



BHARAT HEAVY ELECTRICALS LIMITED

TRANSMISSION PROJECTS ENGINEERING MANAGEMENT

DOC. No.	TB-342-552-002	Rev.	01	Prepared	Checked	Approved
TYPE OF DOC.	TECHNICAL SPECIFICATION	NAME	AK	VSK	RMS	
TITLE	FIRE PROTECTION SYSTEM	SIGN	-sd-	-sd-	-sd-	
		DATE	19.9.11	19.9.11	19.9.11	
		GROUP	TBEM	W.O. No	80008	

CUSTOMER	KARNATAKA POWER TRANSMISSION CORPORATION LIMITED
CONSULTANT	
PROJECT	400/220 kV SWITCHYARD AT TALAGUPPA & GUTTUR
LOA NO.	CEE/T&P/SEE(E)/EE(T)/T-2/10478-86; CEE/T&P/SEE(E)/EE(T)/T-2/10487-95; CEE/T&P/SEE(E)/EE(T)/T-2/10497-504

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01	24.12.11	<i>Quilash</i>	<i>[Signature]</i>	<i>[Signature]</i>	PI is being revised for inclusion of fire extinguishers to scope as per additional input given by PPE on date 01.12.2011			
Rev No.	Date	Altered	Checked	Approved	REVISION DETAILS			
Distribution				To	TBMM	VENDOR	TBEO	
				Copies				

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System : FIRE PROTECTION SYSTEM **Rev 01**
Owner : KARNATAKA POWER TRANSMISSION CORP. LIMITED
Purchaser : BHARAT HEAVY ELECTRICALS LIMITED



CHECK LIST

SCHEDULE OF INFORMATION TO BE FURNISHED WITH THE OFFER

BIDDER SHALL

PUT A TICK '✓' IF THE INFORMATION IS ENCLOSED WITH THE OFFER,
PUT A CROSS 'X' IF THE INFORMATION IS NOT ENCLOSED, OR
WRITE 'NOT APPLICABLE' IF THE QUERY/ SCHEDULE IS NOT RELEVANT
AND RETURN THIS CHECKLIST AS PART OF THE OFFER DULY SIGNED

The offer may not be considered if the following information and this Checklist are not enclosed with the Offer.

PROJECT:

PACKAGE:

TENDER SPECIFICATION NO.:

BIDDER:

OFFER REFERENCE:

1. Technical offer with detailed schedules of equipment/ material and spares _____
2. Unpriced bid in the prescribed format given in Schedule-10 of Section-5 of tender specification _____
3. Filled up Guaranteed Technical Particulars as per Section – 4 _____
4. Schedule of Deviations listing deviations, if any, clause-wise with respect to technical specification _____
5. Confirmation On adequacy of modifications on transformer in line with cl. 6.3.0 of Section-1 of Technical Specification _____
6. List of Special tools & tackles for operation & maintenance of the system. _____
7. Type test reports. The type test reports shall be accompanied with a list listing all the relevant clauses of the applicable standard and the corresponding type test report. The manufacturer shall also furnish a certificate certifying that the test reports have been carried out on equipment identical in all respects to the one offered. In case the reports are for different equipment and the applicability of the report is permitted as per applicable standards, the justification shall be enclosed to the list of type test reports. _____
8. Bar Chart showing time schedule showing time required for design, manufacture, test and inspection, transport, erection, site testing and commissioning _____
9. Any additional information called for in any part of the technical specification. _____

Date:

Signature of the authorized representative of Bidder

Company Seal

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SECTION 1

INTENT, SYSTEM REQUIREMENT, DESIGN CRITERIA AND SCOPE

1.0.0 INTENT OF SPECIFICATION

- 1.1.0 This specification covers the design, manufacture, inspection and testing at Contractor's and/ or his Subcontractor's works, proper packing for transportation, delivery (FOR destination), unloading, storage and handling at site, erection, testing & commissioning of 'Fire Protection System' at 400/220 KV STATION at TALAGUPPA & GUTTUR
- 1.2.0 The system shall be designed, erected & commissioned in accordance with TAC, NFPA or any other guidelines of international repute applicable for the system.
- 1.3.0 Various technical requirements are laid down in Section-1, Section-2 & Section-3 of this specification. In the event of any contradiction w.r.t. other sections of this specification, requirements of Section 1 shall prevail.
- 1.4.0 The Bidder to note carefully that the parameters, estimated capacities of equipment indicated under this specification or in the tender drawings are only for the guidance of the Bidder. The system shall be designed as per relevant standards/ codes and exact capacities and quantities are to be estimated by the Bidder. All such estimations and design calculations shall be submitted for Purchaser's approval.
- 1.5.0 **The unit rate contract shall be based on the BOQ furnished by BHEL for the package. Addition/ deletion in quantities during contract stage shall be settled on the basis of unit rates, quoted by the bidders in their respective bids.**
- 1.6.0 The Contract shall be on unit rate basis for the quantities furnished by BHEL. During contract stage, quantities of various items of BOQ may vary to any extent and same rates will be applicable so far the resultant variation in total contract value is within $\pm 20\%$. Variations beyond $\pm 20\%$ shall be negotiated mutually.
- 1.7.0 The term 'Owner' appearing in this specification shall refer to Karnataka Power Transmission Corporation Ltd. (KPTCL), the term 'Purchaser' shall refer to Bharat Heavy Electricals Ltd. (BHEL) and the term 'Contractor' shall refer to the **successful Bidder**.
- 1.8.0 In case of any deviation, the bidder shall indicate clause-wise deviations with respect to the specification separately in the '**Schedule of Deviation**' given as Annexure-1 in Section-5 of this specification. *Deviations in any other form including clarifications / assumptions / etc will not be considered and it will be construed that the bid conforms strictly to the specification.*

2.0.0 QUALIFYING REQUIREMENT FOR THE BIDDER

- 2.1.0 The bidder shall have a minimum experience of 5 years in design, manufacture, testing and commissioning of nitrogen injection fire protection system in the present enquiry. At least 50% of the quantity called for in the present enquiry shall be in successful operation for a minimum period of 2 years. The tendered shall also furnish the details of similar nitrogen injection fire protection system supplied by them so far, giving order reference name and address of the customer etc, also indicating the period of commissioning. The bidder shall also furnish performance certificates for a period of

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minimum 2 years of similar nitrogen injection fire protection system in proof of satisfactory operation of the equipment.

3.0.0 TYPE OF FIRE PROTECTION REQUIRED

- 3.1.0 Nitrogen injection fire protection system for 63 MVAR Shunt reactors one at each site Nelamangla and Hoody

4.0.0 DESIGN CRITERIA

- 4.1.0 NITROGEN INJECTION FIRE PROTECTION SYSTEM shall prevent tank explosion and fire during internal faults resulting in an arc where tank explosion will normally take 3-4 seconds after arc generation and also extinguishes the external oil fires on transformer top cover due to tank explosion and/ or external failures like bushing fires, OLTC fires and fires from surrounding equipments. It should be fully automatic and shall require minimum maintenance and practically no running cost.

All the requirements regarding supplies, provisions of control, interlocks, indications, annunciations, alarms etc, stipulated in Section-2 shall be satisfied by the contractor in totality.

5.0.0 SCOPE OF SUPPLIES & SERVICES

The requirements mentioned under this clause are *indicative* for the system. Any other item/ service, which is not specifically mentioned herein but required to complete the work for safe and sound operation of system shall be supplied and installed by the contractor at no extra cost to the purchaser.

Anything major left out in the BOQ shall be clearly highlighted/ brought to purchaser's notice in the Bid itself.

5.1.0 SCOPE OF SUPPLY

- i. The Bill of Quantities shall be read in conjunction with the Instructions to Bidders, General and Special Conditions of Contract, Technical Specifications, and Drawings.
- ii. The quantities given in the Bill of Quantities are estimated and provisional, and are given to provide a common basis for bidding. The basis of payment will be the actual quantities of work ordered and carried out, as measured by the Contractor and verified by the Purchaser and valued at the rates and prices bid in the priced Bill of Quantities.
- iii. A rate or price shall be entered against each item in the priced Bill of Quantities. The cost of Items against which the Contractor has failed to enter a rate or price shall be deemed to be covered by other rates and prices entered in the Bill of Quantities.
- iv. The whole cost of complying with the provisions of the Contract shall be included in the Items provided in the priced Bill of Quantities, and where no Items are provided, the cost shall be deemed to be distributed among the rates and prices entered for the related Items of Work.
- v. General directions and descriptions of work and materials are not necessarily repeated nor summarized in the Bill of Quantities. References to the relevant



sections of the Contract documentation shall be made before entering prices against each item in the priced Bill of Quantities.

- vi. Miscellaneous items like hardware, fixtures etc. shall be deemed to be included under the relevant BOQ items and bidders shall consider the same while quoting for BOQ items.

5.1.1 BILL OF MATERIAL OF NITROGEN INJECTION SYSTEM

Sl. No.	Item Description	Unit	Qty.	
			Talaguppa	Guttur
1	Fire extinguishing cubicle with base frame, consisting of: a. Nitrogen Gas cylinder of sufficient capacity with pressure regulator and manometer with sufficient number of adjustable NO contacts. b. Oil Drain Assembly c. Mechanical release device for oil drain and nitrogen release. d. Limit switches for monitoring the systems e. Panel lighting f. Flanges on top of the panel for connecting oil drain and nitrogen injection pipes for transformer. g. Oil drain pipe extension of suitable size for connecting pipes to oil pit. h. Limit switch for pressure switch/ sensor.	SETS	1	1
2	Control box to be installed in control room for monitoring system operation, automatic controls and remote operations. Control box should be complete with DC-DC converter for audio-visual alarm, indicating lights, switches, push buttons etc. suitable for tripping and signaling on 220V DC supply.			
3	Signal box for terminating cable connections from PRV/ pressure sensor, PNRV/POBV, fire detectors and circuit breaker trip signal.			
4	Pre-stressed non-return valve (PNRV)/ high speed pneumatically operated ball valve (POBV) with sufficient number of NC contacts for remote alarm indication and with visual position indicator.			
5	Fire detectors rated for heat sensing at 141°C or suitable temperature recommended by the manufacturer and each fitted with two nos. PG 13.5 size cable glands.	Nos.	12	12
6	Fire survival cables of size 4Cx1.5 mm ² for connecting fire detectors, PNRV/ POBV, buchholz relay and other signals on transformer top cover to terminals in signal box.	Mtrs	25	25
7	FRLS cable of size 12Cx1.5 mm ² for connecting signal box mounted on transformer to control box in the	Mtrs.	1000	650

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	station control room.			
7.1	FRLS cable of size 4CX1.5mm sq for interconnection of AC supply and connection in relay panel	Mtrs	50	50
8	Piping along with supports & fittings between transformer, FE cubicle and oil drain pit			
8.1	Oil drainpipe connection between outlet valve provided on transformer tank and flange provided on top of FE cubicle.	Mtrs.	10	10
8.2	Oil drainpipe connection between oil drainpipe bottom (in FE cubicle) to the oil pit.	Mtrs.	10	10
8.3	Nitrogen injection pipe connection between inlet openings on transformer tank and flange provided on top of FE cubicle.	Mtrs.	25	25

Fire Extinguishers

1	Foam type extinguisher (Mechanical) 45 Ltr. capacity	No.	4	4
2	Foam type extinguisher (Mechanical) 9 Ltr. capacity	No.	4	4
3	Water type (gas pressure type) 9 Ltr. capacity	No.	10	10
4	Carbon di-oxide type 6 Ltr. Capacity	No.	10	10
5	Sand type G.I Buckets 9 Ltr. Capacity	No.	16	16
6	Steel stands for above to have 4 buckets to each stand.	No.	4	4

NOTE: - Following items pertaining to Nitrogen injection system at each site are excluded and are in BHEL scope

1. 25 NB Gate valve
2. BUCHHOLZ relay
3. 150NB Gate valve

Bidder shall note the following:

- BHEL shall lay single feeder for 220VDC upto control box in station control room. Bidder shall terminate this feeder in his control box and make his own arrangements to extend this supply elsewhere, if required.
- Cable trays, if required, shall be provided to contractor on free issue basis, however necessary hardware for fixing the same on walls or elsewhere shall be included by the bidders in their offers.
- Earthing of various equipment under his scope of supply shall be in contractor's scope, however GS flat (25X3mm or 50x6 or 75x10mm) shall be provided by BHEL on free issue basis. Bidders shall furnish their tentative requirements in their respective bids.
- Bidders shall consider only reputed makes of equipments. All makes shall be subjected to acceptance of final customer. No additional price implication shall be made to BHEL on account of non-acceptance of proposed makes during contract stage.
- Bidder shall consider following items also while quoting:

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- i. Cable glands, lugs, marker, and cable ties etc. for termination of power and control cables.
- ii. Fixing hardware for mounting various equipments in the system and cable trays etc.
- iii. Standard tools & tackles required for operation & maintenance of the system. (The list of tools required shall be furnished in the bid.)
- iv. Civil work for FE cubicle plinth and pipe support

➤ **Bidder shall also furnish a list of tools and tackles, which shall be brought to site for erection & commissioning purpose and shall not constitute 'Supply' items under the contract. If such list is not furnished, the items shall be construed to be part of scope of supply.**

5.2.0 SCOPE OF SERVICES

5.2.1 Erection, Testing & Commissioning (ETC) requirements

- a) The scope of ETC shall include receipt of material at site, safe unloading, storage and handling of equipment/ material at site, erection of equipment /material at site including fabrication, equipment/ system testing and commissioning of the entire system.
- b) Laying and termination of piping between transformer, FE cubicle and drain pit along with supports and fittings.
- c) Laying and termination of power and control cables for the equipment under the scope this specification.
- d) Laying & fixing of cable trays on walls or elsewhere, if required.
- e) Earthing of all the system components (equipments) to the nearest earth mat riser of the Owner / Purchaser.
- f) The contractor shall arrange all machinery -tools & tackles and consumables required for erection of the system.
- g) Contractor shall ensure that sufficient quantity of commissioning spares is made available for timely completion of commissioning of the system. The contractor shall furnish a list of commissioning spares that will be brought by him. The unused commissioning spares shall be returnable to the Contractor.
- h) Construction water and 415 V power shall be made available by purchaser at one point. Contractor shall be required to make own arrangement for taking supplies from there.
- i) It is the responsibility of the successful Bidder to obtain necessary approval/ clearance from statutory organizations wherever applicable for the equipment/ systems under the scope specified.
- j) The contractor shall train engineers of Purchaser/ Owner so that they are fully conversant with both electrical and mechanical part of the package.
- k) **CIVIL WORKS:** The following shall be in the scope of Contractor:
 - i) Construction of foundation and brick housing for fire extinguishing cubicle and painting the same on inside & outside. The housing shall have RCC roof.
 - ii) Any other civil work involved in the system.

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- iii) Any damage caused to civil works during ETC work of the equipment/ system shall be made good to the original finish by the Contractor at no extra cost to the Purchaser.
- l) The contractor shall furnish the operation and maintenance manual for the system. The draft O&M manual shall be submitted within 4 weeks after award of contract.
- The O&M manual shall contain the following information:
- i) Description of the system and equipment with design particulars
 - ii) Scheme of operation for prevention of tank explosion and fire protection alongwith a flowchart showing sequence and time of operation of various devices of the system.
 - iii) Instruction for installation, operation, maintenance and repair at site.
 - iv) Recommended inspection practices and inspection schedule.
 - v) Ordering information for all replaceable parts

6.0.0 EXCLUSIONS

6.1.0 Supply of necessary cable trays for laying power and control cables, wherever required.

6.2.0 Supply of

- i. 25 NB Gate valve
- ii. BUCHHOLZ relay
- iii. 150NB Gate valve

6.3.0 Supply of GI flat for earthing of equipments.

6.4.0 Modifications on transformer:

- a. Oil drain opening with pipe flange and manual gate valve at about 120mm below the top cover.
- b. Nitrogen injection openings with suitable size of pipe with flange and manual gate valve on tank sides at about 50-200mm from the bottom plate.
- c. Flanges on conservator pipe between buchholz relay and conservator tank for fixing PNRV/ POBV.
- d. Provision for temperature and pressure sensors if required.
- e. Supply and welding of fire detector bracket on top cover.
- f. Supply and welding of brackets for fixing signal box at a suitable location on top cover or tank side wall.

Bidder shall confirm adequacy of the above arrangements on transformer. Any other requirement shall be brought out clearly in the bid itself. Bidder shall also indicate sizes of various openings and valves, mentioned above.

7.0.0 HANDING & TAKING OVER

It is the responsibility of Contractor to maintain the system till it is handed over to the owner.

Pre commissioning tests shall be carried jointly with the purchaser's representative prior to handing over the system. Not with standing above technical specifications any additions be incorporated for correct operating of nitrogen injection fire protection system without extra cost.



SECTION 2 EQUIPMENT SPECIFICATION

1.0.0 GENERAL DESIGN AND CONSTRUCTIONAL REQUIREMENT

It is not the intent to specify herein all the details of design and manufacture. However, the fire fighting equipment and the system shall conform in all respects to high standards of design, engineering and workmanship and shall be capable of performing the required duties in a manner acceptable to Purchaser/ Owner, who will interpret the meaning of drawings and specifications and shall be entitled to reject any work or material, which in his judgment is not in full accordance herewith.

2.0.0 EQUIPMENT SPECIFICATION

2.1.0 PORTABLE FIRE EXTINGUISHERS

2.1.1 STANDARD

The fire fighting equipments to be supplied shall conform to the latest revisions there of the following Indian standards (IS).

IS:933-1976	Portable chemical fire extinguisher foam type
IS:940-1972	Portable chemical fire extinguisher water type (gas pressure)
IS:2546-1974	Galvanized mild steel fire buckets
IS:2878-1964	Portable chemical fire extinguisher carbon-dioxide type
IS:5490-1969	Refills for portable fire extinguishers and chemical fire engines

Fire fighting equipments offered by the supplier if conform to other standards, salient points of difference between the standards adopted and the specified standard shall clearly be brought out in the offer. Four (4) copies of the reference standards in English language shall be furnished along with the offer.

2.1.2 MATERIAL, DESIGN AND WORKMANSHIP

- 2.1.2.1 The fire fighting equipments shall be suitable for outdoor use.
- 2.1.2.2 The portable fire extinguishers shall be complete with handle, bracket, trolley (wherever necessary) and other connected accessories. The bracket design shall be such that the extinguisher can be easily removed during the fire emergency.
- 2.1.2.3 Front of the portable fire extinguishers shall be clearly marked with the type of extinguisher capacity contents and method of operation.
- 2.1.2.4 In case, of GI buckets, suitable stand hooks shall be provided for keeping 4 Nos. at a place. The buckets shall be secured at a height of 0.9 Mtrs an above ground level.
- 2.1.2.5 The buckets shall be enamel painted (RED) with the contents indicated on each bucket.
- 2.1.2.6 Reputed makes of various fire extinguishers shall be offered which is subject to approval of the purchaser. All extinguishers shall be approved by the National standards Institution.



2.1.3 TEST

All type tests and routine/ acceptance tests shall be conducted as per relevant IS.

2.1.4 TYPE TESTS

2.1.4.1 Bid shall contain the type tests certificates as per relevant IS not older than 5 years in respect of fire fighting equipments from the date of bid opening.

2.1.4.2 In case the fire fighting equipments offered, has already been type tested. The bidder shall furnish four sets of type test report along with the offer. In case these type tests are conducted earlier than five years, all the type tests as per the relevant standards shall be carried out by the successful bidder in the presence of owner's representative at free of cost.

2.2.0 NITROGEN INJECTION FIRE PROTECTION SYSTEM

2.2.1 The system shall work on the principle of drain and stir and on activation, shall drain a predetermined quantity of oil from the tank top through outlet valve to reduce the tank pressure and inject nitrogen gas at high pressure from the lower side of the tank through inlet valves to create stirring action and reduce the temperature of top oil surface below flash point to extinguish the fire. Conservator tank oil shall be isolated during tank explosion and oil fire to prevent aggravation of fire.

2.2.2 Transformer isolation shall be an essential pre-condition for activating the system. The system shall consist of following equipments.

- a. Fire extinguishing cubicle placed on a plinth at about 5-10 meters away from the transformers.
- b. Control box placed in the control room.
- c. Pre-stressed non-return valve in the conservator pipe / high speed pneumatically operated ball valves. Backup valve may be provided to the main valve, if necessary. These backup valves could be operated on the same principle or by a different principle as the main valve.
- d. Required number of fire detectors on the tank top cover.
- e. Signal box fitted on the tank top or tank sidewall.
- f. Terminating signals from PRV, fire detectors. Differential relay, buchholz relay. PNRV / Pneumatic valve and for cable connecting to control box.
- g. On line testing facility of the system.

2.2.3 OPERATIONAL CONTROLS

The system shall be provided with automatic controls for fire prevention fire extinction and besides remote electrical push button control on con box and local manual control in the fire-extinguishing cubicle shall provided.

2.2.4 SYSTEM ACTIVATING SIGNALS

2.2.4.1 To avoid transformer explosion two fast trip signals given by circuit breaker of transformer and Buchholtz relay paralleled with pressure relief valve / pressure & temperature sensors to initiate.



- (i) Explosion prevention by opening quick depressurisation valve to release the internal pressure and to prevent the transformer explosion.
- (ii) Oil cooling - by injecting a large flow of nitrogen at the transformer base to limit the damages of overheated panel affected by short circuit and to evacuate the very explosion hydrogen gas by dielectric oil.

2.2.4.2 (i) The fire protection back up system should be initiated by two signals from one of the high temperature sensors, located on the transformer cover and by the operation of Buchholtz relay paralleled with pressure relief device / pressure & temperature sensors. The drain valve should open out within 3 second. The nitrogen injection shall cause stirring of transformer oil and should immediately drop its surface temperature below flash point to extinguish fire with a minimum possible time. Nitrogen injection should continue for sufficient time, which will further cool the transformer and prevent any re-combustion.

- (ii) Fire protection back up system shall be provided to function in case if all transformer electrical protections leading to breaker trip or if all pressure sensors have failed during the incident, by the conventional nitrogen fire extinguishing method.

In case of fire, even if the circuit breaker has not tripped the system shall inject nitrogen into the transformer tank even when the transformer is live but after giving warning signal to the operating personnel to manually isolate the circuit breaker.

2.2.4.3 The system shall be of automatic operation and in addition, remote push button control through control box and manual local control in fire extinguishing cubicle are to be provided.

2.2.4.4 During the initiation / activation of sensing devices mentioned in 4(a) & above, for prevention of tank explosion or for fire protection, the oil from the conservator tank should be isolated, by action of PNRV / POBV

2.2.5 TECHNICAL PARTICULARS

- (i) Power supply, for control box / Fire extinguishing cubicle (lighting) : 220V DC / 230V AC
- (ii) Fire Extinguishing Cubicle Dimension/ Weight / capacity : Suitable for 100MVA Transformer
- (iii) Control Box dimensions / weights : Suitable for 100MVA Transformer
- (iv) Nitrogen Cylinder Capacity : Suitable for 100MVA Transformer with approx. 40 to 50 tonnes of transformer oil
- (v) Fire detectors Heat sensing Temperature : 141°C

2.2.6 TESTS

Type test certificates not later than 5 years as per relevant standards for Nitrogen injection fire protection system as a whole unit shall be furnished.

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2.2.6.1 SHOP TESTS

All shop tests shall be done in accordance with relevant IS codes/ standards. Charges for all these routine and acceptance tests shall be deemed to be included in the bid price.

Contractor shall submit the QP for all such equipments calling inspection/ testing for purchaser's approval in the prescribed format enclosed in Section 5. Approved QP & approved data sheets/ drawings shall be the basis of inspection/ testing.

2.2.6.2 SITE TEST

The contractor shall submit the field quality plan for approval of Purchaser/ owner in the prescribed format enclosed in Section 5. Various checks required beginning receipt & storing of material to commissioning of system should be mentioned in field quality plan.

Pre commissioning tests shall be carried jointly with the purchaser's representative prior to handing over the system. Schedule of these tests shall also be submitted for customer's approval.

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8.0.0 PERFORMANCE GUARANTEE

The equipment offered shall be guaranteed for satisfactory performance for a period of 18 months from the date of satisfactory commissioning of equipment. The equipment found defective / failed within the above guarantee period shall be replaced or repaired by the contractor free of cost within one month from the receipt of intimation. If the defective / failed nitrogen injection fire protection system are not replaced / repaired as per the above guarantee clause, Purchaser shall recover an equivalent amount plus 15% supervision charges from any of the contractor's bills.

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SECTION - 3 GENERAL TECHNICAL REQUIREMENTS

3.0 GENERAL

This section stipulates the General Technical Requirements under the Contract and will form an integral part of the Technical Specification.

The provisions under this section are intended to supplement general requirements for the materials, equipment and services covered under other sections and are not exclusive. However in case of conflict between the requirements specified in this section and requirements specified under other sections, the requirements specified under respective sections shall hold good.

3.1 SITE INFORMATION

Particulars		
a)	Customer/ Purchaser/ Owner	KPTCL/BHEL/KPTCL
b)	Engineer/ Consultant	NIL
c)	Project Title	Design, supply, erection commissioning of MVAR, 400 KV Bus ductor on Total Turn key basis at : 1) 400/220 KV HOODY ATION in Bangalore Urban District 2) 400/220 KV LAMANGALA STATION in Bangalore Rural District
		Design, supply, erection commissioning of MVAR, 400 KV Bus ductor on Total Turn key basis at : 1) 400/220 KV TALAGUPPA STATION in Taluk & Shimoga District 2) 400/220 KV GUTTUR STATION in Harihara Taluk, Channarayana District
d)	Location	
e)	Postal Address	Shall be furnished to successful bidder
SITE CONDITIONS		
a)	Max. ambient air temp.	50 deg C
b)	Min. ambient air temp.	0 deg C
c)	Max. design ambient temp.	50 DEG C
d)	Min. design ambient temp.	0 deg C
e)	Max. RH	100%
f)	Min. RH	10%
g)	Height above MSL	Upto 1500 m
h)	Pollution Severity	
i)	Seismic Zone	
WIND DATA		
a)	Site Wind Pressure	130 kg/sq.m

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b)	Average No. of understorm days per um	
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3.2 INSTRUCTION TO BIDDERS

The bidders shall submit the technical requirements, data and information as per the technical data sheets, provided in Section-4.

The bidders shall furnish catalogues, engineering data, technical information, design documents, drawings etc fully in conformity with the technical specification.

It is recognised that the Contractor may have standardised on the use of certain components, materials, processes or procedures different from those specified herein. Alternate proposals offering similar equipment based on the manufacturer's standard practice will also be considered provided such proposals meet the specified designs, standard and performance requirements and are acceptable to the Purchaser's. Unless brought out clearly, the Bidder shall be deemed to conform to this specification scrupulously. All deviations from the specification shall be clearly brought out in the respective schedule of deviations. Any discrepancy between the specification and the catalogues or the bid, if not clearly brought out in the specific requisite schedule, will not be considered as valid deviation.

Wherever a material or article is specified or defined by the name of a particular brand, Manufacturer or Vendor, the specific name mentioned shall be understood as establishing type, function and quality and not as limiting competition.

Equipment furnished shall be complete in every respect with all mountings, fittings, fixtures and standard accessories normally provided with such equipment and/or needed for erection, completion and safe operation of the equipment as required by applicable codes though they may not have been specifically detailed in the Technical Specifications unless included in the list of exclusions. Materials and components not specifically stated in the specification but which are necessary for commissioning and satisfactory operation of the switchyard/substation unless specifically excluded shall be supplied. All similar standard components/parts of similar standard equipment provided, shall be inter-changeable with one another.


In case there is a discrepancy between the data of offered equipment and catalogue furnished, and unless the deviation are brought out clearly in the Technical Deviation Schedule, the equipment will be deemed to conform compliance to the specification scrupulously.

The Contractor shall supply type tested (including special tests as per tech. specification) equipment and materials. The test reports shall be furnished by the Contractor, along with equipment/ material drawings. In the event of any discrepancy in the test reports, (i.e., if any test report is not acceptable due to any design/ manufacturing changes or due to non-compliance with the Technical Specification and/ or applicable standard), the tests shall be carried out without any additional cost implication to the PURCHASER. The PURCHASER reserves the right to get any or all type/tests conducted/repeated.

3.3 STANDARDS

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) of specified standards.

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In addition to meeting the specific requirement called for in Sections 1 and 2 of the Technical Specification, the equipment shall also conform to the general requirement of the applicable standards, which shall form an integral part of the specification.

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

When the specific requirements stipulated in the specifications exceed or differ from those required by the applicable standards, the stipulation of the specification shall take precedence.

Other internationally accepted standards, which ensure equivalent or better performance than that specified in the standards referred, shall also be accepted. The bidder shall submit copies of such standards.

In case governing standard for the equipment is different from IS or IEC,, the salient points of difference shall be clearly brought out in the offer along with English language version of standard or relevant extract of the same. The equipment conforming to standards other than IS/IEC shall be subject to Purchaser's / owner's approval.

The bidder shall clearly indicate in his bid the specific standards in accordance with which the works will be carried out.

3.4 SERVICES TO BE PERFORMED BY THE EQUIPMENT BEING FURNISHED

The 420kV system is being designed to limit the switching surge over voltage of 2.5 p.u., and the power frequency over voltage of 1.5 p.u., In case of the 420kV system, the initial value of the temporary overvoltages could be 2.0 p.u. for 1 - 2 cycles. The equipment furnished under this specification shall perform all its functions and operate satisfactorily without showing undue strain, restrike etc under such over voltage conditions.

All equipment shall also perform satisfactorily under various other electrical, electromechanical and meteorological conditions of the site of installation

All equipment shall be able to withstand all external and internal mechanical, thermal and electromechanical forces due to various factors like wind load, temperature variation, ice & snow, (wherever applicable) short circuit etc for the equipment. The equipment shall also comply to the following:

- a) All outdoor EHV equipment except marshalling kiosks shall be suitable for hot line washing.
- b) To facilitate erection of equipment, all items to be assembled at site shall be "match marked".
- c) Piping, if any, between equipment control cabinet and operating mechanism to marshalling box of the equipment shall bear proper identification to facilitate the connection at site.

3.5 ENGINEERING DATA

3.5.1 Drawings

All drawings submitted by the Contractor including those submitted at the time of bid shall be in sufficient detail to indicate the type, size, arrangement, material description, Bill of Materials, weight of each component, break-up for packing and shipment, the external connections, fixing arrangement required. the dimensions required for installation and interconnections with other equipment and materials, clearances and spaces required for installation and interconnections between various portions of equipment and any other information specifically requested in the specifications.

Each drawing submitted by the Contractor shall be clearly marked with the name of the Purchaser, the unit designation, the specifications title, the specification number and the name of

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the Project. If standard catalogue pages are submitted, the applicable items shall be indicated therein. All titles, noting, markings and writings on the drawing shall be in English. All the dimensions should be in metric units.

Further work by the Contractor shall be in strict accordance with these drawings and no deviation shall be permitted without the written approval of the Purchaser, if so required.

The review of these data by the Owner will cover only general conformance of the data to the specifications, documents and interfaces with the equipment provided under the specifications, external connections and of the dimensions which might affect substation layout. Owner may not indicate a thorough review of all dimensions, quantities and details of the equipment, material, any devices or items indicated or the accuracy of the information submitted. This review and /or approval by the Owner shall not be considered by the Contractor, as limiting any of his responsibilities and liabilities for mistakes and deviations from the requirements, specified under these specifications and documents.

All manufacturing and fabrication work in connection with the equipment prior to the approval of the drawings shall be at the Contractor's risk. The Contractor may make any changes in the design which are necessary to make the equipment conform to the provisions and intent of the Contract and such changes will again be subject to approval by the Purchaser. Approval of Contractor's drawing or work by the Purchaser shall not relieve the contractor of any of his responsibilities and liabilities under the Contract

All engineering data submitted by the Contractor after final process including review and approval by the Owner shall form part of the Contract Document and the entire works performed under these specifications shall be performed in strict conformity, unless otherwise expressly requested by the Owner in Writing.


3.5.2 Approval Procedure

The scheduled dates for the submission of these as well as for, any data/ to be furnished by the Owner would be discussed and finalised at the time of award. The Contractor shall also submit Four (4) copies of all drawings/design documents/test reports for approval of the Owner. The following schedule shall be followed generally for approval.

- | | |
|--|--|
| i) Approval/ comments/ by
Owner on initial submission
Of receipt | Within 4 (Four) weeks |
| ii) Resubmission (whenever Required) | Within 2 (Two) weeks from
Date of comments
(including both ways postal
time). |
| iii) Approval or comments | Within 2 (Two) weeks of
receipt of resubmission. |
| iv) Furnishing of distribution Copies | 2 weeks from the date of
final approval |

Notwithstanding the time schedule indicated for approvals, the contractor (successful bidder) shall be responsible for completing the works in stipulated time as per approved PERT Chart.

NOTES:

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- a) The contractor may note that all re-submissions must incorporate all comments given in the prior submission by the Purchaser. Adequate justification for not incorporating the same must be submitted, failing which the submitted documents may be returned.
- b) The drawings, which are required to be frequently referred during execution, should be submitted on cloth lined paper. The list of such drawings shall be finalised with the Contractor at the time of Award.
- c) All major drawings shall be submitted in Auto Card Version 12 or better.
- d) The instruction Manuals shall contain full detailed drawings of all equipment being supplied under this contract, their exploded views with complete instructions for storage, handling, erection, commissioning, testing, operation, trouble shooting, servicing and overhauling procedures.
- e) If after the commissioning and initial operation of the installation, the instruction manuals require any modifications/ additions/ changes, the same shall be incorporated and the Contractor shall submit the updated final instruction manuals to the Purchaser.
- f) The Contractor shall furnish to the Purchaser, spare parts catalogues also

Other requirements of Documentation.

Three sets of microfilm and 8 sets of all drawings per substation plus one set of microfilm and four sets of all drawings to Chief Engineer Eley., (Tendering & Procurement) KPTCL, Bangalore shall be furnished after approval of drawings, Microfilms submitted should be compatible with 35mm microfilming system.

The manufacturer shall also submit one video cassette (VHS-PAL) per substation and one for Chief Engineer, Electricity, (Tendering & Procurement), KPTCL, Bangalore highlighting installation and maintenance techniques / requirements of Circuit Breaker and isolators.

On completion of the entire works, the Contractor shall also furnish eight bound sets of all built drawings, duly signed by the site in-charge along with 1 set of microfilms. Computer floppies for each substation to Chief Engineer, Electricity, (Tendering & Procurement), KPTCL, Bangalore, containing as built drawings in Auto-cad version 12 or better shall also be submitted.

12(18+2+2) copies of instruction/operation manuals per sub-station to Chief Engineer, Eley., Tendering & Procurement, KPTCL, Bangalore shall also be furnished. The instruction manuals shall contain full details of drawings of equipment being supplied under this contract, their exploded diagrams with complete instructions for storage, handling, erection, commissioning, testing, operation, trouble shooting, servicing and overhauling procedures.


After approval of test reports, 6(six) bound sets containing all drawings/manuals, type and routine test reports etc., along with sub-vendor's test reports for all bought out assemblies/components/ parts including internal wiring diagrams and exploded diagrams of assemblies/components / parts, shall be furnished.

If after the commissioning and initial operation of the substation, the instruction manuals require any modifications/ additions/ changes, the same shall be incorporated and the updated final instruction manuals shall be submitted by the Contractor to the Owner.

The contractor shall furnish to the Owner, spare parts catalogues also.

3.6 COLOUR SCHEME

All steel structures, plates, etc. shall be painted with non-corrosive paint on a suitable primer. It may be noted that normally all Purchaser's electrical equipment in Purchaser's switchyard are painted with shade 697 of IS 5. All the indoor cubicles shall be of same colour scheme. For other miscellaneous items, the Purchaser will approve colour scheme.

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3.7 PROVISIONS FOR EXPOSURE TO HOT AND HUMID CLIMATE

Outdoor equipment supplied under the specification shall be suitable for service and storage under tropical conditions of high temperature, high humidity, heavy rainfall and environment favourable to the growth of fungi and mildew. The indoor equipment located in non-air-conditioned areas shall also be of same type.

One or more adequately rated thermostatically controlled heaters, suitable for continuous operation at 240-V supply, shall be provided to maintain temperature so as to prevent condensation in any compartment. On-off switch and fuse shall also be provided. The surface temperature of the heater assembly shall be restricted to a value which will not shorten the life of the heater sheaths or the wire insulation or other components in the compartment. The heaters shall be installed in the compartment and electrical connections shall be made sufficiently away from the heaters to minimize deterioration of supply wire insulation. The heaters shall be designed to prevent any contact between the heater wire and air. The design and construction of the heater shall be to approval.

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

The compartments may be provided with ventilation openings, if required. These openings shall be covered with fine wire mesh of brass to prevent ingress of insects and minimise the entry of dirt and dust. Openings in outdoor equipment shall be provided with shutter type blinds.

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

The minimum requirements for panels are as follows :

- a) Installed out door: IP- 55
- b) Installed indoors in air-conditioned area: IP-31
- c) Installed in covered area: IP-52
- d) Installed indoors in non air-conditioned area where possibility of entry of water is limited: IP-41.
- e) For LT Switchgear (AC & DC distribution Boards): IP-52.


3.8 RATING PLATES, NAME PLATES AND LABELS

Each main and auxiliary item of substation shall have, permanently attached to it in a conspicuous position, a rating plate of non-corrosive material. Upon this plate, shall be engraved manufacturer's name, year of manufacture, equipment name, type or serial number together with details of the loading conditions under which the item in question has been designed to operate, and such diagram plates as may be required by the Purchaser. The rating plate shall be according to IEC recommendations.

All such nameplates, instruction plates, rating plates shall be bilingual with Hindi inscription first followed by English. Alternatively two separate plates, one with Hindi and the other with English inscription, may be provided.

3.9 QUALITY ASSURANCE PROGRAMME

To ensure that the equipment and services under the scope of this Contract, whether manufactured or performed within the Contractor's Works or at his Sub-contractor's premises or at the Purchaser's site or at any other place of Work, are in accordance with the

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specifications, the Contractor shall adopt a suitable quality assurance programme to control such activities at all points, as necessary. Such programme shall be outlined by the Contractor and shall be finally accepted by the Purchaser after discussions before the award of Contract. A quality assurance programme of the contractor shall generally cover the following:

- (a) Contractor's organisation structure for the management and implementation of the proposed quality assurance programme ;
- (b) Documentation control system;
- (c) Qualification data of bidder's key personnel;
- (d) The procedure for purchases of materials, parts components and selection of sub-Contractor's services including vendor analysis, source inspection, incoming raw material inspection, verification of material purchases etc.
- (e) System for shop manufacturing and site erection controls including process controls and fabrication and assembly control;
- (f) Control of non-conforming items and system for corrective actions;
- (g) Inspection and test procedure both for manufacture and field activities;
- (h) Control of calibration and testing of measuring instruments and field activities;
- (i) System for indication and appraisal of inspection status;
- (j) System for quality audits;
- (k) System for authorising release of manufactured product to the Purchaser
- (l) System for maintenance of records;
- (m) System for handling storage and delivery; and
- (n) A quality plan detailing out the specific quality control measures and Procedures adopted for controlling the quality characteristics relevant to each item of equipment furnished and/or services rendered.

The Purchaser or his duly authorised representative reserves the right to carry out quality audit and quality surveillance of the system and Procedure of the Contractor/his vendors quality management and control activities.

On completion of erection of the equipment and before charging, each item of the equipment shall be thoroughly cleaned and then inspected jointly by the Purchaser and the Contractor for correctness and completeness of installation and acceptability for charging, leading to initial pre-commissioning tests at Site. The list of pre-commissioning tests to be performed shall be included in the Contractor's quality assurance programme.

3.10 Quality Assurance Documents

The Contractor shall be required to submit the following Quality Assurance Documents within three weeks after despatch of the equipment.

All Non - Destructive Examination Procedures, stress relief and weld repair. Procedure actually used during fabrication and reports including radiography interpretation reports.

Welder and welding operator qualification certificates Welder's identification list, listing welder's qualification procedure and welding identification symbols.


Raw material test reports on components as specified by the specification and/or agreed to in the quality plan.

Stress relief time temperature charts/oil impregnation time temperature charts

Factory test results for testing required as per applicable codes/mutually agreed quality plan/standards referred in the technical specification.

The quality plan with verification of various customer inspection points (CIP) as mutually agreed and methods used to verify the inspection and testing points in the quality plan were performed satisfactorily.

3.11 INSPECTION, TESTING & INSPECTION CERTIFICATE

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The Purchaser, his duly authorised representative and/or outside inspection agency acting on behalf of the Purchaser shall have at all reasonable times free access to the Contractor's premises or Works and shall have the power, at all reasonable times to inspect and examine the materials and workmanship of the Works during its manufacture or erection if part of the Works is being manufactured or assembled at other premises or works, the Contractor shall obtain for the Engineer and for his duly authorised representative permission to inspect as if the works were manufactured or assembled on the Contractor's own premises or works. Inspection may be made at any stage of manufacture, despatch or at site at the option of the Purchaser and the equipment if found unsatisfactory due to bad workmanship or quality, material is liable to be rejected.

The reports for all type tests and additional type tests as per technical specification and shall be furnished by the Contractor along with equipment/material drawings. The type tests conducted earlier should have either been conducted in accredited laboratory (accredited based on ISO/IEC Guide 25/17025 or EN 45001 by the national accreditation body of the country where laboratory is located) or witnessed by the representative(s) of POWERGRID or Utility. The test-reports submitted shall be of the tests conducted within last 5 (five) years prior to the date of bid opening i.e. 09.11.2006. In case the test reports are of the test conducted earlier than 5 (five) years prior to the date of bid opening, the contractor shall repeat these test(s) at no extra cost to the purchaser.


In the event of any discrepancy in the test reports i.e. any test report not acceptable due to any design/manufacturing changes (including substitution of components) or due to non-compliance with the requirement stipulated in the technical specification or any/all additional type tests not carried out without any additional cost implication to the Purchaser.

The purchaser intends to repeat the type tests and additional type tests on transformers, reactors, cables and battery chargers for which test charges shall be payable as per provision of contract. The price of conducting type tests and additional type tests shall be included in Bid price and break up of these shall be given in the relevant schedule of Bid Proposal sheets. These type tests charges would be considered in bid evaluation. In case the bidder does not indicate charges for any of the type tests or does not mention the name of any test in the price schedules, it will be presumed that the particular test has been offered free of charge. Further, in case any bidder indicates that he shall not carry out a particular test, his offer shall be considered incomplete and shall be liable to be rejected.

All equipment being supplied shall conform to type tests and shall be subject to routine tests in accordance with requirements stipulated under respective sections. Purchaser reserves the right to witness any or all the type tests. The Contractor shall intimate the Purchaser the detailed programme about the tests at least three (3) weeks in advance in case of domestic supplies & six (6) weeks in advance in case of foreign supplies. Purchaser reserves the option for getting any or all the type tests repeated on the equipment. The Contractor shall also submit type test procedure for approval of the Purchaser.

The Contractor shall give the Purchaser/inspector thirty (30) days written notice of any material being ready for testing. Such tests shall be to the Contractor's account except for the expenses of the inspector. Unless witnessing of the tests is virtually waived, the Purchaser/ inspector will attend such tests within thirty (30) days of the date of which the equipment is notified as being ready for test/ inspection, failing which the Contractor may proceed with the test which shall be deemed to have been made in the Inspector's presence and the Contractor shall forthwith forward duly certified copies of test reports in triplicate to the Inspector.

The Purchaser or Inspector shall, within fifteen (15) days from the date of inspection as defined herein, give notice in writing to the Contractor, of any objection to any drawings and all or any equipment and workmanship which in his opinion is not in accordance with the Contract. The Contractor shall give due consideration to such objections and shall either make the modifications

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that may be necessary to meet the said objections or shall confirm in writing to the Purchaser/ inspector giving reasons therein, that no modifications are necessary to comply with the Contract.

When the factory tests have been completed at the Contractor's or Sub-Contractor's works, the Purchaser/ inspector shall issue a certificate to this effect within fifteen (15) days after completion of tests but if the tests are not witnessed by the Purchaser/inspector, the certificate shall be issued within fifteen (15) days of receipt of the Contractor's Test certificate by the Engineer/ Inspector. Failure of the Purchaser/inspector to issue such a certificate shall not prevent the Contractor from proceeding with the Works. The completion of these tests or the issue of the certificate shall not bind the Purchaser to accept the equipment should it, on further tests/ after erection, be found not to comply with the Contract. The equipment shall be dispatched to site only after approval of test reports and issuance of MICC by the Purchaser.

In all cases where the Contract provides for tests whether at the premises or at the works of the Contractor or of any Sub-Contractor, the Contractor except where otherwise specified shall provide free of charge such items as labour, materials, electricity, fuel, water, stores, apparatus and instruments as may be reasonably demanded by the Purchaser /Inspector or his authorised representative to carry out effectively such tests of the equipment in accordance with the Contract and shall give facilities to the Purchaser Inspector or to his authorised representative to accomplish testing.

The inspection by Purchaser and issue of Inspection Certificate thereon shall in no way limit the liabilities and responsibilities of the Contractor in respect of the agreed quality assurance programme forming a part of the Contract.

The Purchaser will have the right of having at his own expenses any other test(s) of reasonable nature carded out at Contractor's premises or at site or in any other place in addition of aforesaid type and routine tests, to satisfy that the material comply with the specification.

The Purchaser reserves the right for getting any field tests not specified in respective sections of the technical specification conducted on the completely assembled equipment at site. The testing equipment for these tests shall be provided by the Purchaser


3.12 FINISHING OF METAL SURFACES

All metal surfaces shall be subjected to treatment for anti-corrosion protection. All ferrous surfaces for external use unless otherwise stated elsewhere in the specification or specifically agreed, shall be hot-dip galvanized after fabrication. High tensile steel nuts & bolts and spring washers shall be electro-galvanized to service condition 4. All steel conductors including those used for earthing/ grounding (above ground level) shall also be galvanized according to IS: 2629.

3.12.1 HOT DIP GALVANISING

The minimum weight of the zinc coating shall be 610 g/ m² and minimum thickness of coating shall be 85 microns for all items thicker than 6mm. For items lower than 6mm thickness requirement of coating thickness shall be as per relevant ASTM. For surface which shall be embedded in concrete, the zinc coating shall not be less than 610 g/ m².

The galvanized surfaces shall consist of a continuous and uniform thick coating of zinc, firmly adhering to the surface of steel. The finished surface shall be clean and smooth and shall be free from defects like discoloured patches, bare spots, unevenness of coating, spelter which is loosely attached to the steel globules, spiky deposits, blistered surface, flaking or peeling off, etc. The presence of any of these defects noticed on visual or microscopic inspection shall render the material liable to rejection.

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After galvanizing no drilling or welding shall be performed on the galvanized parts of the equipment excepting that nuts may be threaded after galvanizing. Sodium dichromate treatment shall be provided to avoid formation of white rust after hot dip galvanisation. The galvanized steel shall be subjected to six one-minute dips in copper sulphate solution as per IS-2633.

Sharp edges with radii less than 2.5 mm shall be able to withstand four immersions of the Standard Preece test. All other coatings shall withstand six immersions.

Following galvanizing tests shall essentially be performed as per relevant Indian Standards.

- Coating thickness
- Uniformity of zinc
- Adhesion test
- Mass of zinc coating

Galvanised material must be transported properly to ensure that galvanised surfaces are not damaged during transit. Application of zinc rich paint at site shall not be allowed.

3.12.2 PAINTING

All sheet steelwork shall be degreased, pickled, phosphated in accordance with the IS-6005 "Code of practice for phosphating iron and sheet". All surfaces, which will not be easily accessible after shop assembly, shall beforehand be treated and protected for the life of the equipment. The surfaces, which are to be finished painted after installation or require corrosion protection until installation, shall be shop painted with atleast two coats of primer. Oil, grease, dirt and swaf shall be thoroughly removed by emulsion cleaning. Rust and scale shall be removed by pickling with dilute acid followed by washing with running water, rinsing with slightly alkaline hot water and drying.

After phosphating, thorough rinsing shall be carried out with clean water followed by final rinsing with dilute dichromate solution and oven drying. The phosphate coating shall be sealed with application of two coats of ready mixed, stoving-type zinc chromate primer. The first coat may be 'flash dried' while the second coat shall be stoved.

After application of the primer, two coats of finishing synthetic enamel paint shall be applied, each coat followed by stoving. The second finishing coat shall be applied after inspection of first coat of painting.

The exterior colour of the paint shall be as per shade no. 697 of IS -5 and inside shall be glossy white. Each coat of primer and finishing paint shall be of slightly different shade to enable inspection of the painting. A small quantity of finishing paint shall be supplied for minor touching up required at site after installation of the equipment.

In case the Bidder proposes to follow his own standard surface finish and protection procedures or any other established painting procedures, like electrostatic painting etc., the procedure shall be submitted along with the Bids for Purchaser's review & approval.

3. 13 AUXILIARY SUPPLY

The sub-station auxiliary supply is normally met through a system indicated under section-5 having the following parameters. The auxiliary power for station supply, including the equipment drive, cooling system of any equipment, air-conditioning, lighting etc shall be designed for the



specified Parameters as under. The DC supply for the instrumentation and PLCC system shall also conform to the parameters as indicated in the following.

<i>Normal Voltage</i>	<i>Variation in Voltage</i>	<i>Frequency in HZ</i>	<i>Phases</i>	<i>Neutral connection</i>
415V	+/- 1 0%	50 +/- 5%	3/4-Wire	Solidly Earthed.
240 V	+/- 1 0%	50 +/- 5%	1 /2-wire	
220V	240-190 V	DC	2-wire	Isolated
50 V	53- 41.5 V	DC	2-wire	+ve -earthed

Combined variation of voltage and frequency shall be limited to +/- 10%.


3.15 CLAMPS AND CONNECTORS INCLUDING TERMINAL CONNECTORS

3.15.1 All power clamps and connectors shall conform to IS:5561 & NEMA CC1 and shall be made of materials listed below-

a	connecting ACSR conductors	Aluminium alloy casting, conforming to designation A6 of IS:617 and shall be tested for all test as per IS:617
b	connecting bimetallic equipment terminals made of copper/ brass with ACSR conductors	Connectors made from Al alloy casting, conforming to designation A6 of IS 617 with 2-mm thick bimetallic liner and shall be tested as per IS 617. Copper alloy liner shall be cast integral with Al body.
c	connecting G.I. Shield wire	Galvanised mild steel
d	Bolts, nuts & Plain washers	o-galvanised for sizes below M12, for others hot dip galvanised
e	Spring washers for items 'a' to 'c'	o-galvanised mild steel suitable for at least service conditions as per IS 1573

Each equipment shall be supplied with the necessary terminals and connectors, as required by the ultimate design for the particular installation. The conductor terminations of equipment shall be either expansion, sliding or rigid type suitable for 4" IPS (O.D. : 114.2 mm, ID: 97.18 mm) aluminium tube or suitable for Quad/Twin Moose ACSR Conductor (450 mm sub-conductor spacing and 250 mm Sub-Conductor spacing for 400 kV & 220 kV respectively). The requirement regarding external corona and RIV as specified for any equipment shall include its terminal fittings and the equipment shall be factory tested with the connectors in position. If corona rings are required to meet these requirements they shall be considered as part of that equipment and included in the scope of work.

Where copper to aluminium connections are required, bimetallic clamps shall be used, which shall be properly designed to ensure that any deterioration of the connection is kept to a

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minimum and restricted to parts which are not current carrying or subjected to stress. The design details of the joints shall be furnished to the Purchaser by the Contractor.

Low voltage connectors, grounding connectors and accessories for grounding all equipment as specified in each particular case, are also included in the scope of Work.

No current carrying part of any clamp shall be less than 10 mm thick. All ferrous parts shall be hot dip galvanised. Copper alloy liner of minimum 2 mm thickness shall be cast integral with aluminium body for Bimetallic clamps.

All casting shall be free blow holes, surface blisters, cracks and cavities. All sharp edges and corners shall be blurred and rounded off.

Flexible connectors, braids or laminated straps made for the terminal clamps for bus posts shall be suitable for both expansion or through (fixed/ sliding) type connection of 4" IPS Al tube as required. In both the cases the clamp height (top of the mounting pad to centre line of the tube) should be same.

Clamp shall be designed to carry the same current as the conductor and the temperature rise shall be equal or less than that of the conductor at the specified ambient temperature. The rated current for which the clamp/connector is designed with respect to the specified reference ambient temperature, shall also be indelibly marked on each component of the clamp/connector, except on the hardware.

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

Clamps and connectors shall be designed to be corona controlled. Corona extinction voltage for 400kV class clamps shall not be less than 320KV (rms) and R.I.V. level shall not be more than 1000 micro volts at the test voltage specified in respective sections.

3.15.2 Tests

Clamps and connectors should be type tested as per IS:5561 and shall also be subjected to routine tests as per IS:5561. Type tests/special tests shall be carried out on three samples.


The following is the list of type tests:

- i) Temperature rise test (max. temp. rise allowed is 35°C over 50°C ambient)
- ii) Short time current test
- ii) Corona (dry) and RIV (dry) test (for 220 kV and higher voltage level)
- iv) Resistance test and tensile test

3.16 CONTROL CABINETS, JUNCTION BOXES, TERMINAL BOXES & MARSHALLING BOXES FOR OUTDOOR EQUIPMENT

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

Control cabinets, junction boxes, Marshalling boxes and terminal boxes shall be made of sheet steel or aluminium enclosure and shall be dust, water and vermin proof. 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. In case of aluminium enclosed box

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the thickness of aluminium shall be such that it provides adequate rigidity and long life as comparable with sheet steel of specified thickness.

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 the gasket shall be such that it does not get damaged/cracked during the operation of the equipment.

All doors, removable covers and plates shall be gasketed all around with suitably profiled 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 ten years of operation of the equipment or its major overhaul whichever is earlier. All gasketed surfaces shall be smooth straight and reinforced if necessary to minimise 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 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 plate. 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. The Nickel- plated glands shall be dust-proof, screw on & double compression type and made of brass. The gland shall have provision for securing armour of the cable separately and shall be provided with earthing tag. The glands shall conform to BS: 6121.

A 240-V, single phase, 50 Hz, 15-A AC plug and socket shall be provided in the cabinet with ON-OFF switch for connection of hand lamps. Plug and socket shall be of industrial grade. For illumination, 20-W fluorescent tube or a 15-W CFL shall be provided. The switching of the fittings shall be controlled by a door switch.

All control switches shall be of rotary switch type and Toggle/piano switches shall not be accepted.

Positive earthing of the cabinet shall be ensured by providing two separate earthing pads. The earth wire shall be terminated on to the earthing pad and secured by the use of self- etching washer. Earthing of hinged door shall be done by using a separate earth wire.

The bay marshalling kiosks shall be provided with danger plate and a diagram showing the numbering/connection/ferruling by pasting the same on the inside of the door.

Tests

a) In addition to routine tests as per IS 5039, following routine tests shall also be conducted:

- i) Check for wiring
 - ii) Visual and dimension check
- b) The enclosure of bay marshalling kiosk, junction box, terminal box shall be type tested for IP-55 as per IS: 13947. After IP-55 test, 2.5 kV rms for 1 (one) minute, insulation resistance and functional tests shall be carried out.

A canopy and sealing arrangements for operating rods shall be provided in Marshalling Boxes control cubicles to prevent ingress of rain water.



3.17 AUXILIARY SWITCHES

The auxiliary switches shall conform to following type tests:

- (a) Electrical endurance test - A minimum of 2000 operations for 2 A DC with a time constant greater than or equal to 20 millisecond with a subsequent examination of mV drop/visual defects/temperature rise test.
- (b) Mechanical endurance test. A minimum of 1,00,000 operations with a subsequent checking of contact pressure test/ visual examination.
- (c) Heat run test on contacts.
Insulation Resistance Test / HV test (2.5 kV for one minute)

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 Wago or equivalent.

Terminal blocks 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 such 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.

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 terminal rows.

Unless otherwise specified, terminal blocks shall be suitable for connecting the following conductors on each side.

a)	All circuits except CT circuits	Min. of two of 2.5 mm ² of copper flexible.
b)	All CT circuits	Min. of 4 nos. of 2.5 mm ² copper flexible

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There shall be a minimum clearance of 250 mm 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 Contractor shall furnish all wire, conduits and terminals for the necessary inter-phase electrical connections (where applicable) as well as between phases and common terminal boxes or control cabinets. For equipment rated for 400 kV and above the wiring required in these items shall be run in metallic ducts or shielded cables in order to avoid surge over voltages either transferred through the equipment or due to transients induced from the EHV circuits.

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 Contractor 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

3.19 LAMPS AND SOCKETS

3.19.1 Lamps:

All incandescent lamps shall use a socket base as per IS-1258, except in the case of signal lamps.

3.19.2 Sockets

All sockets (convenience outlets) shall be suitable to accept both 5 Amp & 15 Amp pin round Standard Indian plugs. They shall be switched sockets with shutters.

3.19.3 Hand Lamp:

A 240 Volts, single Phase, 50 Hz AC plug point shall be provided in the interior of each cubicle with ON-OFF Switch for connection of hand lamps.


3.19.4 Switches and Fuses:

Each control panel shall be provided with necessary arrangements for receiving, distributing, isolating and fusing of DC and AC supplies for various control, signalling, lighting and space heater circuits. The incoming and sub-circuits shall be separately provided with switch-fuse units. Selection of the main and sub-circuit fuse ratings shall be such as to ensure selective clearance of sub-circuit faults. Potential circuits for relaying and metering shall be protected by HRC fuses.

All fuses shall be of HRC cartridge type conforming to IS 9228 mounted on plug-in type fuse bases. Miniature circuit breakers with thermal Protection and alarm contacts will also be accepted. All accessible live connection to fuse bases shall be adequately shrouded. Fuses shall have operation indicators for indicating blown fuse condition. Fuse carrier base shall have imprints of the fuse rating and voltage.

3.20 FIRST FILL OF CONSUMABLES, OIL AND LUBRICANTS

All the first fill of consumables such as oils, lubricants, filling compounds, touch up paints, soldering/brazing material for all copper piping of circuit breakers and essential chemicals etc. which will be required to put the equipment covered under the scope of the specifications, into successful Operation, shall be furnished by the Contractor unless specifically excluded under the exclusions in these specifications and documents.

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3.21 PACKAGING & PROTECTION

All the equipments shall be suitably protected, coated, covered or boxed and crated to prevent damage or deterioration during transit, handling and storage at Site till the time of erection. On request of the Owner / Purchaser, the supplier shall also submit packing details/associated drawing for any equipment/material under his scope of supply, to facilitate the Purchaser to repack any equipment/material at a later date, in case the need arises. While packing all the materials, the limitation from the point of view of availability of Railway wagon sizes in India should be taken into account. The supplier shall be responsible for any loss or damage during transportation, handling and storage due to improper packing. Any demurrage, wharfage and other such charges claimed by the transporters, railways etc. shall be to the account of the supplier.

All coated surfaces shall be protected against abrasion, impact, discolouration 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 and pipings and conduit equipment connections shall be properly sealed with suitable devices to protect them from damage.

3.22 Bushings, Hollow Column Insulators, Support Insulators:

Bushings shall be manufactured and tested in accordance with IS: 2099 & IEC: 137 while hollow column insulators shall be manufactured and tested in accordance with IEC 233/IS 5621. The support insulators shall be manufactured and tested as per IS 2544/IEC 168 and IEC 273. The insulators shall also conform to IEC 815 as applicable.

The bidder may also offer composite silicon insulator, conforming to IEC-1109.

Support insulators, bushings and hollow column insulators shall be manufactured from high quality porcelain. Porcelain used shall be homogeneous, free from laminations, cavities and other flaws or imperfections that might affect the mechanical or dielectric quality and shall be thoroughly vitrified tough and impervious to moisture.

Glazing of the porcelain shall be uniform brown in colour, free from blisters, burrs and similar other defects.

Supports insulators/bushings/hollow column insulators shall be designed to have ample insulation, mechanical strength and rigidity for the conditions under which they will be used.

When operating at normal rated voltage there shall be no electric discharge between the conductors and bushing which would cause corrosion or injury to conductors, insulators or supports by the formation of substances produced by chemical action. No radio interference shall be caused by the insulators/bushings when operating at the normal rated voltage.

Bushing porcelain shall be robust and capable of withstanding the internal pressures likely to occur in service. The design and location of clamps and the shape and the strength of the porcelain flange securing the bushing to the tank shall be such that there is no risk of fracture. All portions of the assembled porcelain enclosures and supports other than gaskets, which may in any way be exposed to the atmosphere shall be composed of completely non hygroscopic material such as metal or glazed porcelain.

All iron parts shall be hot dip galvanised and all joints shall be air tight. Surface of joints shall be trued up porcelain parts by grinding and metal parts by machining. Insulator/bushing design shall be such as to ensure a uniform compressive pressure on the joints.

3.23 MOTORS

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Motors shall be “Squirrel Cage” three phase induction motors of sufficient size capable of satisfactory operation for the application and duty as required for the driven equipment and shall conform to type tests and shall be subjected to routine tests as per applicable standards. The motors shall be of approved make.

Motors to be installed outdoor without enclosure shall have hose proof enclosure equivalent to IP 55 as per IS: 4691. For motors to be installed indoor i.e. inside a box, the motor enclosure, shall be dust proof equivalent to IP 44 as per IS: 4691.

Two independent earthing points shall be provided on opposite sides of the motor for bolted connection of earthing conductor.

Motors shall have drain plugs so located that they will drain water resulting from condensation or other causes from all pockets in the motor casing

Motors weighing more than 25Kg. shall be provided with eyebolts, lugs or other means to facilitate lifting.

Continuous motor rating (name plate rating) shall be at least ten (10) percent above the maximum load demand of the driven equipment at design duty point and the motor shall not be over loaded at any operating point of driven equipment that will rise in service.

Motors shall be capable at giving rated output without reduction in the expected life span when operated continuously in the system having the particular as given in Clause 15.0 of this section.

All induction motors shall be suitable for full voltage direct-on-line starting and accelerating to the rated speed along with the driven equipment without exceeding the acceptable winding temperature even when the supply voltage drops down to 80% of the rated voltage.

Motors shall be capable of withstanding the electro-dynamic stresses and heating imposed if it is started at a voltage of 110% of the rated value.


The locked rotor current shall not exceed six (6) times the rated full load current for all motors, subject to tolerance as given in IS: 325.

Motors when started with the driven equipment imposing full starting torque under the supply voltage conditions specified under Clause 15.0 shall be capable of withstanding at least two successive starts from cold condition at room temperature and one start from hot condition without injurious heating of winding. The motors shall also be suitable for three equally spread starts per hour under the above referred supply condition.

The locked rotor withstand time under hot condition at 110% of rated voltage shall be more than starting time with the driven equipment of minimum permissible voltage by at least two seconds or 15% of the above requirement, the Bidder shall offer centrifugal type speed switch mounted on the motor shaft which shall remain closed for speed lower than 20% and open for speeds above 20% of the rated speed. The speed switch shall be capable of withstanding 120% of the rated speed in either direction of rotation.

The maximum permissible temperature rise over the ambient temperature of 50 degree C shall be within the limits specified in IS: 325 (for 3 phase induction motors) after adjustment due to increased ambient temperature specified.

The double amplitude of motor vibration shall be within the limits specified in IS: 4729. Vibration shall also be within the limits specified by the relevant standard for the driven equipment when measured at the motor bearings.

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All the induction motors shall be capable of running at 80% of rated voltage for a period of 5 minutes with rated load commencing from hot condition.


TESTING AND COMMISSIONING

An indicative list of tests is given below. Supplier shall perform any additional test based on specialities of the items as per the filed O.P./Instructions of the driven equipment supplier or Owner / purchaser without any extra cost to the owner / Purchaser. The supplier shall arrange all instruments required for conducting these tests alongwith calibration certificates and shall furnish the list of instruments to the Owner / Purchaser for approval.

Insulation resistance.

Phase sequence and proper direction of rotation.

Any motor operating incorrectly shall be checked to determine the cause and the conditions corrected.

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ANNEXURE - A

CORONA AND RADIO INTERFERENCE VOLTAGE (RIV) TEST

General:

Unless otherwise stipulated, all equipment together with its associated connectors, where applicable, shall be tested for external corona both by observing the voltage level for the extinction of visible corona under failing power frequency voltage and by measurement of radio interference voltage (RIV).

Test Levels:

The test voltage levels for measurement of external RIV and for corona extinction voltage are listed under the relevant clauses of the specification.

3.0 Test Methods for RIV:

3.1 RIV tests shall be made according to measuring circuit as per CISPR Publication 16-1(1993) Part -1. The measuring circuit shall preferably be tuned to frequency within 10% of 0.5 MHz but other frequencies in the range of 0.5 MHz to 2 MHz may be used, the measuring frequency being recorded. The results shall be in micro-volts.

3.2 Alternatively, RIV tests shall be in accordance with NEMA standard Publication No. 107-1964, except otherwise noted herein.

3.3 Temporary additional external corona shielding may be provided in measurement of RIV. Only standard fittings of identical type supplied with the equipment and a simulation of the connections as used in the actual installation will be permitted within 3.5 meters of terminals.

3.4 Ambient noise shall be measured before and after each series of tests to ensure that there is no variation in ambient noise level. If variation is present, the lowest ambient noise level will form basis for the measurements. RIV levels shall be measured at increasing and decreasing voltages of 85%, 100%, 115% and 130% of the specified RIV test voltage for all equipment unless otherwise specified. The specified RIV test voltage for 400 kV and 220 kV is listed in Section -1/ Section -2 of the specification together with maximum permissible RIV level in micro-volts.

3.5 The measuring instruments shall be as per CISPR recommendation or equivalent device so long as it has been used by other testing authorities.

3.6 The RIV measurement may be made with a noise meter. A calibration procedure of the frequency to which noise meter shall be tuned shall establish the ratio of voltage at the high voltage terminal to voltage read by noises meter.

4.0 Test Methods Visible Corona

The purpose of this test is to determine the corona extinction voltage of apparatus, connectors etc. The test shall be carried out in the same manner as RIV test described above with the exception that RIV measurements are not required during test and a search technique shall be used near the onset and extinction voltages, when the test voltage is raised and lowered to determine their precise values. The test voltage shall be raised to 130% of RIV test voltage and maintained for five minutes. The voltage will then be decreased slowly until visible corona disappears. The procedure shall be repeated at least 4 times with corona inception and extinction voltage recorded each time. The corona extinction voltage for purpose of determining compliance with the specification shall be the lowest of the four values at which visible corona (negative or positive polarity) disappears. Photographs with laboratory in complete darkness shall be taken

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under test conditions, at all voltage steps i.e. 85%, 100%, 115% and 130%. Additional photographs shall be taken at corona inception and extinction voltages. At least two views shall be photographed in each case using Panchromatic film with an ASA daylight rating of 400 with an exposure of two minutes at a lens aperture of f/5.6 or equivalent. The photographic process shall be such that prints are available for inspection and comparison with conditions as determined from direct observation. Photographs shall be taken from above and below the level of connector so as to show corona on bushing, insulators and all parts of energised connectors. The photographs shall be framed such that test object essentially, fills the frame with no cut-off.

The test shall be recorded on each photograph. Additional photographs shall be taken from each camera position with lights on to show the relative position of test object to facilitate precise corona location from the photographic evidence.

In addition to photographs of the test object, at least four photographs shall be taken of the complete test assembly showing relative positions of all the test equipment and test objects. These four photographs shall be taken from four points equally spaced around the test arrangement to show its features from all sides. Drawings of the laboratory and test set up locations shall be provided to indicate camera positions and angles. The precise location of camera shall be approved by Purchaser's inspector, after determining the best camera locations by that energisation of test object at a voltage which results in corona.

The test to determine the visible corona extinction voltage need not be carried out simultaneously with test to determine RIV levels.

However, both tests shall be carried out with the same test set up and as little time duration between tests as possible. No modification on treatment of the sample between tests will be allowed. Simultaneous RIV and visible corona extinction voltage testing may be permitted at the discretion of Purchaser's inspector if, in his opinion, it will not prejudice other test.

Test Records:

In addition to the information previously mentioned and the requirements specified as per CISPR or NEMA 107-1964 the following data shall be included in test report:

- a) Background noise before and after test.
- b) Detailed procedure of application of test voltage.
- c) Measurements of RIV levels expressed in micro-volts at each level.
- d) Results and observations with regard to location and type of interference sources detected at each step.
- e) Test voltage shall be recorded when measured RIV passes through 100 micro-volts in each direction.
- f) Onset and extinction of visual corona for each of the four tests required shall be recorded.

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ANNEXURE - B

SEISMIC WITHSTAND TEST PROCEDURE

The seismic withstanding test if required to be conducted on the complete equipment shall be carried out alongwith supporting structure.

The supplier shall arrange to transport the structure from his premises/POWERGRID sites for the purpose of seismic withstand test only.

The seismic level specified shall be applied at the base of the structure. The accelerometers shall be provided at the Terminal Pad of the equipment and any other point as agreed by the Purchaser / owner. The seismic test shall be carried out in all possible combinations of the equipment. The seismic test procedure shall be furnished for approval of the Purchaser / owner.

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SECTION 4 GUARANTEED TECHNICAL PARTICULARS

GUARANTEED TECHNICAL PARTICULARS N₂ INJECTION SYSTEM

(Bidder should indicate the guaranteed technical data of all equipments/materials)

1	Name of manufacturer and country of origin	
2	Reference standards	
3	Details of system equipments	
	a. Fire extinguishing cubicle	
	i) Dimensions	
	ii) Weight	
	iii) Capacity of Nitrogen cylinder	
	iv) Pressure of Nitrogen filling	
	v) Minimum distance of FE cubicle from the transformer	
	vi) Method of mounting	
	vii) Whether the following items are provided in FE cubicle. If so furnish make, type & other details	
	- Contact manometer	
	- Pressure regulator	
	- Oil release unit	
	- Gas release unit	
	- Oil drain unit	
	- Pressure / limit switches	
	- No. of contacts & spare contacts(NO & NC)	
	viii) Oil drain valve	
	- Make	
	- Type	
	- Size	
	- Type of metal	
	ix) Nitrogen Injection valve	
	- Make	
	- Type	
	- Size	
	- Quantity required	
	x) Oil Drain pipe	
	- size	
	- Length	
	- Material	
	xi) Nitrogen Injection pipe	
	- size	

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	- Length	
	- Number of openings in the transformer tank	
	- Material	
	b) Control Box	
	i) Dimensions	
	ii) Weight	
	iii) Type & Thickness of sheet steel	
	iv) Details of components provided in the control box	
	v) Control voltage	
	vi) Method of mounting	
	vii) Whether audio and visual alarms provided?	
	c) Pre-stressed non-return valve/Pneumatically operated ball valve (Main/Backup)	
	i) Make	
	ii) Type	
	iii) Location	
	iv) Whether suitable for pipe of size 80mm dia	
	v) No. of contacts & spare contacts (NO & NC)	
	d) Fire detectors	
	i) Make	
	ii) Type	
	iii) Quantity Required	
	iv) Method of Fixing	
	v) Effective head sensing area	
	vi) Temperature recommended for effective heat sensing	
	vii) Number of contacts NO/NC	
4	Necessity and condition of re-filling	
5	Drawings/ literature enclosed with the offer	
6	Whether approved by TAC of India	
	TECHNICAL PARTICULARS OF NITROGEN INJECTION FIRE EXTINGUISHING	
1	Power Supply	
	- Control Box	
	- Fire extinguishing cubicle	
2	Fire extinction period	
	On system activation	
	On commencement of nitrogen injection	
3	Fire extinguishing cubicle suitable for 100MVA transformer	
	- Dimension	
	- Weight	
	- Nitrogen cylinder capacity	

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4	Control Box	
	- Dimension	
	- Weight	
5	Fire detectors	
	- Heat sensing temperature	

SIGNATURE OF BIDDER

SEAL

Date :

Place :

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SECTION- 5 ENCLOSURES TO SPECIFICATION

SCHEDULES TO BE FILLED UP BY THE BIDDER

- Schedule 1 **Schedule of Activities**
- Schedule 2 **Schedule of makes of Equipments**
- Schedule 3 **Schedule of Deviations**
- Schedule 4 **Format for Manufacturing Quality Plan**
- Schedule 5 **Format for Field Quality Plan**
- Schedule 6 **Schedule of past experience and qualifying requirements**
- Schedule 7 **Schedule of performance certificates**
- Schedule 8 **Schedule of type test and special tests**
- Schedule 9 **Details of contact persons (technical & commercial)**
- Schedule 10 **Schedule of UNPRICED quote**
- Schedule 11 **Drawings**

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SCHEDULE –1

ACTIVITY SCHEDULE

(TO BE FILLED-UP THE SUPPLIER)

Tender enquiry no. :

Sl. No.	ACTIVITY	ACTIVITY TIME IN WEEKS	CUMULATIVE TIME IN WEEKS FROM LOI/PO DATE	REMARKS IF ANY
1	Submission of documents Necessary for getting Manufacturing clearance Like drawings, date sheet etc			
2	Approval of documents In cat-I from BHEL / Customer*			
3	Manufacturing time			
4	Inspection call			
5	Customer inspection & Despatch clearance			
6	Transportation to destination			

- 1) * Supplier must ensure the completeness and correctness of the requisite documents before submission for approval. Delay in approval on account of incomplete/ inadequate information shall be the responsibility of supplier. Cat I approval denotes final approval after successful incorporation of all comments made by BHEL/PGCIL on previously submitted versions of drawings/documents.
- 2) Inspection call should be given in the prescribed format only. Inspection calls in any format, other than the prescribed format shall not be entertained.
- 3) Qty to be offered for inspection should be in accordance within delivery schedule. BHEL reserves the right not be entertain multiple inspection calls and delay on this account shall be responsibility of supplier

Place Signature of the authorized representative of Bidder

Name -----

Date

Designation-----

Company seal-----

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SCHEDULE-2

MAKES OF IMPORTANT ITEMS / COMPONENTS OF EQUIPMENTS AND THEIR DETAILS

ITEM NAME	NAME OF MANUFACTURER	PLACE OF MANUFACTURE OF ITEM	PLACE OF TESTING AND INSPECTION	COMPLIANCE WITH ISO 9001 (YES/NO)

Place

Signature of the authorized representative of Bidder

Name -----

Date

Designation-----

Company seal-----

Project : 400/220 kV SWITCHYARD AT TALAGUPPA-GUTTUR;
System : FIRE PROTECTION SYSTEM
Owner : KARNATAKA POWER TRANSMISSION CORP. LIMITED
Purchaser : BHARAT HEAVY ELECTRICALS LIMITED

TB 342 552 002
Rev 01



SCHEDULE-3

SCHEDULE OF TECHNICAL DEVIATION

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

Section	Clause No./ Page No.	Statement of deviation/ Variations/Exceptions
---------	-------------------------	--

- 1) 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.
- 2) If there is NIL deviation, even then the format to be filled as **NIL DEVIATION**
- 3) Continuation sheets of like size and format may be used as per the Bidder's Requirement and shall be annexed to this schedule.

Place

Signature of the authorized representative of Bidder

Name -----

Date

Designation-----

Company seal-----

Project : 400/220 kV SWITCHYARD AT TALAGUPPA-GUTTUR;
System : FIRE PROTECTION SYSTEM
Owner : KARNATAKA POWER TRANSMISSION CORP. LIMITED
Purchaser : BHARAT HEAVY ELECTRICALS LIMITED

TB 342 552 002
 Rev 01



SCHEDULE-5

FORMAT FOR FIELD QUALITY PLAN

	Name of contract Equipment / Items	FIELD QUALITY PLAN FOR _____			MATERIAL-RECEIPT STORAGE / PRE-ERECTION / ERECTION / PRE-COMMISSIONING / COMMISSIONING / POST-COMMISSIONING			QP No.____ Rev No.____ Date____ —
	Package No.____ CONTRACTOR_____	SUB SYSTEM _____			(DELETE WHICH EVER IS NOT APPLICABLE)			
SL. No.	Characteristics/ Items	Type of Check	Instrument	Class	Quantum / Frequency Of Check	Reference Documents And Acceptance Standard	Format Of Records	Remark
1	2	3	4	5	6	7	8	9

Place


Signature of the authorized representative of Bidder

Name -----

Date

Designation-----

Company seal -----

Project	:	400/220 kV SWITCHYARD AT TALAGUPPA-GUTTUR;	TB 342 552 002	
System	:	FIRE PROTECTION SYSTEM	Rev 01	
Owner	:	KARNATAKA POWER TRANSMISSION CORP. LIMITED		
Purchaser	:	BHARAT HEAVY ELECTRICALS LIMITED		

SCHEDULE – 6

SCHEDULE OF PAST EXPERIENCE AND QUALIFYING REQUIREMENT

Following is the list of earlier orders executed by us for supply of equipment / material of Similar nature over the last past five years:

S.No.	Item	Brief rating	Qty	customer	Date of order	Date of supply	Order value
-------	------	--------------	-----	----------	---------------	----------------	-------------

Place _____ Signature of the authorized representative of Bidder

Date _____ Name-----

Designation-----

Company seal -----

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

Project	:	400/220 kV SWITCHYARD AT TALAGUPPA-GUTTUR;	TB 342 552 002	
System	:	FIRE PROTECTION SYSTEM	Rev 01	
Owner	:	KARNATAKA POWER TRANSMISSION CORP. LIMITED		
Purchaser	:	BHARAT HEAVY ELECTRICALS LIMITED		

SCHEDULE – 7

SCHEDULE OF PERFORMANCE CERTIFICATE

Bidder shall furnish the performance certificate of the similar equipment having
The following details:

S.No.	Item	Brief rating	Qty	Customer	Date of supply
-------	------	--------------	-----	----------	----------------

Place _____ Signature of the authorized representative of Bidder

Date _____ Name-----

Designation-----

Company seal -----

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

Project : 400/220 kV SWITCHYARD AT TALAGUPPA-GUTTUR;
 System : FIRE PROTECTION SYSTEM
 Owner : KARNATAKA POWER TRANSMISSION CORP. LIMITED
 Purchaser : BHARAT HEAVY ELECTRICALS LIMITED

TB 342 552 002
 Rev 01



SCHEDULE-8

SCHEDULE OF TYPE TESTS AND SPECIAL TESTS

The following type tests and special tests as called for in the Specification shall be conducted (all type tests / special tests as mentioned in the relevant clauses of the Specification shall be listed here):

Sl no.	Clause no/ page no of Specification	Details of test	Lab in which to be conducted	Whether test to be conducted free or on chargeable basis. Mention 'FREE' or 'CHARGEABLE'	If charges per test have been quoted for in the price bid. YES / NO
		A. Type Tests			
		1.			
		2.			
		B. Routine Tests			DO NOT
		1.			MENTION
		2.			ANY PRICE
		C. Site Tests			IN THIS
		1.			COLUMN
		2.			
		D. Special Tests (specified)			
		1.			
		2.			
		E. Other tests at works / site recommended by the Bidder			
		1.			
		2.			

NOTE:

- 1) Details have to be furnished on cables as well as accessories, each separately.
- 2) **NO PRICE SHALL BE FURNISHED IN THIS FORMAT.**

Place

Signature of the authorized representative of Bidder

Name-----

Date

Designation-----

Company seal-----

Project : 400/220 kV SWITCHYARD AT TALAGUPPA-GUTTUR; TB 342 552 002
System : FIRE PROTECTION SYSTEM Rev 01
Owner : KARNATAKA POWER TRANSMISSION CORP. LIMITED
Purchaser : BHARAT HEAVY ELECTRICALS LIMITED



SCHEDULE-9

DETAILS OF CONTACT PERSON BOTH TECHNICAL AND COMMERCIAL

Name

Address for correspondence

Phone No.

Fax No.

Email

Place

Signature of the authorized representative of Bidder

Date

Name-----

Designation-----

Company seal -----

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

Project : 400/220 kV SWITCHYARD AT TALAGUPPA-GUTTUR;
 System : FIRE PROTECTION SYSTEM
 Owner : KARNATAKA POWER TRANSMISSION CORP. LIMITED
 Purchaser : BHARAT HEAVY ELECTRICALS LIMITED

TB 342 552 002
 Rev 01



SCHEDULE –10

SCHEDULE OF UNPRICED QUOTE

Bidder shall furnish an **UNPRICED** copy of the performa given below as proof of having sent all the data to our TBMM group at Bhopal.

S. No.	Item Description	Unit		Unit Rate		Amount	
		Talaguppa	Guttur	(Supply)	(ETC)	(Supply)	(ETC)
1	Fire extinguishing cubicle with base frame, consisting of: a. Nitrogen Gas cylinder of sufficient capacity with pressure regulator and manometer with sufficient number of adjustable NO contacts. b. Oil Drain Assembly c. Mechanical release device for oil drain and nitrogen release. d. Limit switches for monitoring the systems e. Panel lighting f. Flanges on top of the panel for connecting oil drain and nitrogen injection pipes for transformer. g. Oil drain pipe extension of suitable size for connecting pipes to oil pit. a. Limit switch for pressure switch/ sensor..	1 SETS	1 SETS				
2	Control box to be installed in control room for monitoring system operation, automatic controls and remote operations. Control box should be complete with DC-DC converter for audio-visual alarm, indicating lights, switches, push buttons etc. suitable for tripping and signaling on 220V DC supply.						
3	Signal box for terminating cable connections from PRV/ pressure sensor, PNRV/POBV, fire detectors and circuit breaker trip signal.						

Project : 400/220 kV SWITCHYARD AT TALAGUPPA-GUTTUR;
System : FIRE PROTECTION SYSTEM
Owner : KARNATAKA POWER TRANSMISSION CORP. LIMITED
Purchaser : BHARAT HEAVY ELECTRICALS LIMITED

TB 342 552 002
 Rev 01



4	Pre-stressed non-return valve (PNRV)/ high speed pneumatically operated ball valve (POBV) with sufficient number of NC contacts for remote alarm indication and with visual position indicator.						
5	Fire detectors rated for heat sensing at 141°C or suitable temperature recommended by the manufacturer and each fitted with two nos. PG 13.5 size cable glands.	12 Nos.	12 Nos.				
6	Fire survival cables of size 4Cx1.5 mm ² for connecting fire detectors, PNRV/ POBV, buchholz relay and other signals on transformer top cover to terminals in signal box.	25 Mtrs	25 Mtrs				
7	FRLS cable of size 12Cx1.5 mm ² for connecting signal box mounted on transformer to control box in the station control room.	1000 Mtrs.	650 Mtrs				
7.1	FRLS cable of size 4CX1.5mm sq for interconnection of AC supply and connection in relay panel	50Mtrs	50Mtrs				
8.0	Piping along with supports & fittings between transformer, FE cubicle and oil drain pit	.					
8.1	Oil drainpipe connection between outlet valve provided on transformer tank and flange provided on top of FE cubicle.	10 Mtrs.	10 Mtrs.				
8.2	Oil drainpipe connection between oil drainpipe bottom (in FE cubicle) to the oil pit.	10 Mtrs.	10 Mtrs.				
8.3	Nitrogen injection pipe connection between inlet openings on transformer tank and flange provided on top of FE cubicals	25Mtrs.	25Mtrs				

Fire Extinguishers

1	Foam type extinguisher (Mechanical) 45 Ltr. capacity	No.	4	4			
---	--	-----	---	---	--	--	--

Project : 400/220 kV SWITCHYARD AT TALAGUPPA-GUTTUR;
System : FIRE PROTECTION SYSTEM
Owner : KARNATAKA POWER TRANSMISSION CORP. LIMITED
Purchaser : BHARAT HEAVY ELECTRICALS LIMITED

TB 342 552 002
Rev 01



2	Foam type extinguisher (Mechanical) 9 Ltr. capacity	No.	4	4			
3	Water type (gas pressure type) 9 Ltr. capacity	No.	10	10			
4	Carbon di-oxide type 6 Ltr. Capacity	No.	10	10			
5	Sand type G.I Buckets 9 Ltr. Capacity	No.	16	16			
6	Steel stands for above to have 4 buckets to each stand.	No.	4	4			

Place

Signature of the authorized representative of Bidder

Date

Name-----

Designation-----

Company seal -----

Project : 400/220 kV SWITCHYARD AT TALAGUPPA-GUTTUR;
System : FIRE PROTECTION SYSTEM
Owner : KARNATAKA POWER TRANSMISSION CORP. LIMITED
Purchaser : BHARAT HEAVY ELECTRICALS LIMITED

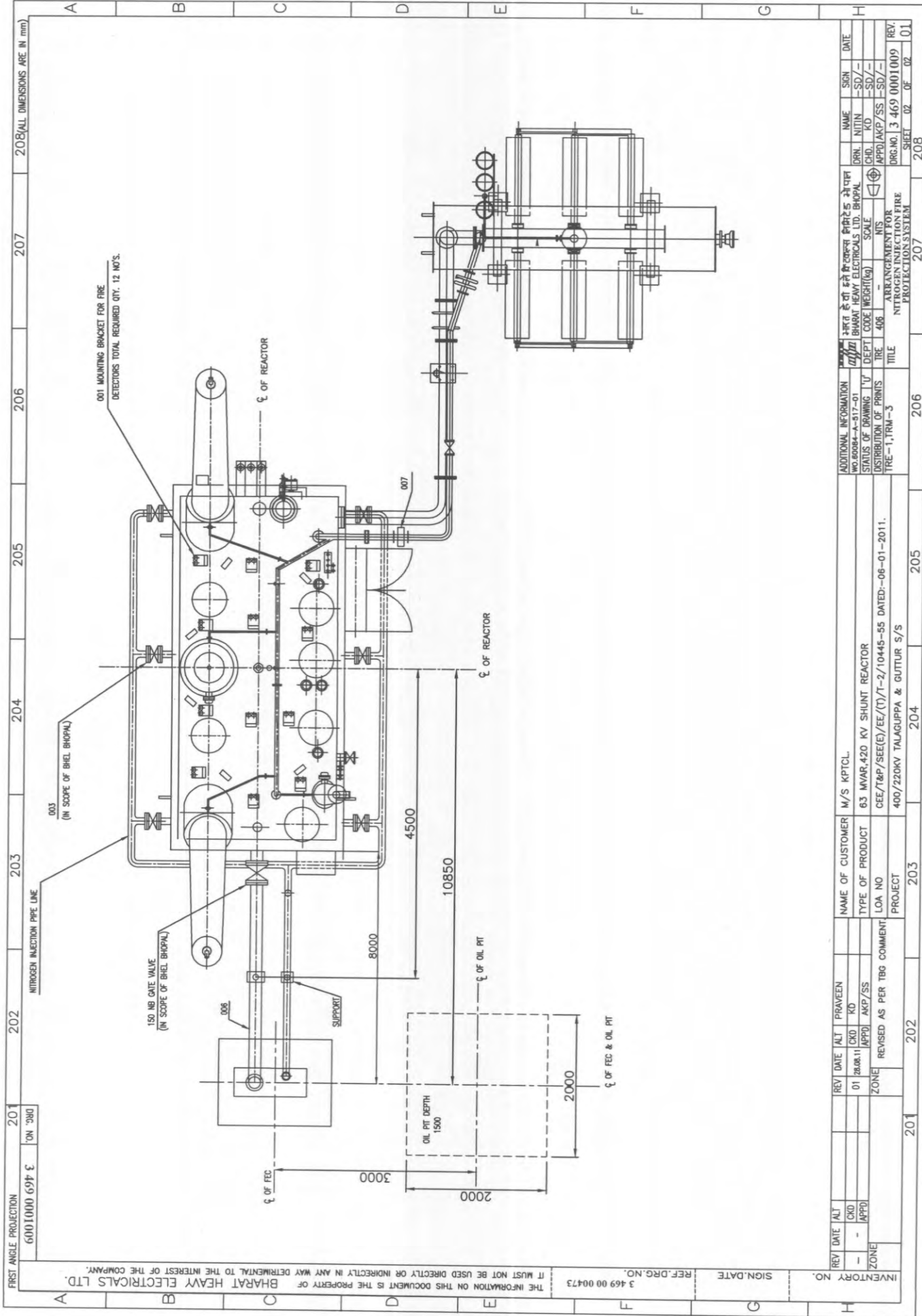
TB 342 552 002
Rev 01



SCHEDULE –11

DRAWINGS

1. OGA FOR 63 MVA SHUNT REACTOR – DRG. NO. 3 469 0001009 R1
2. LAYOUT PLAN OF THE SUB-STATION AT NELAMANGLA – DRG. NO. TB-2-341-316-002A R1
3. LAYOUT PLAN OF THE SUB-STATION AT HOODY– DRG. NO. TB-2-341-316-002 R1



FIRST ANGLE PROJECTION
 Dwg. No. 3 469 00010009

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3 469 00 00473 REF. DRG. NO.
 SIGN. DATE

INVENTORY NO. 201

REV	DATE	ALT	PRAVEEN	NAME OF CUSTOMER	M/S KPTCL.
01	18.08.11	CHKD / APPD	KD / AKP/SS	63 MW, 420 KV SHUNT REACTOR	
ZONE		REVISED AS PER TBG COMMENT			

PROJECT	400/220KV TALAGUPPA & GUTTUR S/S
LOA NO	CEE/T&P/SEE(E)/EE/(T)/T-2/10445-55 DATED:-06-01-2011.
TYPE OF PRODUCT	63 MW, 420 KV SHUNT REACTOR
NAME OF CUSTOMER	M/S KPTCL.

PROJECT	FIRE-1, TRM-3
DISTRIBUTION OF PRINTS	TRM
DEPT CODE	408
WEIGHT(Kg)	M/S
SCALE	AS SHOWN

STATUS OF DRAWING	T/V
WO. 60004-A-517-01	
ADDITIONAL INFORMATION	ARRANGEMENT FOR NITROGEN INJECTION FIRE PROTECTION SYSTEM

DRN. INTIN	NAME	SGN	DATE
CHKD / APPD	KD / AKP/SS	SD / -	
APPD / AKP / SS			

DRG. NO.	3 469 00010009
SHEET	01
OF	02

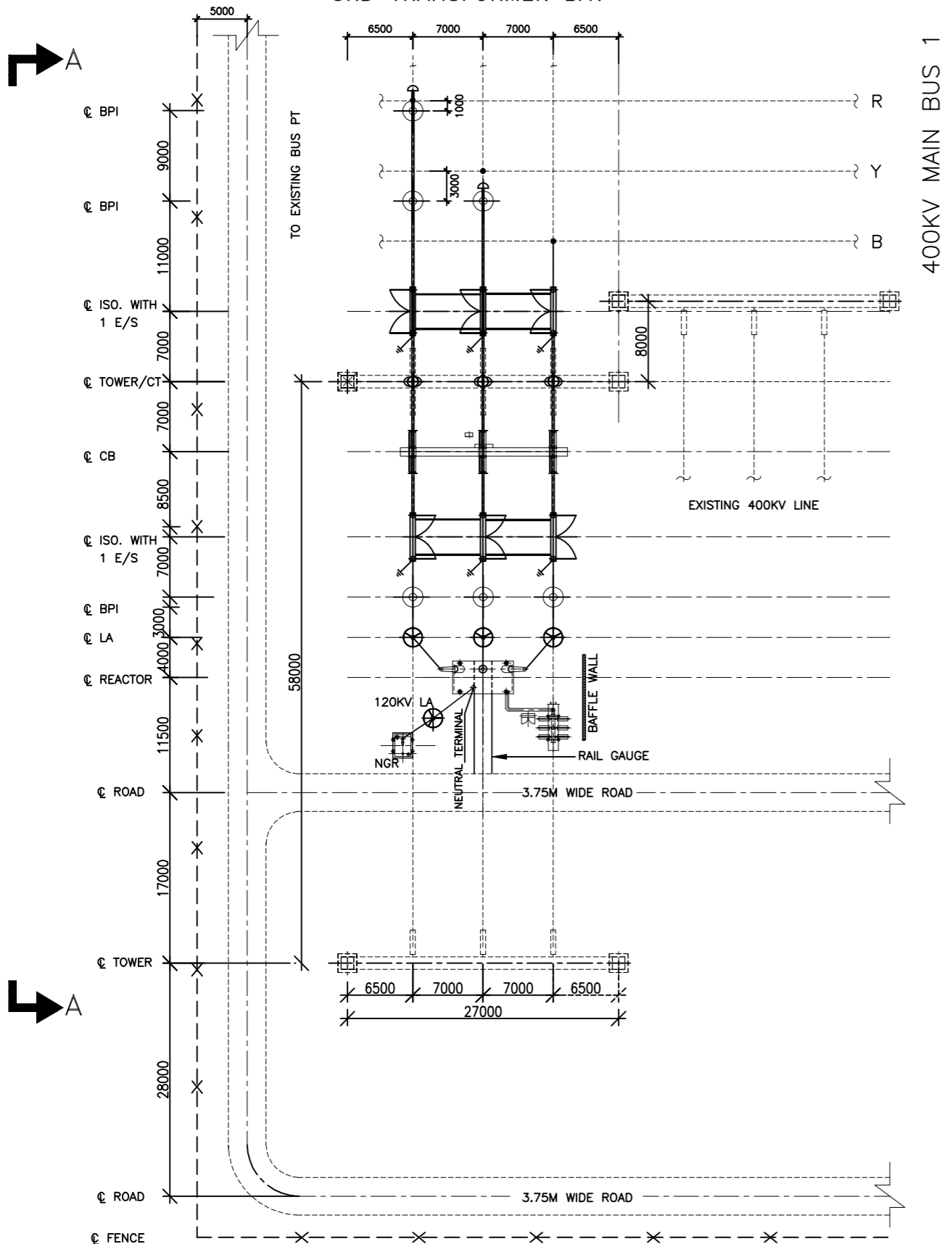
DRG. NO.	3 469 00010009
SHEET	01
OF	02

ALL DIMENSIONS ARE IN (mm)

FIRST ANGLE PROJECTION (ALL DIMENSIONS ARE IN MM.)

DRAWING No. TB-2-342-316-002

EXISTING 220/400KV
3RD TRANSFORMER BAY



400KV MAIN BUS 1

SCHEDULE OF EQUIPMENT

S.NO.	DESCRIPTION	SYMBOL	QTY.
1	400 kV, 2000A, 40 KA FOR 1 SEC, 3-PH SF6 CIRCUIT BREAKER WITHOUT CLOSING RESISTOR		01
2	400KV, 3150A, 40KA FOR 1 SEC, 3-PH. CENTRE BREAK ISOLATOR WITH ONE EARTH SWITCH		02
3	400KV, 2000/1-1A & 500/1-1-1A, 40KA FOR 1 SEC CURRENT TRANSFORMER		03
4	390KV, 10ka Class-3 SURGE ARRESTER		03
5	120KV, 10ka Class-3 SURGE ARRESTER		01
6	63MVAR, 400KV REACTOR		01
7	NEUTRAL GROUNDING REACTOR		01
8	400KV POST INSULATOR		06

PARTICULARS	400KV
1. BASIC INSULATION LEVEL (KV)	1425 KV
2. MINIMUM CLEARANCE (a) B/W PHASES (FOR RIGID BUS) (b) B/W PHASES (FOR STRUNG BUS) (c) B/W PHASES TO EARTH	4000 MM 4000 MM 3500 MM
3. (a) BAY WIDTH (b) HEIGHT OF MAIN BUS (c) HEIGHT OF JACK BUS	7000 MM 15000 MM 22000 MM
4. HEIGHT OF LIVE POINT OF VARIOUS EQUIPMENTS ISOLATOR, CT, BRAKER ETC.	8000 MM
5. POWER FREQUENCY WITH STAND VOLTAGE	630 KV
6. CREPAGE DISTANCE	10500 MM
7. SECTIONAL CLEARANCE	6500 MM

CONDUCTOR-ALUMINIUM TUBE-100MM	
1. NOMINAL SIZE	114.2 MM
2. OUTER DIAMETER	8.51 MM
3. INNER DIAMETER	97.18 MM
4. WALL THICKNESS	8.51 MM
5. CROSS SECTION	2825.61SQMM
6. MAX. DC RESIST AT 20° C	-
7. CURRENT RATING AT OUTDOOR	NOMINAL SIZE
8. WEIGHT PER UNIT LENGTH	7.7 KG/M
9. GRADE OF ALUMINIUM.	63401 WP (RANGE 2) AS PER IS 5082

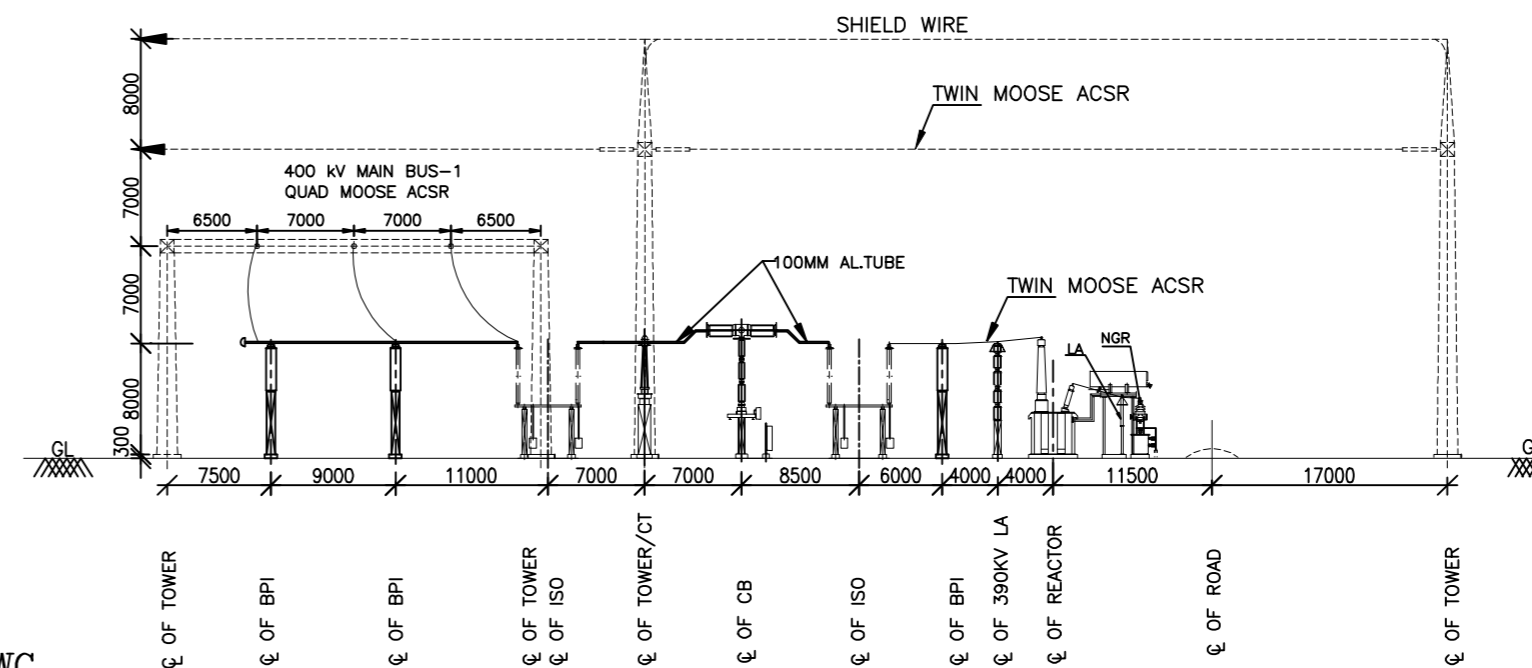
CONDUCTOR - MOOSE	
1. STANDING AND WIRE DIAMETER	54/3.53(AL) +7/3.53(STEEL)
2. SECTIONAL AREA OF ALUMINIUM	528.5 SQ.MM.
3. TOTAL SECTIONAL AREA	597.00 SQ.MM.
4. OVERALL DIA	31.77 MM.
5. WEIGHT (APPROX.)	2004 KG/M
6. DC RESISTANCE AT 20° C	0.05552 OHM/KM
7. MINIMUM U.T.S.	161.2 KN

EQUIPMENTS STRUCTURE QUANTITY	
1. 400KV CT STRUCTURE	03
2. (a) LA STRUCTURE-390KV	03
(b) LA STRUCTURE-120KV	01
3. ISOLATOR STRUCTURE	18
4. BPI STRUCTURE	06

BUS POST INSULATOR	TOP PCD	BOTTOM PCD	QTY.
400KV	127 MM	300 MM	06

REFERENCE DWG.

DWG.NO.: KPTCL/TECH/SS-400/TLE-1
DWG.TITLE: LAYOUT PLAN FOR MODIFICATION
WORKS AT 400/220 KV S/S TALAGUPPA



SECTION A-A

NOTES: -

- ALL DIMENSIONS ARE MM UNLESS OTHERWISE SPECIFIED..
- ALL HEIGHT ARE ABOVE PLINTH LEVEL UNLESS OTHERWISE SPECIFIED.
- PRESENT SCOPE
- EXISTING
- ALL NON-CUENT CARRYING METAL PARTS ARE TO BE EARTHED AND CONNECTED TO GROUND MAT.
- WHILE INSTALLING THE EQUIPMENTS CARE MAY BE ENSURED TO INSTALL THE BRAKER , CTs, ISOLATORS, LIGHTING ARRESTORS, STRUCTURES IN LINE WITH SIMILAR EQUIPMENTS OF ADJACENT BAYS WHEREVER FEASIBLE.
- CABLE DUCTS ARE TO BE CONSTRUCTED IN PROPOSED BAY, SIMILAR TO CABLE DUCTS OF EXTANTION BAYS.
- GROUND MAT IS TO BE PROVIDED FOR THE NEW REACTOR BAY IN CONSULTATION WITH SEE (R&D).
- LA PRESSURE RELIEF VALVE SHALL NOT BE TOWARDS REACTOR SIDE/ ANY EQUIPMENT KEPT NEAR LIGHTNING ARRESTER.

ADDITIONAL INFORMATION W.O.No. 80009	ग्राहक/परियोजना का नाम KARNATAKA POWER TRANSMISSION CORPORATION LIMITED																
STATUS OF DRAWING	NAME OF CUSTOMER/PROJECT (INSTALLATION OF 1X63MVAR BUS REACTOR)																
DISTRIBUTION OF PRINTS	<table border="1"> <tr> <td>भारत हेवी इलेक्ट्रिकल्स लिमिटेड</td> <td>नाम /NAME</td> <td>हस्ता./SIGN.</td> <td>दि./DATE</td> </tr> <tr> <td>भारत भारी बिजली लिमिटेड</td> <td>JUGENDRA</td> <td>JUGENDRA</td> <td>31.01.11</td> </tr> <tr> <td>भारत भारी बिजली लिमिटेड</td> <td>MM/DKM</td> <td>-SD-</td> <td>25.03.11</td> </tr> <tr> <td>भारत भारी बिजली लिमिटेड</td> <td>DS</td> <td>-SD-</td> <td>25.03.11</td> </tr> </table>	भारत हेवी इलेक्ट्रिकल्स लिमिटेड	नाम /NAME	हस्ता./SIGN.	दि./DATE	भारत भारी बिजली लिमिटेड	JUGENDRA	JUGENDRA	31.01.11	भारत भारी बिजली लिमिटेड	MM/DKM	-SD-	25.03.11	भारत भारी बिजली लिमिटेड	DS	-SD-	25.03.11
भारत हेवी इलेक्ट्रिकल्स लिमिटेड	नाम /NAME	हस्ता./SIGN.	दि./DATE														
भारत भारी बिजली लिमिटेड	JUGENDRA	JUGENDRA	31.01.11														
भारत भारी बिजली लिमिटेड	MM/DKM	-SD-	25.03.11														
भारत भारी बिजली लिमिटेड	DS	-SD-	25.03.11														

REV. DATE	ALTERED	RK	DEPT.	अनुपात / SCALE	कार्ड कोड
01	10.06.11	CHECKED	MM		
		APPROVED	DKM		
ZONE	DWG. REVISED AS PER CUSTOMER COMMENTS DATED 21.05.11			शीर्षक/TITLE	पुनः/REV.
				LAYOUT PLAN & SECTION FOR MODIFICATION WORKS AT 400/220KV S/S TALAGUPPA	01
				डाईग.क./DRAWING NO.	
				TB-2-342-316-002	
				पृष्ठ क./SHEET No. 01	अगला पृष्ठ/NEXT SHEET --

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it must not be used directly or indirectly in anyway detrimental to the interest of the company.

COMPUTER DRG. PATH NAME :

REF. DRG. No.

SIGN. & DATE

INVENTORY No.

REV.	DATE	ALTERED	REV.	DATE	ALTERED	REV.	DATE	ALTERED	REV.	DATE	ALTERED
		CHECKED			CHECKED			CHECKED			CHECKED
		APPROVED			APPROVED			APPROVED			APPROVED
ZONE			ZONE			ZONE			ZONE		

FIRST ANGLE PROJECTION (ALL DIMENSIONS ARE IN MM.)

DRAWING No. TB-2-342-316-002A

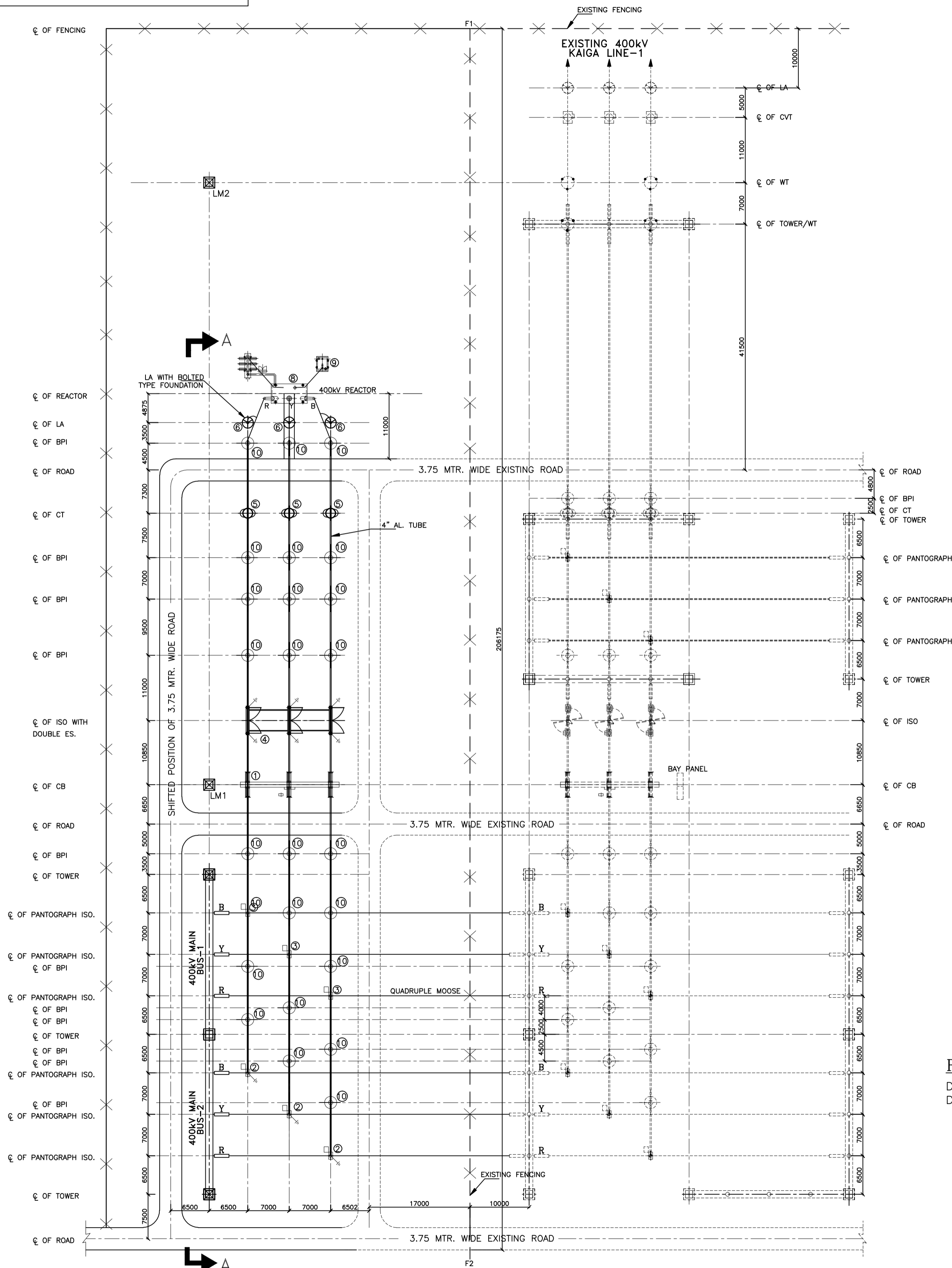
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COMPUTER DRG. PATH NAME :

REF. DRG. No.

SIGN. & DATE

INVENTORY No.



SCHEDULE OF EQUIPMENT

S.NO.	DESCRIPTION	SYMBOL	QTY.
1	400kV, 2000A, 40KA FOR 1 SEC., 3-PH. SF6 CIRCUIT BREAKER WITHOUT CLOSING RESISTOR		01
2	400kV, 3150A, 40KA FOR 1 SEC., 3-PH. PANTOGRAPH ISOLATOR WITH ONE EARTH SWITCH		01
3	400kV, 3150A, 40KA FOR 1 SEC., 3-PH. PANTOGRAPH ISOLATOR WITHOUT EARTH SWITCH		01
4	400kV, 3150A, 40KA FOR 1 SEC, 3- PH. CENTRE BREAK ISOLATOR WITH TWO EARTH SWITCH		01
5	400kV, 3000A, 40KA FOR 1 SEC., 1-PH. CURRENT TRANSFORMER		03
6	390kV, 10KA Class-3 SURGE ARRESTER		03
7	120kV, 10KA Class-3 SURGE ARRESTER		01
8	63MVAR, 400KV REACTOR		01
9	NEUTRAL GROUNDING REACTOR * (145 KV , 600 OHMS)		01
10	400KV POST INSULATOR		24

* NGR RATING TO BE CONFIRMED BY KPTCL.

CONDUCTOR-ALUMINIUM TUBE-100MM

1. NOMINAL SIZE	114.2 MM
2. OUTER DIAMETER	8.51 MM
3. INNER DIAMETER	97.18 MM
4. WALL THICKNESS	8.51 MM
5. CROSS SECTION	2825.61SQMM
6. MAX. DC RESIST AT 20° C	-
7. CURRENT RATING AT OUTDOOR NOMINAL SIZE	-
8. WEIGHT PER UNIT LENGTH	7.7 KG/M
9. GRADE OF ALUMINIUM.	63401 WP (RANGE 2) AS PER IS 5082

CONDUCTOR - MOOSE

1. STANDING AND WIRE DIAMETER	54/3.53(AL) +7/3.53(STEEL)
2. SECTIONAL AREA OF ALUMINIUM	528.5 SQ.MM.
3. TOTAL SECTIONAL AREA	597.00 SQ.MM.
4. OVERALL DIA	31.77 MM.
5. WEIGHT (APPROX.)	2004 KG/M
6. DC RESISTANCE AT 20° C	0.05552 OHM/KM
7. MINIMUM U.T.S.	161.2 KN

BEAMS

SLNO.	BEAM DESIGNATION	BEAM WIDTH	QTY.
1	TO BE FURNISHED BY KPTCL	27MTR.	02

PARTICULARS

PARTICULARS	400KV
1. BASIC INSULATION LEVEL (KV)	1425 KV
2. MINIMUM CLEARANCE (a) B/W PHASES (FOR RIGID BUS) (b) B/W PHASES (FOR STRUNG BUS) (c) B/W PHASES TO EARTH	4000 MM 4000 MM 3500 MM
3. (a) BAY WIDTH (b) HEIGHT OF MAIN BUS (c) HEIGHT OF JACK BUS	27000 MM 15000 MM 22000 MM
4. HEIGHT OF LIVE POINT OF VARIOUS EQUIPMENTS ISOLATOR, CT, BRAKER ETC. FROM PLINTH	8000 MM
5. POWER FREQUENCY WITH STAND VOLTAGE	630 KV
6. CREPAGE DISTANCE	10500 MM
7. SECTIONAL CLEARANCE	6500 MM

EQUIPMENTS STRUCTURE QUANTITY

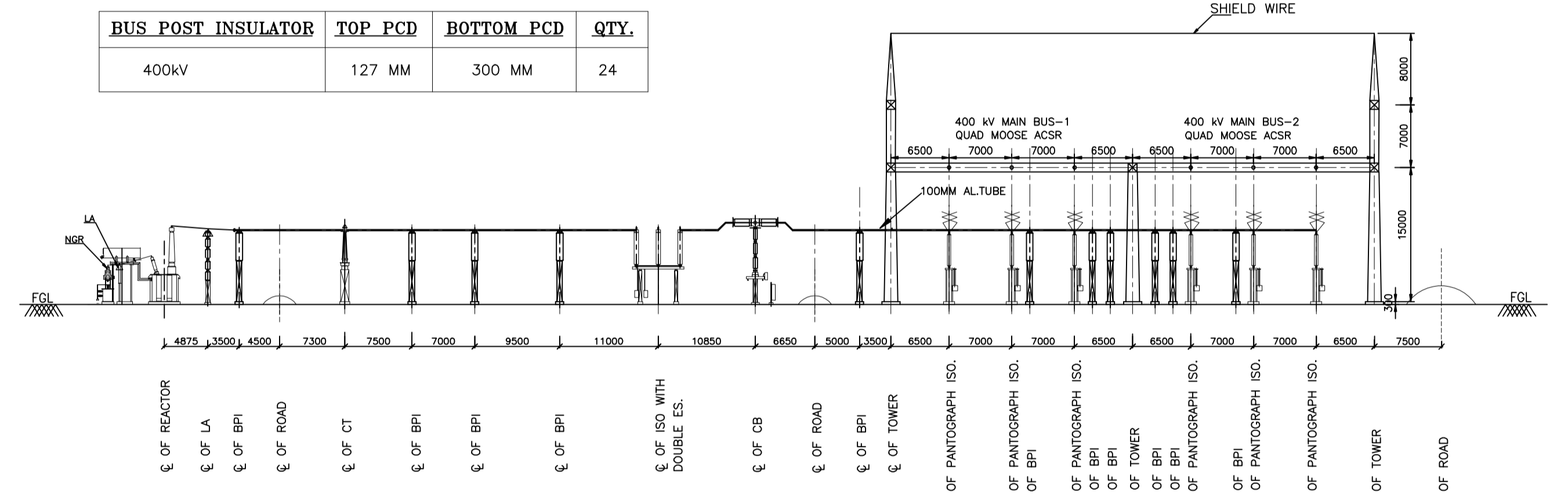
1. 400KV CT STRUCTURE	03
2. (a) LA STRUCTURE-390KV	03
(b) LA STRUCTURE-120KV	01
3. ISOLATOR STRUCTURE	12
4. BPI STRUCTURE	24

TOWERS

SLNO.	TOWER DESIGNATION	STR. HEIGHT	QTY.
1	TO BE FURNISHED BY KPTCL		03
2	LM	TO BE FURNISHED BY KPTCL	02

BUS POST INSULATOR

	TOP PCD	BOTTOM PCD	QTY.
400kV	127 MM	300 MM	24



NOTES:-

- ALL DIMENSIONS ARE MM UNLESS OTHERWISE SPECIFIED..
- ALL HEIGHT ARE ABOVE PLINTH LEVEL UNLESS OTHERWISE SPECIFIED.
- PRESENT SCOPE
- EXISTING
- ALL NON-CUENT CARRYING METAL PARTS ARE TO BE EARTHED AND CONNECTED TO GROUND MAT.
- WHILE INSTALLING THE EQUIPMENTS CARE MAY BE ENSURED TO INSTALL THE BRAKER , CTs, ISOLATORS, LIGHTING ARRESTORS, STRUCTURES IN LINE WITH SIMILAR EQUIPMENTS OF ADJACENT BAYS WHEREVER FEASIBLE.
- CABLE DUCTS ARE TO BE CONSTRUCTED IN PROPOSED BAY, SIMILAR TO CABLE DUCTS OF EXTANTION BAYS.
- GROUND MAT IS TO BE PROVIDED FOR THE NEW REACTOR BAY IN CONSULTATION WITH SEE (R&D).
- LA COMING BETWEEN RAIL TRACK AND REACTOR MUST HAVE REMOVABLE TYPE STEEL STRUCTURE SO THAT THESE CAN BE REMOVED WHEN REACTOR HAS TO BE TAKEN OUT FOR REPAIR/ REPLACEMENT.
- LA PRESSURE RELIEF VALVE SHALL NOT BE TOWARDS REACTOR SIDE/ ANY EQUIPMENT KEPT NEAR LIGHTNING ARRESTER.
- FENCE SECTION F1-F2 SHALL BE DISMANTLED

REFERENCE DWG.

DWG.NO. KPTCL/TECH/SS-400/GTR-1(R1)
DWG.TITLE: DETAILED LAYOUT PLAN FOR PROVIDING
BUS REACTOR AT 400/220/33 KV GUTTUR STATION

ADDITIONAL INFORMATION W.O.No. 80009	आहक/परियोजना का नाम KARNATAKA POWER TRANSMISSION CORPORATION LIMITED (INSTALLATION OF 1X63MVAR BUS REACTOR)
STATUS OF DRAWING	NAME OF CUSTOMER/PROJECT
DISTRIBUTION OF PRINTS	भारत हेवी इलेक्ट्रिकल्स लिमिटेड ट्रांसमिशन परियोजना विभाग BHARAT HEAVY ELECTRICALS LTD. TRANSMISSION PROJECTS DIVISION
DEPT. कोड कोड	अनुपात / SCALE कार्ड कोड CARD CODE
ड्राईंग.क./DRAWING NO. TB-2-342-316-002A	पुनः/REV. 01
पृष्ठ क./SHEET No. 01	उगला पृष्ठ/NEXT SHEET --

REV.	DATE	ALTERED	REV.	DATE	ALTERED
		CHECKED			CHECKED
		APPROVED			APPROVED