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,

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.

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	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-

SCHEDULE OF GUARANTEED TECHNICAL PARTICULARS OF 800 KV SURGE ARRESTERS

1. Name and address of Manufacturer	1. .....
2. Manufacturer's type designation	2. .....
3. Applicable standards	3. .....
4. Arrester class and type	4. .....
5. Rated arrester voltage (kV)	5. .....
6. Rated system voltage (kV)	6. .....
7. Maximum continuous operating voltage (COV) at 50 deg.C ambient temperature (kV)	7. .....
8. Nominal discharge current(8/20 micro sec.wave) (kA)	8. .....
9. Minimum discharge capability (kJ / kV)	9. .....
10. a) Maximum residual voltage at nominal discharge current (kVpeak)	10.a) .....
b) Minimum residual voltage at nominal discharge current (kVpeak)	10.b) .....
11. a) Maximum residual voltage at 50 % nominal discharge current (kVpeak)	11.a) .....
b) Maximum residual voltage at 200% nominal discharge current (kVpeak)	11.b) .....
12. Steep fronted wave residual voltage at 1 KA (kVpeak)	12. .....
13. Long duration discharge class	13. .....
14. Impulse current withstand 14.	
a) High current short duration (4/10 micro-sec wave) in kVpeak	a) .....
b) Low current long duration (2000 microsec.)	b) .....
15. Current for pressure relief test (kA)	15. .....
16. Pressure relief class (as per IEC 99)	16. .....
17. One minute power frequency (dry) withstand voltage of arrester housing (kVrms)	17. .....
18. Lightning Impulse withstand test voltage of arrester housing with 1.2/50 microsec wave (kVp)	18. .....
19. Total creepage distance of whole arrester housing (mm)	19. .....
20. Cantilever strength of complete arrester (N)	20. .....
21. Total height of the arrestor (mm)	21. .....
22. Total weight of the arrestor (Kg)	22. .....
23. Maximum radio interference voltage at 1.1 Ur/ root 3 voltage at 1 MHz (microvolts)	23. .....
24. Partial discharge at 1.05 continuous operating voltage (pC)	24. .....
25. Minimum prospective symmetrical fault current (kArms)	25. .....

26. ZnO block details 26.....

a) Confirm whether equipment type tested with offered type of ZnO block a)

27. Confirm whether similar equipment are type tested as per IEC/IS or equivalent standard and are in successful operation for at least one year. 27.....

28. Overall General Arrangement drawing of Surge arrester is to be enclosed. 28. .....

SECTION V

TECHNICAL CHECK LIST FOR SURGE ARRESTOR

(INFORMATION TO BE FURNISHED WITH OFFER)

BIDDERS ARE INSTRUCTED TO

WRITE **'YES'** UNDER CLOUMN '2', IF THE INFORMATION / SCHEDULE IS FURNISHED / ENCLOSED WITH THE OFFER, **OR**

WRITE **'NO'** UNDER CLOUMN '2', IF THE INFORMATION / SCHEDULE IS NOT FURNISHED / ENCLOSED WITH THE OFFER, **OR**

WRITE **'NOT APPLICABLE (NA)'** UNDER CLOUMN '2', IF THE INFORMATION / QUERY / SCHEDULE IS NOT RELEVANT TO THEM, **AND**

RETURN THIS CHECKLIST AS THE PART OF THE OFFER DULY SIGNED BY THEM.

	Parameters	1	2	3
S.No.		Specified Requirement	Confirmation Yes	Comments, if Any
1.	Type	Gapless , Zinc Oxide		
2.	Installation	Outdoor		
3.	Nominal System Voltage	765kV		
4.	Highest system Voltage	800kV		
5.	Rated Arrestor Voltage(KV)	624kV		
6.	Type of Insulator housing	Polymer/Porcelain		
7.	Standard applicable for Surge arrestor	IEC:60099-4		
8.	Nominal discharge current	20kA of 8/20 microsecond wave		
9.	Continuous Operating Voltage at 50 deg C	490kV (rms)		
10	Max. Residual Voltage at 20kA nominal discharge current	1480kVp		
11	Max. Residual Voltage at steep front wave at 10kA	1480kVp		
12	Min. discharge capability	13kJ/kV		
13	Rated frequency (Hz)	50		
14	High current short duration test value(4/10 micro second wave)	100kAp		
15	Current for Pressure relief test	50kA rms		
16	Long duration discharge class	Class 5		
17.	Cantilever strength of Polymer Insulator (min)	500kG		
18.	Min. creepage distance	20000mm		
19.	Length of connecting lead between Surge arrestor to counter	8.7 meter		
20	Potential free contact in surge counter	Provided		
21	Degree of Protection for Surge counter	IP67		

SECTION V

TECHNICAL CHECK LIST FOR SURGE ARRESTOR

	Parameters	1	2	3
S.No.		Specified Requirement	Confirmation Yes	Comments, if Any
22	Accessories & Earthing Connection leads between the bottom of the Arrester & Surge counter	included		
23	Hardware required for inter-unit connection and to connect the Lightening arrester to structure	Yes		
24.	Corona ring (If applicable)	Yes		
25	Terminal connectors suitable for Quad Bull AAC Conductor	Yes		
26	Type test Reports as per clause 6 of section-1 of Technical specification as on 30.09.16	Yes		
27	Compliance of all tests as per clause no. 5 of section 2B.	YES		
28	Type test Reports	Enclosed		
29	Type test charges (if not acceptable to customer)	Free		
29	GA drawing, GTP & VI characteristics graphs	Enclosed		
30	Technical requirement as per clause 3.0 of section-1	Enclosed		
31	A legally enforceable undertaking by the manufacturer shall be furnished during contract execution for guarantee quality, timely supply and performance of the 765 KV Surge arrester.	Confirmation		

Date:
Place:

(Signature of the authorized representative of Bidder / Firm / Company)
Name:
Designation:
Company Seal:

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