



BHARAT HEAVY ELECTRICALS LIMITED
TRANSMISSION BUSINESS ENGINEERING MANAGEMENT
NEW DELHI

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TITLE	DATE	10/07/18
Visual Monitoring System for Watch and Ward of Substation Premises	GROUP	TBEM
	W.O. No	86009

CUSTOMER	Tamilnadu Transmission Corporation Limited (TANTRANSCO)
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PROJECT	765/400kV AIS S/S Ariyalur
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NOA Ref:	
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2.	Section and elevation for 765kV/400kV Ariyalur S/s	TB-0-394-316-003	02
3.	Outdoor trench layout for 765kV/400kV Ariyalur S/s	TB-0-394-316-005	01
4.	Conceptual switchyard panel room drawing	TB-3-394-316-017	00
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SECTION - 1

1.1 SCOPE:

This technical specification covers the requirements of **design, packing at works, supply, unloading at site, storage at site including safety & security of supplied materials, erection/installation, testing and commissioning the complete visual monitoring system including cameras, digital video recorder system, mounting arrangement for cameras, cables, LAN switches, UPS and any other items/accessories for the 765kV/400kV Ariyalur S/s.** It shall also be bidder's responsibility to provide all necessary licenses to Owner i.e. TANTRANSCO to run the system successfully.

Storage space at site shall be provided by BHEL.

The Contract shall be on Bill of Quantity basis for the package. In case of change in scope after award of the contract, the additions/ deletions to the scope shall be as per the breakup unit rates for all the equipment and services furnished by the bidder in his offer.

The Bidder shall be responsible for the design and verification of the visual monitoring system at site.

After placement of order, the bidder has to design the system as per relevant standards/codes, practice to the satisfaction of BHEL/ ultimate Customer i.e. TANTRANSCO.

It is the responsibility of the successful Bidder to obtain necessary approval/clearance from statutory organizations wherever applicable for the equipment/system under the scope specified.

The VMS system is required for the following Projects

Customer : Tamilnadu Transmission Corporation Limited (TANTRANSCO)
Project : 765/400kV AIS S/S Ariyalur

The scope also covers.

Bidder shall submit the detailed BOQ and drawings indicating qty. of each items required for Visual monitoring system in the detailed engineering stage, the drawings and BOQ shall be submitted to BHEL/TANTRANSCO for approval. It shall be bidder's responsibility to get the approval in the drawing/BOQ from TANTRANSCO. Bidder shall also be required to visit BHEL/ TANTRANSCO office for technical discussion.

Visual monitoring system (VMS) is required for effective watch and ward of 765kV/400kV Ariyalur Substation premises covering the areas of complete switchyard, control room building, pump house, stores, security gate and main gate.

System with colour IP cameras for VMS surveillance would be located at various locations including indoor areas and outdoor switchyard and as per the direction of engineer in charge. The VMS data completely shall be recorded (minimum for 15 days) and stored on network video recorder.

It will be bidder's responsibility to assess number of cameras and their locations shall be decided in such a way that any location covered in the area can be scanned. The cameras shall be located in such a way to monitor at least the following.

1. The operation of each and every isolator pole of the complete yard (**including future scope**).
2. All the Transformer and Reactors (**including future scope**).
3. All the entrance doors of control room building, pump house and switchyard panel room.
4. All the gates of switchyard.
5. Main entrance gate.
6. All other Major equipments (such as CB, CT, CVT, SA etc. **for present and future**).

The cameras shall be mounted on structures, buildings or any other suitable mounting arrangement to be provided by the contractor. Bidder is advised to refer Layout and Sectional elevation drawing enclosed with this specification, and if bidder feels that at any one or more locations it is not possible to cover the requisite area by placing cameras on existing structure or building, in that case bidder can suggest alternative mounting arrangement and such alternative arrangement should be supplied by bidder without any extra cost implication to BHEL. Further alternative mounting arrangement should be proposed to BHEL/TANTRANSCO for acceptance.

The scope of supplies shall be as per commercial terms and conditions enclosed separately with the enquiry.

1.2 SPECIFIC TECHNICAL REQUIREMENTS:

The video monitoring system shall be an integral system with IP network centric functional and management architecture aimed at providing high speed manual/automatic operation for best performance.

The system should facilitate viewing of live and recorded images and controlling of all cameras by the authorized users.

The system shall use video signals from various types of indoor/outdoor CCD/CMOS.

Color cameras installed at different locations, process them for viewing on workstations/monitors in the control room and simultaneously record all the cameras after compression using **H 264/MPEG 4** or better standard.

Mouse/Joystick -keyboard controllers shall be used for pan, tilt, zoom and other functions of desired cameras.

The system shall provide sufficient storage of all the cameras recordings for a period of 15 days or more @ 25FPS, at 4 CIF or better quality using necessary compression techniques for all cameras. It shall be ensured that data once recorded shall not be altered by any means. The recording resolution and frame rate for each camera shall be user programmable.

The surveillance VMS system shall operate on 230V, 50Hz single phase Power supply. System shall have back up UPS Power supply meeting the power supply need of all the cameras in the stations including those which are installed at gate for a **period of 2 hrs**. The bidder shall submit the sizing calculation for the UPS considering the total load requirement of video monitoring system.

System Requirements:

1. System must provide built in facility of watermarking or digital certificate to ensure tamperproof recording.
2. All cameras may be connected through a suitable LAN which shall be able to perform In 765kV class substation environment without fail.
3. All cameras recording shall have camera ID, location/area of recording as well as date /time stamp , camera ID , location /area of recording & date /time shall be programmable by the system administrator with user ID & Password.
4. Facility of camera recording in real time mode (25 FPS)/15/12.5/10 or lower FPS as well as in any desired combination must be available in the system.
5. Facility of camera recording in HD (1280X720P), D1, 4CIF, CIF, VGA as well as in any combination i.e. any camera can be recorded in any quality.
6. System to have facility of **100%** additional camera installation beyond the originally planned capacity.
7. In order to optimize the memory, while recording, video shall be compressed using H 264/MPEG-4 or better standard and streamed over the IP network.
8. System shall have triplex i.e. it should provide facility of viewing, recording & replay simultaneously.
9. The offered system shall have facility to export the desired portion of clipping (from a specific date/time to another specific date/time) on CD or DVD. Viewing of this recording shall be possible on standard PC using standard software like windows media player etc.
10. System shall have provision of WAN connectivity for remote monitoring.
11. The equipment should generally conform to electro-magnetic compatibility requirements for outdoor equipment in EHV switchyards. **The major EMC required for cameras and other equipment shall be as under:**
 1. Electrical Fast transient (Level 4)-As per IEC 61000-4-4
 2. Damped Oscillatory (1MHz and 100kHz) (Level3)- As per IEC 61000-4-12
 3. AC Voltage dips & Interruption/Vibration (Level 4)-As per IEC 61000-4-12
 4. Electrostatic discharge (Level 4)-As per IEC 61000-4-2
 5. Power frequency Magnetic field (Level 4) –As per IEC 61000-4-8
 6. Ripple on DC Power supply (Level 4) -As per IEC 61000-4-17

Type test reports to establish compliance with the above requirement shall be submitted during detailed engineering.

1.3 Video Surveillance Application software:

- a) Digital video surveillance control software should be capable to display and manage the entire surveillance system. It should be capable of supporting variety of devices such as cameras, video encoder, servers, NAS boxes/Raid backup devices etc.
- b) The software should have inbuilt facility to store configuration of encoders and cameras.
- c) The software should support flexible 1/2/4/8/16/32 windows split screen display mode and scroll mode on the PC monitor.
- d) The software should be able to control all cameras i.e. PTZ control, Iris control, auto/manual focus, and color balance of cameras, selection of presets, Video tour selection etc.
- e) The software should have user access authority configurable on per device or per device group basis. The system shall provide user activity log with user ID, time stamp, action performed etc.
- f) The user should be on a hierarchical basis as assigned by the administrator. The higher priority person can take control of cameras, which are already being controlled by a lower priority user.
- g) It should have recording modes viz. continuous, manual or programmed modes on date, time and camera-wise. All modes should be disabled and enabled using scheduled configuration. It should also be possible to search and replay the recorded images on date, time and camera wise. It should provide on screen controls for remote operation of PTZ cameras. It should have the facility for scheduled recording. Different recording speeds (fps) and resolution for each recording mode for each camera should be possible.
- h) The software for clients should also be working on a browser based system for remote users. This will allow any authorized user to display the video of any desired camera on the monitor with full PTZ and associated controls.
- i) Retrieval: The VMS application should allow retrieval of data instantaneously or any date/time interval chosen through search functionality of the application software. In case data is older than 15 days and available , the retrieval should be possible. The system should also allow for backup of specific data on any drives like DVD's or any other device in a format which can be replayed through a standard PC based software. Log of any such activity should be maintained by the system.

- j) VMS shall provide the full functionality reporting tool which can provide reports for user login/logoff, camera accessibility report, server health check reports etc.

1.4 Network Video Recorder:

The Network video recorder shall also include at least server (Min 3GHz, 4 GB RAM, 3000GB HDD(min) , RAID 5, with suitable configuration along with colored TFT 22" High resolution monitor, and Internal DVD writer, Windows XP/Vista/7 Prof. or VMS compatible operating system latest version with hardware like graphic cards, licensed Anti virus etc.

Further the digital video recorder shall conform to the following requirements:

1	Server specification	Intel Quad core (or better) 3 Ghz (min), 8MB cache, 4 GB memory with suitable NVIDIA graphics card, 3TB HDD , Raid 5
2	Recording and Display Frame Rate	Real time 25 frames per second per channel, manual select
3	Recording Resolution (PAL)	1280x720, 704(H) x 586(V). It shall be possible to select lower resolution.
4	Compression Method	H,264/MPEG-4 or better and latest
5	Video Motion detection	Capable Standard and built in (selectable in menu)
6	Monitoring Options Split screen	1,2,4,8,16,32 or more cameras
7	Playback options Search	still image capture
8	Alarm/Event recording Capable	To be provided with built in external alarm input/output ports minimum (8 in , 2 Out)
9	Network Operation Capable	To be provided by using WAN or LAN router
10	Remote internet viewing	10 Capable Using WAN or LAN router
11	HDD storage consumption	1GB ~ per hour/channel variable based on frame speed and resolution settings, as well as compression
12	Operation Triplex operation	(simultaneous recording, playback, network operation)
13	Number of video channel	32
14	Audio Recording capable	32
15	Input storage	230V AC or equivalent with UPS as a backup for 30 minutes

1.5 VMS Cameras:

- The color IP camera for substation shall have PAN, TILT and ZOOM facilities so that it can be focused to the required location from the remote station through a controller. Whereas wireless IP cameras with PTZ

controls are required for installation at gates of the TANTRANSCO premises as per the direction of Engineer-In –Charge.

2. The IP camera at the main gate can be fixed or PTZ based and shall be used for monitoring entry and exit.
3. It should have sufficient range for viewing all the poles of isolators and other equipments with high degree of clarity.
4. The VMS cameras shall be suitable for wall mounting, ceiling mounting and switchyard structure mounting.
5. It shall be possible to define at 128 selectable preset locations so that the camera gets automatically focussed on selection of the location for viewing a predefined location.
6. The cameras should be able to detect motion in day & night environment having light intensity of Color: 0.5 Lux, B & W : 0.05lux
7. Housing of cameras meant for indoor use shall be of IP 42 or better rating whereas outdoor camera housing shall be of IP 66 or better rating. Housing shall be robust and not have the effect of electromagnetic induction in 765kV/400kV switchyard.
8. All camera recordings shall have camera ID & location/area of recording as well as date/time stamp. Camera ID location /area of recording & date /time shall be programmable by the system administrator with user ID & Password.
9. Facility of camera, recording in real time mode (25FPS)/15/12.5/10 or lower FPS as well as in any desired combination must be available in the system.

1.6 Outdoor IP Fixed Megapixel Camera Specifications (For Main Gate)

1.	Image sensor	2Megapixel Progressive 1/3" CMOS/CCD sensor, Minimum Illumination 0.1 Lux
2.	Min Luminous ring)	0.5Lux (Color) 0.05 Lux (Back)
3.	Camera Enclosure type	IP 66 Grade
4.	Iris/Focus	Auto/Manual
5.	Video Compression	Dual stream H. 264 and MPEG 4 user selectable
6.	Support dual-stream	Primary/secondary stream, H .264/MPEG 4 optional
7.	Video definition	Primary stream: 1600x1200,1200x960,1280x720 Secondary stream: 800x600, 400x288, 192x144
8.	Video parameters	Brightness, hue, contrast ,saturation and image quality

9.	Video frame rate	PAL: 1-25 frames/second NTSC: 1-30 frames/second
10.	Video compression BR	32Kbit/S-6Mbit/S
11.	Video Output	One channel composite Streaming
12.	Supported Protocols	TCP,UDP,IP,HTTP,FTP,SMTP,DHCP ,DNS,ARP,ICMP,POP3,NTP,IPsec,UpnP,RTP,RTCP
13.	Operating Temperature	-5~+50°C
14.	Operating humidity	10~90%

1.7 Outdoor IP66 PTZ HD Camera specifications (For Switchyards)

1.	Image Sensor	1/3 type solid state progressive scan CCD,WDR (high definition)
2.	Security	Multiple user access with password protection
3.	Effective Pixels	(PAL): Main stream: 1280x720 Sub stream: 640x360, 320x280 selectable
4.	Compression	Dual Stream H.264 and MPEG 4 user selectable
5.	Signal system	50Hz
6.	S/N (Signal to Noise)	Better than 50 dB
7.	Electronic Shutter	1/60~1/10,000 sec. automatic or better
8.	Scanning system	Progressive/Interlace
9.	Low Light Sensitivity (Lux)	Color: 0.5 Lux, B & W :0.02 Lux
10.	Lens	Minimum 10X (Min.)optical in high definition (The system shall be able to zoom the images on the monitor without any distortion to the maximum level of optical zoom)
11.	Lens size	Minimum 4.1~73.8mm
12.	Lens Aperture	F1.6(wide)~F2.8(tele), f=4.1~41.0mm,10X zoom Video Auto Focus Angle of view Horizontal: 52° (wide) 2.8°(tele)
13.	PTZ data Transfer	Baud/Bit Rates supported Selectable 2400bps/4800bps/9600 bps
14.	Panning Range	Complete 360degrees (horizontal)
15.	Pan Speed	Adjustable, 0.1 degrees/Second ~250 degrees/second
16.	Tilting Range	Minimum 180° Tilt rotation
17.	Tilt speed	Adjustable, 0.1 degrees/sec~150degrees/sec
18.	In built storage	Camera should have inbuilt storage TF or SD format for recording and storing pictures
19.	IP class	IP 66 Standard
20.	Working temperature	-0°C~ +50°C
21.	Working Humidity	10~90%

1.8 PTZ- Keyboards

The features of PTZ shall include:

- Fully functional dynamic keyboard/joystick controllers
- Controls all pan, tilt, zoom, Iris, preset functions
- Control up to 255 units from a single keyboard
- Many preset options and advanced tour programming
- Compatible with all connected cameras

1.	Key Application	Wired keyboard control operation of PTZ functions for weatherproof dome cameras
2.	Pan/Tilt/Zoom Protocol Languages supported	Selectable
3.	PTZ data transfer Baud Rates supported	Selectable 1200bps/2400bps/4800bps/9600bps
4.	Additional Features	Dynamic joystick for smooth camera movements, preset location option for quick access to frequently monitored areas.

1.9 Test Requirement

The vendor shall submit a FAT (factory acceptance test) & SAT (site acceptance test) plan complying the specification for TANTRANSCO/ BHEL approval that will be used during inspection at works & and site respectively.

- i) Complete operating and maintenance manuals and training of O&M personnel.
- ii) System commissioning and acceptance tests as specified in site acceptance test (SAT) plan.

1.10 Documents to be provided by bidder

- Make and model of each item.
- Technical datasheet/Catalogues/brochures of the item.
- **Test certificates including valid type test reports as per relevant standards.**
- Reference list of the Projects where similar equipment for similar application is being used for at least 2 years.

1.11 BILL OF QUANTITY FOR SUPPLIES & SERVICES: As per Annexure-1

Note -1 -Tentative quantities are mentioned in **BOQ under Annexure-1**. The above quantities (BOQ) are as per preliminary design only. The detail design will be submitted by Vendor and subject to approval by Customer. The BOQ quantities which are finalised after approval has to be supplied. BHEL reserves the right for quantity variation due to any reason **upto $\pm 30\%$ of total value at same unit rate and terms during execution of contract** . The quantity of individual items may however vary upto any extent.

Note-2- The Following shall be free issue items from BHEL :

- (i) Multicore Power Cables 4C x 2.5 sq.mm Cu/PVC-used for power supply to UPS of individual camera and UPS located in control room for NVR /server/keyboard (actual required power cable is 3 core , it meant that one core will be spare).
- (ii) 50X8 mm mild steel strip for earthing of visual monitoring system.

Bidder shall estimate the power cables and earthing mild steel strip required for successful completion of the full scope of works and furnish the break up of quantity during detailed engineering stage.

Note -3 -If trench is not available then power Cable will be laid in 75mm dia. Pipe PVC class -4 Pipe. Supply and laying of PVC pipes alongwith accessories will be in Bidder scope. Fiber optics cable shall be laid in 25mm dia.HDPE pipes.

Bidder shall estimate total required quantities of PVC pies and HDPE pipes during detailed engineering.

Note- 4-Supply of all applicable **erection/mounting hardware material of visual monitoring system** shall be in Bidder scope.

1.12 TYPE TESTING:

Bidder shall submit valid type test reports (As per relevant IEC/IS standard) for the tests carried out within last ten years **from the date of opening of the tender (i.e. 30.09.2016)**. The reports should have been conducted on identical or similar equipment/components to those offered. In case type test reports are more than 10 years old (from the date of opening of the tender) or the reports of type tests are found to be technically unacceptable , the type test shall be conducted by the vendor without cost and delivery implication to BHEL. The type test if conducted shall be witnessed by BHEL/Customer.

1.13 INSPECTION & TESTING:

Before being fitted on the equipment, all components shall be subjected to routine tests at the Contractors factory, as per the relevant IEC/IS standards. A

detailed test report proving the successful passing of such tests shall be provided.

Prior to dispatch, the routine & acceptance tests shall be carried out on equipment in accordance with the applicable IEC /IS and the material shall be offered for final inspection to BHEL and TANTRANSCO in accordance with agreed quality plan with 3 weeks advance information.

1.14 QUALITY PLAN:

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

			Rev -00	Annexure-1
BOQ of Visual Monitoring system for 765/400KV AIS SS at Ariyalur in Villupuram Region				
Sl.No	Description of work	Unit	Qty.	Remark
A	Supply and training of Visual Monitoring system			
1	Supply of HD PTZ Camera	Nos.	16	Used for Switchyard, pump house, and switchyard panel room
2	Supply of HD fixed Camera	Nos.	5	Used for main entrance gate and switchyard control room building
3	Supply of Network Video recorder including server and 22" Screen	Lot.	1	
4	Supply of Video management software for all camera	Lot	1	With camera licence
5	Supply of PTZ controller keyboard	No.	1	
6	Supply of Fiber optic cable (6 Pair)	km	3	
7	Supply of Fiber optic cable (3 Pair)	km	6	
8	Supply of Ethernet Switch	Lot	1	
9	Supply of UPS for NVR/Screen/keyboard etc.	No.	1	(1) Sizing calculation (for back up of 30 minute) to be provided by bidder during detailed engineering . (2) Power supply of UPS for NVR shall be taken from Control room ACDB.
10	Supply of UPS for Camera	Nos.	21	(1) Sizing calculation (for back up of 2 hour) to be provided by bidder during detailed engineering . (2) Power supply of UPS for Camera shall be taken from nearest AC junction box located in switchyard.
11	Supply of Media convertor	Pair	21	
12	Supply of Fiber duplex patch cord	Nos.	42	
13	Supply of LIU 12 port	Nos.	5	
14	Supply of LIU 6 port	Nos.	21	
15	Supply of Junction box	Nos.	21	
16	Supply of CAT 6 Cable between Camera and media convertor	Lot	1	Supply for all camera
17	Supply of network rack	No.	1	
18	Supply of 25mm dia. HDPE pipes for laying of Fiber optic cable	km	6	(1) Supply of sockets , joints and bends of pipes shall be in Bidder scope. (2) Supply of required clamp for fixing HDPE pipe conduits on Cable rack/tray/trench wall shall be in Bidder scope. (3) Payment will be made for the as supply pipe length.

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			Rev -00	Annexure-1
BOQ of Visual Monitoring system for 765/400KV AIS SS at Ariyalur in Villupuram Region				
Sl.No	Description of work	Unit	Qty.	Remark
19	Supply of any other additional required accessories not mentioned above but those are required as per technical specification for completion of visual monitoring system	Lot	1	Detailed break-up to be provided in offer (if applicable/required with purpose) .
20	Supply of 75mm dia. PVC class -4 pipes for laying of power cable	m	1000	(1) If trench is not available then power cable shall be laid in PVC pipes . (2) Supply of sockets , joints and bends of pipes shall be in Bidder scope. (3) Payment will be made for the as supply pipe length.
21	Training (1 day at Site)	Lot	1	Training at Site shall include familiarization of the TANTRANSCO personnel with operation, maintenance and troubleshooting of the VMS System.
B	ETC of Visual Monitoring system			
22	ETC of HD PTZ Camera with LIU , UPS, Media convertor, junction box and cat 6 cable etc.	Nos.	16	
23	ETC of HD fixed Camera with LIU , UPS, Media convertor, junction box and cat 6 cable etc.	Nos.	5	
24	ETC of Network Video recorder , server , 22" Screen , Video management software for all camera , PTZ controller keyboard , Ethernet Switch , UPS for NVR/Screen/keyboard, Media convertor located in control room , Fiber duplex patch cord , LIU located in control room , network rack etc.	Lot.	1	
25	ETC of Fiber optic cable (6 Pairs /3 pairs)	km	6	
26	ETC of 25 mm dia. HDPE pipes for laying of Fiber optic cable	km	6	
27	ETC of any other additional required accessories not mentioned above but those are required as per technical specification for completion of visual monitoring system	Lot	1	
28	ETC of 75mm dia. PVC class -4 pipes for laying of power cable	m	1000	laying of PVC pipes at a depth of 300mm including excavation, backfilling, making and repairing of walls in trenches, cutting, threading, fixing of sockets/ bends where required etc. complete. Both ends of PVC pipe shall be closed . If route length is more than required pull pit shall be constructed by Bidder (Payment will be made for the as erected pipe length)

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			Rev -00	Annexure-1
BOQ of Visual Monitoring system for 765/400KV AIS SS at Ariyalur in Villupuram Region				
SI.No	Description of work	Unit	Qty.	Remark
29	ETC of 4C X 2.5 Sq mm cable Cu/PVC	m	2000	Cabling including laying, tagging , dressing, ferruling, lugging, installation of cable gland ,soldering, tapping, jointing, crimping, termination, and drilling/ cutting holes in cable gland plates- laying can be either on trays, supports, underground, buried in ground or through /PVC pipe over/under ground, through wall etc. All erection materials viz. ferrules, glands , copper lugs, cable ties / straps, Al. tags, markers, GI / PVC wall sleeves with rubber / nylon bushes and flexible steel conduits shall be supplied by bidder. Cable Gland shall be Nickel Plated (coating thickness not less than 10 microns) brass cable glands, double compression heavy-duty type complete with necessary armour clamp & tapered washer etc .
30	ETC of 50 x 8 mm MS Flat	m	100	MS strip including cutting, bending, welding with 40 mm dia MS rod riser/earth strip, applying zinc rich paint, clamping to structure/building wall etc. to complete. Hardware required for connecting flat on pads of structure & equipment included in scope.

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SECTION – 2

GENERAL TECHNICAL REQUIREMENTS

3.0 FOREWORD

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

3.1 PROJECT INFORMATION AND SYSTEM PARAMETERS

- a) Customer : M/s Tamil Nadu Transmission Corporation Limited
- b) Project Title : 765/400KV AIS SUB STATION AT ARIYALUR
- c) Transport facilities : Road/Rail

Physical and other parameters:

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

(xii) Basic Wind Speed : 39 m/s (Zone -2)

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

3.1.4 System Parameter

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

3.1.5 AUXILIARY POWER SUPPLY:

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

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

3.2 GENERAL REQUIREMENT

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

3.2.1 The bidder shall also furnish drawings for the following:

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

3.2.2 GENERAL:

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

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

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

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

3.3 SPECIFIC REQUIREMENT

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

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

3.4 STANDARD:

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

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

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

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

3.5 TYPE TEST:

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

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

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

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

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

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

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

3.6 MATERIALS AND WORKMANSHIP:

All the materials shall be of the best class and capable of satisfactory operation in the tropics with

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

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

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

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

3.7 INSPECTION:

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

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

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

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

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

The BHEL/TANTRANSCO or his representative shall have the right to inspect and/or test the goods/works to confirm their conformity to the supplier. BHEL/TANTRANSCO shall notify the

supplier in writing of the identity of any representatives authorized for these purposes.

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

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

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

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

3.8 GUARANTEE:

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

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

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

3.9 PRE COMMISSIONING TESTING (if applicable) :-

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

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

3.11 PAINTING, GALVANISING:

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

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

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

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

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

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

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

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

3.12 SURFACE FINISH

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

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

3.13 PROTECTION

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

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

3.14 FUNGI-STATIC VARNISH

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

3.15 DEGREE OF PROTECTION

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

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

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

3.16 RATING PLATES, NAME PLATES AND LABELS :-

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

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

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

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

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

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

3.17 EARTHING :

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

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

3.18 TERMINAL BLOCKS AND WIRING

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

filters. The screen shall be fine wire mesh made of brass.

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

3.20 SPACE HEATERS

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

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

3.21 DELIVERY OF GOODS AND DOCUMENTS RELATED THERETO:

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

3.22 INCIDENTAL SERVICES:

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

3.23 DISCREPANCIES BETWEEN DRAWING AND SPECIFICATION:

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

3.24 LIST OF DRAWINGS AND DOCUMENTS :

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

The bidder shall furnish One sets of relevant descriptive and illustrative published literature

pamphlets and the following drawings/documents for preliminary study along with the offer.

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

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

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

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

3.25 **QUALITY ASSURANCE PLAN:**

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

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

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

- (ii) Information and copies of test certificates as in

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

The supplier shall submit following information to the TANTRANSCO.

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

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

3.26 **TEMPERATURE RISE:**

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

3.27 **FITTINGS AND ACCESSORIES:**

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

Operation mechanism housing complete with :

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

3.28 **PACKING AND FORWARDING:**

The equipment shall be packed in crates suitable for vertical/horizontal Transport, as the case may

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

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

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

3.29 SPECIFICATION FOR NITRYL BUTYL RUBBER

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

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

3.30 APPROVAL PROCEDURE

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

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

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

in the drawing, clearly marking the changes incorporated.

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

Title Block

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

3.31 DOCUMENTS TO BE SUBMITTED ALONGWITH OFFER

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

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

3.31 DOCUMENTATION SCHEDULE

Following Documentation schedule to be followed per project.

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

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

ANNEXURE - A
SCHEDULE OF TECHNICAL DEVIATIONS

Bidder shall list below all technical deviation clause wise w.r.t. tender specifications:

S.No.	Page No.	Clause No.	Deviation	Reason / Justification
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Any deviation not specifically brought out in this section shall not be admissible for any commercial implication at later stage. Except to the technical deviations listed in this schedule, bidder's offer shall be considered in full compliance to the tender specifications irrespective of any such deviation indicated / taken elsewhere in the submitted offer.

Date:

Tenderer's Stamp & Signature