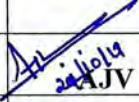


	SPECIFICATION FOR PLC & UPS Package	SPEC. NO.: ROS 4258 REV. NO: 00
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**BHARAT HEAVY ELECTRICALS LIMITED,
RANIPET- 632 406.**

**TECHNICAL SPECIFICATION
FOR PLC & UPS PACKAGE**

00	24.10.19	 AJV	 MKV 24/10/19	 VNS 24/10/19	FRESH ISSUE
Rev.No	Date	Prepared	Checked	Approved	Remarks

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	SPECIFICATION FOR PLC & UPS Package	SPEC. NO.: ROS 4258
		REV. NO: 00

Scope

This specification is intended to cover the design, manufacture, assembly, testing at manufacturer's works/testing laboratories, supply & delivery of properly packed PLC system and accessories complete with all fittings, accessories and auxiliary equipment for efficient and trouble-free operation

Sl.No	Description	Qty
1	PLC System & Accessories inclusive of commissioning activities at site.	1 Set
2	UPS, battery, ACDB and Accessories inclusive of commissioning activities at site.	1 Set
3	Mandatory spare for PLC & Control Panel/desk as per Table A: Mandatory Spare List	1 Set
4	Mandatory spare for UPS as per Table A: Mandatory spare List	1 Set

Note:

- 3 No: of 3 ph 415 V supply feeder cables will be terminated at UPS end by BHEL.
- Cable supply & Cabling between UPS, Battery, PLC, LVS, workstations and any other vendor supplied equipment in vendor scope.
- Cable supply & Cabling to field equipment from PLC in BHEL scope.
- Detailed IO list, P&ID and control philosophy will be shared after ordering.
- Attached vendor list to be followed.
- For UPS sizing in addition to PLC load 1KVA to be considered for 4 wire instruments powering. 14 outgoing feeders in ACDB (7 in each) also to be considered for the same.
- Scope includes commissioning of PLC system, UPS and all accessories at site for successful operation of PLC, to make logic changes if necessary at site and to ensure system performance during trial operation for a period of 50 working mandays in three visits inclusive of to & fro charges, lodging, local conveyance etc. Duration of each visit may vary as per site requirement.
After successful commissioning and trial operation, upon intimation from purchaser, PG test/Site Acceptance Test should be conducted. PG test/Site Acceptance Test is the responsibility of the supplier. PG Test shall be considered for a period of 10 working mandays to site inclusive of to & fro charges, lodging, local conveyance etc.
- Vendor may quote for as an optional per diem rate for the visit to site, for the additional working mandays beyond trial period and for PG test. This shall include to & fro charges, lodging, local conveyance to site etc. Payment will be made after the completion to each visit & certification from site engineer.

	TITLE: 4 X 270 MW BHADRADRI TPS		SPECIFICATION NO. PE-TS-411-163A-A001	
	TECHNICAL SPECIFICATION FOR DM PLANT			
			REV. NO. 00	DATE : 20/03/2017

PROJECT INFORMATION

4x270 MW Bhadradi TPS is being set up by Telangana State Electricity Corporation Limited (TSGENCO) at Manuguru in the district of Khammam, Telangana, India.

The Bidder shall acquaint himself by a visit to the site, if felt necessary, with the conditions prevailing at site before submission of the bid. The information given here in under is for general guidance and shall not be contractually binding on BHEL/Owner. All relevant site data /information as may be necessary shall have to be obtained /collected by the Bidder.

APPROACH TO SITE

The distance from Manuguru to Major cities in state

City	Km
Hyderabad	345
Warangal	180
Bhadrachalam	38
Kothagudem	70
Khammam	130
Vijayawada	195

District : **KHAMMAM**
 State : **TELANGANA**

Nearest Airport: **The nearest airport is Vijayawada Airport but the most used airport is the Hyderabad International Airport.**

Nearest Railway Station: **Manuguru railway station is 10KM from nearby town. However, Warangal/ Vijaywada railway Station is major railway station near to Manuguru.**

1. Owner : TSGENCO
2. Project Title : 4X270 MW Bhadradi TPS
3. Location : 16 Km from Manuguru Railway station
4. Nearest Railway Stn. : Manuguru
5. Temperature
 - a. Mean daily minimum ambient temperature during oldest month of the year: 11.5 Deg.C
 - b. Mean daily minimum ambient temperature during hottest month of the year: 45.1 Deg.C
6. Rainfall: Intensity of rainfall @ 50 mm/hr considering heaviest fall in 24 hrs
7. Wind Data: Basic wind speed at 10m height : 44 m/sec
8. Wind pressure: As per IS: 875 Part III- 1987
9. Seismic Zone: Zone III as defined in IS:1893 (pat-1)-2002 according to Indian Standard Seismic Zoning Map

10	Power Supply : The power supplies for distribution and auxiliaries shall be as under:	
	a) In plant generation	16.5kV $\pm 5\%$, 3ph, 50Hz $\pm 5\%$, high resistance earthed.



TITLE:
4 X 270 MW BHADRADRI TPS

SPECIFICATION NO. PE-TS-411-163A-A001

**TECHNICAL SPECIFICATION FOR
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	b) MV distribution	6.6kV $\pm 6\%$, 3ph, 3w, 50 Hz, + 5 % to – 5%, Non-effectively earthed
	c) LT distribution	415V $\pm 10\%$, 3ph, 4W, 50Hz + 5% to –5%, Effectively earthed
	d) Motor rated above 160kW	6.6kV $\pm 6\%$, 3 ph 50Hz +5% to -5%.
	e) Motor rated 160kW and below all motorized actuators.	415V $\pm 10\%$, 3 ph, 50Hz +5% to -5%.
	f) For motors equal and below 30kW winding heating	24V AC $\pm 10\%$, 50 Hz %, [to be generated in 415V switchgear by vendor]
	g) DC Motors	220V DC + 10% to - 15%, 2 wire ungrounded system
	h) Control supply for relay panel/ 6.6kV breakers/415V breakers and DC emergency lighting.	220V DC + 10% to - 15%, 2 wire ungrounded system
	i) UPS for instrumentation & Control system	240V AC $\pm 1\%$, 1 ph ,50Hz $\pm 0.5\%$ 2 Wire AC system
	j) Control supply for 415V Motor contactors/AC Control circuits [to be generated in MCC /panel by vendor]	110V AC $\pm 10\%$, 50Hz + 5% to –5%.
	k) Diesel Generator emergency supply	415V $\pm 10\%$, 3ph,3W, 50Hz +5%to –5%.
	Fault levels	
	a) 400kV	40kA rms for 1 sec
	b) 6.6kV	40 kA rms for 1 sec.
	c) 415V	50 kA rms for 1 sec.
	d) DC Supply	25 kA

SUMMARY OF IO COUNTS

SR.NO	IO DETAILS	DI	DO	AI	AO
1	INSTRUMENT	5	0	211	0
	DRIVES	165	110	11	6
	PNEUMATIC VALVES	610	341	3	3
	MOTORISED VALVE	10	4	0	0
	UPS	0	0	4	0
ACTUAL IO COUNTS		790	455	229	9
2	BACK-UP PANEL	110	723	0	0

NOTE :

1. COMMUNICATION OF BACK UP PANEL WITH MAIN PLC SHALL BE THROUGH ETHERNET COMMUNICATION
2. ANNUNCIATION WINDOW WITH HOOTER, PUSH BUTTON INDICATION AND MIMIC WILL BE MOUNTED IN BACK UP PANEL

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INTENTIONALLY BLANKED-DATA NOT RELAVANT TO PLC/UPS

TABLE A: MANDATORY SPARE LIST

13.4	Programmable Logical Control (PLC)	
13.4.1	Function controller and control modules (10% of number for each type or minimum of 4 number for each type whichever is high.)	2 Lot
13.4.2	Process I/O cards and drive modules (10% of the number of cards offered for the project from each category.)	2 Lot
13.4.3	All other type of electronic modules like CPU of workstation, Power supply modules, communication modules, modules for Data highway / modules for LAN, controllers not covered	2 Lot

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	above (10% of each type or minimum of 2 nos. of each type whichever is more).	
13.4.4	All cards, controllers, lamp and other components used in LVS.	2 Lot (10%)
13.4.5	Control logic power supply fuses at each current rating (Three times the one hundred percent spare replacement).	2 Lot
13.4.6	Electric to pneumatic converters (10% of each type utilized with automatic control system using pneumatic drives or a minimum of one of each type, whichever is more.)	2 Lot
13.4.7	Plug-in type keyboard	2 No. of each type
13.4.8	Dot matrix Printer	2 No.
13.4.9	CRT	2 No.
13.4.10	DVDs	40 Nos.
13.4.11	Printer ribbons /inking mechanism for colour printer.	20 Nos.
13.4.12	Ribbons for dot matrix printer.	60 Nos.
13.4.13	Data highway cable with adequate connectors.	500 meters
13.4.14	Hard disc drive unit as offered for system complete with accessories.	2 No.
13.4.15	Interface cables for each type	4 Sets
13.4.16	Power supply modules of each type and rating	2 Lot (10%)
13.4.17	Interposing / coupling relays of each type.	2 Lot (5% of total quantity)
13.5	MANDATORY SPARES FOR UN-INTERRUPTIBLE POWER SUPPLY SYSTEM	
13.5.1	Fuses (3 times, the one hundred percent spare replacement fuses shall be furnished with each panel board.)	2 Lot
13.5.2	Electronic modules for UPS , Charger, static switch & stabilizer and DC power supply system with each set consisting of at least one number of each type of electronic module for inverters, chargers, static switch, stabiliser etc.	2 Set
13.5.3	Battery cells	2 Lot (10%)
13.5.4	Thyrister without heat sink	2 Lot (10%)
13.5.5	Semiconductor fuse	2 Lot (10%)
13.6	Mandatory Spares for Control Panels / Desks	
13.6.1	Crimping Pins	2 Rolls
13.6.2	Bulbs for indicating lights (Three times the one hundred percent spare replacement)	2 Lot
13.6.3	control circuit fuses of each current rating (Three times, the one hundred percent spare replacement)	2 Lot
13.6.4	Push buttons, electrical control switches and Illuminated push buttons etc	Lot (20%)

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Notes:

- i) The Mandatory spares for the equipment under the contract provided by the vendor will strictly conform to the specifications and documents and will be identical to the corresponding main equipment/components supplied under the contract.
- ii) The quality plan and the inspection requirement finalized for the main equipment will also be applicable to the corresponding mandatory spares.
- iii) In case, mandatory spares are not applicable as per equipment / item selected, bidder has to provide equivalent mandatory spare as per for selected equipment / item in line with list of mandatory spares.
- iv) Unless stated otherwise, a "set" or "Lot" means items required for complete replacement in one equipment of each type / size/ range.
- v) Wherever quantity has been specified as percentage(%), it shall mean percentage (%) of the population of the item required for station (project), unless specified otherwise.

The vendor warrants:

1. That all spares supplied will be new and in accordance with the contract document and will be free from defects in design, material and workmanship and shall further guarantee as under:
 2. In case of any failure in the original component/equipments due to faulty designs, materials and workmanship, the corresponding spare parts if any, supplied will be replaced without any extra cost to the BHEL and customer unless a joint examination and analysis by BHEL and/or customer of such spare parts prove that the defect found in the original part that failed can safely be assured not to be present in spare parts.
 3. The long term availability of spares to the BHEL and the customer for the full life of the equipment covered under the contract and that before going out of production of spare parts of the equipment covered under the contract, vendor and his sub-vendors shall give the BHEL and the customer at least 24 (Twenty-Four) months advance notice so that the latter may order his bulk requirements of spares, if he so desires. The same provision will also be applicable to the sub-vendors. Further, in case of discontinuance of manufacture of any spares by the vendors or his sub-vendors the vendors and his sub-vendors, will provide the BHEL and the customer, 2 (two) years in advance, with full manufacturing drawings, material specifications and technical information required by the BHEL and the customer for the purpose of manufacture of such items and also the right to manufacture such spares for their own requirements.
 4. Further in case of discontinuance of supply of spares by the vendors or his sub-vendors, the vendor will provide the BHEL and the customer with full information for replacement of such spares with other equivalent makes, if so required by the BHEL and the customer.
 5. Notwithstanding the above, the vendor shall be responsible for supply of spares for the lifetime of the package at reasonable prices. The prices of all future requirements of spares shall be derived from the corresponding ex-works price at which the orders for such spares have been placed by the BHEL and the customer as a part of the mandatory or long term or any other kind of spares. The base indices for calculating ex-works price shall be commissioning of last equipment under main contract.
- vi) The vendor will indicate the delivery period of the spares, which the BHEL and the customer may procure in accordance with this clause.
 - vii) In case of emergency requirements of spares, the vendor would make every effort to expedite the manufacture and delivery of such spares on the basis of mutually agreed time schedule.
 - viii) In case the vendor fails to supply the mandatory or long term or any other kind of spares on the terms stipulated above, the BHEL and the customer shall be entitled to purchase the same from the alternate sources at the risk and the cost of the vendor and recover from the vendor, the excess amount paid by the BHEL and the customer over the rates as per the contract. In the event of such risk purchase by the BHEL



TITLE:
4 X 270 MW BHADRADRI TPS

SPECIFICATION NO. PE-TS-411-163A-A001

**TECHNICAL SPECIFICATION FOR
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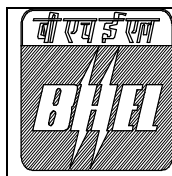
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or the customer, the purchases will be as per the works and procurement policy of the BHEL and the customer prevalent at the time of such purchases and BHEL & the customer at his option may include a representative from the vendor in finalizing the purchases.

- ix) It is expressly understood that the final settlement between the parties in terms of relevant clauses of the tender document shall not relieve the vendor of any of his obligations under the provision of long term availability of spares and such provisions shall continue to be enforced till the expiry of 30 (thirty) years period reckoned from the scheduled date of completion of trial operation of the last equipment unless otherwise discharged expressly in writing by the BHEL or the customer.

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TITLE:
4 X 270 MW BHADRADRI TPS

SPECIFICATION NO. PE-TS-411-163A-A001

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DM PLANT**

SECTION I

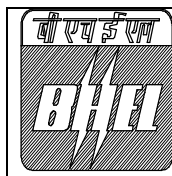
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GENERAL REQUIREMENT

6. PLC control system as defined in the enclosed specification and Data Sheets shall be in bidder scope. The PLC system shall comprise of (i) PLC based local panel (ii) UPS Power supply (iii) Operator interface in the form of CRT, keyboard and OWS along with required furniture.
7. PLC shall have the facility to synchronize its time with BHEL plant master clock system using IRIG-B signals. Necessary Hardware (IRIG-B port) for same at PLC end to be provided by bidder. The cable connecting PLC and plant master clock system shall be in BHEL scope.
8. PLC shall be connected to DCS through serial link with OPC Compliant for monitoring/Control. For details, please refer PLC Configuration Diagram.
9. All furniture (tables, chairs etc.) required for PLC operator HMI shall be in bidder's scope. Chairs shall be capable of being adjusted for height and position of backrest. The chairs shall be mounted on five castors, shall swivel and shall have arm rests'. One table and chair shall be provided for each operator station and separate table for each printer.



TITLE:
4 X 270 MW BHADRADRI TPS

SPECIFICATION NO. PE-TS-411-163A-A001

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10. The requirements given below are to be read in conjunction with detailed Technical specification enclosed.

11. **INTENTIONALLY BLANKED-DATA NOT RELAVANT TO PLC/UPS**

12. Bidder shall provide at least 20% or minimum two numbers, spare channels each type.

13. **INTENTIONALLY BLANKED-DATA NOT RELAVANT TO PLC/UPS**

14. Supplied system shall provide critical group alarms for the system to be hardwired to plant DCS.

15. Provision for input fire signal from fire alarm system to be ensured in the PLC panel for opening/ closing of the motor operated fire dampers.

16. Provision for separate Terminal block/wiring diagram for power and control blocks of control panel to be ensured.

17. Provision for earthing of the panel to be provided by vendor.

18. Vendor to submit GA drawing of control panel indicating layout of instruments, construction details, wiring diagram, class of protection for enclosure, paint type, paint color, thickness and material of enclosure sheet, control scheme during detailed engineering.

19. Layout & space requirement of panel to be specified during detailed engineering.

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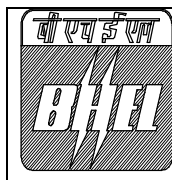
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24. Bidder to delegate/depute their person/experts as per owner/consultant requirements.
25. The make of all the items shall be from approved sub-vendor list.
26. The design, manufacture, inspection, testing, site calibration and installation of all C&I equipment and systems covered under this specification shall conform to the latest editions of applicable codes and standards eg. ANSI, ASME, IEEE, ISO, IEC, IGCI, AWS, NFPA, AISC, IGS, SAMA, UBC, UL, NESC, NEMA, ISA, DIN, VDE, IS etc.
27. Bidder shall provide the signal exchange, to Plant DCS in BHEL prescribed format to be furnished during detailed engineering.

NOTES:

1. All equipment items shall be of latest design with proven on track record from reputed experienced manufacturers of specified type and range of equipment. The make/model of various instruments/items/systems and instrument sub-vendor shall be subject to approval of BHEL/Customer during detailed engineering stage.
2. The above given scope is indicative & minimum. Any item/ equipment not indicated above however required for the completeness of the system is to be supplied by bidder without any technical, commercial and delivery implication to BHEL.



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3. Documents of C&I System shall be submitted to end user/owner for approval during detail engineering. Changes, if any, shall be accommodated by the bidder without any price/time implication.

Additional Specific requirement

Remote I/O

Remote I/O panels shall be provided by bidder with pushbuttons, indicating lamps and hardwired annunciation system for local control/ operations.

Ethernet Specification

Networking (LAN) components:

Networking (LAN) components including switches, Firewall, fibre optics cable, other cable as required, jack panel with wire manager, patch cord, coupler, rack with all accessories, connectors, port, etc. shall be provided by bidder.

- A) The Industrial graded, IEC 61850-3 Std compliant, Managed Ethernet Switches shall meet following minimum requirements:

- i) 48 X Gigabit Ethernet Port
- ii) 24 or 48 x 10/100/1000 Base TX ports (STP)
- iii) SNMP, RMON, VOIP, VLAN, Multi link Trunk support
- iv) Broadcast/multicast storm control
- v) Supervisor Engine redundancy capability
- vi) Redundant Power Supply
- vii) Extra expansion slots for future up gradation.
- viii) Integrated Security features (IPS, ACL, Firewall)
- ix) 10 GB module support for future upgradeability

Expandability / stackability through a dedicated high speed expansion port.

Routable, remotely manageable, configurable.

One intelligent SNMP manageable mini-UPS for 30 minutes backup shall be provided with all accessories and software.

- B) Secondary switches shall have the following features:

- i) 24 or 48 X 10/100/1000 Base TX ports (STP)
- ii) 2 or 4 X Gigabit Ethernet Port
- iii) SNMP, RMON, VOIP, VLAN, Multi link Trunk support.
- iv) Support for stacking with high throughput
- v) Broadcast/multicast storm control

- C) The Firewall shall meet following minimum requirements:

Firewall appliance shall facilitate multi-vendor, multi-application environment and shall support third-party products on open alliance. It shall support Active-Active configuration.

- i) The firewall shall contain following features:

- a) Stateful inspection of packets.

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- b) NAT functionality, including dynamic and static NAT translations
- c) Latest version of SNMP
- ii) The firewall must send log information to a separate log server via an encrypted connection. Firewall logging must not impact firewall performance.
- iii) Remote network access to the firewall shall only be possible through the administration interface.
- iv) The firewall administration station must be capable of pushing firewall security policies and configurations to individual or multiple firewalls through a secure, encrypted connection to the firewall administration interfaces.
- v) Graphical User Interface (GUI) and a Command Line Interface (CLI) for making changes to the firewall rules set shall be provided. (Access to the firewalls via the GUI or the CLI must be through a secure encrypted channel).
- vi) Any changes or commands issued by an authenticated user shall be logged to a database configured on any of the machines in the LAN. The administration station must allow for a hierarchical architecture for rules set administration and viewing of firewall configurations Management.
- vii) The firewall must not support any unencrypted means of access to the firewall.
- viii) It shall Monitor ALL network traffic-traffic at Firewalls (Internet and external networks), in the DMZ and detect known threat through deep packet inspection.
- ix) Detects unknown threats via anomaly scanning.
- x) Detect unknown threats via behavior pattern to protect from zero day attacks.
- xi) Keeps up-to-date on new threats and vulnerabilities.

D) Intrusion Detection System (IDS) and Intrusion Prevention System (IPS)

Features:

In order to inspect all inbound and outbound network activity and identify suspicious patterns that may indicate a network or system attack from someone attempting to break into or compromise a system on the Station LAN Network, the recommended IDS/IPS shall contain the following combined features. Any feature can be selected depending on whether it is to be configured as IPS or IDS.

- i) Able to analyze, detect and report on security related events.
- ii) Able to inspect traffic and to drop malicious traffic based on the configuration of security policy.
- iii) Able to inspect the content of network packets for unique sequences/signatures.
- iv) Able to detect and prevent known types of attacks such as worm or Trojan infections and hacks.
- v) Able to prevent denial of service (DOS) and Distributed Denial of Service attacks.
- vi) Able to prevent abnormal behaviors by monitoring and learning normal network behaviors.
- vii) Keeps up-to-date on new threats and vulnerabilities.
- viii) Shall provide user friendly interface to queries and reports on threats and event data so that security administrators can gain a better understanding of their ability to protect their network.

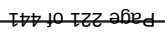
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- ix) Shall provide detailed activity logs for auditing.
- x) Able to detect known threats via deep-packet inspection.
- xi) Able to detect unknown threats via anomaly scanning.
- xii) Able to detect unknown threats via behavior pattern to protect from zero day attacks.

UPS signal IO List

The following minimum hardware/software signal shall be provided between UPS and PLC by bidder. These analog & digital signals shall be updated in HMI MIMICS.

- a. Main I/P 1, 2 alternate I/P voltage, currents.
- b. After line transformer -1&2 voltages
- c. DC O/P VOLTAGE, current and battery charging , discharging currents,
- d. Inverter o/p voltage, current.
- e. Static switch main I/P, alternate i/p voltage.
- f. SCVS O/P VOLTAGE, CURRENT, HZ
- g. UPS-1 & 2 –KVA, KW o/ps
- h. ACDB -1&2 VOLTAGE, CURRENT
- i. UPS-1,2 –POWER FACTOR



THIS IS A PART OF TECHNICAL SPECIFICATION NO. PE-TS-411-163A-A001

		STANDARD QUALITY PLAN FOR PROGRAMMABLE LOGIC CONTROLLER										QUALITY PLAN NO.: PE-QP-999-145-1036		
												VOLUME IIB		
												SECTION C1-D		
												REV. NO. 0 DATE:		
												SHEET OF		
Sl. No.	Component / operation	Characteristics Checked	* Category	Type/Method of Check	Extent of Check	Reference documents	Acceptance Norms	Format of Records	Agency \$			Remarks		
1.0	Materials /Components													
1.1	Panels & Control Desks	Physical Inspection for Dimensions, Painting, Cutouts, Lifting / Locking Arrangements, Components, Drawing Pocket, Mounting accessories, Plinth & AV Pads, Cable Gland Plates, Hardwares, Hinges, Louvers & Filters, Fans & Panel Lamps	MA Visual	I	100%	Contract specifications, Approved GA Drawings, BOQ	As per ref documents. No physical damage.	BHEL Quality Inspection Report.	3/2	2	1			
1.2	Power Supply/Packs, Battery charger, Transformer, UPS.	Physical Inspection Physical Damages Dimensions Mounting Accessories	MA Visual	I	100%	Contract specifications, BOQ.	As per reference documents, Test Report	BHEL Quality Inspection Report.	3/2	2	1			
1.3	Indicating Lamp, Annunciator, Meters, Transducers, Signal Converters, Instruments, Single Loop Controllers	Physical Verification Physical Damages Dimensions Accessories	MA Visual	I	100%	Contract specifications, BOQ.	As per ref documents No physical damage. Test/ Calibration report.	BHEL Quality Inspection Report	3/2	2	1			
1.4	PLC processors, I/O modules, Power Supply modules, Communication modules, Mounting Racks, Ethernet	Physical Inspection - Identification Labels - Physical Damages - Quantity - Spare Capacity	MA Visual	I	100%	Product Catalogue, Data sheets, Approved Configuration diagram, BOQ	As per ref documents. Test Certificates	BHEL Quality Inspection Report.	3/2	2	1			

LEGEND: * CR - Critical characteristics
MA - Major characteristics
MI - Minor characteristics

\$ P - Agency Performing the Test.
W - Agency Witnessing the Test.
V - Agency Verifying the Test.

1 - BHEL
2 - Vendor
3 - Sub-vendor

THIS IS A PART OF TECHNICAL SPECIFICATION NO. PE-TS-411-163A-A001

	STANDARD QUALITY PLAN FOR PROGRAMMABLE LOGIC CONTROLLER										QUALITY PLAN NO.: PE-QP-999-145-1036			
											VOLUME IIB			
											SECTION C1-D			
											REV. NO. 0		DATE:	
											SHEET OF			
Sl. No.	Component / operation	Characteristics Checked	* Category	Type/Method of Check	Extent of Check	Reference documents	Acceptance Norms	Format of Records	Agency \$ W V		Remarks			
1.5	CPU, Monitor, Keyboard, Mouse, CD Drives, Printers, OS, System Software, Engineering software in the form of Licensed CD.	Physical Inspection Identification Labels, Tech. Specification Physical Damages Accessories Installation arrangements for Computers & Printers	MA	Visual	100%	Contract specifications, Product Catalogue, Approved GA / Configuration drawing, BOQ.	As per reference documents.	BHEL Quality Inspection Report.	3/2 2	1				

LEGEND:	* CR	- Critical characteristics		\$	P	- Agency Performing the Test.	1	- BHEL
	MA	- Major characteristics			W	- Agency Witnessing the Test.	2	- Vendor
	MI	- Minor characteristics			V	- Agency Verifying the Test.	3	- Sub-vendor

THIS IS A PART OF TECHNICAL SPECIFICATION NO. PE-TS-411-163A-A001

	STANDARD QUALITY PLAN FOR PROGRAMMABLE LOGIC CONTROLLER										QUALITY PLAN NO.: PE-QP-999-145-1036		
											VOLUME IIB		
											SECTION D		
											REV. NO.	0	DATE:
											SHEET OF		
Sl. No.	Component / operation	Characteristics Checked	* Category	Type/Method of Check	Extent of Check	Reference documents	Acceptance Norms	Format of Records	Agency \$ W V		Remarks		

2.0	Ass embly										
2.1	Functional Test for HMI/OWS devices such as Monitors, Keyboards, Mouse, Printers etc.	Operation	MA	Functional	100%	Approved Configuration Diagram & BOQ and FAT	Correct Operation of interconnected Devices of HMI system.	BHEL Quality Inspection Report.	2 1	1	
2.2	Hardware Functional Verification.	Physical arrangement, Wiring check & labelling, Continuity Checking, IR & HV test	MA	Visual/ Electrical	100%	Approved GA Drawing, Panel Wiring Diagram, IR & HV as per relevant International standard	Test Certification	BHEL Quality Inspection Report.	2 2	1	
2.3	Power wiring Up	Healthiness of all the modules/equipment, associated with Powering of PLC system	MA	Visual /Electrical	100%	Approved power supply scheme	All equipment to be healthy on power ON	BHEL Quality Inspection Report.	2 1	1	
2.4	Burn in test for PLC modules	Healthiness of PLC modules on Continuous Energisation, Temperature maintenance	MA	Visual/ Electrical	100% F	AT Procedure	Test certification as per FAT	BHEL Quality Inspection Report.	2 2	1	

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	STANDARD QUALITY PLAN FOR PROGRAMMABLE LOGIC CONTROLLER										QUALITY PLAN NO.: PE-QP-999-145-1036		
											VOLUME IIB		
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											SHEET	OF	
Sl. No.	Component / operation	Characteristics Checked	* Category	Type/Method of Check	Extent of Check	Reference documents	Acceptance Norms	Format of Records	Agency \$ W V		Remarks		

3.0	Factory Acceptance Test (FAT)										
3.1	Input Output Functional Verification	I/O configuration, I/O operation	MA	Visual/Electrical	100%	FAT Procedure	AS per FAT	BHEL Quality Inspection Report.	2 1		1
3.2	Processor Verification	Processor configuration, Powering up, standby operation (as applicable) and Loading	MA	Visual	100%	FAT Procedure	AS per FAT	BHEL Quality Inspection Report.	2 1		1
3.3	Power Supply Module Verification	Redundancy Operation	MA	Electrical	100%	FAT Procedure	AS per FAT	BHEL Quality Inspection Report.	2 1		1
3.4	Communication System Verification	Redundancy operation of Communication System, Measurement of Response Time, Communication with third party system	MA	Electrical	100%	FAT Procedure	AS per FAT	BHEL Quality Inspection Report.	2 1		1
3.5	Diagnostic Verification	Self Diagnostic features of PLC system	MA	Visual	100%	FAT Procedure	AS per FAT	BHEL Quality Inspection Report.	2 1		1
3.6	Control Panel/Desktop Verification	Operation of PLC driven annunciation system, Mosaic, Push buttons & selector switches, Indicating lamps	MA	Visual	100%	FAT Procedure	AS per FAT	BHEL Quality Inspection Report.	2 1		1
3.7	Software Verification	(i) Control Logics (ii) Engineering Features (iii) HMI Features	MA	Visual	100%	FAT Procedure	AS per FAT	BHEL Quality Inspection Report.	2 1		1

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THIS IS A PART OF TECHNICAL SPECIFICATION NO. PE-TS-411-163A-A001

STANDARD QUALITY PLAN FOR LOCAL CONTROL PANEL												STD QUALITY PLAN NO.: PE-QP-999-145-I056							
PEM :: C&I												VOLUME IIB		SECTION D					
												REV. NO. 01		DATE: 22-02-2008					
												SHEET 1		OF 7					
Sl. No.	Component / operation	Characteristics Checked	* Category	Type/Method of Check	Extent of Check	Reference documents	Acceptance Norms	Format of Records	Agency ^s			Remarks							
									P	W	V								
1.0	INCOMING Sheet Steel (CRCA & HR)	1. Chemical Composition	MA	Chemical analysis	Sample	Relevant standard	Relevant standard	Test Certificate	3	---	2								
		2. Bend Test	CR	Mech. test	Sample	Relevant standard	Relevant standard	Log Book	2	---	---								
		3. Surface finish	MA	Visual	100%	Factory Standard / Sample	Factory Standard / Sample	Log Book	2	---	---								
		4. Waviness	MA	Visual	100%	Factory Standard	No Waviness	Log Book	2	---	---								
		5. Thickness	MA	Measurement	100%	BHEL Spec.	BHEL Spec.	Log Book	2	---	---								
		6. Mill marking	MA	Visual	100%	Factory Standard	Factory Standard	Log Book	2	---	1								
2.0	Flats / Angles / Channels	1. Dimensions	MA	Measurement	Sample	Relevant standard	Relevant standard	Log Book	2	---	---								
		2. Surface Defects	MA	Visual	100%	Factory Standard / Sample	Factory Standard / Sample	Log Book	2	---	---								
		3. Straightness	MA	Measurement	100%	Factory Std.	Factory Std.	Log Book	2	---	---								
		4. Mill marking	MA	Visual	100%	Relevant standard	Relevant standard	Log Book	2	---	1								
3.0	Cables / Wires	1. Visual / Surface defects	MA	Visual	100%	BHEL Spec. and Relevant standard	BHEL Spec. and Relevant standard	Log Book	2	---	---								
		2. IR and HV	MA	Electrical	100%	BHEL Spec. and Relevant standard	BHEL Spec. and Relevant standard	Log Book	2	---	---								
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STANDARD QUALITY PLAN FOR LOCAL CONTROL PANEL															STD QUALITY PLAN NO.: PE-QP-999-145-I056					
PEM :: C&I															VOLUME		IIB			
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															REV. NO.		01		DATE: 22-02-2008	
															SHEET		2		OF 7	
Sl. No.	Component / operation	Characteristics Checked	* Category	Type/Method of Check	Extent of Check	Reference documents	Acceptance Norms	Format of Records	Agency ^s			Remarks								
									P	W	V									
		3. Conductor a) Resistance b) Size c) Sheet colour	MA MA MA	Electrical Measurement Visual	100% 100% 100%	BHEL Spec. and Relevant standard	BHEL Spec. and Relevant standard	Log Book	2	---	---									
		4. Type / Routine Test Certificates	MA	Verification	100%	BHEL Spec. and Relevant standard	BHEL Spec. and Relevant standard	Log Book	3	---	2									
4.0	Electrical Components like Annunciator Transformers Lamps Switches PBs Contactors Relays Timers Space Heaters Thermostat Indicating meters etc.	1. Verification at make and Type	CR	Visual	Sample	BHEL Spec. and BOM	BHEL Spec. and BOM	Log Book	2	---	---									
		2. Verification of Test Certificates	CR	Scrutiny of Type / Routine T.Cs.	100%	Relevant standard	Relevant standard	Log Book	2	---	---									
		3. Operation / Functional check	CR	Electrical	Sample+ 100%@	Relevant standard & Catalogue	Relevant standard & Catalogue	Log Book	2	---	---	+ for relay & contactors only								
		4. I.R.	MA	Electrical	100%	Relevant standard & Catalogue	Relevant standard & Catalogue	Log Book	2	---	---	@ for all components except relays & contactors.								
		5. H.V.	MA	Electrical	100%	Relevant standard & Catalogue	Relevant standard & Catalogue	Log Book	2	---	---									
		6. Calibration	MA	Electrical	100%	Relevant standard & Catalogue	Relevant standard & Catalogue	Log Book	2	---	1									
		7. Pick up / Drop off Voltage	MA	Electrical	100%	Relevant standard & Catalogue	Relevant standard & Catalogue	Log Book	2	---	---									
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STANDARD QUALITY PLAN FOR LOCAL CONTROL PANEL												STD QUALITY PLAN NO.: PE-QP-999-145-J056				
PEM :: C&I			VOLUME IIB													
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			REV. NO. 01 DATE: 22-02-2008													
			SHEET 3 OF 7													
Sl. No.	Component / operation	Characteristics Checked	* Category	Type/Method of Check	Extent of Check	Reference documents	Acceptance Norms	Format of Records	Agency ^s			Remarks				
									P	W	V					
5.0	Misc. Components like Gaskets, Terminal Blocks etc.	1. Verification of Type / Make 2. Surface defects 3. IR / HV on Terminal Blocks	MA MA MA	Visual Visual Electrical	Sample Sample Sample	BHEL Spec. & Mfrs. Catalogue BHEL Spec. & Mfrs. Catalogue BHEL Spec. & Mfrs. Catalogue	BHEL Spec. & Mfrs. Catalogue BHEL Spec. & Mfrs. Catalogue BHEL Spec. & Mfrs. Catalogue	Log Book Log Book Log Book	2 2 2	--- --- ---	--- --- ---					
6.0	IN PROCESS Blanking / Bending / Forming	1. Dimensions 2. Surface defects after bending	MI MA	Measurement Visual	100% 100%	Approved Mfr. drgs. Factory Standard	Approved Mfr. drgs. Factory Standard	Log Book Log Book	2 2	--- ---	--- ---					
7.0	Nibbling / Punching	1. Cutout Sizes 2. Deburring	MI MA	Measurement Visual	100% 100%	Approved Mfr. drgs. Approved Mfr. drgs.	Approved Mfr. drgs. Approved Mfr. drgs.	Log Book Log Book	2 2	--- ---	--- ---					
8.0	ASSEMBLY Frame Assembly & Sheet fixing	1. Dimensions 2. Alignment 3. Welding Quality 4. Surface defects	MA MA MA MA	Measurement Measurement Visual Visual	100% 100% 100% 100%	Approved drg. / Mfr. Standards Approved drg. / Mfr. Standards Approved drg. / Mfr. Standards Approved drg. / Mfr. Standards	Approved drg. / Mfr. Standards Approved drg. / Mfr. Standards Approved drg. / Mfr. Standards Approved drg. / Mfr. Standards	Log Book Log Book Log Book Log Book	2 2 2 2	--- --- --- ---	2 2 2 2					
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STANDARD QUALITY PLAN FOR LOCAL CONTROL PANEL											STD QUALITY PLAN NO.: PE-QP-999-145-J056			
PEM :: C&I											VOLUME IIB			
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Sl. No.	Component / operation	Characteristics Checked	* Category	Type/Method of Check	Extent of Check	Reference documents	Acceptance Norms	Format of Records	Agency ^s			Remarks		
									P	W	V			
9.0	Pre-treatment and Painting	1. Pretreatment Process	MA	Visual	100%	Factory Standard & Relevant standard	Factory Standard & Relevant standard	Log Book	2	---	1			
		2. Process parameters like bath temp. concentration etc.	MA	Measurement	Periodic	Factory Standard & Relevant standard	Factory Standard & Relevant standard	Log Book	2	---	1			
		3. Dipping / Removal Time	MA	Measurement	100%	Factory Standard & Relevant standard	Factory Standard & Relevant standard	Log Book	2	---	1			
		4. Surface quality after every dip	MA	Visual	100%	Factory Standard & Relevant standard	Factory Standard & Relevant standard	Log Book	2	---	1			
		5. Primer after phosphating	MA	Visual, Thickness	100%	Factory Standard & Relevant standard	Factory Standard & Relevant standard	Log Book	2	---	1			
		6. Putty Application & Rubbing after primer	MA	Visual	100%	Factory Standard & Relevant standard	Factory Standard & Relevant standard	Log Book	2	---	1			
		7. Paint first coat	MA	Visual, Thickness	100%	Factory Standard & Relevant standard	Factory Standard & Relevant standard	Log Book	2	---	1			
		8. Putty Application and Rubbing after first coat of paint	MA	Visual	100%	Factory Standard & Relevant standard	Factory Standard & Relevant standard	Log Book	2	---	1			
		9. Paint second coat	MA	Visual, Thickness, Scratch test Colour adhesion	100%	Factory Standard & Relevant standard	Factory Standard & Relevant standard	Log Book	2	---	1			
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STANDARD QUALITY PLAN FOR LOCAL CONTROL PANEL										STD QUALITY PLAN NO.: PE-QP-999-145-I056				
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Sl. No.	Component / operation	Characteristics Checked	* Category	Type/Method of Check	Extent of Check	Reference documents	Acceptance Norms	Format of Records	Agency ^s			Remarks		
									P	W	V			
10.	Panel Wiring	1. Wiring Layout 2. Wiring Termination (Crimped Lugs) 3. Ferrule numbers 4. Colour of wiring 5. Size of Conductor	MA MA MA MA MA	Visual Visual Visual Visual Measurement	100% 100% 100% 100% 100%	Approved drgs. & Specs. Approved drgs. & Specs. Approved drgs. & Specs. Approved drgs. & Specs. Approved drgs. & Specs.	Approved drgs. & Specs. Approved drgs. & Specs. Approved drgs. & Specs. Approved drgs. & Specs. Approved drgs. & Specs.	Log Book Log Book Log Book Log Book Log Book	2 2 2 2 2	--- --- --- --- ---	--- --- --- 1 1	--- --- --- 1 1		
11.	Component Mounting	1. Correct components 2. Fixing	MA MA	Visual Visual	100% 100%	Approved drgs., Specs. & BOM Approved drgs., Specs. & BOM	Approved drgs., Specs. & BOM Approved drgs., Specs. & BOM	Log Book Log Book	2 2	--- ---	--- ---	--- ---		
12.	FINAL Final Inspection	1. Workmanship 2. Component layout (neatness, accessibility & safety) Mounting / Proper fixing of all components 3. Components identification Marking / Name plates	MA MA MA	Visual Visual Visual	100% 100% 100%	Factory Standard BHEL approved drg. / Spec. BHEL approved drg. / Spec.	Factory Standard BHEL approved drg. / Spec. BHEL approved drg. / Spec.	Inspection Report Inspection Report Inspection Report	2 2 2	1 1 1	1 1 1		At Random by BHEL, based on 100 % internal test reports by Mfr.	

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STANDARD QUALITY PLAN FOR LOCAL CONTROL PANEL										STD QUALITY PLAN NO.: PE-QP-999-145-I056				
PEM :: C&I										VOLUME IIB				
										SECTION D				
										REV. NO. 01		DATE: 22-02-2008		
										SHEET 6		OF 7		
Sl. No.	Component / operation	Characteristics Checked	* Cate gory	Type/Method of Check	Extent of Check	Reference documents	Acceptance Norms	Format of Records	Agency ^s			Remarks		
		5. Dimensions	MA	Measurement	100%	BHEL approved drg. / Spec., BOM	BHEL approved drg. / Spec., BOM	Inspection Report	2	1	1	At Random by BHEL, based on 100 % internal test reports by Mfr.		
		6. Door functioning	MA	Functional	100%	BHEL approved drg. / Spec.	BHEL approved drg. / Spec.	Inspection Report	2	1	1			
		7. Paint Shade	CR	Visual	100%	BHEL approved drg. / Spec.	BHEL approved drg. / Spec.	Inspection Report	2	1	1			
		8. Paint Thickness	CR	Measurement	100%	BHEL approved drg. / Spec.	BHEL approved drg. / Spec.	Inspection Report	2	1	1			
		9. Workmanship of Gaskets	MA	Visual	100%	Factory Standard	Factory Standard	Inspection Report	2	1	1			
		10. Wiring Layout	MA	Visual	100%	BHEL approved drg.	BHEL approved drg.	Inspection Report	2	1	1			
		11. Wire Termination	MA	Pulling manually	Sample	----	Firm termination	Inspection Report	2	1	1			
		12. Continuity	MA	Electrical	100%	----	Continuity OK	Inspection Report	2	1	1			

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THIS IS A PART OF TECHNICAL SPECIFICATION NO. PE-TS-411-163A-A001

STANDARD QUALITY PLAN FOR LOCAL CONTROL PANEL										STD QUALITY PLAN NO.: PE-QP-999-145-1056				
PEM :: C&I										VOLUME		IIB		
										SECTION		D		
										REV. NO.		DATE: 22-02-2008		
										SHEET		7 OF 7		
Sl. No.	Component / operation	Characteristics Checked	* Category	Type/Method of Check	Extent of Check	Reference documents	Acceptance Norms	Format of Records	Agency ^s			Remarks		
									P	W	V			
13.	TYPE TEST	Degree of Protection	CR	Mech. Protection	Sample	BHEL approved spec., drg relevant IEC-60947, IEC-60079	BHEL approved spec., drg relevant IEC-60947, IEC-60079	Type Test Certificate	3	---	1			
14	ROUTINE TEST	IR before & after HV Test	CR	Electrical	100%	BHEL approved spec., drg., BOM & relevant standard	BHEL approved spec., drg., BOM & relevant standard	Test Report	2	1	1			
15	FUCTIONAL TEST	1. Control Logic Operation	CR	Electrical	100%	BHEL approved spec. / drg.	BHEL approved spec. / drg.	Inspection Report	2	1	1			
		2. Instrument Calibratio	CR	Electrical	10%	BHEL approved spec. / drg.	BHEL approved spec. / drg.	Inspection Report	2	1	1			
		3. Temperature rise	CR	Electrical	100%	BHEL approved spec/drg. & relevant standard	BHEL approved spec/drg & relevant standard	Inspection Report	2	1	1			

	TITLE: 4 X 270 MW BHADRADRI TPS		SPECIFICATION NO. PE-TS-411-163A-A001	
	TECHNICAL SPECIFICATION FOR DM PLANT		SECTION II	
			REV. NO. 00	DATE : 20/03/2017

2. CONTROL PHILOSOPHY

Operation of the complete DM plant along with UF system shall be through programmable logic controller (PLC). PLC system configuration shall be given C&I portion of this specification. The operation of DM plant along with UF system is envisaged with semi-automatic/remote manual/local remote manual modes.

In semi-auto mode, the starting of the service /regeneration shall be through keyboard operation to be initiated by the operator. Once the operator initiates the operation of regeneration, the sequence of regeneration such as "Backwash", "chemical injection", "displacement", "rinse", "air-scouring", etc. of a particular stream or ion exchange unit/filter shall proceed from one step to the next step automatically. Upon completion of the complete regeneration, the service cycle shall proceed after initiation of the same by the operator. The sequence of the Activated Carbon filter backwashing shall be programmed in line with system supplier's recommendations.

Under remote manual mode, each step or sequence of regeneration shall be initiated by the operator from the keyboard.

Before going into back flush mode PLC will check the level in DM water storage tank. The level has to be above low level.

In local-remote manual mode, the individual valves/pumps etc. shall be operated locally and duration of each step shall be decided by the operator.

Soft link communication shall be provided from the DMPlant PLC to DDCMIS for monitoring of DM Plant at CCR-1 & CCR-2. Total length of Fibre optic cable to meet above requirement shall be considered as 1800 meter by bidder in his scope.

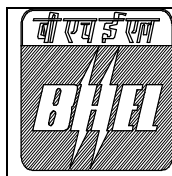
Only one stream shall be regenerated at a time.

INTENTIONALLY BLANKED-DATA NOT RELAVANT TO PLC/UPS

ANNUNCIATIONS

Annunciations for abnormal conditions like conductivity, pH and silica levels, high flow through filters and ion exchange units, levels (high & low) in chemical tanks, filtered water tank, degassed water storage tank, and neutralization pit shall be annunciated in the control panel.

ANNUNCIATION LIST



TITLE:
4 X 270 MW BHADRADRI TPS

SPECIFICATION NO. PE-TS-411-163A-A001

**TECHNICAL SPECIFICATION FOR
DM PLANT**

SECTION II

REV. NO. 00

DATE : 20/03/2017

Sr. no.	Description
1.	Pressure at outlet of DM plant supply pumps – low and high
2.	Differential pressure across all PSF – high
3.	Differential pressure across all ACF – high
4.	Blowers for PSF – Tripped
5.	PSF Air blower flow - Low
6.	All Degasified water storage tanks level – very low, low, high
7.	Degassed water transfer pumps – tripped
8.	DM plant supply pumps - tripped
9.	Degasified water pump discharge header pressure – low and high
10.	Degassed Air blower flow - Low
11.	Blowers for Degassed water – Tripped
12.	Pressure at outlet of PSF & ACF backwash pumps – low and high
13.	Sodium level at SAC outlet - High
14.	Conductivity at SAC outlet – high
15.	pH level at SBA outlet - High
16.	Conductivity at SBA outlet – high
17.	Conductivity at MB outlet – high
18.	Totalized flow through MBs – exceeded
19.	pH level at MB outlet - High
20.	Silica level at MB outlet-High
21.	Blowers for MB – Tripped
22.	MB Air blower flow - Low
23.	UF feed tank level – very low, low, high
24.	UF feed pumps – tripped
25.	UF feed discharge pressure – low and high
26.	Bulk Acid storage tank level – very low, low, high
27.	Bulk alkali storage tank level – very low, low, high
28.	Acid unloading pumps - Tripped
29.	Acid unloading pumps discharge pressure – low and high
30.	Alkali unloading pumps - Tripped
31.	Alkali unloading pump discharge pressure – low and high
32.	Alkali Transfer cum recirculation pumps - Tripped
33.	Alkali Transfer cum recirculation pumps discharge pressure – low and high
34.	Acid Measuring / dosing Tanks Level - very low, low, high
35.	Alkali Measuring / dosing Tanks Level - very low, low, high
36.	Hypo chlorite / dosing Tank Level - very low, low, high
37.	Alkali preparation Tanks Level - very low, low, high
38.	Differential pressure across all ACF for alkali – high
39.	All agitator– Tripped
40.	Motive water Flow at inlet of ejectors for acid - low
41.	Motive water Flow at inlet of ejectors for alkali - low
42.	All Dosing pumps - tripped
43.	All Dosing pumps pressure – low and high
44.	Hot water tank - level low and high
45.	Hot water tank – Temperature low and high
46.	UF fast flush pumps – tripped
47.	UF fast flush discharge pressure – low and high
48.	UF back flush pumps – tripped
49.	UF back flush discharge pressure – low and high
50.	DM regeneration pumps – tripped
51.	DM regeneration pumps discharge pressure – low and high
52.	Differential pressure across all cartridge filter – high
53.	CIP Tank Level - very low, low, high
54.	CIP cleaning pump discharge pressure – low and high
55.	CIP cleaning pump - tripped
56.	Flow at outlet of each UF stream - low
57.	Neutralization pit Level – high, low and very low
58.	Neutralized effluent disposal pump – Tripped
59.	Neutralized effluent disposal pump pressure– low and high
60.	Filtered water overhead tank level- high, low and very low
61.	Clarified water storage tank level - low

	TITLE: 4 X 270 MW BHADRADRI TPS	SPECIFICATION NO. PE-TS-411-163A-A001	
	TECHNICAL SPECIFICATION FOR DM PLANT	SECTION II	
		REV. NO. 00	DATE : 20/03/2017

62.	Power supply failure
63.	Regeneration sequence for SAC over
64.	Regeneration sequence for SBA over
65.	Regeneration sequence for MBs over
66.	DM Water Storage Tanks- Level High & Low.

Note: The annunciation list detailed above is minimum requirement, however any additional annunciation required will be as per system requirement during detail engineering stage. Bidder to include the same in system without any price and delivery implication to BHEL/ Customer.

INTENTIONALLY BLANKED-DATA NOT RELAVANT TO PLC/UPS

THIS IS A PART OF TECHNICAL SPECIFICATION NO. PE-TS-411-163A-A001
CONTROL AND INSTRUMENTATION SPECIFICATION FOR DM PLANT

FORM NO. PEM-6666-0

	Technical specification for CONTROL & INSTRUMENTATION 4 X 270 MW BHADRADRI TPS	SPEC NO.:		
		VOLUME		
		SECTION		
		REV. NO.	00	DATE : 19.03.2015
		SHEET	OF	

PLC SPECIFICATION

	TITLE: SPECIFICATION FOR PROGRAMMABLE LOGIC CONTROLLER SYSTEM	SPECIFICATION NO. PES-145-36	
		VOLUME II-B	
		SECTION D	
		REV. NO. 03	DATE: 18.03.2014
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1. SCOPE

This specification covers the Design, Manufacture, Assembly, Inspection and Testing at manufacturer's works, proper packing and delivery to site, erection & commissioning, site acceptance test of the PLC Control & Monitoring System comprising PLC Control panel/Remote I/O panel (housing Processors, I/O cards, power supply packs etc.), Operator workstations(OWS), Printers, Annunciation system, UPS, cables and all other equipment and accessories required for completeness of the system as mentioned in different sections of this specification.

2. GENERAL

- 2.1. The offered PLC shall be of Industrial Grade and from Original Equipment manufacturer (OEM).
- 2.2. The PLC shall perform protection logic, interlock and sequential control functions such as binary logic operation, set/reset operation, timers, counters, logic blocks, math functions, input quality checking engineering unit conversion, Boolean functions & PID control (Analog logic function) etc.
- 2.3. The system shall be redundant in processor, power supply and communication interfaces unless otherwise specified. The control of all drives and equipment shall be effected through the keyboard/mouse / panel mounted push button / control switches as per Data sheets-A&B. The system shall include self-diagnostic features not limited to the following:-
 - Memory Faults, both PROM and EPROM
 - Processor Faults
 - Communication Faults
 - I/O interface or address faults
 - Voltage signal discrepancy on input and output
 - Power supply faults
 - Output loop check
 - Channel level diagnostics such as fault monitoring, contact bounce filtering etc.
 - Failure of main or I/O processor
- 2.4. The system shall have facility for connecting to Main Plant's Distributed control system (DCS) using hardware/software interface for two-way transfer of signals.
- 2.5. The mimic shall be displayed on the OWS screen and may also be provided on the control desk/panel (as per Datasheet).
- 2.6. In case OWS is provided, HMI functions like trends, curves, bar charts, historical storage of data, logs and reports etc. shall be provided in addition to Plant schematics. The necessary catalogue / literature elaborating the features of HMI shall be supplied along with the bid.
- 2.7. It shall be possible to use the same OWS as programming station.
- 2.8. The PLC system shall be sized to meet process/system requirements as per the approved P&IDs and Control write-up.
- 2.9. The PLC system shall be designed to ensure that no single device failure should result in failure of any other device.

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- 2.10. Signal multiplication where required shall be done in PLC. Use of relays for multiplication of contacts (for control, monitoring and alarm) is not acceptable. The control/ monitoring components on the control panel/ desk shall be driven through I/O modules.
- 2.11. Bidder shall provide all software on CDs along with required software licenses .The original CDs of installed operating & application software shall be maintained by bidder. Software modification and up gradation (as & when required) shall also be covered under the vendor scope without any cost implication.
- 2.12. PLC programming console shall be provided with industry proven antivirus software with perpetual license (free version not acceptable).

3. TECHNICAL REQUIREMENTS

Details of various PLC system components shall be inclusive of but not limited to the following:

3.1. CODES AND STANDARDS

- 3.1.1. The equipment covered under this specification shall meet the requirements of latest edition of all applicable codes and standards like ANSI, NEMA, IEEE, IEC, NEC & IS.
- 3.1.2. PLC shall conform to IEC: 61131
- 3.1.3. The offered PLC shall comply with safety standards as per Data sheet-A&B.

3.2. CONTROL PANEL

- 3.2.1. PLC control panel shall be freestanding type with provision for mimic display, push-button stations, control switches, indicating lamps, metering instruments like Indicators, ammeters etc. and facia windows for critical alarms.
- 3.2.2. The salient features of construction shall be:
- Sheet material: Cold rolled sheet steel
Frame thickness: Not less than 3.0mm
Enclosure thickness: Not less than 2.5 mm for load bearing sections (mounted with instruments) and not less than 1.6 mm for others
Gland plate thickness: 3.0mm
Base channel: ISMC 100 with anti-vibration mounting & foundation bolts.
- 3.2.3. Each panel shall be identified by a name plate, which shall be of non-rusting metal or three ply lamicold, with engraved lettering.

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- 3.2.4. Vendor shall indicate earthing details along with bid.
- 3.2.5. 25 x 6 mm Copper ground bus to be provided for each panel.
- 3.2.6. 240V AC single phase, thermostatically controlled space heaters shall be provided. Each free standing panel shall have a door switch operated fluorescent lamp and a 240V AC plug point.
- 3.2.7. Painting treatment shall be as per IS: 6005. Two coats of lead oxide primer shall be followed by powder coating. Paint shade shall be as specified in the "Data sheet for PLC system"-Data Sheet-A&B. Project specific paint shade, if applicable, shall be followed.
- 3.2.8. Panel internal wiring shall be as per NEC and NEMA standard.
- 3.2.9. TB points in terminal block shall be cage clamp type/screw type.
- 3.2.10. The annunciation system shall be facia window type, driven by the PLC. Audible alarm, Acknowledge, Reset and lamp test facility shall be provided as per ISA sequence – S18.1, M.

3.3. PROCESSORS

- 3.3.1. The microprocessors shall be 32 bit, and Hot redundant.
- 3.3.2. Hot redundancy: PLC shall be provided with two processors (Main processing unit and memories) one for normal operation and one as hot standby. In case of failure of working processor, there shall be an appropriate alarm and simultaneously the hot standby processor shall take over the complete operation automatically. This transfer from main processor to standby processor shall be bump less and shall not cause any disturbance whatsoever. In the event of both processors failing, the system shall revert to fail safe mode. It shall be possible to keep any of the processor as master and other as standby.
- 3.3.3. An authorized forcing facility shall be provided for changing the status of inputs and outputs, timers and flags to facilitate fault finding and other testing requirements.
- 3.3.4. The standby processor shall be updated automatically in line with the changes made in the working processor.
- 3.3.5. In the event of any replacement of the processor, synchronization of the replaced processor shall be automatic upon live insertion.
- 3.3.6. The cycle time for input scanning, execution of logics, overheads and output scan shall not exceed 120 m sec.
- 3.3.7. The processor & memory shall be loaded up to 50% at normal conditions and maximum up to 60% under worst loading conditions.
- 3.3.8. The memories shall be field expandable. Memory capacity shall be sufficient for complete system operation and have a capability for at least 20% expansion in future.
- 3.3.9. Memory shall be non-volatile, preferably EEPROM type. However, in case volatile memory is provided, battery backup shall be provided for a minimum of three months to keep the stored program intact. Battery drain indication shall be provided at least 1 week before the battery gets drained and same shall be annunciated in OWS.

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3.4. INPUT / OUTPUT Modules

3.4.1. Input/output card assignments shall be modular i.e. no single card shall be assigned with more than one drive of a particular sub-system. The maximum number of channels per I/O module shall be as follows.

- Analog Input Module: 16
- Analog Output Module: 16
- Binary Input Module: 32
- Binary Output Module: 32
- Analog Input/output combined: 16
- Binary Input/output combined: 32

3.4.2. On line module replacement (hot swappable): All modules cards shall have quick disconnect terminations allowing for card replacement without disconnection of external wiring and without switching off the power supply.

3.4.3. Each I/O shall be protected against the reversal of polarity of the power voltage to I/O.

3.4.4. 10% spare capacity shall be ensured in each card channel assignment. Overall minimum 20% spare channels shall be provided.

3.4.5. Output command to MCC/Switchgear shall be through coupling relays, whose mounting location shall be as per "Data sheet A & B for PLC System". In case coupling relays are located in PLC Panel, the same shall be in PLC vendor's scope of supply.

3.4.6. Status feedback from MCC shall be in the form of potential free contact.

3.5. DATA BUS/ I/O BUS

3.5.1. The Data bus connecting PLC and HMI work stations shall be TCP/IP on Ethernet.

3.5.2. The Data bus and I/O bus communication medium shall be twisted pair shield copper conductor for indoor locations and those areas not subjected to induced signals. Repeaters/signal amplifiers shall not be used. Copper conductor cable used shall be Category-5 or better. The communication medium shall be Fibre optic cable in the event any portion of communication cable run is in outdoor or where distances are beyond 500 meters.

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3.6. OPERATOR WORK STATION (OWS)

3.6.1. The OWS and Keyboard shall be desktop mounted and shall be used for controlling, monitoring and programming function.

3.6.2. Colour CRT(s) with keyboard and mouse shall be as per Data Sheet-A&B. CRT shall have graphic display facility.

3.6.3. The OWS shall be with Windows based operating system having necessary Engineering/Configuring software.

3.6.4 Specification of OWS

(a) CPU

1. Processor	32 Bit or better
2. Main Memory	Min. 1 GB and expandable to at least 4 GB
3. Hard drive	Min 40 GB
4. Floppy drive	3.5", 1.44 MB
5. Removable bulk storage	DVD (R/RW)
6. Graphic memory	Min. 16 MB
7. Auto controller	16 bit or better
8. Operating system	Window XP or better
9. Communication ports	2 serial, 1 parallel, 8 Nos. USB, Dual 100 MB Ethernet
10. Expansion slot	3 Nos. or more

(b) Monitor

1. Type	LCD colour monitor (TFT based)
2. Screen diagonal	22" (approx.) flat
3. Display	XGA or better
4. Degree of Protection	IP-30
5. External controls	Brightness, Contrast, Horizontal/vertical amplification & shift
6. Power supply	240 VAC, 50 Hz, 1 phase
7. Version	Industrial grade

(c) Keyboard & Mouse

1. Type	Flat spill membrane or positive depression type ASCII
2. Life expectancy	50 Million cycles per key
3. Version	Industrial
4. Mouse	Optical

3.7. PRINTER

Printers shall be provided as per Data Sheet-A&B.

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3.8. COMMUNICATION WITH PLANT DCS/ THIRD PARTY SYSTEM

- 3.8.1. The PLC system shall be provided with hardwired/serial interface for communication with plant DCS. Hardwired outputs from PLC shall be isolated. Necessary isolators shall be part of PLC.
- 3.8.2. Serial communication to / from DCS where provided shall be engineered to ensure that signal communication time from / to DCS shall not exceed 1 seconds for control / feedback.
- 3.8.3. Serial communication to DCS shall be OPC (Data access 2.0), Ethernet based TCP/IP Protocol. Alternatively the serial communication shall be MODBUS protocol on RS 485 network.
- 3.8.4. Data transmitted from PLC to DCS shall include all information necessary for the DCS graphic displays to monitor and control the process equipment and PLC. Such data may include pertinent analog and digital status information, interlock, alarms and maintenance conditions. Data transmitted from DCS to the PLC shall include necessary signals to provide operator control interface from DCS for the process/ equipment being controlled by PLC.
- 3.8.5. Bidder to include 'Light interface units, converters, Ethernet switch, accessories etc. at both ends viz PLC and DCS for connectivity to other system. The bidder's terminal point shall be Ethernet port in case of copper medium connection to DCS or LIU in case of Fiber optic medium for connectivity with plant DCS. In case distance between PLC & DCS is greater than 1.8 Km, single mode of optical fiber cable with compatible accessories shall be used. For distance less than 1.8 Km multimode optical fiber ports shall be used.

3.9. POWER SUPPLY Scheme

- 3.9.1. PLC Panel and I/O Cabinets: PLC system shall be provided with 2x100% UPS fed from Two Nos. redundant 415V, 3-ph feeders, as per the scheme PE-SD-999-145-001, sh-08 of 08. Each UPS shall have 30 minutes back up. Input feeder failure shall be monitored in the PLC system. Necessary redundant power pack and transformers shall be provided (in the PLC panel) to derive the power supply for control desk, PLC panel and input / output cabinets etc
- 3.9.2. Remote I/O panels: Similar power supply arrangement as for PLC panels shall be provided if it is not possible to extend the power cable form UPS of PLC panels.
- 3.9.3. Each OWS and associated HMI peripherals shall be provided with a feeder from Either one of the UPS

4. DRAWING/DOCUMENT AND DATA TO BE FURNISHED AFTER AWARD OF THE CONTRACT:

4.1. For Approval:

- PLC system configuration drawing along with functional write-up.
- Input/output signal list.
- BOM of PLC
- List of PLC controlled devices
- Control panel/control desk GA drawings.
- Control desk/panel component layout drawing.
- Control panel/control desk Foundation detail and cutout drawings.

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- Power distribution scheme.
- Block logic diagrams/ Ladder diagram mimic.
- Annunciation list.
- PLC control room layout drawing.
- List of soft signal exchange with Plant DCS.
- List of mandatory spares.
- UPS load calculation details.
- Quality plan
- FAT
- Data Sheet-C
- CRT display
- Power supply scheme for PLC system, HMI & peripherals, Remote I/O etc.

4.2. For Information:

- Cable schedule and cable interconnection drawing(in BHEL approved format)
 - Between Field and PLC
 - Between Field and MCC
 - Between MCC and PLC
- Electronic earthing requirements.
- Panel Heat dissipation data
- Product/component catalogues.
- Operation & Maintenance Manual on CDs.
- Softcopy of Final/As-built drawings on CDs.
- Calculation for Processor, Memory & Data bus loading

The above list is the minimum requirements. Additional documents/calculations required shall be finalized during contract stage.

5. DRAWINGS AND DOCUMENTS TO BE SUBMITTED ALONG WITH THE BID

- Proposed PLC system configuration drawing with write-up
- Product catalogues and specifications for PLC as well as HMI application.
- Proposed power supply schemes for PLC system, peripherals, and Remote I/O panels.

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6. TESTING AND INSPECTION

- 6.1. The bidder shall adopt suitable quality assurance program to ensure that the equipments offered will meet the specification requirements in full.
- 6.2. BHEL's standard Quality Plan for PLC is enclosed with the specification. The bidder shall furnish his acceptance to BHEL's QP and submit the signed and stamped copy of QP along with the offer.
- 6.3. The complete PLC system, including all instrument and devices shall be subjected to standard factory tests (i.e. Type Tests and Routine Tests) as per relevant IS, NEMA, IEEE, IEC.
- 6.4. Factory Acceptance Test-FAT (Functional Tests) shall be performed prior to shipment and Owner/Purchaser shall be notified 15 days before the schedules dates of the test.
- 6.5. The certificates for following type tests, as per IEC Standard, shall be submitted: -
 - Surge protection test as per IEC-225-4
 - Dry heat test as per IEC-68-2-2
 - Damp Heat test as per IEC-68-2-3
 - Vibration Heat test as per IEC-68-2-6
 - Electrostatic discharge test as per IEC-801-2 or equivalent
 - Radio frequency Immunity test as per IEC-801-6 or equivalent
 - Electromagnetic Immunity test as per IEC-801-3 or equivalent

7. SPARES AND CONSUMABLES**7.1. Commissioning Spares and consumables**

The bidder shall supply all commissioning spares and consumables 'as required' during Start-up, as part of the main equipment supply.

7.2. Mandatory Spares

The bidder shall offer along with main offer, the Mandatory Spares as specified elsewhere in the specification. The Mandatory Spares offered shall be of the same make and type as the main equipment.

7.3. Recommended Spares

The bidder shall furnish a list of Recommended Spares indicating the normal service expectancy period and frequency of replacement; quantities recommended for 3 years operation along with unit rate against each item to enable BHEL/BHEL's Customer to place a separate order later, if required.

7.4. Special Tools & Tackles

The bidder shall supply all Special Tools & Tackles 'as required' during Start-up and further maintenance of the system, as part of the main equipment supply.

7.5. Spares, Service support

Bidder shall provide availability of spares and service support for minimum 15 years after guarantee period.

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8. MARKING AND PACKING

8.1. Marking:

A stainless steel name-plate shall be permanently fixed on each equipment giving its Tag/serial Number and salient technical specification.

8.2. Packing:

All equipment/materials shall be suitably packed and protected for the entire period of dispatch, storage and erection against impact, abrasion, corrosion, incidental damage due to vermin, sunlight, high temperature, rain, moisture, humidity, dust, sea-water spray (where applicable) as well as rough handling and delays in transit and storage in open.

9. PERFORMANCE AND GUARANTEE

The PLC system shall be guaranteed to meet the performance requirement as specified and also for trouble-free continuous operation for 12 months from the date of commissioning or 18 months from the date of delivery at site whichever is later unless specified otherwise in Vol-II B Section - B or Section - C.

10. APPLICABLE DATA SHEET FORMS

This document shall be read with the following data sheet forms :

- Data Sheet A & B for PLC system - PE-DC-999-145-I036-1
- Data Sheet C for PLC system - PE-DC-999-145-I036-2

THIS IS A PART OF TECHNICAL SPECIFICATION NO. PE-TS-411-163A-A001
CONTROL AND INSTRUMENTATION SPECIFICATION FOR DM PLANT

FORM NO.: PEM-6666-0

	Technical specification for CONTROL & INSTRUMENTATION 4 X 270 MW BHADRADRI TPS	SPEC NO.: PE-TS-411-145-I		
		VOLUME		
		SECTION		
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PLC DATA SHEET

THIS IS A PART OF TECHNICAL SPECIFICATION NO. PE-TS-411-163A-A001
CONTROL AND INSTRUMENTATION SPECIFICATION FOR DM PLANT

FORM NO. PEM-6666-0

	DATA SHEET FOR PLC SYSTEM		SPECIFICATION NO.: PE-TS-411-	
			VOLUME II B	
			SECTION D	
			REV. NO. 00	DATE: 04.03.2015
			SHEET 1	OF 1
Data Sheet No.:				
Data Sheet A&B				
DATA SHEET – A FOR PLC SYSTEM (TO BE FILLED BY PURCHASER)			DATA SHEET – B FOR PLC SYSTEM (TO BE FILLED BY BIDDER)	
GENERAL	PROJECT	4X 270 MW BHADRADRI TPS		
	SERVICE			
	QUANTITY	☐ UNITISED ☒ COMMON		
	LOCATION	☒ INDOOR ☐ OUTDOOR ☒ AC ☐ NON-AC*		
PLC EQUIPMENT	MAKE / MODEL NO.	BIDDER TO INDICATE		
	PROCESSOR	REDUNDANT WITH HOT STANDBY		
	DATA BUS (HMI)	☐ COPPER WIRE ☐ FIBRE OPTIC		
	DATA BUS (I/O - CPU)	☐ COPPER WIRE ☐ FIBRE OPTIC		
	DATA BUS (REMOTE I/O - CPU)	☐ COPPER WIRE ☐ FIBRE OPTIC		
	FIELD CONTACTS INTERROGATION VOLTAGE	☒ 24 V DC ☐ 48 V DC ☐ 110 V AC		
	LOCATION OF COUPLING RELAYS	☐ MCC ☒ PLC PANEL		
	DESKTOP OWS QUANTITY	☐ ONE ☐ TWO ☐ _____ ☒ DESKTOP VERSION ☐ SERVER VERSION ☐ WORK STATION VERSION REQUIREMENT OF OWS IN CCR ☐ YES ☐ NO QUANTITY _____		OWS, EWS and LVS shall be as per PLC Configuration diagram attached elsewhere in the specification.
	DESKTOP MONITOR TYPE	☐ 19" ☒ 24" TFT/CRT MONITOR ☐ GIU ☐ OTHERS		
	PRINTER	INKJET ☐ A3__NOS ☐ A4__NOS LASER B/W ☐ A3__NOS ☐ A4__NOS COLOR INKJET ☐ A3__NOS ☐ A4__NOS COLOR LASER ☒ A3_1_NOS ☐ A4__NOS		
PROGRAMMING / CONFIGURATION FACILITY	A) ☐ HAND HELD ☒ LAPTOP B) ☐ ENGINEERING SOFTWARE ☐ ONE OWS ☐ ALL OWS ☐ LAPTOP		OWS, EWS and LVS shall be as per PLC Configuration diagram attached elsewhere in the specification. One number Laptop is mandatory.	
SAFETY STANDARD	☐ SIL-3 ☐ SIL-2 ☒ NIL			
	COMPUTER FURNITURE	BOO ☒ YES ☐ NO INDUSTRIAL GRADE ☒ YES ☐ NO ☐ START UP & COMMISSIONING		
SPARE LIST	SPARE LIST	☒ MANDATORY SPARE ☐ RECOMMENDED		
	SPARE LIST ATTACHED	☒ YES ☐ NO		
REDUNDANCY	CPU	☒ YES ☐ NO		
	POWER SUPPLY	☒ YES ☐ NO		
	COMMUNICATION	☒ YES ☐ NO		
	I/O CARD	☐ YES ☐ NO		
	OTHER ELECTRONICS	☐ YES ☐ NO		As per vendor practice

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FORM NO. PEM-6666-0

	DATA SHEET FOR PLC SYSTEM		SPECIFICATION NO.: PE-TS-411-	
			VOLUME II B	
			SECTION D	
			REV. NO. 00	DATE: 04.03.2015
			SHEET 1	OF 1
Data Sheet No.:				
Data Sheet A&B				
DATA SHEET – A FOR PLC SYSTEM (TO BE FILLED BY PURCHASER)			DATA SHEET – B FOR PLC SYSTEM (TO BE FILLED BY BIDDER)	
No. of CHANNELS PER CARD	ANALOG INPUT	☐ 8 NOs ☐ 16 NOs		
	ANALOG OUTPUT	☐ 8 NOs ☐ 16 NOs		
	BINARY INPUT	☐ 16 NOs ☐ 32 NOs		
	BINARY OUTPUT	☐ 16 NOs ☐ 32 NOs		
	RTD**	4 NOs		
	THERMOCOUPLE**	8 NOs		
	ELECTRONIC CARD ISOLATION	☐ GALVANIC ☐ OPTICAL ☐ OTHER		
PANEL	QUANTITY	BIDDER TO INDICATE		
	CLASS OF PROTECTION(Refer Location of PLC)	☐ IP-42		
	REMOTE I/O PANEL	☐ YES ☐ NO AC REQUIREMENT ☐ YES ☐ NO		
	COLOUR#	RAL 7032		
	BACK-UP DESK	☐ YES ☐ NO		
	MIMIC	☐ YES ☐ NO IF YES, THEN ☐ PANEL MOUNTED GUI ☐ ACRYLIC		
	CONTROL HARDWARE	☐ PB ☐ INDICATORS ☐ FACIAS 25 Nos. ☐ OTHERS		
	CONFORMAL COATING	☐ YES ☐ NO		
COMMUNICATION WITH OTHER SYSTEM	HARDWIRED	☐ YES ☐ NO		
	PURPOSE	☐ CONTROL ☐ MONITORING		
	MEDIUM	☐ UTP ☐ FIBRE OPTIC ☐ OTHERS		
	TIME SYNCHRONIZATION SIGNAL FORMAT	☐ PULSE ☐ RS-485 ☐ IRIG-B ☐ NTP		
	SOFTLINK	☐ MODBUS ☐ OPC IF MODBUS THEN ☐ RS-485 ☐ ETHERNET		
	SERIAL LINK	COMMUNICATION PORT TYPE _____		
POWER SUPPLY INPUT FEEDER	PLC PANEL	BIDDER TO INDICATE LOAD DATA		
	REMOTE I/O PANEL	BIDDER TO INDICATE LOAD DATA		
POWER SUPPLY	SOURCE \$\$	☐ UPS(INDUSTRIAL GRADE) ☐ 24V DC CHARGER		
	BATTERY TYPE	☐ Ni-Cd ☐ LEAD ACID ☐ OTHERS		
	BACK-UP TIME	☐ 30 MINS ☐ 60 MINS ☐ OTHERS		
	BATTERY CONFIGURATION	☐ 1X100% ☐ 2X100% ☐ 2X50%		As per MAX philosophy
CUSTOMER TRAINING	TRAINING	☐ REQUIRED ☐ NOT REQUIRED		
	NO OF DAYS	3 DAYS		
	LOCATION	☐ VENDOR'S WORK ☐ PROJECT SITE ☐ OTHERS		

*IF THE LOCATION IS INDOOR, KINDLY SPECIFY IF PLC PANEL IS PLACED IN AC OR NON-AC ENVIRONMENT.

**SHALL NOT BE APPLICABLE IF TEMPERATURE TRANSMITTERS ARE ENVISAGED.

PROJECT SPECIFIC PAINT SHADES, IF APPLICABLE TO BE USED.

\$\$ CHECK & REPLACE WITH MAIN UPS SLD IF POWER SUPPLY IS NOT APPROVED BY CUSTOMER.

THIS IS A PART OF TECHNICAL SPECIFICATION NO. PE-TS-411-163A-A001
CONTROL AND INSTRUMENTATION SPECIFICATION FOR DM PLANT

FORM NO.: PEM-6666-0

	Technical specification for CONTROL & INSTRUMENTATION 4 X 270 MW BHADRADRI TPS	SPEC NO.: PE-TS-411-145-I		
		VOLUME		
		SECTION		
		REV. NO.	00	DATE : 19.03.2015
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PLC Quality Plan

THIS IS A PART OF TECHNICAL SPECIFICATION NO. PE-TS-411-163A-A001
CONTROL AND INSTRUMENTATION SPECIFICATION FOR DM PLANT

 PEM :: C&I		STANDARD QUALITY PLAN FOR PROGRAMMABLE LOGIC CONTROLLER										QUALITY PLAN NO.: PE-QP-999-145-1036		
												VOLUME IIB		
												SECTION D		
												REV. NO. 01 DATE: 24.08.2007		
												SHEET 1 OF 8		
Sl. No.	Component / operation	Characteristics Checked	* Category	Type/Method of Check	Extent of Check	Reference documents	Acceptance Norms	Format of Records	Agency			Remarks		
1.0	Materials /Components													
1.1	Panels & Control Desks	Physical Inspection for Dimensions, Painting, Cutouts, Lifting / Locking Arrangements, Components, Drawing Pocket, Mounting accessories, Plinth & AV Pads, Cable Gland Plates, Hardwares, Hinges, Louvers & Filters, Fans & Panel Lamps	MA Visual	I	100%	Contract specifications, Approved GA Drawings, BOQ	As per ref documents. No physical damage.	BHEL Quality Inspection Report.	3/2	2	1			
1.2	Power Supply/Packs, Battery charger, Transformer, UPS.	Physical Inspection Physical Damages Dimensions Mounting Accessories	MA Visual	I	100%	Contract specifications, BOQ.	As per reference documents, Test Report	BHEL Quality Inspection Report.	3/2	2	1			
1.3	Indicating Lamp, Annunciator, Meters, Transducers, Signal Converters, Instruments, Single Loop Controllers	Physical Verification Physical Damages Dimensions Accessories	MA Visual	I	100%	Contract specifications, BOQ.	As per ref documents No physical damage. Test/ Calibration report.	BHEL Quality Inspection Report	3/2	2	1			
1.4	PLC processors, I/O modules, Power Supply modules, Communication modules, Mounting Racks, Ethernet	Physical Inspection - Identification Labels - Physical Damages - Quantity - Spare Capacity	MA Visual	I	100%	Product Catalogue, Data sheets, Approved Configuration diagram, BOQ	As per ref documents. Test Certificates	BHEL Quality Inspection Report.	3/2	2	1			

LEGEND: * CR - Critical characteristics
MA - Major characteristics
MI - Minor characteristics

P - Agency Performing the Test.
W - Agency Witnessing the Test.
V - Agency Verifying the Test.

1 - BHEL
2 - Vendor
3 - Sub-vendor

THIS IS A PART OF TECHNICAL SPECIFICATION NO. PE-TS-411-163A-A001
CONTROL AND INSTRUMENTATION SPECIFICATION FOR DM PLANT

 PEM :: C&I	STANDARD QUALITY PLAN FOR PROGRAMMABLE LOGIC CONTROLLER										QUALITY PLAN NO.: PE-QP-999-145-1036			
											VOLUME IIB			
											SECTION D			
											REV. NO. 01		DATE: 24.08.2007	
											SHEET 3		OF 8	
Sl. No.	Component / operation	Characteristics Checked	* Category	Type/Method of Check	Extent of Check	Reference documents	Acceptance Norms	Format of Records	Agency		Remarks			
									W	V				

2.0	Ass embly										
2.1	Functional Test for HMI/OWS devices such as Monitors, Keyboards, Mouse, Printers etc.	Operation	MA	Functional	100%	Approved Configuration Diagram & BOQ and FAT	Correct Operation of interconnected Devices of HMI system.	BHEL Quality Inspection Report.	2 1	1	
2.2	Hardware Functional Verification.	Physical arrangement, Wiring check & labeling, Continuity Checking, IR & HV test	MA	Visual/ Electrical	100%	Approved GA Drawing, Panel Wiring Diagram, IR & HV as per relevant International standard	Test Certification	BHEL Quality Inspection Report.	2 2	1	
2.3	Power wiring Up	Healthiness of all the modules/equipment, associated with Powering of PLC system	MA	Visual /Electrical	100%	Approved power supply scheme	All equipment to be healthy on power ON	BHEL Quality Inspection Report.	2 1	1	
2.4	Burn in test for PLC modules	Healthiness of PLC modules on Continuous Energisation, Temperature maintenance	MA	Visual/ Electrical	100% F	AT Procedure	Test certification as per FAT	BHEL Quality Inspection Report.	2 2	1	

LEGEND: * CR - Critical characteristics
MA - Major characteristics
MI - Minor characteristics

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								VOLUME IIB			
								SECTION D			
								REV. NO. 01 DATE: 24.08.2007			
								SHEET 4 OF 8			
Sl. No.	Component / operation	Characteristics Checked	* Category	Type/Method of Check	Extent of Check	Reference documents	Acceptance Norms	Format of Records	Agency \$ W V		Remarks

3.0	Factory Acceptance Test (FAT)										
3.1	Input Output Functional Verification	I/O configuration, I/O operation	MA	Visual/Electrical	100%	FAT Procedure	AS per FAT	BHEL Quality Inspection Report.	2 1		1
3.2	Processor Verification	Processor configuration, Powering up, standby operation (as applicable) and Loading	MA	Visual	100%	FAT Procedure	AS per FAT	BHEL Quality Inspection Report.	2 1		1
3.3	Power Supply Module Verification	Redundancy Operation	MA	Electrical	100%	FAT Procedure	AS per FAT	BHEL Quality Inspection Report.	2 1		1
3.4	Communication System Verification	Redundancy operation of Communication System, Measurement of Response Time, Communication with third party system	MA	Electrical	100%	FAT Procedure	AS per FAT	BHEL Quality Inspection Report.	2 1		1
3.5	Diagnostic Verification	Self Diagnostic features of PLC system	MA	Visual	100%	FAT Procedure	AS per FAT	BHEL Quality Inspection Report.	2 1		1
3.6	Control Panel/Desktop Verification	Operation of PLC driven annunciator system, Mosaic, Push buttons & selector switches, Indicating lamps	MA	Visual	100%	FAT Procedure	AS per FAT	BHEL Quality Inspection Report.	2 1		1
3.7	Software Verification	(i) Control Logics (ii) Engineering Features (iii) HMI Features	MA	Visual	100%	FAT Procedure	AS per FAT	BHEL Quality Inspection Report.	2 1		1

LEGEND: * CR - Critical characteristics
MA - Major characteristics
MI - Minor characteristics

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THIS IS A PART OF TECHNICAL SPECIFICATION FOR PLC & UPS PACKAGE
 QUALITY PLAN
 FOR
 PROGRAMMABLE LOGIC CONTROLLER

QUALITY PLAN NO. PE-QP-009-145-1036	
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FACTORY ACCEPTANCE TEST (FAT) PROCEDURE

This document covers procedure to conduct/witness PLC system functional tests in order to demonstrate conformity to purchase specifications and related engineering documents. The test shall be conducted at the system suppliers works. The system supplier shall conduct all functional tests before commencing FAT and test results shall be made available during FAT. Vendor must furnish following relevant drawings, duly approved by BHEL Engineering, for reference during FAT.

- a) Technical Specification of PLC.
- b) PLC System Configuration
- c) General Assembly Drawings.
- d) Panel Wiring Diagrams.
- e) Bill of Quantity for PLC System.
- f) Logic Diagram.
- g) HMI Schematics.
- h) Input / Output List.

Further the vendor shall furnish applicable product specification, datasheets, catalogues, test-certificates, and internal inspection records to enable FAT. Vendor shall also submit, [to the inspecting agency](#), his standard test procedure, for clauses given below; where vendor's standard practice has been referred.

APPLICABLE TEST PROCEDURE:

1. Input/Output Functional Verification.

Check for correctness of addressing of racks, slots and I/O modules as per applicable PLC configuration diagram. Appropriate signal generators shall be used to simulate Inputs and outputs to check operation and SCAN time. [Check online replacement of cards, processors, power supply etc.](#)

2. Processor Verification

PLC Configuration drawing to be referred for ascertaining

- i) Redundancy

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ii) Type (Hot or Cold)

Both the processors are to be checked for healthiness in case of redundant configuration as per vendor's standard practice. In case of hot redundancy, switchover of control from primary processor to standby processor shall be demonstrated for uninterrupted control and data processing as per vendor's standard practice. Switchover shall be witnessed, by manual power off or resetting the Primary CPU or simulating failure of primary processor. Checking should be by witnessing the lighting up of Processor's LEDs as per manufacturer's product standard.

Vendor shall demonstrate, as per Vendor's standard practice, adequate Loading (Spare Capacity) of Processors, as mentioned in contract specs. This shall be done, by simulating worst load operation of fully integrated PLC system.

3. Power Supply Module Verification

Check if PSM is in redundant mode as per specification. Check the healthiness of power supply from both the modules' lamp indication/measurement. Simulate failure of one PSM and verify that standby PSM has taken over without any interruption.

4. Communication System Verification

Communication system has to be in line with approved PLC Configuration Diagram. Verify that both the communication buses are intact and connected. Communication between PLC processors, I/O rack, OWS etc. is to be checked through simulation of input data. Simulate the bus failure by disconnection of working bus. Check that the communication continues without interruption or loss of data.

Following response times are to be demonstrated as per vendor's standard practice for conformance to contract specifications:

1. Screen update time
2. I/O scan time
3. SOE resolution time
4. Data transfer time with third party system using Communication Protocol as per Contract specification and as per quantum of data as per approved signal exchange list.

5. Diagnostic Verification

Product Catalogue/Literature shall be referred for checking of all diagnostic features. Hardware failure to be simulated by removing an I/O

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6. Control Panel /Desk Verification

- i) PLC driven annunciation system should be checked by alarm signal simulation.
- ii) Push Button and selector switch operation should be checked by verification of corresponding change of status of Data Base point.
- iii) Indicating lamp / MIMIC should be checked by corresponding Data Base point simulation.

7. Software Verification

- i). Control Logics:— Software switches, lamps and Analog sources shall be used for simulation of field conditions .Control logics shall be checked for its correct functionality as per approved logic schemes
- ii). Engineering features:-
 - a) Online changing of parameters, set points.
 - b) Online modification in Control Logic Diagrams.
 - c) Online configuration of Graphics, Trends, Logs, HSR.
- iii). HMI features:-
Check for configuration & operation of Graphics, Trends, Logs, HSR and Alarms, in the form of Displays and Printouts, by simulation of Inputs as per approved documents.

8. Burn in Elevated Temperature test

Electronic equipments shall be subjected to Burn in elevated temperature test as per the procedure detailed below:

- a) (i) PLC modules are kept at 50 Deg c under continuous energized condition for 48 hours.

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ii) 48 hours test period shall be divided into 4 equal time segment of 12 hours duration each. For every 12 hours duration segment, after lapse of first 11 hours 110% of nominal voltage shall be applied to the panel under test for a period of 30 minutes followed by application of 90% of nominal voltage for the next 30 minutes.

b) Assembled Panels with complete wiring shall be kept under continuous energized condition for 120 hours at ambient temperature. Temperature rise in panels should be below 10 Deg C above ambient.

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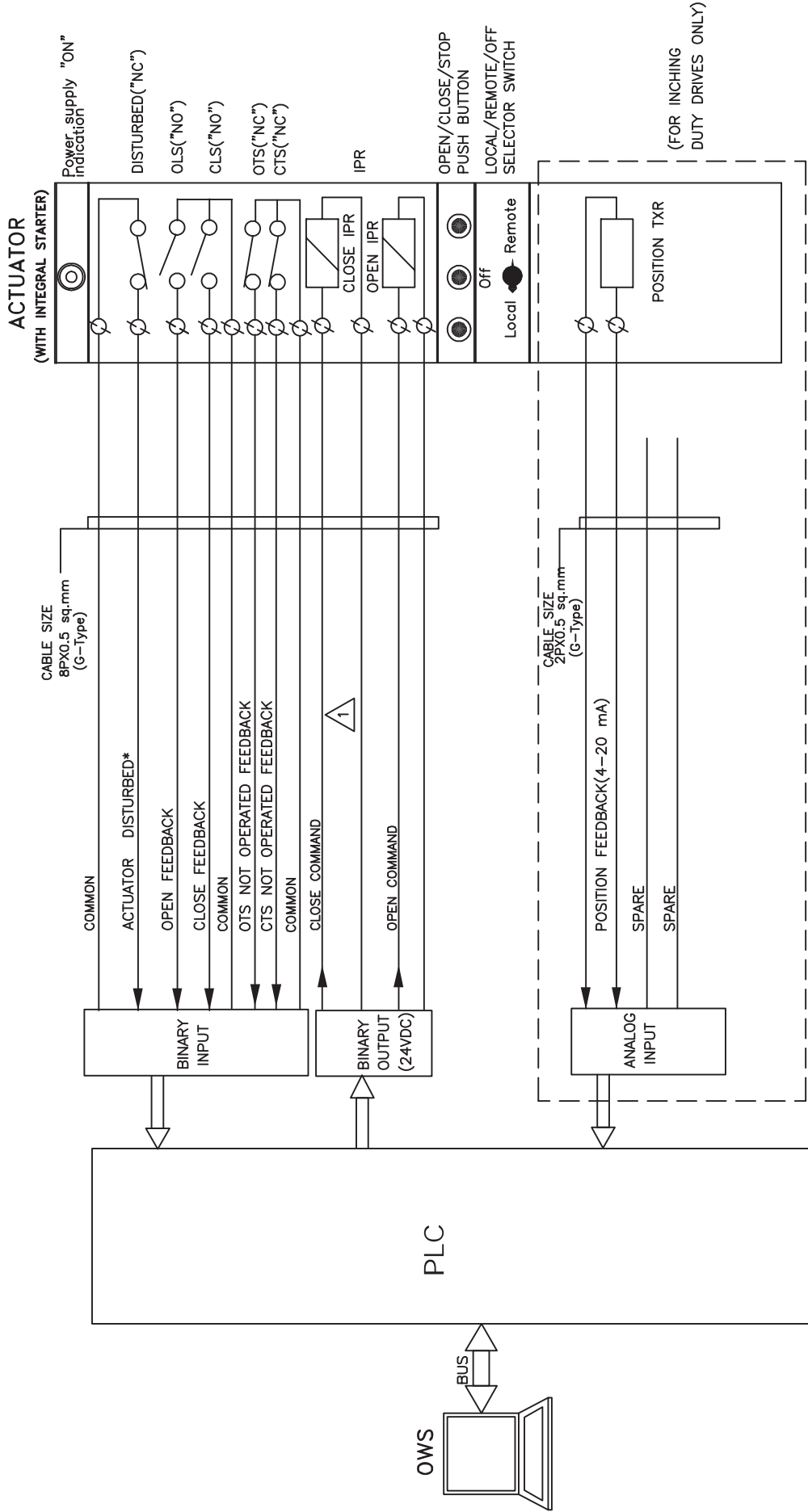
FORM NO.: PEM-6666-0

	Technical specification for CONTROL & INSTRUMENTATION 4 X 270 MW BHADRADRI TPS	SPEC NO.: PE-TS-411-145-I		
		VOLUME		
		SECTION		
		REV. NO.	00	DATE : 19.03.2015
		SHEET	OF	

Drive Control Philosophy

THIS IS A PART OF TECHNICAL SPECIFICATION NO. PE-TS-411-163A-A001

PLC INTERFACE FOR BIDIRECTIONAL DRIVE(WITH INTEGRAL STARTER)

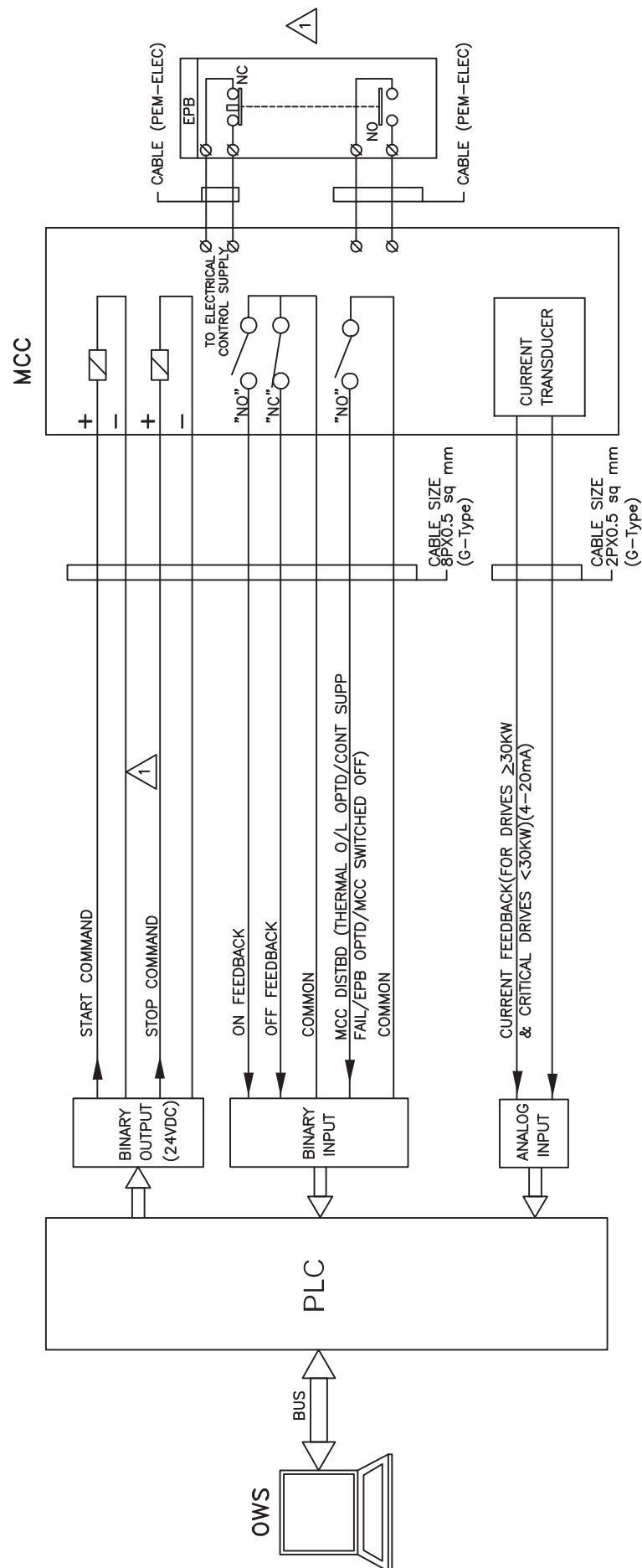


NOTE:

- * DISTURBED= Loss of Power supply (1 Phase/3 Phase)/ Loss of control supply/ Motor thermostat trip/ Thermal over load/ Local/Off/Remote Sel. switch in local or off mode/ Stop PB optd.

	PROJECT: 4 X 270 MW BHADRADRI TPS			DRG.NO.	PE-DM-411-145-I002
	TITLE PLC INTERFACE FOR BIDIRECTIONAL DRIVE			DATE	06.02.2015
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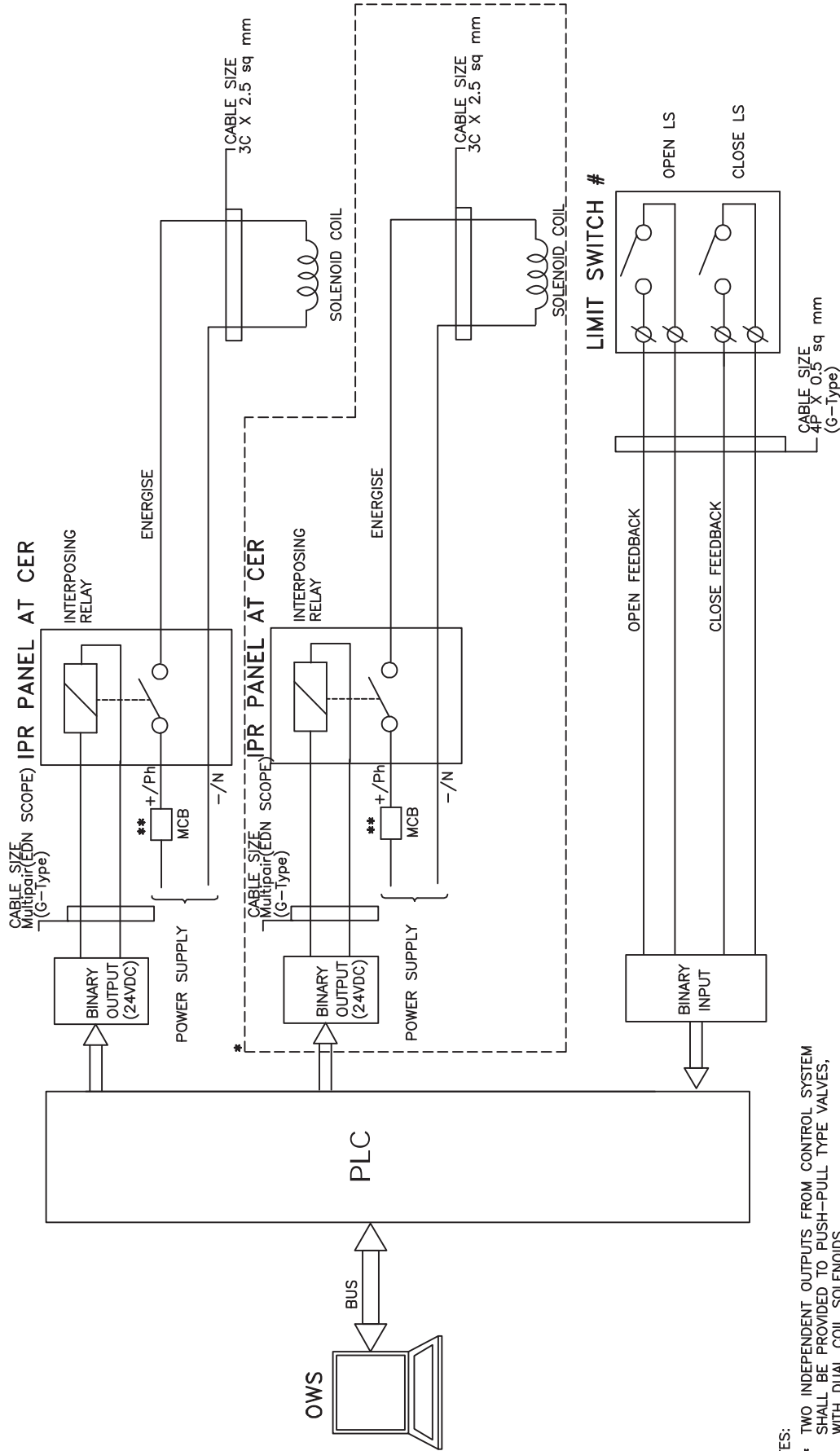
PLC INTERFACE FOR UNIDIRECTIONAL LT DRIVE



	PROJECT: 4 X 270 MW BHADRADRI TPS		DRG.NO. PE-DM-411-145-I002
	TITLE	PLC INTERFACE FOR UNIDIRECTIONAL LT DRIVE	DATE 06.02.2015
			REV.NO. 01
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THIS IS A PART OF TECHNICAL SPECIFICATION NO. PE-TS-411-163A-A001
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PLC INTERFACE FOR SOLENOID DRIVE
(24V DC / 240V AC UPS)



- NOTES:
- * TWO INDEPENDENT OUTPUTS FROM CONTROL SYSTEM SHALL BE PROVIDED TO PUSH-PULL TYPE VALVES, WITH DUAL COIL SOLENOIDS.
 - ** MCB SHALL BE PROVIDED FOR EACH SOLENOID
 - # FOR ON/OFF TYPE, SOLENOID ACTUATED CONTROL VALVE.



PROJECT: 4 X 270 MW BHADRADRI TPS

DRG.NO. PE-DM-411-145-I002

DATE 18.11.2014

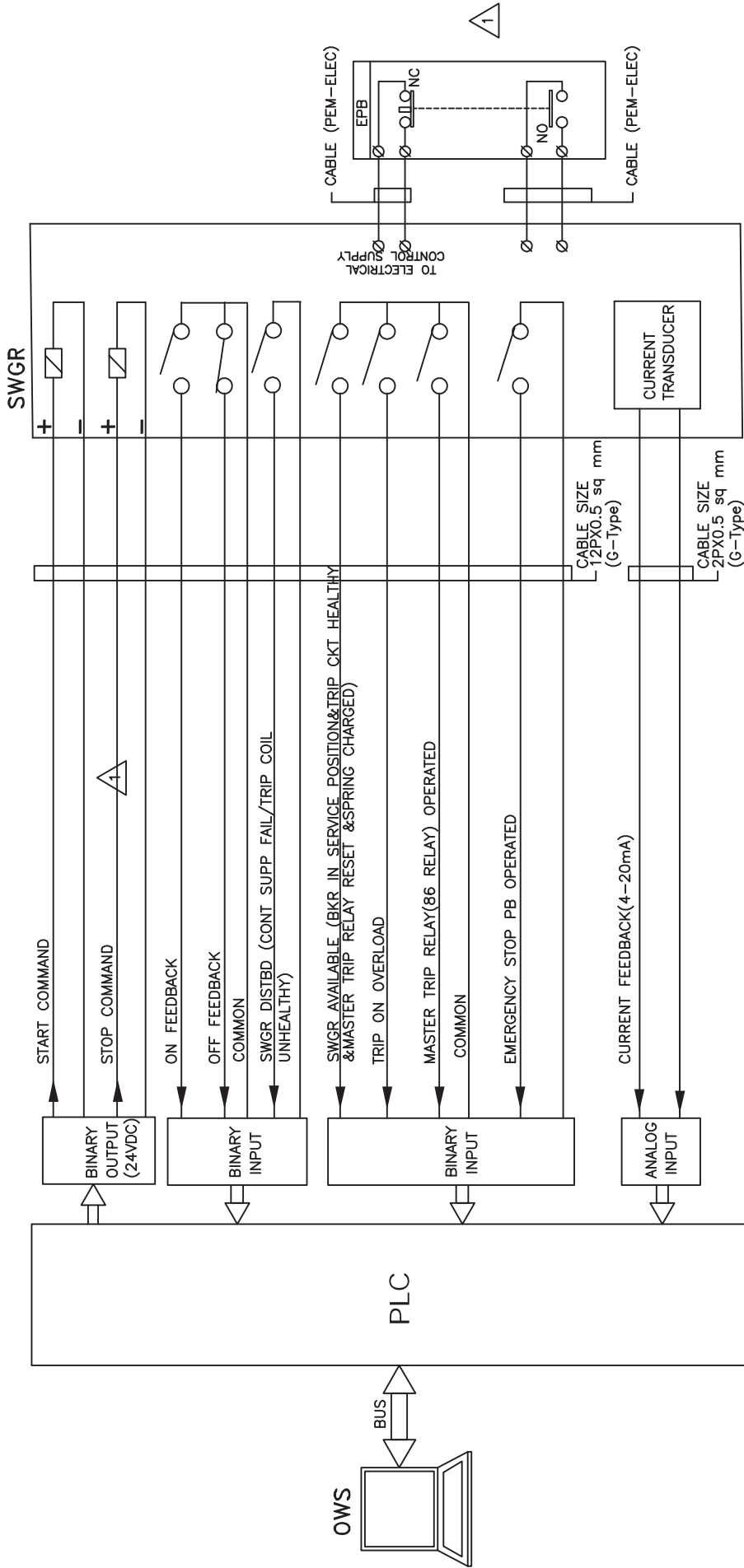
REV.NO. 00

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TITLE PLC INTERFACE FOR SOLENOID DRIVE

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PLC INTERFACE FOR HT/LT UNIDIRECTIONAL DRIVES(BREAKER OPERATED)



PROJECT: 4 X 270 MW BHADRADI TPS

TITLE PLC INTERFACE FOR UNIDIRECTIONAL HT DRIVE

DRG.NO: PE-DM-411-145-I002

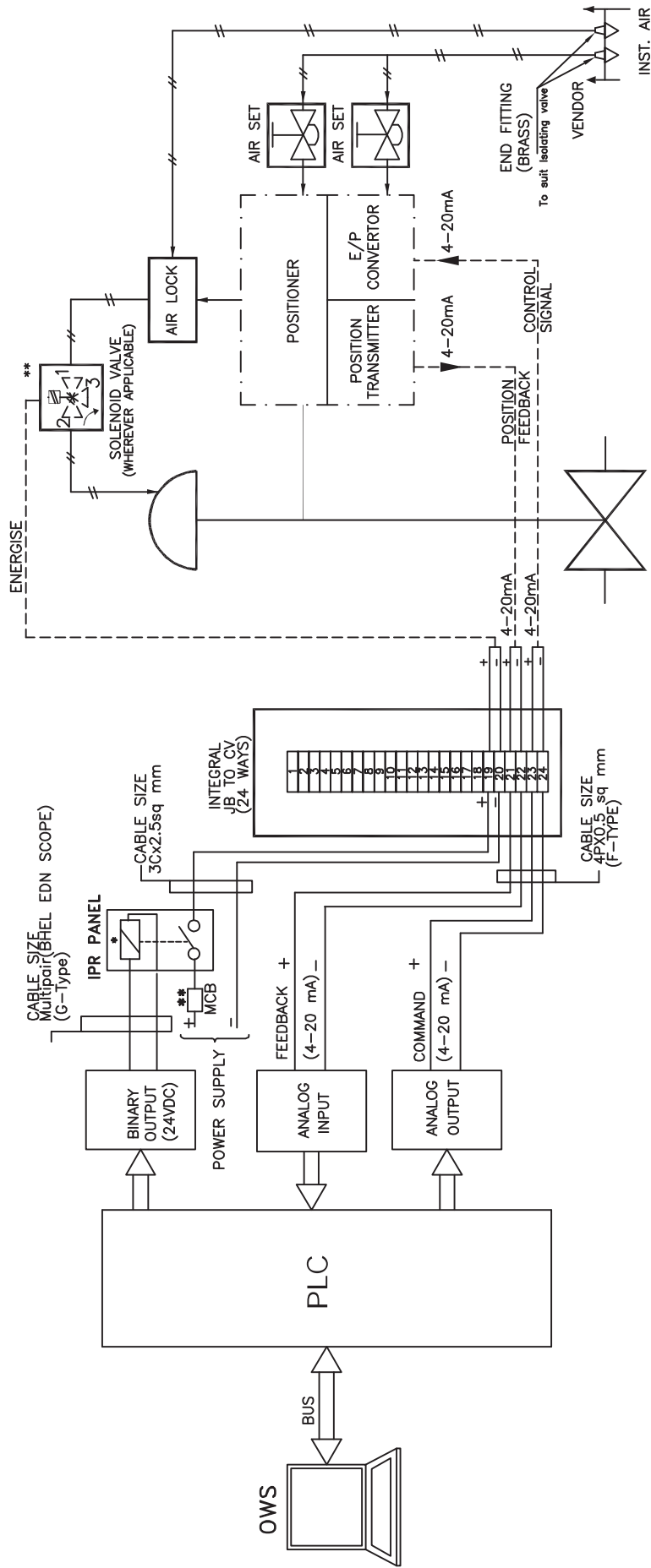
DATE 06.02.2015

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THIS IS A PART OF TECHNICAL SPECIFICATION NO. PE-TS-411-163A-A001
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PLC INTERFACE FOR ANALOG DRIVE



NOTES:
* APPLICABLE TO VALVES WHERE PROTECTION OPEN/CLOSE ACTION FOR CONTROL DEMAND OVERRIDING IS REQUIRED.
** MCB SHALL BE PROVIDED FOR EACH SOLENOID

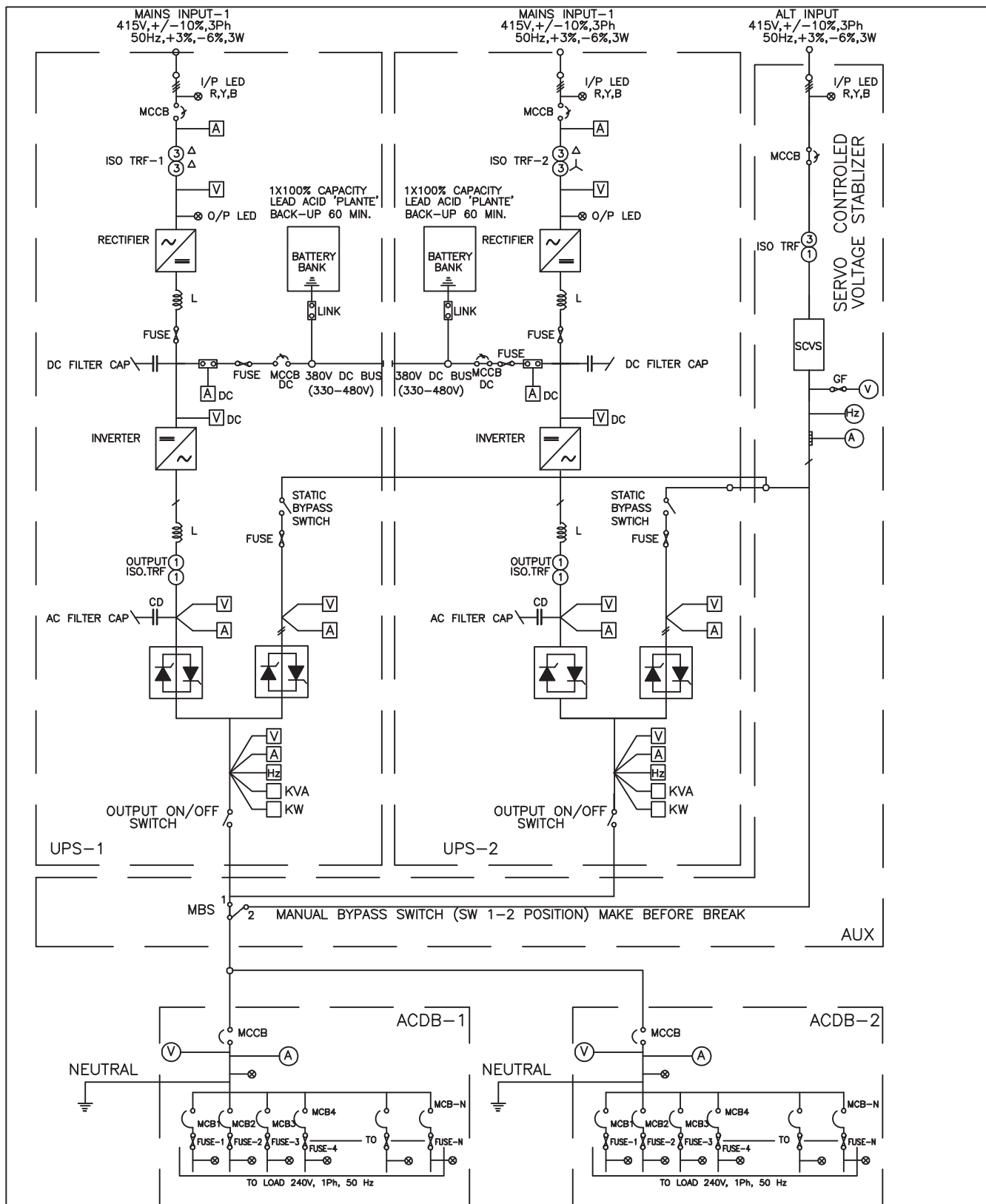
	PROJECT: 4 X 270 MW BHADRADRI TPS			DRG.NO.	PE-DM-411-145-I002
	TITLE TYPICAL HOOK-UP DIAGRAM ANALOG DRIVE(WITH SMART POSITIONER)			DATE	18.11.2014
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FORM NO.: PEM-6666-0

	Technical specification for CONTROL & INSTRUMENTATION 4 X 270 MW BHADRADRI TPS	SPEC NO.: PE-TS-411-145-I		
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UPS SCHEME



4 X 270 MW BHADRADRI TPS

TITLE:-

UPS SINGLE LINE DIAGRAM

DRG.
No.

PE-DM-411-145-I900

REV.
No.

02

DATE

01.07.2015

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	Technical specification for CONTROL & INSTRUMENTATION 4 X 270 MW BHADRADRI TPS	SPEC NO.: PE-TS-411-145-I		
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LCP & JUNCTION BOXES SPECIFICATION

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 CONTROL AND INSTRUMENTATION SPECIFICATION FOR DM PLANT
 Telangana State Power Generation Corporation Ltd. EPC Bid Document
 1x800 MW Kothagudem TPS e-PCT/TS/K/02/2014-15

- 1.00.00 GENERAL REQUIREMENT
- 1.01.00 ENCLOSURES FOR INSTRUMENTS AND OTHER EQUIPMENT
- 1.01.01 All panels, cabinets, distribution boxes, junction boxes, terminal boxes and all other field mounted equipment / enclosures shall have suitable environmental protection as detailed in Section-I of this volume of the specification.
- 1.02.00 SURFACE PREPARATION & PAINTING
- 1.02.01 All sheet metal panel/ desk exterior steel surfaces shall be sand blasted, ground smooth and painted as specified below.
- 1.02.02 Suitable filler shall be applied to all pits, blemishes and voids in the surface. The filler shall be sanded so that surfaces are level and flat; corners are smooth and even. Exposed raw metal edges shall be ground burr-free. The entire surface shall be blast clean to remove rust and scale and all other residue due to the fabrication operation. Oil, grease and salts etc. shall be removed from the panels by one or more solvent cleaning methods prior to blasting.
- 1.02.03 Two spray coats of inhibitive epoxy primer surfacer shall be applied to all exterior and interior surfaces, each coat of primer surfacer shall be of dry film thickness of 1.5 mil. A minimum of two spray coats of final finish color (Catalyzed epoxy or polyurethane) shall be applied to all surface of dry film thickness 2.0 Mil. The finish colors for exterior and interior surfaces shall conform to the following shades:
- Exterior – Opaline green shade 275 of IS: 5 or equivalent international code..
 - Interior - Brilliant White.
- 1.02.04 Paint films, which show sags, cheeks, blisters, teardrops, fat edges or other painting imperfections, shall not be acceptable.
- 1.03.00 WIRING
- 1.03.01 All spare contacts of relays, switches and push buttons shall be wired up to the terminal blocks. All intercommunications between sections of panels/desks shall be furnished.
- 1.03.02 Each wire shall be identified at both ends with wire designation as per approved wiring diagram. Heat shrinkable type ferrules with indelible computerized ink print shall be used with cross- identification.
- 1.03.03 All wire termination shall be made with insulated sleeve and crimping type lugs. Wire shall not be spliced or tapped between terminals. Open-ended terminal lugs will not be accepted. Wires shall not be looped around the terminal screws or studs.

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- 1.03.04 Internal wiring should be terminated uniformly on one side of the terminal block leaving the other side available for termination of outgoing cables. Internal wiring shall be grouped so that all outgoing wiring to each particular remote location is terminated on adjacent terminal blocks. Interior wiring and jumperings shall be arranged so that external connections can be made from internal side of terminal blocks. Common connections shall be limited to two (2) wires per terminal.
- 1.03.05 Wiring shall be arranged to ensure free access to all instrument or devices for maintenance. No wire shall be routed across the face or rear of any device in a manner, which will impede the opening of covers or obstruct access to leads, terminals or devices
- 1.03.06 Wires shall be dressed and run in trays or troughs with clamp-on type covers. Wirings may be neatly bunched in groups by non-metallic cleats or bands. Each group shall be adequately supported along its run to prevent sagging or strain on termination.
- 1.03.07 Shield wires shall be terminated on separate terminal blocks. Common connections shall be limited to two wires per terminal. Signal circuit shields shall be grounded at the power supply end only or as recommended by manufacturer.
- 1.03.08 All low level signal cables shall be separately bundled to from control cable and maintained at 300 mm minimum spacing from control bundles.
- 1.03.09 Panel internal wiring shall follow distinct color-coding to segregate different voltage levels viz. 24V DC, 48V, 110V AC, 240V AC, 220V DC etc.
- 1.03.10 Thermocouple lead wires, analyzer measuring lead wires, or any other lead wires carrying measuring signal of the order of low milli volt or micro volt shall be electrically and physically isolated from other AC and DC wiring. Shielded wires used in such cases for panel internal wiring shall be continuous and ungrounded with the shield terminated individually and separately in panel terminal block.
- 1.03.11 Wiring to door mounted devices shall be provided with multi-strand wires of (49 strands minimum) adequate loop lengths of hinge-wire so that multiple door openings will not cause fatigue failure of the conductor.
- 1.03.12 Internal wiring in factory pre-wired electronic systems cabinets may be installed according to the Contractor's standard wire size, insulation, and method of termination on internal equipment. Insulation for all wiring, including circuit board wiring, back panel wiring, power supply wiring and interconnecting cables between devices shall pass the vertical flame test per IPCEAS-1981. Identification of conductors may be done by insulation color-coding identified on drawings or by printed wiring lists.

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1.04.00 TERMINAL BLOCKS

- 1.04.01 All terminal blocks shall be rail mounted/ post mounted type, cage clamp type with high quality non-flammable insulating material of melamine suitable for working temperature of 105 Deg C. The terminal blocks in field mounted junction boxes, instrument enclosures racks etc. shall be suitable for cage clamp connections. The terminal blocks in Control Equipment Room termination/ marshalling cubicles shall be suitable for post mounted cage clamp connection at the field input end. The exact type of terminal blocks to be provided by Bidder shall be subject to Owner.
- 1.04.02 All terminal blocks shall be provided complete with all required accessories including assembly rail, locking pin and section, end brackets, small partitions, transparent covers, support brackets, distance sleeves, warning level, marking etc. For RTDs ring - tong type lugs shall be used at Junction Boxes.
- 1.04.03 The characteristics of the terminal blocks shall be as follows.
- i) High contact force, independent of conductor cross-section and large contact surface area.
 - ii) Integrated self-loosening protection to avoid shifting of contact surface that may allow contamination of connection point.
 - iii) Inspection and maintenance free (resistant to thermal aging and vibration)
 - iv) Low and constant voltage drop
- 1.04.04 The insulation of the terminal blocks shall be of suitable thermoplastic material.
- 1.04.05 The spacing between Terminal blocks channels in panels and cubicles shall be adequate for routing the cable troughs and to allow adequate free workspace for termination and removal of wires. The terminal blocks shall be arranged with atleast 100 mm clearance between two sets of terminal blocks and junction box walls.
- 1.04.06 Signals of different voltage levels shall be clearly segregated by providing separate rows to each type of signal and by using terminal blocks of different color for each type of signal and by providing barrier strips between them.
- 1.04.07 Terminal blocks shall be provided with white marking strips / self-adhesive marker cards and where permitted by the safety codes and standards, shall be without covers. Power terminals and high voltage (above 48 volts) terminals shall have protection covers. All terminals shall be provided with permanent terminal identification numbers on both sides.
- 1.04.08 At least 20% spare unused terminals shall be provided on each terminal block for circuit modifications and for termination of all conductors in a multi-conductor control cable.

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- 1.04.09 The bottom of the terminal block shall be at least 200 mm above the cable gland for bottom entry type panels.
- 1.04.10 For extending 24 V DC supply to panels, the size of the terminals shall be decided based on voltage drop and not based on current.
- 1.04.11 Other requirements of the terminal blocks are as follows:
- i) The last terminal in a rail-mounted assembly shall be closed with an end plate and end bracket.
 - ii) For visual and electrical separation of terminal groups, partition plates shall be provided, which can be push fitted after forming an assembly.
 - iii) Design shall permit testing of incoming and outgoing signals by using suitable test plug and socket without disconnecting the cable connections.
 - iv) It shall be possible to use jumper plugs through the above test plug socket to connect adjacent terminals. Adequate number of short circuit jumper plugs shall be provided for the purpose.
 - v) Where more than one connection to a terminal block is required, two tier terminals shall be used.
- 1.05.00 GROUNDING
- 1.05.01 Separate Protective and Electronic system ground as required shall be provided.
- 1.05.02 All panels, desks, cabinets shall be provided with a continuous bare copper ground bus (Frame ground), bolted to the panel structure at bottom on both sides and effectively ground the entire structure. The bolts shall face inside of panels.
- 1.05.03 For electronic system cabinets the electronic system ground bus (Electronic ground) shall be similar but insulated from the cabinet and shall be separately connected to the system ground. The same ground may be used to earth the shield of shielded signal cables, otherwise a separate ground bus shall be provided for connecting the signal cable shields. Cable shields shall be grounded at the panel end only and shall never be left open. The electronic ground between panels of a shipping section shall be firmly looped.
- 2.00.00 CONTROL DESKS & PANELS
- 2.01.00 GENERAL
- 2.01.01 All control desk, panels etc. shall be furnished fully wired with necessary provision for convenience outlets, internal lighting, utility receptacles, grounding, ventilation, space heating, anti-vibration pads, internal piping &

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accessories as required for completeness of the system.

- 2.01.02 The design shall conform to the EN ISO 11064 (Ergonomical design of Control Room), Part 1, 2 and 3.
- 2.01.03 The exact dimensions, material, construction details, grounding, general arrangement etc. shall be as per actual requirement and shall be finalized during detail engineering and subjected to Owner's approval.
- 2.01.04 Incoming power supply feeders shall be duplicated. Alarm shall be provided for failure of a power supply feed.
- 2.01.05 For Control desk/ panel mounted instruments/ devices etc. which are to be powered from UPS, all required conversion of interface equipments/ accessories to make such devices compatible with UPS supply shall be provided. All necessary hardware like input switches/ fuse unit for each feeder as well as switch fuse unit for each instrument/ device on the power supply line shall be provided. From UPS redundant feeders shall be provided with suitably rated MCB and provision of fast auto changeover of UPS feeders.
- 2.01.06 Crating of the panels and desks shall be suitable for protection against shock, vibration, inappropriate handling and inclement weather conditions during transportation and warehousing. Mounted equipment shall have adequate protection against damage during handling, transit and storage. Suitable desiccant shall be used inside the packing case.
- 2.01.07 Nameplate
- a) Nameplate shall be provided for instrument or device mounted on the panel.
 - b) Nameplates for panels shall be provided both in front and rear.
- 2.02.00 CONTROL DESK
- 2.02.01 Control desk shall be free standing, floor mounting, table top type with doors at back and shall be constructed of 3 mm thick (minimum) CRCA steel or Aluminium extrusion. Aluminium structure shall be anodized or powder coated paint finish. The top surface of control desk shall be 30 mm (minimum) thick with the top 12 mm (minimum) of acrylic solid surface and the remaining 18 mm of laminated medium density fibre (MDF) board.
- 2.02.02 Monitors with retractable keyboard shall be provided on the desk. Desk shall be arranged in arc-like shape without any sharp edges. Edges shall be extruded PVC or rounded post-formed laminate.
- 2.02.03 Desks shall be of modular, scalable and industrially ruggedized design and shall have connections for PA system handsets & telephone sets.
- 2.02.04 Desks shall have concealed cable trays for wire dressing. Both Horizontal & Side Managers (2 separate horizontal cable routing wire baskets for power & data cables) shall be provided.

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Each User station will be provided with 2 separate power distribution units (1 for Main line & 1 for UPS line). Each power distribution unit will have 6 points of 5/13 Amp sockets, Mains MCB On/Off Switch & Indicator.

Adequate heat management provision for Exhaust of heat from within the Console Desk Assembly shall be provided. There will be multiple fans provided in the Main Control Desk. Each Fan will be of 230 VAC 250 CFM Ball Bearing based. Ventilation louvers will be provided on both Front & Rear Modesty with special Air Filters. Adequate space for CPU & Other equipments placed with in the desk.

- 2.02.05 Design shall include Earthing bolts.
- 2.02.06 Back installed items shall be suitably concealed from front view.
- 2.02.07 All operator workstations for SG, TG, Auxiliaries & Off-site Plants shall be mounted on this Control Desk. The cabling / wiring between OWS & CPUs, power supply cables etc. shall be aesthetically routed and concealed from view.
- 2.02.08 **HARDWIRED DEVICES ON CONTROL DESK (DRAW OUT SECTION)**

Release and Lamp Test push buttons shall be provided for a set of push buttons (decided during detail engineering stage). Depending on the type of control/ function, required number of push buttons/ indicating LEDs & their color, push button stations shall be selected. The size of push button stations shall be 24 x 48 mm or 25 x 50 mm and shall have service inscription details at the front. Emergency push buttons (with cover) shall be mounted on top of Control Desk.
- 2.03.00 **BACK UP PANEL**
- 2.03.01 Construction shall be from CRCA steel of thickness not less than 3mm.
- 2.03.02 Upright back-up panel shall be provided where hardwired devices shall be mounted on a mosaic grid type console. The mosaic grid tiles shall be of 24 mm x 48 mm (or 25 mm x 50 mm) size, made of heat & flame retardant, self extinguishing and non-hygroscopic material with flat matt finish without glare and non reflecting type.
- 2.03.03 DDCMIS Back-up Panel (referred as Unit Control Panel-UCP) shall also mount annunciation fascia (minimum 500 nos.) and the flame monitoring cameras along with other hardwired devices as decided during detail engineering stage by Owner. Color coding shall also subject to Owner's approval.
- 2.03.04 Colored Mimic for different Off-site plant control systems (as enumerated elsewhere in this specification) and hardwired annunciation system shall also

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be mounted on the back up panels.

2.04.00 PANELS/CABINETS

2.04.01 All DDCMIS system modules, power supply components and other Local Control panels (PLC/Relay based) shall be housed in cabinets as specified below.

2.04.02 The cabinet mounted equipments shall be fully assembled, installed in mounting racks, wired and fully tested as per specification requirements and Owner approved drawings prior to shipment to the project site.

2.04.03 The Bidder shall ensure that the cabinets are complete & ready for installation before dispatch from manufacturing works. The installation work at project site for these cabinets shall only involve connections through multi-pair cables from marshalling cabinets (wherever provided) to system cabinets and inter-cabinet/cabinet to Control Desk/ Back up Panel.

2.04.04 All electronic cards, network components, power supply modules etc. located shall be suitably housed in cabinets and shall be neatly arranged in sub-racks. Network components shall be visible in door closed condition (e.g. Glass doors etc.) as approved by Owner.

2.04.05 Bidder shall design the cabinet internal arrangement, floor cutout and cable gland plate such that all the cables entering or leaving the cabinet can be properly glanded in the gland plate.

2.04.06 The packaging density of panels shall be such that the temperature rise within the panels shall never exceed 10°C above ambient even under worst operating conditions. Cooling Fans shall be provided wherever required and this shall be of industrial grade.

2.04.07 TECHNICAL PARTICULARS

- | | | | |
|----|--------------------------|---|--|
| 1. | Material of Construction | : | Cold Rolled Coal Annealed (CRCA) steel sheet |
| 2. | Thickness of Sheet | : | a) 2.0 mm for faces supporting instruments / terminals |
| | | : | b) 1.6 mm for other sides and top |
| 3. | Construction | : | Welded throughout as per approved National Standards |
| 4. | Post welding operation | : | a) Grounding of all welds to smoothness |
| | | : | b) Rounding of corners |

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- : c) Cleaning of weld spatters
- 5. Panel height : 2300 mm (approx)
- 6. Corners : 7 mm inner radius
- 7. Dimensional Tolerances :
 - a) In height & length - 3 mm
 - b) In height between adjacent sections - 2 mm
 - c) Total for a group - 6 mm
- 8. Doors : Double, recessed, turned back edges, full height front & rear
 - i) Thickness of Sheet : 2 mm
 - ii) Hinges : Stainless steel
 - iii) Door latches : Three point type
 - iv) Door gaskets : Neoprene rubber on fixed frame to result dust proof/weatherproof enclosure
 - v) Opening of the doors : Outward
 - vi) Louvers : With removable wire mesh to ensure dust and vermin proof
- 9. Gland plates : Removable in sections
4 mm thick (bottom)
- 10. Cable entry : Bottom
- 11. Hardware :
 - a) Anti vibration pad- 15 mm
 - b) Predrilled base channel ISMC – 100 or equivalent for all sides
 - c) Stainless steel buff- finished 2 mm thick kick plate for all sides
 - d) Stainless steel scratch strips along desk edges fixed with pan-head recessed screws
 - e) Rubber strips to ensure air

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- tightness between kick plate and finished floor
- f) Lifting hook / Eye bolt
- g) Drawing pocket
- h) Door switch, lamps, thermostat, heaters and industrial grade cooling fans,, illumination fixtures
12. Name Plate : Both at front and back surface of the panel
13. Fixing of name plate : Stainless steel pan head screws
14. Name plate material : Laminated phenolic (3 layers)
15. Lettering : Black with white engraved
16. Mounting of terminal blocks : Vertical angle support bracket tack welded on sheet steel plate, screwed on internal wall of enclosure

2.05.00 FURNITURE

All the furnitures in the Central / Local control Room (s), Engineers' rooms, Instrument laboratory , SWAS Room & any other rooms with C&I equipments located in different plant buildings under Bidder's scope shall be included in Bidder's scope of supply. Bidder shall provide following industrial grade furniture items as a minimum from reputed manufacturers/suppliers meeting International Standards. The furniture shall be modular and latest with ease of operational features. The furniture shall be modern, aesthetically designed, modular, flexible, space saving and future safe.

2.05.01 WORK STATION FURNITURE

Modular work station furniture, suitable for mounting servers & historians, programmer stations, PC based systems, printers (A4/A3 color laserjet) etc. shall be provided.

2.05.02 PC RACK

PC Racks shall be provided to mount CPUs of workstations/PCs of OWS/LVS etc. in control room. For each PC / workstation / monitor at least one chair shall be included.

2.05.03 CHAIRS

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Industry standard revolving chairs with wheels and with provision for adjustment of height (hydraulically/gas lift) shall be provided for the operators, unit-in-charge & other personnel in control room area. These shall be designed for sitting for long duration such that these are comfortable for the back.

2.05.04 TABLES

Industry standard computer tables shall be provided & shall be as approved by Owner during detailed Engineering. Glass top teak wood horse shoe shaped table with vertical file mounting arrangement (two layers to house approx. 40 Nos of files and lockable drawers at both ends) for Engineering Room shall be provided.

2.05.05 ALMIRAHs

Steel Almirahs shall be provided for keeping documents in the documentation room. Glass doors for each rack shall be provided such that the documents are visible from outside. Size of the rack shall be sufficient to easily fit technical manuals. The exact details shall be approved by Owner during detailed Engineering.

2.05.06 KEYPAD

One keypad per unit shall be provided for the storing of keys of relevant areas of the unit in the control room.

2.05.07 LOCKERS

Suitable lockers shall be provided in the room adjacent to the control room for storing of personal articles of control room personnel. Also, lockers of bigger size shall be provided in documentation Room for storing of personal documents. Details shall be finalized and approved by Employer during detailed engineering.

3.00.00 LVS PANEL

3.01.00 An arc shaped Large Video Screen (LVS) panel shall be supplied for mounting large video screens in number of tiers in various Control rooms as specified elsewhere in this specification.

Bidder shall provide and fix ACP cladding around the LVS screen including covering the LVS back side and LVS stand. The cladding will be from floor finish to 600 mm above LVS screen like a self-standing partition with necessary openings for system requirement. ACP paneling shall be with 304 grade & approx. 0.5 mm mirror finish SS strip.

3.02.00 The profile, dimensions and the general arrangement shall be finalized & approved by Owner during detailed engineering. Recommendations, if any, for the control room lighting in order to ensure continuous proper viewing of the LVS screen by the operator & shift incharge (without any fatigue) shall be

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clearly brought out by the Contractor in his offer, alongwith all relevant details/basis.

3.03.00 Any other requirement for proper LVS mounting & functioning & viewing shall also be specifically brought out by the Contractor in his offer, along with all relevant details.



INTENTIONALLY BLANKED-DATA NOT RELAVANT TO PLC/UPS



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SPECIFICATION NO.: PE-SS-999-145-054A

DATA SHEET FOR LOCAL PANELS

VOLUME

SECTION

REV. NO.

02

DATE: 16.09.2013

SHEET

1

OF

3

TAG No. Qty.....

Data Sheet No.: PES-145A-DS1-0

Data Sheet A & B

DATA SHEET-A FOR LOCAL PANEL
(TO BE FILLED BY PURCHASER)DATA SHEET-B
(TO BE FILLED-UP BY
BIDDER)

GENERAL	MANUFACTURER		
	CONSTRUCTION		☒ FOLDED ☐ WELDED
	ENCLOSURE SHEET THICKNESS (As per Section 8.13, Volume V of contract specification)	FRONT	☐ 2.0 mm
		OTHER	☐ 2.0 mm
		DOOR	☐ 1.6 mm
		HEIGHT	☐ 2365 mm for stand alone panels. ☐ Other
	OTHER	☐ Load bearing sheet front shall have 3mm thickness	
TECHNICAL	INPUT POWER SUPPLY * (As per Electrical specification) (ANY OTHER POWER REQUIREMENT TO BE DERIVED FROM THIS SUPPLY ONLY)		☐ 240V 50 Hz AC ☐ 220V DC ☒ 415V 3 PHASE 3W ☐ 400V 3 PHASE 4W
	NO. OF FEEDERS (As per Electrical specification)		☐ ONE ☐ TWO
	STARTER WITH MCC		☐ REQUIRED ☒ NOT REQUIRED
	IPR POSITION		☒ MCC ☐ RELAY PANEL
	CONTACT RATING OF RELAY		☒ 5 Amp, 230 V AC ☒ 0.25 Amp, 220V DC
	CONTROL SUPPLY		☐ 110V AC ☐ 220V AC ☐ 220V DC ☐ Other. (As per requirement)
	ALARM ANNUNCIATOR WINDOW (EXCLUDING SPARES)		____ NOS. (AS REQUIRED)
	TEMP SCANNER (IF REQUIRED - NO. OF CHANNELS TO BE SPECIFIED UNDER SEC-C)		☐ REQUIRED ☒ NOT REQUIRED
	PAINT TYPE (As per Annex-1, Section 7.6, Volume IV of contract specification)		☐ EPOXY ENAMEL ☐ EPOXY POWDER COATED
	MIMIC (TYPE OF MIMIC- MATERIAL, THICKNESS TO BE SPECIFIED DURING DETAILED ENGG.)		☒ REQUIRED ☐ NOT REQUIRED
	PANEL COLOUR (EXTERNAL) (As per Annex-1, Section 7.6, Volume IV of contract specification)		☐ LIGHT GREY ☐ OPALINE GREEN
	FINISH (EXTERNAL) (As per Annex-1, Section 7.6, Volume IV of contract specification)		☐ MATT ☐ GLOSSY ☐ SEMI GLOSSY
	PANEL COLOUR (INTERNAL) (As per Annex-1, Section 7.6, Volume IV of contract specification)		☐ WHITE ☐ CREAM ☐ OFF WHITE
	FINISH (INTERNAL) (As per Annex-1, Section 7.6, Volume IV of contract specification)		☐ MATT ☐ GLOSSY ☐ SEMI GLOSSY
	CLASS OF PROTECTION		☒ IP-55 (FOR INDOOR SERVICE) ☒ IP-67 (FOR OUTDOOR SERVICE) ☐ ANY OTHER
	CONTROL HARDWARE		☒ RELAY BASED
	FOUNDATION ARRANGEMENT		☐ FOUNDATION BOLTS ☐ ANCHOR FASTENERS
	WEIGHT OF PANEL (Kg.)		(Vendor to specify)

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DATA SHEET FOR LOCAL PANELS		VOLUME		
		SECTION		
		REV. NO. 02	DATE: 16.09.2013	
		SHEET 2	OF 3	
TAG No. Qty.....		Data Sheet No.: PES-145A-DS1-0		
Data Sheet A & B				
DATA SHEET-A FOR LOCAL PANEL (TO BE FILLED BY PURCHASER)			DATA SHEET-B (TO BE FILLED-UP BY BIDDER)	
	PANEL TYPE	☐ PRESSURISED ☐ UNPRESSURISED As per Requirement		
	CABLE GLAND	☒ DOUBLE COMPRESSION		
	AMMETER (TYPE OF INPUT) *	☐ 1 Amp CT ☐ 4-20 mA		
	SCOPE OF SUPERVISION FOR ERECTION & COMMISSIONING	☐ APPLICABLE ☒ NA		
	* TO BE CO-ORDINATED WITH PEM ELECTRICAL			
NAME DESIGNATION SIGNATURE DATE	PREPARED BY	CHECKED BY	APPROVED BY	COMPANY SEAL NAME: SIGNATURE: DATE:
	AANCHAL CHOUDHARY	SACHIN SRIVASTAVA	MA MANSOORI	
	SR.ENGR	DY.MNGR	D. GM	
	16.09.2013	16.09.2013	16.09.2013	

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TAG No. Qty.....			Data Sheet No.: PES-145A-DS1-0	
Data Sheet C				
DATA SHEET-C FOR LOCAL PANEL (TO BE FILLED BY CONTRACTOR AFTER AWARD OF CONTRACT)				
GENERAL	MANUFACTURER			
	CONSTRUCTION		☐ FOLDED ☐ WELDED (As per requirement EDN)	
	ENCLOSURE SHEET THICKNESS	FRONT		
		OTHER		
		DOOR		
		HEIGHT		
OTHER				
TECHNICAL	INPUT POWER SUPPLY			
	NO. OF FEEDERS			
	CONTACT RATING OF RELAY			
	TEMP SCANNER			
	CONTROL SUPPLY			
	ALARM ANNUNCIATOR WINDOW (EXCLUDING SPARES)			
	PAINT TYPE			
	PANEL COLOUR (EXTERNAL)			
	FINISH (EXTERNAL)			
	TYPE OF MIMIC MATERIAL OF MIMIC THICKNESS OF MIMIC			
	PANEL COLOUR (INTERNAL)			
	FINISH (INTERNAL)			
	CLASS OF PROTECTION			
	CONTROL HARDWARE			
	FOUNDATION ARRANGEMENT			
	WEIGHT OF PANEL (Kg.)			

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	DATA SHEET FOR LOCAL PANELS			SPECIFICATION NO.: PE-SS-999-145-054A	
				VOLUME	
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TAG No. Qty.....			Data Sheet No.: PES-145A-DS1-0		
Data Sheet C					
DATA SHEET-C FOR LOCAL PANEL (TO BE FILLED BY CONTRACTOR AFTER AWARD OF CONTRACT)					
	PANEL TYPE				
	CABLE GLAND				
	AMMETER (TYPE OF INPUT)				
	SCOPE OF SUPERVISION				
NAME SIGNATURE DATE	PREPARED BY	CHECKED BY	APPROVED BY	COMPANY SEAL NAME: SIGNATURE: DATE:	
	AANCHAL CHOUDHARY	SACHIN SRIVASTYAVA	MA MANSOORI		
	16.09.2013	16.09.2013	16.09.2013		

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FORM NO.: PEM-6666-0

	Technical specification for CONTROL & INSTRUMENTATION 4 X 270 MW BHADRADRI TPS	SPEC NO.: PE-TS-411-145-I		
		VOLUME		
		SECTION		
		REV. NO.	00	DATE : 19.03.2015
		SHEET	OF	

LCP Quality Plan

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PEM :: C&I												VOLUME			IIB								
												SECTION			D			REV. NO.			DATE: 22-02-2008		
												1	OF	7									
Sl. No.	Component / operation	Characteristics Checked	* Cate gory	Type/Method of Check	Extent of Check	Reference documents	Acceptance Norms	Format of Records	Agency \$			Remarks											
									P	W	V												
1.0	INCOMING Sheet Steel (CRCA & HR)	1. Chemical Composition	MA	Chemical analysis	Sample	Relevant standard	Relevant standard	Test Certificate	3	---		2											
		2. Bend Test	CR	Mech. test	Sample	Relevant standard	Relevant standard	Log Book	2	---		---											
		3. Surface finish	MA	Visual	100%	Factory Standard / Sample	Factory Standard / Sample	Log Book	2	---		---											
		4. Waviness	MA	Visual	100%	Factory Standard	No Waviness	Log Book	2	---		---											
		5. Thickness	MA	Measurement	100%	BHEL Spec.	BHEL Spec.	Log Book	2	---		---											
		6. Mill marking	MA	Visual	100%	Factory Standard	Factory Standard	Log Book	2	---		1											
2.0	Flats / Angles / Channels	1. Dimensions	MA	Measurement	Sample	Relevant standard	Relevant standard	Log Book	2	---		---											
		2. Surface Defects	MA	Visual	100%	Factory Standard / Sample	Factory Standard / Sample	Log Book	2	---		---											
		3. Straightness	MA	Measurement	100%	Factory Std. Relevant standard	Factory Std. Relevant standard	Log Book	2	---		---											
		4. Mill marking	MA	Visual	100%			Log Book	2	---		1											
3.0	Cables / Wires	1. Visual / Surface defects	MA	Visual	100%	BHEL Spec. and Relevant standard	BHEL Spec. and Relevant standard	Log Book	2	---		---											
		2. IR and HV	MA	Electrical	100%	BHEL Spec. and Relevant standard	BHEL Spec. and Relevant standard	Log Book	2	---		---											
LEGEND: * CR - Critical characteristics MA - Major characteristics MI - Minor characteristics \$ P - Agency Performing the Test. W - Agency Witnessing the Test. V - Agency Verifying the Test. 1 - BHEL 2 - Vendor 3 - Sub-vendor																							

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Sl. No.	Component / operation	Characteristics Checked	* Category	Type/Method of Check	Extent of Check	Reference documents	Acceptance Norms	Format of Records	Agency \$			Remarks				
									P	W	V					
		3. Conductor a) Resistance b) Size c) Sheet colour	MA MA MA	Electrical Measurement Visual	100% 100% 100%	BHEL Spec. and Relevant standard	BHEL Spec. and Relevant standard	Log Book	2	---	---					
		4. Type / Routine Test Certificates	MA	Verification	100%	BHEL Spec. and Relevant standard	BHEL Spec. and Relevant standard	Log Book	3	---	2					
4.0	Electrical Components like Annunciator Transformers Lamps Switches PBs Contactors Relays Timers Space Heaters Thermostat Indicating meters etc.	1. Verification at make and Type 2. Verification of Test Certificates 3. Operation / Functional check 4. I.R. 5. H.V. 6. Calibration 7. Pick up / Drop off Voltage	CR CR CR MA MA MA MA	Visual Scrutiny of Type / Routine T.Cs. Electrical Electrical Electrical Electrical Electrical	Sample 100% Sample+ 100% 100% 100% 100% 100%	BHEL Spec. and BOM Relevant standard Relevant standard & Catalogue Relevant standard & Catalogue Relevant standard & Catalogue Relevant standard & Catalogue Relevant standard & Catalogue	BHEL Spec. and BOM Relevant standard Relevant standard & Catalogue Relevant standard & Catalogue Relevant standard & Catalogue Relevant standard & Catalogue Relevant standard & Catalogue	Log Book Log Book Log Book Log Book Log Book Log Book Log Book	2 2 2 2 2 2 2	---	---	---	+ for relay & contactors only @ for all components except relays & contactors.			
									2	---	---	1				
									2	---	---	---				

LEGEND: * CR
MA
MI

- Critical characteristics
- Major characteristics
- Minor characteristics

\$ P W V
- Agency Performing the Test.
- Agency Witnessing the Test.
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1 - BHEL
2 - Vendor
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Sl. No.	Component / operation	Characteristics Checked	* Category	Type/Method of Check	Extent of Check	Reference documents	Acceptance Norms	Format of Records	Agency \$			Remarks	
									P	W	V		
5.0	Misc. Components like Gaskets, Terminal Blocks etc.	1. Verification of Type / Make 2. Surface defects 3. IR / HV on Terminal Blocks	MA MA MA	Visual Visual Electrical	Sample Sample Sample	BHEL Spec. & Mfrs. Catalogue BHEL Spec. & Mfrs. Catalogue BHEL Spec. & Mfrs. Catalogue	BHEL Spec. & Mfrs. Catalogue BHEL Spec. & Mfrs. Catalogue BHEL Spec. & Mfrs. Catalogue	Log Book Log Book Log Book	2 2 2	-- -- --	--- --- ---		
6.0	IN PROCESS Blanking / Bending / Forming	1. Dimensions 2. Surface defects after bending	MI MA	Measurement Visual	100% 100%	Approved Mfr. drgs. Factory Standard	Approved Mfr. drgs. Factory Standard	Log Book Log Book	2 2	-- --	--- ---		
7.0	Nibbling / Punching	1. Cutout Sizes 2. Deburring	MI MA	Measurement Visual	100% 100%	Approved Mfr. drgs. Approved Mfr. drgs.	Approved Mfr. drgs. Approved Mfr. drgs.	Log Book Log Book	2 2	-- --	--- ---		
8.0	ASSEMBLY Frame Assembly & Sheet fixing	1. Dimensions 2. Alignment 3. Welding Quality 4. Surface defects	MA MA MA MA	Measurement Measurement Visual Visual	100% 100% 100% 100%	Approved drg. / Mfr. Standards Approved drg. / Mfr. Standards Approved drg. / Mfr. Standards Approved drg. / Mfr. Standards	Approved drg. / Mfr. Standards Approved drg. / Mfr. Standards Approved drg. / Mfr. Standards Approved drg. / Mfr. Standards	Log Book Log Book Log Book Log Book	2 2 2 2	--- --- --- ---	2 2 2 2		
LEGEND: * CR - Critical characteristics MA - Major characteristics MI - Minor characteristics										\$			
										1 - BHEL 2 - Vendor 3 - Sub-vendor			
										P - Agency Performing the Test. W - Agency Witnessing the Test. V - Agency Verifying the Test.			

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Sl. No.	Component / operation	Characteristics Checked	* Cate gory	Type/Method of Check	Extent of Check	Reference documents	Acceptance Norms	Format of Records	Agency \$			Remarks							
									P	W	V								
9.0	Pre-treatment and Painting	1. Pretreatment Process	MA	Visual	100%	Factory Standard & Relevant standard	Factory Standard & Relevant standard	Log Book	2	---	1								
		2. Process parameters like bath temp. concentration etc.	MA	Measurement	Periodic	Factory Standard & Relevant standard	Factory Standard & Relevant standard	Log Book	2	---	1								
		3. Dipping / Removal Time	MA	Measurement	100%	Factory Standard & Relevant standard	Factory Standard & Relevant standard	Log Book	2	---	1								
		4. Surface quality after every dip	MA	Visual	100%	Factory Standard & Relevant standard	Factory Standard & Relevant standard	Log Book	2	---	1								
		5. Primer after phosphating	MA	Visual, Thickness	100%	Factory Standard & Relevant standard	Factory Standard & Relevant standard	Log Book	2	---	1								
		6. Putty Application & Rubbing after primer	MA	Visual	100%	Factory Standard & Relevant standard	Factory Standard & Relevant standard	Log Book	2	---	1								
		7. Paint first coat	MA	Visual, Thickness	100%	Factory Standard & Relevant standard	Factory Standard & Relevant standard	Log Book	2	---	1								
		8. Putty Application and Rubbing after first coat of paint	MA	Visual	100%	Factory Standard & Relevant standard	Factory Standard & Relevant standard	Log Book	2	---	1								
		9. Paint second coat	MA	Visual, Thickness, Scratch test Colour adhesion	100%	Factory Standard & Relevant standard	Factory Standard & Relevant standard	Log Book	2	---	1								
LEGEND: * CR - Critical characteristics MA - Major characteristics MI - Minor characteristics																			
\$ P - Agency Performing the Test. W - Agency Witnessing the Test. V - Agency Verifying the Test. 1 - BHEL 2 - Vendor 3 - Sub-vendor																			

THIS IS A PART OF TECHNICAL SPECIFICATION NO. PE-TS-411-163A-A001
CONTROL AND INSTRUMENTATION SPECIFICATION FOR DM PLANT

STANDARD QUALITY PLAN FOR LOCAL CONTROL PANEL												STD QUALITY PLAN NO.: PE-OP-999-145-I056					
PEM :: C&I												VOLUME		IIB			
												SECTION		D			
												REV. NO.		01		DATE: 22-02-2008	
												SHEET		5		OF 7	
Sl. No.	Component / operation	Characteristics Checked	* Category	Type/Method of Check	Extent of Check	Reference documents	Acceptance Norms	Format of Records	Agency \$			Remarks					
									P	W	V						
10.	Panel Wiring	1. Wiring Layout	MA	Visual	100%	Approved drgs. & Specs.	Approved drgs. & Specs.	Log Book	2	--	---						
		2. Wiring Termination (Crimped Lugs)	MA	Visual	100%	Approved drgs. & Specs.	Approved drgs. & Specs.	Log Book	2	--	---						
		3. Ferrule numbers	MA	Visual	100%	Approved drgs. & Specs.	Approved drgs. & Specs.	Log Book	2	--	---						
		4. Colour of wiring	MA	Visual	100%	Approved drgs. & Specs.	Approved drgs. & Specs.	Log Book	2	--	1						
		5. Size of Conductor	MA	Measurement	100%	Approved drgs. & Specs.	Approved drgs. & Specs.	Log Book	2	--	1						
11.	Component Mounting	1. Correct components	MA	Visual	100%	Approved drgs., Specs. & BOM	Approved drgs., Specs. & BOM	Log Book	2	--	---						
		2. Fixing	MA	Visual	100%	Approved drgs., Specs. & BOM	Approved drgs., Specs. & BOM	Log Book	2	--	---						
12.	FINAL Final Inspection	1. Workmanship	MA	Visual	100%	Factory Standard	Factory Standard	Inspection Report	2	1	1	At Random by BHEL, based on 100 % internal test reports by Mfr.					
		2. Component layout (neatness, accessibility & safety) Mounting / Proper fixing of all components	MA	Visual	100%	BHEL approved drg. / Spec.	BHEL approved drg. / Spec.	Inspection Report	2	1	1						
		3. Components identification Marking / Name plates	MA	Visual	100%	BHEL approved drg. / Spec.	BHEL approved drg. / Spec.	Inspection Report	2	1	1						
LEGEND: * CR - Critical characteristics MA - Major characteristics MI - Minor characteristics																	
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3 - Sub-vendor

THIS IS A PART OF TECHNICAL SPECIFICATION NO. PE-TS-411-163A-A001
CONTROL AND INSTRUMENTATION SPECIFICATION FOR DM PLANT

PEM :: C&I		STANDARD QUALITY PLAN FOR LOCAL CONTROL PANEL										STD QUALITY PLAN NO.: PE-OP-999-145-I056			
												VOLUME IIB			
												SECTION D			
												REV. NO. 01 DATE: 22-02-2008			
												SHEET 6 OF 7			
Sl. No.	Component / operation	Characteristics Checked	* Category	Type/Method of Check	Extent of Check	Reference documents	Acceptance Norms	Format of Records	Agency \$			Remarks			
									P	W	V				
		5. Dimensions	MA	Measurement	100%	BHEL approved drg. / Spec., BOM	BHEL approved drg. / Spec., BOM	Inspection Report	2	1	1	At Random by BHEL, based on 100 % internal test reports by Mfr.			
		6. Door functioning	MA	Functional	100%	BHEL approved drg. / Spec.	BHEL approved drg. / Spec.	Inspection Report	2	1	1				
		7. Paint Shade	CR	Visual	100%	BHEL approved drg. / Spec.	BHEL approved drg. / Spec.	Inspection Report	2	1	1				
		8. Paint Thickness	CR	Measurement	100%	BHEL approved drg. / Spec.	BHEL approved drg. / Spec.	Inspection Report	2	1	1				
		9. Workmanship of Gaskets	MA	Visual	100%	Factory Standard	Factory Standard	Inspection Report	2	1	1				
		10. Wiring Layout	MA	Visual	100%	BHEL approved drg.	BHEL approved drg.	Inspection Report	2	1	1				
		11. Wire Termination	MA	Pulling manually	Sample	-----	Firm termination	Inspection Report	2	1	1				
		12. Continuity	MA	Electrical	100%	-----	Continuity OK	Inspection Report	2	1	1				

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THIS IS A PART OF TECHNICAL SPECIFICATION NO. PE-TS-411-163A-A001
CONTROL AND INSTRUMENTATION SPECIFICATION FOR DM PLANT

PEM :: C&I		STANDARD QUALITY PLAN FOR LOCAL CONTROL PANEL										STD QUALITY PLAN NO.: PE-OP-999-145-I056			
												VOLUME IIB			
												SECTION D			
												REV. NO. 01 DATE: 22-02-2008			
												SHEET 7 OF 7			
Sl. No.	Component / operation	Characteristics Checked	* Category	Type/Method of Check	Extent of Check	Reference documents	Acceptance Norms	Format of Records	Agency \$			Remarks			
									P	W	V				
13.	TYPE TEST	Degree of Protection	CR	Mech. Protection	Sample	BHEL approved spec., drg relevant IEC-60947, IEC-60079	BHEL approved spec., drg relevant IEC-60947, IEC-60079	Type Test Certificate	3	---	1				
14	ROUTINE TEST	IR before & after HV Test	CR	Electrical	100%	BHEL approved spec., drg., BOM & relevant standard	BHEL approved spec., drg., BOM & relevant standard	Test Report	2	1	1				
15	FUNCTIONAL TEST	1. Control Logic Operation	CR	Electrical	100%	BHEL approved spec. / drg.	BHEL approved spec. / drg.	Inspection Report	2	1	1				
		2. Instrument Calibration	CR	Electrical	10%	BHEL approved spec. / drg.	BHEL approved spec. / drg.	Inspection Report	2	1	1				
		3. Temperature rise	CR	Electrical	100%	BHEL approved spec./drg. & relevant standard	BHEL approved spec./drg. & relevant standard	Inspection Report	2	1	1				

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MA - Major characteristics
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1 - BHEL
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THIS IS A PART OF TECHNICAL SPECIFICATION NO. PE-TS-411-163A-A001
CONTROL AND INSTRUMENTATION SPECIFICATION FOR DM PLANT

FORM NO.: PEM-6666-0

	Technical specification for CONTROL & INSTRUMENTATION 4 X 270 MW BHADRADRI TPS	SPEC NO.: PE-TS-411-145-I		
		VOLUME		
		SECTION		
		REV. NO.	00	DATE : 19.03.2015
		SHEET	OF	

PC SPECIFICATION

	Technical specification for Computer For 4X270 MW BHADRADRI TPS	SPEC NO.: PE-TS-411-145-I	
		VOLUME	
		SECTION	
		REV. NO. 00	DATE : 19.03.2015
		SHEET 1 OF 2	

SPECIFICATION FOR PC

a. CPU

1. Processor : Intel core i5 or better, 32 bit
2. RAM : 4 GB min. and expandable to 16 GB
3. Hard Drive : 500 GB or more
4. Removable bulk storage : DVD (R/RW)
5. Graphic accelerator : 8MB (minm.)
6. Graphic Memory : dedicated 1GB or better
7. Operating System : Windows 7 or better
8. Audio controller : 16 bit
9. Communication Port : 2 serial, one parallel, 8 USB, Dual 100Mbps Ethernet
10. Expansion Slot : 3
11. Cache : 512 KB Level 2
12. Video Card : PCI

b. MONITOR

1. Type : LCD COLOUR MONITOR
2. Screen Diagonal : 24" (approx.) flat
3. Display : XGA or better
4. Resolution : 1024 by 768 or better
5. Degree of Protection : IP-30
6. External Controls : Brightness, contrast, Horizontal/Vertical, amplification & Shift
7. Version : To suit Industrial application

	Technical specification for Computer For 4X270 MW BHADRADRI TPS	SPEC NO.: PE-TS-411-145-I	
		VOLUME	
		SECTION	
		REV. NO. 00	DATE : 19.03.2015
		SHEET 2 OF 2	

c. KEY BOARD & MOUSE

1. Type : Flat spill proof membrane or positive depression type ASCII
2. Life Expectancy : 50 million cycles per key
3. Version : To suit Industrial application
4. Mouse : Optical mouse

d. SOFTWARE

Diagnostic Software, Anti Virus, Microsoft office, Acrobat Adobe Software and other application software.

THIS IS A PART OF TECHNICAL SPECIFICATION NO. PE-TS-411-163A-A001
CONTROL AND INSTRUMENTATION SPECIFICATION FOR DM PLANT

FORM NO.: PEM-6666-0

	Technical specification for CONTROL & INSTRUMENTATION 4 X 270 MW BHADRADRI TPS	SPEC NO.: PE-TS-411-145-I		
		VOLUME		
		SECTION		
		REV. NO.	00	DATE : 19.03.2015
		SHEET	OF	

FURNITURE SPECIFICATION

	Technical specification for FURNITURE For 4X270 MW BHADRADRI TPS	SPEC NO.: PE-TS-411-145-I	
		VOLUME	
		SECTION	
		REV. NO.	00
		DATE : 19.03.2015	
		SHEET	OF

SPECIFICATION FOR FURNITURE

- a) 4 Nos. cushioned revolving, independently adjustable seat and back chairs.
- b) Glass top Teak wood / MDF table for mounting Operator Station monitors.
- c) Printer tables.
- d) Glass top Teak wood / MDT table for System Engineering Room / Engineering stations with drawer at end.
- e) Glass top teak wood / MDF table with vertical file mounting arrangement (two layer to house approx. 40 Nos of files and lockable drawers at both end) for System Engineering Room / Engineers.

LIST OF DELIVERABLES OF PEM - C&I DEPARTMENT FOR MAUX PACKAGES									
4 X 270MW BHADRADRI TPS									
DOCUMENT NUMBER PE-GL-411-145-I100									
Sl.No.	DRAWING NO.	DRAWING/DOCUMENT TITLE	CATEGORY	CUSTOMER	FROM	USER	REMARKS		
INTENTIONALLY BLANKED-DATA NOT RELAVANT TO PLC/UPS									
PLC PANEL									
1	PE-V9-411-XXX-1906	PLC CONFIGURATION DRAWING	A	A		VENDOR	C&I		
2	PE-V9-411-XXX-1907	PLC PANEL GA (INTERNAL & EXTERNAL) DRAWING	A	-		VENDOR	C&I		
3	PE-V9-411-XXX-1908	CONTROL SCHEMES (BLOCK LOGIC)	A	-		VENDOR	C&I		
4	PE-V9-411-XXX-1909	PLC INPUT / OUTPUT SIGNAL LIST	I	-		VENDOR	C&I		
5	PE-V9-411-XXX-1910	UPS BATTERY CHARGER/ BATTERY DATASHEET & SLD	I	\$\$		VENDOR	C&I		
6	PE-V9-411-XXX-1911	UPS SIZING CALCULATIONS	I	-		VENDOR	C&I		
7	PE-V9-411-XXX-1912	BATTERY SIZING CALCULATIONS	I	-		VENDOR	C&I		
8	PE-V9-411-XXX-1913	CONTROL DESK LAYOUT / GA DRAWING	A	-		VENDOR	C&I		
9	PE-V9-411-XXX-1914	PLC-OWS/PRINTER FURNITURE BOM	A	-		VENDOR	C&I		
10	PE-V9-411-XXX-1915	PLC CONTROL ROOM LAYOUT DRAWING	A	-		VENDOR	C&I		
11	PE-V9-411-XXX-1916	PLC CATALOGUE	I	-		VENDOR	C&I		
12	PE-V9-411-XXX-1917	PLC QUALITY PLAN & FAT PROCEDURE	A	-		VENDOR	C&I		
13	PE-V9-411-XXX-1918	LIST OF SIGNAL EXCHANGE WITH DDCMIS (BOTH HARDWIRED & SERIAL INTERFACE IN BHEL FORMAT)	A	-		VENDOR	C&I		
14	PE-V9-411-XXX-1919	PROCESS GRAPHIC MANUSCRIPTS PLC	I	-		VENDOR	C&I		
15	PE-V9-411-XXX-1920	PROCESS GRAPHIC MANUSCRIPTS FOR DDCMIS	I	-		VENDOR	C&I		
16	PE-V9-411-XXX-1921	CABLE SCHEDULE (IN BHEL EXCEL FORMAT) & CABLE INTERCONNECTION DETAILS	I	-		VENDOR	C&I		
17	PE-V9-411-XXX-1923	PANEL & ELECTRONIC EARTHING REQUIREMENT	I	-		VENDOR	C&I		
18	PE-V9-411-XXX-1924	PANEL HEAT DISSIPATION DATA	I	-		VENDOR	C&I		
19	PE-V9-411-XXX-1925	MANDATORY SPARES BILL OF MATERIAL	A	A		VENDOR	C&I		
20	PE-V9-411-XXX-1926	PLC O & M MANUAL	I	-		VENDOR	C&I		
21	PE-V9-411-XXX-1927	PLC EARTHING SCHEME	I	-		VENDOR	C&I		
Notes:		411 - Project No							
		XXX -SI No of MAX Package							
		\$\$ -Approval by BHF if Vendor BBU Item Approval by Customer if Customer BBU Item							

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ANNEXURE-1

ELECTRICAL VENDOR LIST- 1X800 MW KOTHAGUDAM TPS

S.No	ITEM DESCRIPTION	S.No	VENDOR PROPOSED BY BHEL-ISG	TSGENCO Remarks
1	UPS	1	APLAB, THANE,	Not Approved
		2	EMERSON NETWORK POWER (PUNE) PVT.LTD., BANGALORE	Approved
		3	HITACHI HI-REL POWER ELECTRONICS PVT LTD	Approved
		4	EMERSON NETWORK POWER INDIA PVT.LTD., BANGALORE	Not Approved
		5	SCHNEIDER ELECTRIC IT BUSINESS INDIA PRIVATE LIMITED	Not Approved
		6	DUBAS ENGG.PVT.LTD., BANGALORE	Not Approved
		7	Grid power conversion Pvt Ltd.	Not Approved
		8	Delta India Electronics Pvt Ltd	Approved
2	BATTERY CHARGER	1	AMAR RAJA POWER SYSTEMS, TIRUPATHI ✓	Approved
		2	CHLORIDE POWER SYSTEMS & SOLUTIONS LIMITED	Not Approved
		3	CHABBI ELECTRICALS, MUMBAI ✓	Approved
		4	EMERSON NETWORK POWER (PUNE) PVT.LTD., BANGALORE ✓	Approved
		5	UNIVERSAL INSTRUMENTS MANUFACTURING Co. Pvt. Ltd.	Not Approved
		6	SERVILINK ENGINEERS PVT.LTD., VADODARA	Not Approved
		7	DUBAS ENGG.PVT.LTD., BANGALORE	Not Approved
		8	Electronic Systems	Not Approved
		9	Power & Protection	Not Approved
		10	Statcon Power Controls Ltd. ✓	Approved
		11	SIGNOTRON (INDIA) PVT LTD.	Not Approved
		12	System Aid	Not Approved
		13	SHERENE ELECTRO CONTROL PVT LTD	Not Approved
3	BATTERIES ✓	1	AMAR RAJA BATTERIES, TIRUPATHI	Approved
		2	HBL NIFE POWER SYSTEMS LTD.	Approved
		3	EXIDE INDUSTRIES LIMITED	Approved
		4	Grid power conversion Pvt Ltd.	Not Approved
		5	SIGNOTRON (INDIA) PVT LTD.	Not Approved
		6	System Aid	Not Approved
		7	AMCO SAFT INDIA LTD.	Not Approved

↑

INTENTIONALLY BLANKED-DATA NOT RELAVANT TO PLC/UPS

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INTENTIONALLY BLANKED-DATA NOT RELAVANT TO PLC/UPS

6	CONTROL DESK	1	LOTUS POWER GEAR PRIVATE LTD.	Not Approved
		2	CONTROL INFOTECH PVT LTD,	Not Approved
		3	MEDITRON, RANCHI	Not Approved
		4	HI-POWER CONTROLS	Not Approved
		5	SUN ELECTRO CONTROL SYSTEMS PVT. LTD	Not Approved
		6	VENSON ELECTRIC CO. LTD	Not Approved
		7	SEN & SINGH ENGINEERS, KOLKATA	Not Approved
		8	PYROTECH ELECTRONICS PVT. LTD.	Approved
		9	SWITCHING CIRCUITS, KOLKATA	Not Approved
		10	KMG ATOZ SYSTEMS (P) LTD.,	Not Approved
		11	JASPER ENGINEERS PVT.LTD.	Not Approved
		12	Dynaspede Integrated Systems Pvt. Ltd.,	Not Approved
		13	Power & Proection	Not Approved
		14	CONTROL DEVICES	Not Approved
		15	Tech-up Engineering Pvt Ltd.	Not Approved
		16	ELKTRISCHEN POWER GEARS (P) LTD.	Not Approved
		17	VEE VEE CONTROLS PRIVATE LIMITED	Approved
		18	GEMCO CONTROLS LTD	Approved

Approved
9/4/10

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BHEL - EDN			
TSGENCO - KOTHAGUDEM THERMAL POWER STATION, STAGE-VII, UNIT # 12 (1 x 800 MW)			
APPROVED SUB VENDOR LIST			
S.NO	DESCRIPTION	PROPOSED SUB VENDOR	TSGENCO Remarks
1	UPS System with ACDB (3 Phase Input, 1 Phase Output)	M/s EMERSON NETWORK POWER, THANE	Approved
		M/s HITACHI-HIREL POWER ELECTRONICS, GANDHINAGAR	Approved
2	24 V DC thyristor based Battery Charger	M/s KELTRON POWER ELECTRONICS, TRIVENDRUM	Approved
		M/s AMARARAJA POWER SYSTEMS LTD, TIRUPATI.	Approved
		M/s CHLORIDE POWER SYSTEMS, KOLKATA	Approved
		M/s CHHABI ELECTRICALS, JALGAON.	Approved
		M/s HBL POWER SYSTEMS, HYDERABAD	Approved
		M/s AMARARAJA POWER SYSTEMS LTD, TIRUPATI.	Approved
3	24 V DC SMPS based Battery Charger	M/s CHHABI ELECTRICALS, JALGAON.	Approved
		M/s MASTECH, MUMBAI	Approved
		M/s EMERSON NETWORK POWER, THANE	Approved
4	AC Distribution Board/DC Distribution Board	M/s HITACHI-HIREL POWER ELECTRONICS, GANDHINAGAR	Approved
		M/s AMARARAJA POWER SYSTEMS LTD, TIRUPATI.	Approved
		M/s HBL POWER SYSTEMS, HYDERABAD	Approved
		M/s CHHABI ELECTRICALS, JALGAON.	Approved
		M/s CHINO CORPORATION(I), MUMBAI	Approved
5	Digital Indicator	M/s PYROTECH, UDAIPUR	Approved
		M/s YOKOGAWA, BANGALORE	Approved
		M/s MASIBUS, GANDHINAGAR.	Approved

INTENTIONALLY BLANKED-DATA NOT RELAVANT TO PLC/UPS

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38	Lead Acid Battery (Plante type)	M/s EXIDE INDUSTRIES, KOLKATA	Approved
		M/s HOPPECKE, GERMANY	Not Acceptable
39	Master Slave Clock System	M/s SERTEL, CHENNAI	Approved
		M/s MASIBUS, GANDHINAGAR.	Approved
		M/s SANDS, CHENNAI	Approved

INTENTIONALLY BLANKED-DATA NOT RELAVANT TO PLC/UPS

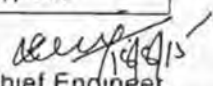
HMI VENDOR LIST

42	Wireless Communication Link	AMG SYSTEMS LTD,UK	Approved
		SHEETAL WIRELESS TECHNOLOGIES PVT LTD,PUNE	Not Acceptable
		ARYA .DELHI	Not Acceptable
		D LINK,GOA	Approved
		PYROTECH LTD , UDAIPUR	Not Acceptable
43	Mini UPS for HMI	APLAB LIMITED ,THANE	Not Acceptable
		POWERTRONIX SYSTEMS LTD.,BANGALORE.	Not Acceptable
		SCHNEIDER ELECTRIC,BANGALORE	Approved
		EMERSON NETWORK ,PUNE	Not Acceptable
44	STATION LAN EQUIPMENT	ORANGE BUSINESS SERVICES	Approved
		NETSOFT SYSTEMS & NETWORKS ,BANGALORE	Not Acceptable
		PRISHA SYSTEMS & NETWORKS PVT LTD.	Approved
		BINARY SYSTEMS PVT LTD	Not Acceptable
		ORVA NETWORKS PVT LTD	Not Acceptable

DAVR VENDOR LIST

INTENTIONALLY BLANKED-DATA NOT RELAVANT TO PLC/UPS

47	INDICATING LAMPS / PUSH BUTTONS	TEKNIC	Approved
		SIEMENS	Approved
		ABB(I) LTD.	Approved
		GE POWER CONTROLS	Approved


 Chief Engineer

 Thermal Projects Construction
 TSGENCO, Vidyut Soudha,
 Khairatabad, Hyderabad-82

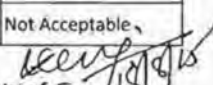
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S.No	Item Description	Vendors	Remarks
INTENTIONALLY BLANKED-DATA NOT RELAVANT TO PLC/UPS			
49	CURRENT TRANSFORMERS (INCLUDING CONDUCTION MONITORING CT's)	KAPPA ELECTRICALS	Approved
		INSTRANS ENGG. & MFG. PVT LTD.	Approved
		INTRA VIDYUT LTD.	Approved
		PARAS POWER ENGG.LTD.	Approved
		VAC, GERMANY	Approved
		KALPA ELECTRICAL PVT LTD.	Approved
50	SHUNT	MECO INSTRUMENTS (GOLIYA ENTERPRISES PVT. LTD)	Approved
		IMP POWER LTD.	Approved
		AUTOMATIC ELECTRIC PVT LTD.	Approved
51	AUX. CONTACTOR	SIEMENS (I) LTD.	Approved
		ABB (I) LTD.	Approved
52	SEMICONDUCTOR FUSE	COOPER BUSSMANN DENMARK	Approved
		MERSEN (FORMERLY FERRAZ SHAWMUT FRANCE)	Approved
53	ELECTRONIC MODULE	BHEL-EDN BANGALORE	Approved
54	MCBS	ABB LTD.	Approved
		SIEMENS AG/SIEMENS (I) LTD.	Approved
		INDO KOPP LEGRAND	Approved
		MDS LOAD CONTACT	Approved
		MERLIN GERIN	Approved
		SCHNEIDER ELECTRIC	Approved
55	FIELD BREAKER	MERSON (FORMERLY KNOWN AS LENOIR ELECTRICALS, FRANCE)	Approved
		ABB CONTROLS,FRANCE	Approved
56	EXCITER FIELD DISCHARGE RESISTOR	AMP CONTROL EQPT. PVT LTD.	Approved
		OHMARK CONTROLS PVT LTD.	Approved
57	TRANSDUCER	ELSTER METERING(FORMERLY ABB)	Approved
		SOUTHERN TRANSDUCERS CHENNAI	Approved
		RISHABH	Approved
58	AUXILIARY RELAY	JYOTHI LTD. BARODA	Approved
		GUARDIAN CONTROLS	Approved

[Signature]
 Chief Engineer
 Thermal Projects Construction
 TSGENCO, Vidyut Soudha,
 Khairatabad, Hyderabad-82

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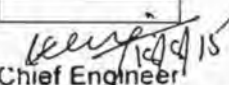
S.No	Item Description	Vendors	Remarks
59	ROTARY SWITCHES	KAYCEE IND	Approved
		KRAUS & NAIMER	Approved
60	HRC FUSES WITH TRIP INDICATOR, FUSE BASE ISOLATOR	FERRAZ SHAWMUT	Approved
		COOPER BUSSMANN INDIA LTD.	Approved
		GE POWER CONTROLS LTD	Approved
		SIEMENS INDIA	Approved
INTENTIONALLY BLANKED-DATA NOT RELAVANT TO PLC/UPS			
63	POWER CABLES AND CONTROL CABLES	UNIVERSAL CABLES	Approved
		DELTON CABLES	Approved
		RADIANT CABLES	Not Acceptable
		INDUSTRIAL CABLES LTD	Not Acceptable
		NICCO CORPORATION LTD.	Approved
		TORRENT CABLES LTD	Not Acceptable
		GEMSCAB INDUSTRIES LTD	Not Acceptable
		POLYCAB WIRES PVT. LTD	Approved
		RPG CABLES	Not Acceptable
		TECHNO CABLES	Approved
		FORT GLASTER INDUSTRIES LTD.	Approved
		RELIANCE ENGINEERS	Not Acceptable
		INCAB INDUSTRIES LTD	Not Acceptable
		PARAMOUNT CABLE CORPORATION	Approved
		KEI INDUSTRIES LTD, BHIWADI	Approved
64	INDUSTRIAL PC	M/S ADVANTECH, TAIWAN	Approved
65	ETHERNET SWITCHES	MOXA	Not Acceptable
		CISCO	Approved
		HIRSCHMAN	Approved
		N-TRON	Not Acceptable


 Chief Engineer

 Thermal Projects Construction
 TSGENCO, Vidyut Soudha,
 Khairatabad, Hyderabad-52

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S.No	Item Description	Vendors	Remarks
Desk			
66	Electrical Analog Meter	AUTOMATIC ELECTRIC, MUMBAI	Approved
		RISHAB, NASHIK	Approved
		MECO, MUMBAI	Approved
		ENERCON, BANGALORE	Approved
67	Mosaic Grid Components	PRO-PLAN, GERMANY [Earlier Boyko Strey]	Approved
		SYMO, SWITZERLAND	Approved
		TEW GERMANY [Earlier Subklew]	Approved
68	Mosaic Mountable Moving Coil indicators	GOSSEN, GERMANY	Approved
		WEIGEL, GERMANY	Approved
		SAMSON ELECTRONIC GMBH	Approved
69	Mosaic Mountable Digital Indicators (48 X 24mm)	GOSSEN, GERMANY	Approved
		WEIGEL, GERMANY	Approved
		SAMSON ELECTRONIC GMBH	Approved
70	Transducers	ADEPT, PUNE	Approved
		AUTOMATIC ELECTRIC, MUMBAI	Approved
		MECO, MUMBAI	Approved
		SOUTHERN TRANSDUCERS, CHENNAI	Approved
71	UCP /ECP /Control desk (Mosaic Grid based panels)	CHEMIN CONTROLS, PONDICHERRY	Approved
		IL, KOTA	Approved
		KHODAY CONTROL SYSTEMS, BANGALORE	Not Acceptable
		MODAYIL PROPERTIES, NANJANGUD	Not Acceptable
		PYROTECH, UDAIPUR	Approved
72	Selector Switches	L&T	Approved
		SALZER	Approved
		KAYCEE	Approved


 Chief Engineer

 Thermal Projects Construction
 TSGENCO, Vidyut Soudha,
 Khairatabad, Hyderabad-82

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BHEL - EDN			
TSGENCO - KOTHAGUDEM THERMAL POWER STATION, STAGE-VII, UNIT # 12 (1 x 800 MW)			
APPROVED SUB VENDOR LIST			
S.NO	DESCRIPTION	PROPOSED SUB VENDOR	TSGENCO Remarks

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72	PC'S	HP	Approved
73	Control / Operator Desk / Rack	BHEL Approved Vendors (If no specific vendor's product)	Approved
74	PANEL METERS	AUTOMATIC ELECTRIC PVT LTD.	Approved
		MECO INSTRUMENTS	Approved
		RISHAB	Approved
75	INDICATING LAMPS	ABB(I) LTD.	Approved
		ESSEN & DEINIKI	Approved
		GE POWER CONTROLS	Approved
		SIEMENS	Approved
76	MCB	SCHNEIDER ELECTRIC	Approved
		SIEMENS AG / SIEMENS(I) LTD.	Approved

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BHEL - EDN			
TSGENCO - KOTHAGUDEM THERMAL POWER STATION, STAGE-VII, UNIT # 12 (1 x 800 MW)			
APPROVED SUB VENDOR LIST			
S.NO	DESCRIPTION	PROPOSED SUB VENDOR	TSGENCO Remarks
77	TRANSDUCER	ELSTER METERING MUMBAI	Approved
		PYROTECH	Approved
78	AUXILIARY RELAY	JYOTHI LTD. BARODA	Approved
79	ROTARY SWITCHES	KAYCEE IND.	Approved
		SALZER,	Approved
80	HRC FUSES WITH TRIP INDICATOR, FUSE BASE ISOLATOR	FUSE GEAR	Approved
		GE POWER CONTROLS LTD	Approved
		SIEMENS INDIA	Approved
82	LVS	DELTA INDIA	Approved
		CHRISTIE-USA	Approved
		BARCO	Approved
		PYROTECH	Approved
83	MODULAR DESK	CHEMIN CONTROLS AND INSTRUMENTATION , PONDICHERRY	Approved
		COSMOS MEDIA PRODUCTS PVT LTD ,NOIDA	Approved
		PYROTECH WORKSPACE SOLUTIONS PVT LTD , UDAIPUR	Approved
84	COMPUTER FURNITURE.	COSMOS MEDIA PRODUCTS PVT LTD ,NOIDA	Approved
		GODREJ AND BOYCE MANUFACTURING CO LTD, BANGALORE	Approved
		PYROTECH WORKSPACE SOLUTIONS PVT LTD , UDAIPUR	Approved
85	CRT Desk	CHEMIN CONTROLS AND INSTRUMENTATION , PONDICHERRY	Approved
86	Dot matrix Printer	EPSON	Approved
87	WORKSTATIONS , SERVER, PC'S	IBM-LENOVO	Approved
88	PRINTERS (Laser/Inkjet)	EPSON(Inkjet only)	Approved
		IBM	Approved
		DELL	Approved
89	TFT MONITOR	IBM-LENOVO	Approved
		SAMSUNG	Approved
90	WIRELESS COMMUNICATION LINK	D LINK,GOA	Approved
		PYROTECH LTD , UDAIPUR	Approved
		APLAB LIMITED ,THANE	Approved
91	MINI UPS FOR HMI	HITACHI HI-REL POWER ELECTRONICS,BANGALORE	Approved
		EMERSON NETWORK INDIA,BANGALORE	Approved
92	GIU	ROCKWELL AUTOMATION INDIA PVT LTD.	Approved
93	STATION LAN EQUIPMENT	IBM INDIA PVT LTD.	Approved
		TEXONIC INSTRUMENTS ,BANGALORE	Approved
		WIPRO INFOTECH ,BANGALORE	Approved
94	OFC	HFCL-GOA	Approved
		FINOLEX ,PUNE/GOA	Approved
		D-LINK	Approved

Pre Pid clarification for DM package for Bhadradri proejct

Sr No	Volume	Section	Clause No	Page no	pdf Page No	Specification Requirement	Reason For Clarification	BHEL REPLY/ADDITIONAL CLARIFICATION
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ELECTRICAL & INSTRUMENTATION									
INTENTIONALLY BLANKED-DATA NOT RELAVANT TO PLC/UPS									
4	Volume - II B	SECTION – IC			223	PLC configuration Drawing - IO Module	We clarify that the we do not require RIO module. Customer to confirm the requirement.	Backup Panel shall be provided as per PLC Configuration Diagram.	
INTENTIONALLY BLANKED-DATA NOT RELAVANT TO PLC/UPS									
6	Volume - II B	SECTION – IIC	3.8.3	page 321 of 441	358	Communication with DCS	In PLC datasheet A & B, communication medium is mentioned of fiber optic over OPC whereas in clause 3.8.3 two types of communication is specified i.e. a)OPC Ethernet based TCP/IP protocol b) additionally, Modbus protocol on RS485 network. We request to confirm the requirement.	It shall be OPC ethernet based TCP/IP protocol.	
7	Volume - II B	SECTION – IIC	3.8.3	page 322 of 441	324	Accessories for communication b/w PLC and DCS	In this clause it is mentioned that necessary accessories for establishing the communication between PLC and DCS shall be in vendor scope at both ends PLC and DCS. However the same is contradictory with PLC configuration diagram PTP on pdf page no 223.	PLC Configuration diagram shall be followed.	
8	Volume - II B	SECTION – IIC	2.00.00	page 398 of 441	400	Control desk and panel	As we are providing PLC panel all the controls and monitoring , alarms, indication are available on HMI/PLC. Please clarify the requirement. This requirement is not mentioned in Electrical scope between BHEL & vendor.	As per PLC configuration diagram, PLC Panel is envisaged with Backup Panel. Bidder shall provide the same in line specification and system requirement.	

9	Volume - II B	SECTION – IA	13.4.1	Page 63 of 441	65	Mandatory Spares	We understand the philosophy as below(typical example), Please clarify: 1. For function controller-10% of number for each type or minimum 4 Number for each type whichever is high- 2 Lot For this project there are redundant PLC controller (no other controller are required) . So Main Quantity is 2. Hence considering 4 Nos of controller(As this is higher than 10%) and 2 lots of such controller means total 8 Nos of controller for mandatory spares. Please confirm whether our understanding is correct or not.	Bidder's understanding is correct.
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9)	Vol- 11B/Section 1C	217 of 441	Remote I/O Remote I/O panels shall be provided by bidder with pushbuttons, indicating lamps and hardwired annunciation system for local control// operations.	We understand that the Remote I/O panel is backup panel as mentioned in the PLC system configuration drawing.	DM Plant is operated through the DM plant PLC with Backup panel as indicated in system configuration drawing.	Noted. Backup panel shall be provided as per specification.
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10)	Vol-11B/Section 1C			PLC Configuration DM Plant Back up panel	Please provide detail control philosophy and Specification for designing Back Up Panel. In Absence of Above Details we cannot design /estimate the same.	This is for better Clarity Tender is Silent About Backup panel details. This is for better Clarity	Back up Panel shall comprise a window Annunciator, MIMIC and Start /Stop push buttons for the drives for which local operation is required (Quantity shall be finalized during detailed engineering stage). Further for Indication /alarm bidder to refer the tender specification pages 236 to 238 of 441. For back up panel specification bidder to refer section II C clause 2.03.00 page 400&401 of 441 of tender technical specification.
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12)	Vol-11B /Sub Section IIA	3.0	236 of 441	Soft link communication shall be provided from the DM Plant PLC to DDCMIS for monitoring of DM Plant at CCR-1 & CCR-2. Total length of Fibre optic cable to meet above requirement shall be considered as 1800 meter by bidder in his scope.	Bidder will supply 1800 meter OFC Cables Only. Other Systems like Trays, Supports, Installation Between PLC to DDCMIS Shall	As the tender is silent about the trays, supports and installation scope, we exclude the same. And we	Kindly refer Electrical scope sheet for scope clarity.
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13)	Vol-11B / Section D	3.9.1	322 of 441	PLC Panel and I/O Cabinets: PLC system shall be provided with 2x100% UPS fed from Two Nos. redundant 415V, 3-ph feeders, as per the scheme PE-SD-999-145-001, sh-08 of 08. Each UPS shall have 30 minutes back up. Input feeder failure shall be monitored in the PLC system UPS scheme 1x100% capacity Lead Acid Plante Back up 60 Min	be in BHEL Scope Kindly Confirm the same	do not know the cable routing between PLC to DDCMIS, Hence We Exclude Trays& Supports for same. We are unable to Locate Drawing with the scheme PE-SD-999-145-001, sh-08 of 08. This is for better clarity.	60 minutes Backup time shall be provided.
			356 of 441				

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Technical Specification for DM Plant	ELECTRICAL SCOPE BETWEEN BHEL AND VENDOR		Pg 196/441		The bidder has understood that the following cables does not come under the scope of Bidder 1) Cables between MCC and PLC Kindly confirm	Bidder to Refer Electrical scope between BHEL and Vendor S no. 3, all types of power, control and screened control cables shall be under BHEL scope.
Technical Specification for DM Plant	section D		Pg 328/441	1) Remote IO Panel - Yes 2) Backup desk- No	The bidder has understood that the following 1) Remote IO Panel Not required 2) Backup desk is required e asper PLC CONFIGURATION Diagram, Kindly confirm	RIO Panel is mentioned in PLC datasheet and Vendor shall provide the same. Backup panel shall be provided as per specification.

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Technical Specification for DM Plant			Pg 221/441	Back up control panel	Please provide the Back up control panel detailed specification	Back up Panel shall comprise a window annunciator, MIMIC and Start /Stop push buttons for the drives for which local operation is required (Quantity shall be finalized during detailed engineering stage). Further for Indication /alarm bidder to refer the tender specification pages 236 to 238 of 441. For back up panel specification bidder to refer section II C clause 2.03.00 page 400&401 of 441 of tender technical specification.
Technical Specification for DM Plant			Pg 221/441	LVS	Please provide the LVS system detailed specification	Please refer "C&I Specification, LCP & Junction Box Specification, 3.00.00"

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IIB	D	3.4.1	319 & 327	No of channel per card	As per tender there is some ambiguity in channel density.At present we have considered AI/AO- 8 channel density. Please review.	Noted & Confirmed
IIB	D		326 & 196	LVS	At present we have not considered any LVS other than OWS & EWS and Laptop as per data sheet & PLC configuration.	Kindly follow the tender specification of DM plant.

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IIB		3.9.1	321 & 196	UPS BACK UP TIME	Please confirm the UPS back up time for estimation purpose.	Please refer the specification, UPS Scheme. Backup time is 60 mins.
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IIB	D		221	PLC configuration dwg	We don't envisage any requirement of separate RIO panel for this package.	Backup Panel shall be provided as mentioned in PLC Configuration Diagram.
IIB	D	3.4.1	320 & 328	No of channel per card & PLC datasheet	As per tender there is some ambiguity in channel density.At present we have considered AI/AO- 8 channel density. Please review.	Noted & Confirmed.

IIB				328	UPS BACK UP TIME	Please confirm the UPS back up time for estimation purpose.	Please refer the specification, UPS Scheme, Backup time is 60 mins.
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INTENTIONALLY BLANKED-DATA NOT RELAVANT TO PLC/UPS

	PRE-QUALIFICATION REQUIREMENTS FOR PLC & UPS PACKAGE	Indent No:RWT90793
		Rev 00 Dt: 24.10.19

PROJECT: 4x270 MW Bhadradri TPS-DM PLANT

ITEM: Programmable Logic Controller(PLC)

SCOPE: Supply : YES; Erection: NO ; Commissioning : YES;

The following are the pre-qualification requirements

1.	Bidder should be designer and manufacturer of PLC systems with in-house panel assembly, software development, HMI/SCADA integration and testing capability.
2.	Bidder should have designed, manufactured & supplied at least two numbers (one each at two different installations) of PLC systems with minimum 1000 number of Input/Outputs and PO value of minimum Rs.1 Cr, which should have been in successful operation for a period of at least one year prior to the date of Enquiry. PO should not be older than 5 years from the date of enquiry. PO copies and Performance certificate/Commissioning protocol from end user to be submitted. In addition to the above, bidder shall fill up the details as per Annexure-I. Note: Two different installations means two different project sites or two different contracts.
3.	Vendor acceptance subject to End customer (TSGENCO) approval.

General Conditions:

1. Bidder shall furnish necessary documentary evidence in original / notarized (legible) copy as a proof of meeting the qualifying criteria for the review by BHEL. Acceptance of documentary evidence rests with BHEL.
2. Bidders who defaulted, in any of the previous tenders floated by BHEL are not permitted to respond. Such offers, if found later, will not be considered for evaluation.
3. After receipt of offers, during scrutiny, if any vendor found to have been banned by BHEL, then their offer will be summarily rejected at any stage.

Prepared  Anjitha Jayan V Sr. Engineers/WS	Reviewed  M K Vinodh Kumar Dy.Mgr/WS	Approved  V N Santhakumar DGM/WS
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	PRE-QUALIFICATION REQUIREMENTS FOR PLC & UPS PACKAGE	Indent No:RWT90793
		Rev 00 Dt: 24.10.19

ANNEXURE-I

A. Customer Details:

- a. Name:
- b. Designation:
- c. Mobile:
- d. Landline:
- e. Fax:
- f. E-mail:
- g. Postal address:

B. Plant Details

Date of supply:

Date of commissioning:

Sl.No	Parameters	Details
1.	Controller Model	
2.	No: of Analog Inputs	
3.	No: of Analog Outputs	
4.	No: of Digital Inputs	
5.	No: of Digital Outputs	
6.	List of accessories supplied (OWS, LVS, Backup panel, OFC,printer etc)	
7.	End use(Package name)	

Prepared  Anjitha Jayan V Sr. Engineers/WS	Reviewed  M K Vinodh Kumar Dy.Mgr/WS	Approved  V N Santhakumar DGM/WS
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Sl.No	BHEL / Customer Requirement	##Specific confirmations by the manufacture
1	Quality Plan Requirement:	
	(i) MQP (Manuafcutering Quality Plan) shall be submitted in attached format for BHEL/Customer review & approval. Typical MQP is attached for indicative purposes for guidance & use.	
	(ii) MQP shall invariably cover w.r.t Inward inspection including on Raw materail Procurement, In process and Final inspection in elaborated way/details.	
	(iii) Bidder shall also to give specific confirmation that on need basis, their competent officials shall visit to BHEL/customer for finalization of Quality plan including test procedure/methodology during preaward / post award approval / detailed engineering in the event of an order.	
	(iv) No deviation on BHEL/Customer approved MQP is acceptable.	
	(v) Bidder shall agree to submit all cross referred documents other than codes/standrads to BHEL/Customer/Consultant.	
	Important Notes shall be included in MQP : (a) Latest revision of Standard s & Specification shall apply. Only International Standards are applicable. Indian & Chinese Standards are not applicable (b) Materials shall be procured in compliance to Functional Technical Specification. (c) Inspection shall be in compliance with Approved Quality Control Procedure for the Product. (d) NDT shall be carried out by Qualified Personnel with compliance to Approved NDT Procedures and Acceptance Norms, as per ASME Section V. (e) Gauges and measuring Instruments, with valid calibration only shall be used. (f) Cleaning and Painting of products shall be carried out as per Approved Painting Schedule. (g) Finished Products shall be packed to comply with Approved Packing Schedule. (h) Welding shall be carried out by Qualified Personnel with compliance to Approved NDT Procedures and Acceptance Norms, as per ASME Section V.	
2	Domestic / Inland Inspection will be carried out by BHEL/BHEL apointed Third Party Inspection Agency (TPIA) / Customer/Customer Apointed Inspection Agency/Consulatnat. This is applicable for all Stage inspection and Final Inspection identified as "W" - Witness or "CHP" - Customer Hold Point as per customer approved Quality Plan/ Technical specification / Approved Drawing/ Approved Data sheet / Scheme / PID / PFD / SLD (Process Instrumentaion Diagram / Process Flow Diagram / Single Line Diagram) etc (As applicable).	
3	Inspection Agency for Foreign Bidders and also for Indian Bidder but importing from Forgign Sources: (1) Any one of the flowing Third Party Inspection Agency (TPIA) shall be appointed by the bidder and same shall be furnished by the bidder in techno commercial bid itself. (2) The details of TPIA with contact details like Name of the official, Phone no, Email id shall also to be submitted during pre/post award. However cost for such inspection agency shall be borne by the bidder only. Inspection charges for such inspection agency shall be indicated separately so that if BHEL/Customer is undertaking the inspection by on their own , then these charges non claimable by the bidder. List of TPIA 1.M/s Bureau Veritas 2.M/s TUV-Nord 3.M/s TUV-SUD 4.M/s TUV Rheinland 5.M/s Lloyds Register 6.M/s SGS 7.M/s Germanischer Lloyds 8.M/s QUEST 9.M/s Certification Engineers International 10.M/s Intertek 11.M/s IR Class Systems and Solutions 12.M/s DNV 13. M/s Fichtner 14. M/s ABS Inspection Services	
4	Stage Inspection during manufacturing Process : Stage Inspection during manufacturing shall be carried out as per approved quality plan and all necessary documents shall be provided for review,verification and clearanace for further processing. This inspection call shall be given well in advance (atleast 2 weeks before) to TPI/Bidder's own inspection agency to avoid delay in the manufacturing processes.	

Sl.No	BHEL / Customer Requirement	##Specific confirmations by the manufacture
5	Inspection before despatch for domestic supplier : Inspection before despatch at supplier's works shall be carried out by BHEL/BHEL appointed inspection agency. Inspection shall be done as per approved Quality plan/ Technical specification/ Approved Drawing/ Approved Data sheet .	
6	Inspection at Foreign Source/Supplier: (a) As in sl no: 3. shall be ensured without fail (b) No materail / items shall be despatched without getting the written communication from BHEL / Customer inspection carried out by BHEL/BHEL apointed Third Party Inspection Agency (TPIA) / Customer/Customer Apointed Inspection Agency/Consulatnat. This is applicable for all Stage inspection and Final Inspection identified as "W" - Witness or "CHP" - Customer Hold Point as per customer approved Quality Plan/ Technical specification / Approved Drawing/ Approved Data sheet / Scheme / PID / PFD / SLD (Process Instrumentaion Diagram / Process Flow Diagram / Single Line Diagram) etc (As applicable). Inspection before despatch for Foreign supplier : Inspection before despatch at supplier's works shall be carried out by bidder appointed inspection agencies having international presence at vendors and or vendor's sub vendor works. Inspection shall be done as per approved Quality plan/ Technical specification/ Approved Drawing/ Approved Data sheet by TPIA mentioned in Sl no: 03 at supplier's cost.	
7	Painting shall be done strictly as per BHEL/Customer approved painting schedule / scheme only. Paint Thickness / Paint shade shall be ensured as per BHEL / Customer approved painting schedule / specification / data sheet etc. No deviation is acceptable unless otherwise accepted by BHEL/Customer in writing. Any conflict if any among BHEL / Customer approved painting schedule / Spec / data sheet etc shall be brought to the notice to BHEL well in advavnce before proceding including the BOI being procured for assy / skid like motors etc	
8	Specific conformation for document package in the event of an order (2 Hard copies & soft copy in PDF file) is to be given containing the following with proper linkages (i) Index Sheet (ii) MQP/RQP/Endorsement Sheet (As applicable) (iii) TCs identified by BHEL/ Customer for record for "CHP" / "W" and Verification portion ("V") as given in approved QP. (iv) Final inspection report + TC including Chemical + Mechnaical + HT + NDT etc (v) Third party Inspection report + TC (vi) Customer CHP/ MDCC (vii) Type test / Performance Test reports conducted (viii) Type test / Performance Test approval/ clearance obtained from BHEL/Customer (ix) BOM with As Build Drgs with actual make / rating used with BHEL/customer approved drawings.	
9	Packing / Seaworthy Packing shall be as per BHEL Packing schedule / approved drg / sketch. This shall be ensured to take care tarnsit / handling / transhipment in Road / Sea / Air. Photographs are to be submitted for BHEL review before despatching the material as per contract conditions.	
10	Outsourcing of test facilities: Bidder shall ensure all the testing facilities in house. However If any of the test facilities are not available with successful bidder, then bidder shall ensure the same at NABL accreadted third party lab / Govt / Govt Lab for major testing such as NDT, Electrical & Mechanical testing.	
11	Important Note: No deviation on the above requirement 01 to 10 is acceptable w.r.t Quality Requirement and those offers not meeting these specific customer requirement is liable for rejection and hence the bidder shall submit all the required documentary evidances in the offer itself.	
12	## Necessorily to be filled up by the bidder at the time of offer itself otherwise the offer may not be considered w.r.t Quality Requirement being customer specific requirement.	