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 &

Arvind S A Khan Praveen Kishore

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 wih 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.

Arvind S A Khan Praveen Kishore

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

Arvind S A Khan Praveen Kishore

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

Arvind S A Khan Praveen Kishore

		:	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

Arvind S A Khan Praveen Kishore

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 fixures

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

Arvind S A Khan Praveen Kishore

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.

Biddr 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

Arvind S A Khan Praveen Kishore

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.

4.00.00 LOCAL INSTRUMENT RACK (LIR) & LOCAL INSTRUMENT ENCLOSURE (LIE)

4.01.00 GENERAL

4.01.01 Devices (Transmitters/ Switches) located in the field shall be suitably grouped together to the extent possible and installed in the LIE (Closed Rack) and LIR (Open Rack) in Boiler/TG Building and Off-site plant areas.

4.01.02 Racks and enclosure shall be factory prefabricated & painted and shall complete with internal piping, tubing, manifold, isolation valves, blowdown valves, integral junction box, illumination etc.

4.01.03 No more than six instruments shall be grouped in a single rack / enclosure.

4.01.04 Racks shall be installed above the tapping points for air, flue gas and coal air mixture application whereas for applications such as for water and steam, racks to be installed below the source point.

4.01.05 Attention shall be paid in the layout to avoid air traps in liquid piping and water accumulation in air /gas piping.

4.01.06 Racks used for furnace, flue gas and air application shall be provided with intermittent & continuous air purging

4.01.07 Welding of impulse lines shall comply with the provisions of the latest applicable ANSI Code for Pressure Piping.

4.01.08 Earth stud shall be furnished at rack for safety grounding.

4.02.00 LOCAL INSTRUMENT ENCLOSURE (LIE)

4.02.01 Enclosure shall be free standing type. Racks shall be adequately reinforced to ensure true surfaces and to provide support. Major load - bearing posts shall be suitably supported by gusset plates or moment members.

4.02.02 Enclosure outer shall be constructed from at least 3 mm thick steel plate and epoxy painted to shade gray. Base frame shall be made of ISMC 100 and black colour finish.

4.02.03 2" NB galvanized pipes shall be laid horizontally and supported at two end channels to mount transmitters at accessible height. Center posts or any

Arvind S A Khan Praveen Kishore

member, which would reduce access, shall be avoided.

4.02.04 Double leaf interlocking front opening doors with three point locking shall be provided and shall be arranged for maximum possible access to the interior. Key shall be of identical for all enclosures.

4.02.05 Doors shall have concealed quick removal type pinned stainless steel hinges and locking handles. Gaskets shall be used between all mating sections to achieve dust and weather proof enclosure rated for IP-65 including the internal junction box. All enclosures shall have access doors on front side.

4.02.06 Removable type bulkhead plates of thickness not less than 6 mm shall be mounted at the racks with suitable high temperature gasket. Impulse lines within the enclosures shall be properly clamped.

4.02.07 All internal wirings between the instruments and junction box shall run through flexible conduits. No exposed wirings within transmitter racks both open and closed type, is admissible.

4.02.08 Racks shall have a common blowdown drain header, which will connect individual instrument blowdown line after suitable pressure breaking through regulating globe type blowdown valves. Covered funnels shall be used for saturated liquid and steam service, whereas, open funnels may be used for cold liquid services. Header (2" NB ASTM A 106, Sch-80 Gr. C) shall be suitably sloped and shall have one end flanged and extending beyond the rack for connection to plant drain header..

4.02.09 Each rack shall be provided with one receptacle, light fixtures with wire guard and one lighting switch each at instrument & Junction box compartments with wire guard. Lighting switches may be door actuated & mounted inside the panel. Outlet box, switch box and device covers shall be of galvanized stamped steel. Light switches and receptacles shall be installed inside the enclosure on the wall near the latch side of the enclosure door. Light fixtures shall be installed on the ceilings of the enclosures.

4.02.10 Power supplies for miscellaneous devices shall be provided with MCB located within the enclosures. MCB shall be mounted in fuse blocks. Nameplates shall be furnished above the MCB blocks, identifying the devices being served.

4.02.11 Vibration dampeners shall be installed for supporting each enclosure. The loading at each corner of the enclosure shall be determined by actual test weighting when construction is complete to determine the correct length of each dampener for proper loading of the dampener in accordance with manufacturer's recommendations

4.03.00 LOCAL INSTRUMENT RACK (LIR)

4.03.01 Rack shall be free standing type constructed from 6 mm thick steel channel frame provided with a canopy to protect the instrument from dripping water or

Arvind S A Khan Praveen Kishore

falling objects and shall be epoxy painted. Canopy shall be of CRCA steel sheet of at least 3 mm thickness.

4.03.02 Rack Major load-bearing posts shall be suitably supported by gusset plates or moment members. Suitable fenders grill shall be welded to the end-posts of the rack to outline a boundary beyond which no mounted equipment shall project to protect instrument from accidental contact during personnel movement. Center posts or any member, which would reduce access, shall be avoided.

4.03.03 2" NB galvanized pipes laid horizontally and supported at two end channels shall be employed at working accessible height for mounting of instruments.

4.03.04 All internal wirings between the instruments and junction box shall run through flexible conduits. No exposed wirings are admissible.

4.03.05 Racks shall have a common blowdown drain header, which will connect individual instrument blowdown line after suitable pressure breaking through regulating globe type blowdown valves. Covered funnels shall be used for saturated liquid and steam service, whereas, open funnels may be used for cold liquid services. Header (2" NB ASTM A 106, Sch-80 Gr. C) shall be suitably sloped and shall have one end flanged and extending beyond the rack for connection to plant drain header..

Each rack shall be provided with one receptacle, one light fixture with wire guard and one lighting switch. Outlet box, switch box and device covers shall be galvanized stamped steel. Light fixtures shall be installed on the canopy of the rack

4.03.06 Power supplies for miscellaneous devices shall be provided with MCB located within the enclosures. MCB shall be mounted in fuse blocks. Nameplates shall be furnished above the MCB blocks, identifying the devices being served.

4.04.00 JUNCTION BOX

1.	Type of Enclosure	:	Dust tight & weatherproof conforming to IP 65
2.	Material	:	3 mm sheet steel / fiberglass reinforced polyester(UV stabilized)
3.	Type of Cover	:	Solid unhinged with retention chain / Screwed at all four corners
4.	Paint	:	i) Exterior : Opaline green shade 275 of IS: 5 ii) Interior - Brilliant Glossy White.

Arvind S A Khan Praveen Kishore

			Surface / Two (2) inch Pipe stanchion
5.	Mounting	:	(At a dry compartment at one side of the enclosure / rack with front opening type door)
6.	Cable Entry	:	3 mm (min) Bottom / side Gland plate
7.	Gasket	:	Neoprene
8.	Grounding	:	Brass earth lug with green screw head External-2 nos , Internal-1no. (M6)
9.	Number of Drain Holes	:	Two at bottom capped
10.	Identification	:	Label for JB and Tags for cable
11.	Accessories	:	a) Rail mounted cage clamp type screwless terminals (suitable for conductor size up to 2.5sq.mm of suitable voltage grade) with markers and 20% spare terminals b) Cable gland (Brass) & raceways c) Ferrules & lugs (Brass) d) Aluminum back panel e) Canopy at top f) Mounting brackets g) bolts and nuts made of brass etc.

Arvind S A Khan Praveen Kishore

BHEL	**DATA SHEET FOR LOCAL PANELS**	SPECIFICATION NO.: PE-SS-999-145-054A 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,Voulme IV of contract specification)**	☐ EPOXY ENAMEL ☐ EPOXY POWDER COATED	
	MIMIC (TYPE OF MIMIC- MATERAIL, THICKNESS TO BE SPECIFIED DURING DETAILED ENGG.)	■ REQUIRED ☐ NOT REQUIRED	
	PANEL COLOUR (EXTERNAL) **(As per Annex-1,Section 7.6,Voulme IV of contract specification)**	☐ LIGHT GREY ☐ OPALINE GREEN	
	FINISH (EXTERNAL) **(As per Annex-1, Section 7.6,Voulme IV of contract specification)**	☐ MATT ☐ GLOSSY ☐ SEMI GLOSSY	
	PANEL COLOUR (INTERNAL) **(As per Annex-1,Section 7.6,Voulme IV of contract specification)**	☐ WHITE ☐ CREAM ☐ OFF WHITE	
	FINISH (INTERNAL) **(As per Annex-1,Section 7.6,Voulme 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)	

Arvind S A Khan Praveen Kishore

	DATA SHEET FOR LOCAL PANELS	SPECIFICATION NO.: PE-SS-999-145-054A	
		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		

	PREPARED BY	CHECKED BY	APPROVED BY	COMPANY SEAL
NAME	AANCHAL CHOUDHARY	SACHIN SRIVASTAVA	MA MANSOORI	NAME:
DESIGNATION	SR.ENGR	DY.MNGR	D. GM	
SIGNATURE				SIGNATURE:
DATE	16.09.2013	16.09.2013	16.09.2013	DATE:

Arvind S A Khan Praveen Kishore

FORM NO. PEM-6666-0

BHEL	**DATA SHEET FOR LOCAL PANELS**	SPECIFICATION NO.: PE-SS-999-145-054A VOLUME SECTION REV. NO. 02 DATE: 16.09.2013 SHEET 3 OF 3

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 MIMC THICKNESS OF MIMIC			
	PANEL COLOUR (INTERNAL)			
	FINISH (INTERNAL)			
	CLASS OF PROTECTION			
	CONTROL HARDWARE			
	FOUNDATION ARRANGEMENT			
	WEIGHT OF PANEL (Kg.)			

Arvind S A Khan Praveen Kishore

FORM NO. PEM-6666-0

	DATA SHEET FOR LOCAL PANELS	SPECIFICATION NO.: PE-SS-999-145-054A
		VOLUME
		SECTION
		REV. NO. 02 / DATE: 16.09.2013
		SHEET 3 OF 3

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			

	PREPARED BY	CHECKED BY	APPROVED BY	COMPANY SEAL
NAME	AANCHAL CHOUDHARY	SACHIN SRIVASTYAVA	MA MANSOORI	NAME:
SIGNATURE				SIGNATURE:
DATE	16.09.2013	16.09.2013	16.09.2013	DATE:

Arvind S A Khan Praveen Kishore

LCP Quality Plan

PEM :: C&I

STANDARD QUALITY PLAN FOR LOCAL CONTROL PANEL

STD QUALITY PLAN NO.:	**PE-QP-999-145-I056**
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 $ P	Agency $ W	Agency $ V	Remarks
	INCOMING											
1.0	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	---	---	

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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STANDARD QUALITY PLAN FOR LOCAL CONTROL PANEL

STD QUALITY PLAN NO.:	**PE-QP-999-145-I056**
VOLUME	IIB
SECTION	D
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 $			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	---	---	

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

PEM :: C&I

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VOLUME	IIB
SECTION	D
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 $			Remarks
									P	W	V	
5.0	Misc. Components like Gaskets, Terminal Blocks etc.	1. Verification of Type / Make	MA	Visual	Sample	BHEL Spec. & Mfrs. Catalogue	BHEL Spec. & Mfrs. Catalogue	Log Book	2	---	---	
		2. Surface defects	MA	Visual	Sample	BHEL Spec. & Mfrs. Catalogue	BHEL Spec. & Mfrs. Catalogue	Log Book	2	---	---	
		3. IR / HV on Terminal Blocks	MA	Electrical	Sample	BHEL Spec. & Mfrs. Catalogue	BHEL Spec. & Mfrs. Catalogue	Log Book	2	---	---	
	IN PROCESS											
6.0	Blanking / Bending / Forming	1. Dimensions	MI	Measurement	100%	Approved Mfr. drgs.	Approved Mfr. drgs.	Log Book	2	---	---	
		2. Surface defects after bending	MA	Visual	100%	Factory Standard	Factory Standard	Log Book	2	---	---	
7.0	Nibbling / Punching	1. Cutout Sizes	MI	Measurement	100%	Approved Mfr. drgs.	Approved Mfr. drgs.	Log Book	2	---	---	
		2. Deburring	MA	Visual	100%	Approved Mfr. drgs.	Approved Mfr. drgs.	Log Book	2	---	---	
	ASSEMBLY											
8.0	Frame Assembly & Sheet fixing	1. Dimensions	MA	Measurement	100%	Approved drg. / Mfr. Standards	Approved drg. / Mfr. Standards	Log Book	2	---	2	
		2. Alignment	MA	Measurement	100%	Approved drg. / Mfr. Standards	Approved drg. / Mfr. Standards	Log Book	2	---	2	
		3. Welding Quality	MA	Visual	100%	Approved drg. / Mfr. Standards	Approved drg. / Mfr. Standards	Log Book	2	---	2	
		4. Surface defects	MA	Visual	100%	Approved drg. / Mfr. Standards	Approved drg. / Mfr. Standards	Log Book	2	---	2	

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VOLUME	IIB
SECTION	D
REV. NO.	01 DATE: 22-02-2008
SHEET	4 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	
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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STD QUALITY PLAN NO.:	**PE-QP-999-145-I056**
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	---	---	
	FINAL											
12.	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	

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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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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	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	

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PC SPECIFICATION

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

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.

FURNITURE SPECIFICATION

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.

CABLE BOQ

CABLE SIZES FOR 4 X 270 MW BHADRADRI TPS PROJECT JOB NO. 411 (PER UNIT)	
Sl no.	**Cable Type**
	G-TYPE
1	2P X 0.5 sqmm
2	4P X 0.5 sqmm
3	8P X 0.5 sqmm
4	12P X 0.5 sqmm
	F-TYPE
1	4P X 0.5 sqmm
2	8P X 0.5 sqmm
3	12P X 0.5 sqmm
4	24P X 0.5 sqmm
	CONTROL CABLE
1	3C X 2.5 sqmm
2	5C X 2.5 sqmm
3	12C X 1.5 sqmm

KKS PHILOSOPHY

KKS NUMBERING PHILOSOPHY

For identifying (tagging) an instrument / equipment in Power plant KKS numbering scheme is used. The purpose is to assign a unique number to every equipment in the power plant. For C&I equipment unique number are to be provided up to the signal level so that a unique number Input / Output exist in DCS for every signal.

Normally KKS number is a 10 digit alpha-numeric code and is typically split into the following:

X	X	X	A	A	Y	Y	B	B	B

First three digits indicate the Sub-System. The Code for the major system are given as per **Annexure-**1.

Fourth and Fifth digits are the **Numerical Keys at System Code Level** and used to distinguish between main systems having same Alpha Codes.

Sixth and Seventh digits are the **Equipment / Apparatus / Measuring Circuit Code**. The code of various Equipment / Apparatus / Measuring Circuit is shown in **Annexure-2**

Eight, Nine and tenth digits are the **Numerical Keys at Equipment / Apparatus / Measuring Circuit Code** and used to distinguish between various instruments in the same sub-group. Numerical keys at System / Equipment / Apparatus / Measuring Circuit is shown in **Annexure-3**.

ANNEXURE-1

List of System / Sub-System Codes used in Power Plant:

1) Compressed air system : QEA, QEC
2) Ventilation System : SAA TO SAZ
3) Fire Detection & Protection System + Fire Water pumps : SGM, SGN, SGO, SGP
4) Sewage Treatment : SJA TO SJZ
5) Pre-treatment Plant : GBI, GBM, GBV
6) RO DM Plant : GCI, GCM, GBV
7) AC SYSTEM : QKA,QKB,...QKZ

ANNEXURE-2

Standard Equipment Codes:

AA	Valves including drives, also hand operated
AB	Seclusions, Lock, Gates, Doors
AC	Heat Exchanger
AE	Turning, Driving, Lifting equipment
AF	Continuous conveyors, Feeders
AG	Generator Units
AH	Heating and Cooling Units
AK	Pressing and Packaging equipment
AM	Mixer, Stirrer
AN	Blower, Air Pumps / Fans, Compressor Units
AP	Pump Units
AT	Purification, Drying, Filter
AV	Combustion Equipment e.g. grates

Standard Apparatus Codes:

BB	Vessels and Tank
BF	Foundation
BG	Boiler Heating Surfaces
BN	Injector, Ejector
BP	Flow and throughput limitation equipment (Orifice)
BQ	Holders, Carrying Equipment, Support
BR	Piping, Ducts, Chutes, Compensator
BS	Sound Absorber
BU	Insulations, Sheatings

Standard Measuring Circuits Codes:

CD	Density
CE	Electrical Quantities
CF	Flow, throughput
CG	Distance, Length, Position
CK	Time
CL	Level
CM	Humidity
CQ	Analysis (SWAS)
CS	Speed, Velocity, Frequency
CT	Temperature
CY	Vibration, Expansion

ANNEXURE-3

Numerical Keys

A) Numerical Keys at System Code Level

i) Use 10, 20, 30, ……. To distinguish between main systems having same Alpha Codes. Examples:

a) Main Steam (Left) and Main Steam (Right)

b) BFP – A/B/C

c) ID Fan – A/B, FD Fan A/B, AH – A/B

ii) For branch off from main system path having code say 10, keep the same alpha code and use 11, 12, 13 etc. Similarly for other branch off from main system path having code say 20, keep the same alpha code and use 21, 22, 23 etc and shall carry on further in the same way.

iii) If the branch off from main system / sub system path is used for some other system, where different alpha codes can be applied, then in that case the said branch line will be designated by the alpha codes of the system to which it is providing the input.

B) Numerical keys at Equipment Code level:

There are three numerical keys available for each type of equipment code. Following has been agreed upon considering present practice, better flexibility and ease in sorting.

i) Valves and Dampers --- *Equipment Code – AA*

N1 N2 N3

Motorised *(on/off duty)*	-	*0*	*01 to 50*
Motorised (inching duty)	-	*0*	*51 to 99*
Pneumatic (Control)	-	*1*	*01 to 50*
Motorised (thyrestor Control)	-	*1*	*51 to 99*
Sol. Operated	-	2	01 to 99
(Open / Close duty (Valves, NRVs, Gate)			
Hydraulic	-	3	01 to 99
NRV (Without actuation)	-	4	01 to 99
Manual	-	5	01 to 99
Manual	-	6	01 to 99
Relief & Safety Valves	-	7	01 to 99
Reserve	-	8	01 to 99
Reserve	-	9	01 to 99

ii) Field Instruments

Field Transmitters & Analog Signals	-	0	01 to 99
Field Switches & Binary Signals	-	1	00 to 99
PG Test Point	-	4	00 to 99
Gauges	-	5	00 to 99
Automatic Turbine Tester (ATT)-HWR	-	2	00 to 99
(Reserved for protection Signals used by Hardwar)			

Example of Numerical Key Usage:

In line with the philosophy adopted for Valves / Dampers /instruments etc. pumps and fans in the main systems (having different system code) can be numbered as AP/N100 and as AP/N101, 102, ……. Where system code is same.

LIST OF DELIVERABLES

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
INSTRUMENTATION							
1	PE-V9-411-XXX-I901	INSTRUMENT DATA SHEETS	A	-	VENDOR	C&I	
2	PE-V9-411-XXX-I902	INSTRUMENT SCHEDULE	I	-	VENDOR	C&I	
3	PE-V9-411-XXX-I903	INSTRUMENT INSTALLATION/ HOOK UP DIAGRAMS	A	-	VENDOR	C&I	
4	PE-V9-411-XXX-I904	FIELD JB TERMINATIONS /GROUPING DOCUMENT	I	-	VENDOR	C&I	
5	PE-V9-411-XXX-I905	QUALITY PLANS (CV,FE, Tx and Analyser)	A	-	VENDOR	C&I	
PLC PANEL							
1	PE-V9-411-XXX-I906	PLC CONFIGURATION DRAWING	A	A	VENDOR	C&I	
2	PE-V9-411-XXX-I907	PLC PANEL GA (INTERNAL & EXTERNAL) DRAWING	A	-	VENDOR	C&I	
3	PE-V9-411-XXX-I908	CONTROL SCHEMES (BLOCK LOGIC)	A	-	VENDOR	C&I	
4	PE-V9-411-XXX-I909	PLC INPUT / OUTPUT SIGNAL LIST	I	-	VENDOR	C&I	
5	PE-V9-411-XXX-I910	UPS BATTERY CHARGER/ BATTERY DATASHEET & SLD	I	$$	VENDOR	C&I	
6	PE-V9-411-XXX-I911	UPS SIZING CALCULATIONS	I	-	VENDOR	C&I	
7	PE-V9-411-XXX-I912	BATTERY SIZING CALCULATIONS	I	-	VENDOR	C&I	
8	PE-V9-411-XXX-I913	CONTROL DESK LAYOUT / GA DRAWING	A	-	VENDOR	C&I	
9	PE-V9-411-XXX-I914	PLC-OWS/PRINTER FURNITURE BOM	A	-	VENDOR	C&I	
10	PE-V9-411-XXX-I915	PLC CONTROL ROOM LAYOUT DRAWING	A	-	VENDOR	C&I	
11	PE-V9-411-XXX-I916	PLC CATALOGUE	I	-	VENDOR	C&I	
12	PE-V9-411-XXX-I917	PLC QUALITY PLAN & FAT PROCEDURE	A	-	VENDOR	C&I	
13	PE-V9-411-XXX-I918	LIST OF SIGNAL EXCHANGE WITH DDCMIS (BOTH HARDWIRED & SERIAL INTERFACE IN BHEL FORMAT)	A	`	VENDOR	C&I	
14	PE-V9-411-XXX-I919	PROCESS GRAPHIC MANUSCRIPTS PLC	I	-	VENDOR	C&I	
15	PE-V9-411-XXX-I920	PROCESS GRAPHIC MANUSCRIPTS FOR DDCMIS	I	-	VENDOR	C&I	
16	PE-V9-411-XXX-I921	CABLE SCHEDULE (IN BHEL EXCEL FORMAT) & CABLE INTERCONNECTION DETAILS	I	-	VENDOR	C&I	
17	PE-V9-411-XXX-I923	PANEL & ELECTRONIC EARTHING REQUIREMENT	I	-	VENDOR	C&I	
18	PE-V9-411-XXX-I924	PANEL HEAT DISSIPATION DATA	I	-	VENDOR	C&I	
19	PE-V9-411-XXX-I925	MANDATORY SPARES BILL OF MATERIAL	A	A	VENDOR	C&I	
20	PE-V9-411-XXX-I926	PLC O & M MANUAL	I	-	VENDOR	C&I	
21	PE-V9-411-XXX-I927	PLC EARTHING SCHEME	I	-	VENDOR	C&I	
	Notes:	411 - Project No					
		XXX -SI No of MAX Package					
		$$ -Approval by BHEL if Vendor BBU Item Approval by Customer if Customer BBU Item					

ANNEXURE-I

LIST OF MAKES

Arvind S A Khan Praveen Kishore

S.No.	Description	Makes
1.	AIR WASHER & UAF*	HYDERABAD POLUTION CONTROL / SK SYSTEM / ADVANCE VENTILATION / DRAFT AIR / BLUE STAR / VOLTAS / STERLING WILSON & ROOTS COOLING SYSTEM / C.DOCTOR & OTHER BHEL QUALIFIED VENDOR
2.	CENTRIFUGAL FAN	FLAKT / KRUGGER / DRAFT AIR / HYDERABAD POLUTION CONTROL / ADVANCE VENTILATION / PATEL AIR / NICOTRA/ SK SYSTEM / MARATHON / CB DOCTOR / SARLA
3.	AXIAL FLOW FANS/RE UNITS	HYDERABAD POLLUTION/ SK SYSTEM / ADVANCE VENTILATION / KRUGER / NICOTRA / MARATHON / FLAKT / CB DOCTOR/ PATEL AIR /SITAL
4.	CENTRIFUGAL WATER PUMP	BEST & CROMPTON / JYOTI / SAM TURBO / KBL / KSB / M&P / VOLTAS / BEACON-WEIR / WORTHINGTON / FLOWMORE / SULZER / BHARAT PUMPS & COMPRESSORS LTD / FLOWSERVE INDIA CONTROL PVT LTD / V-FLOW PUMPS & SYSTEMS CO
5.	INDUCTION MOTORS (LT)	SIEMENS / ABB / CGL / MARATHON / KEC / BHARAT BIJLEE / NGEF /JYOTI / LHP
6.	AIR FILTER	PUROLATOR / FMI / ANFILCO / TENACITY / JOHN FOWLER /SPECTRUM / AIR TECH / PUROMATIC
7.	INSULTATION MATERIAL	BEARDSHELL / K-FLEX / PARAMONT/ ARMAFLEX / SUPREME / LLOYDS / UP TWIGA
8.	FIRE DAMPER	TSC / CARRYAIRE / RAVISTAR (SYSTEM AIR)
9.	BUTTERFLY VALVE	AUDCO / FOURESS / INTER VALVE / BDK / WEIR BDK / TYCO / CRANE PROCESS / KEYSTONE
10.	NON RETURN VALVE	LEADER / H.SARKAR / FLUID LINE / HI -TECH / CRESENT / A V VALVES / BANKIM & COMPANY / SHIVADURGA
11.	GATE/GLOBE VALVES	CRESENT / BDK / AUDCO / FOURESS / KIRLOSKAR / SANT / BOMBAY METAL & ALLOYS / BANKIM / LEADER / H SARKAR / AV VALVES / VENUS PUMPS AND ENGG
12.	PIPING - ERW	SURYA ROSHNI / TISCO / DADU PIPES / INDUS TUBE / WELSPUN / TATA / BST / JINDAL / SAIL
13.	GI SHEETS FOR DUCTING	TISCO / INDIAN IRON & STEEL CO LTD. / RASHITRYA ISPAT NIGAM LTD. / ESSAR/ ISPAT INDUSTRIES / JSW STEEL / LLOYDS STEEL / BHUSHAN / TATA / SAIL / JINDAL
14.	HUMID STAT	JHONSON CONTROL / HONEYWELL / PENN
15.	PRESSURE GAUGE	GENERAL INST CONSORTIUM / BELL / H.GURU INST / WAAREE INSTRUMENTS / H. GURU IND / FORBES MARSHALL / MANOMETER / A.N. INST / GAUGES BOURDON / GLUCK / WIKA / ASHCROFT / BAUMER TECHNOLOGIES

16.	**TEMPERATURE GAUGE**	H. GURU IND/ H.GURU INST/ FORBES MARSHALL/DETRIVE INST & ELECTRONICS / PYRO ELECTRIC /TOSHNIWAL BROSS / WAREE INSTRUMENTS / A.N.INST / GOA INSTRUMENTS / WIKA/ ASHCROFT / H GURU (SI)
17.	**LEVEL GAUGE**	GENERAL INSTRUMENTS / CHEMTROLS / SBEM, PUNE/ AUTOMAT MUMBAI /SIGMA / TOSHNIWAL / TECHNOMATIC / TELACO /LEVCON / D K INSTRUMENTS / PUNE TECHTROL / FLOW STAR
18.	**PRESSURE SWITCH / DP SWITCHES**	BELLS / DANFOSS / DK INSTRUMENTS/ DRESSER / SOR INC / VASU / SWITZER / INDFOSS / TRAFAG / GIC / ASHCROFT
19.	**LEVEL SWITCH**	SBEM / BLISS ANAND / HI TECH / RAMAN INST / SIGMA / SOR INC / WAREE INST / LEVCON / DK INSTURMENT / V ATUOMATE /CHEMTROLS / SIMENS / FLOW STAR / TRAC
20.	**Y / POT STRAINER**	MULTITEX / GREAVES COTTON / JAYPEE / SANT / OTOKLIN / GRAND PRIX / GUJARAT OTOLIFT / DS ENGG / SAROJINI ENTERPRISE / BHATIA ENGINEERING / FILTERATION ENGINEERS INDIA PVT LTD / SUNGOV ENGINEERING
21.	**CONTROL PANEL**	INDUSTRIAL CONTROL & APPLIANCE/ PYROTECH /POSITRONICS / CONTROL & SWITCHGEAR /SIEMENS / L&T /GE POWER /RITTAL / HOFFMAN
NOTE		
	* Designed by C. Doctor / Blue Star / Voltas / Hyderabad Pollution Controls / SK System /Advance Ventilation / Draft Air / Sterling & Wilson / Roots cooling / Other BHEL qualified Vendor and fabricated by their approved fabricators.	
	Above sub-vendor are also subjected to Customer approval during detailed engineering.	

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ANNEXURE-II

MANDATORY SAPRE LIST

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LIST OF MANDATORY SPARES FOR VENTILATION SYSTEM

S.No.	Items	Quantity	Remarks
1.0	**VENTILATION SYSTEM**		
1.1	**Centrifugal fans**		
1.1.1	Set of bearings for Air washer fans	1Set for each Type of Fan	
1.1.2	Set of bearings for U.A.F. fans	1Set for each Type of Fan	
1.2	**Centrifugal pumps**		
1.2.1	Set of bearings for Air washer pumps	1Set for each Type and rating of Pump	
1.2.2	Set of bearings for U.A.F. pumps	1Set for each Type and rating of Pump	
1.2.3	Mechanical seal / gland packing as applicable, shaft sleeve & casing wearing rings and lantern rings for shaft and impeller	1Set for each Type and rating of Pump	
1.2.4	Complete Impeller Assembly	1Set for each application and ratings of Pumps	
1.2.5	Key for impeller	1No. for each application and ratings of Pumps	
1.2.6	Pump shaft	1No. for each application and ratings of Pumps	
1.2.7	Coupling	1No. for each application and ratings of Pumps	
1.3	**Spray Nozzles**		
1.3.1	Spray nozzles for air washer unit	5%	
1.3.2	Spray nozzles for U.A.F. unit	5%	
1.4	**SS Filters**		
1.4.1	SS Filters for Air washer	10%	
1.4.2	SS Filter for Unitary air filtration unit	10%	
1.5	**Basket for POT Strainer**		
1.5.1	Strainer Busket for Air Washer	1No. for each type and size	
1.5.2	Strainer Busket for Unitary Air Filtration unit	1No. for each type and size	
1.6	**Valves**		
1.6.1	Gate valve for Air washer	10% or Minimum 1No. Whichever is higher	
1.6.2	NR Valve for Air Washer	10% or Minimum 1No. Whichever is higher	
1.6.3	Gate valve for Unitary Air Filtration Unit	10% or Minimum 1No. Whichever is higher	
1.6.4	NR valve for Unitary Air Filtration Unit	10% or Minimum 1No. Whichever is higher	
1.6.5	Gate Valve for Make-up Drain of Air washer	10% or Minimum 1No. Whichever is higher	
1.6.6	Gate valve for UAF	20% or Minimum 2Nos. Whichever is	

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		higher	
1.6.7	Other LP Piping valves & traps - Complete assembly	5% or min. 1 no. (whichever is more) for each size, type & rating for total population	
1.7	**Wall mounted supply/ Exhaust fan**		
1.7.1	Fan-motor Bearing	1 set for each rating of fan	
1.7.2	Vibration Isolators	1 set for each fan	
1.8	**Electrical Spares for Motors**		
1.8.1	Motor bearing set for Air washer fan motor	1 set for each type of fan motor	
1.8.2	Motor bearing set for UAF fan motor	1 set for each type of fan motor	
1.8.3	Motor bearing set for axial flow supply fan motor	1 set for each rating of fan motor	
1.8.4	Motor bearing set for axial flow exhaust fan motor	1 set for each rating of fan motor	
1.9	**Mandatory Spares for Temperature Elements and Thermowells**		
1.9.1	Thermocouple / RTD elements (10% of each type and length of elements , or a minimum of one number, whichever is more.)	2 Lot	
1.9.2	Thermowells for each type of temperature sensors (10% or a minimum of one for each type, whichever is more.)	2 Lot	
1.10	**Mandatory Spares for Electronic Transmitters (for pressure, DP, Flow, level, Temperature) and Electrical Transducers.**		
1.10.1	Transmitters and Electrical Transducers (10% of total number of offered for each model and type for the project or a minimum of one number, whichever is more)	2 Lot	
1.11	**Mandatory spares for local gauges/switch (for Pressure, DP, Temperature, Flow, level , etc.)**		
1.11.1	Local gauges/ Switch (for Pressure, DP, Temperature, Flow, level, etc.) (10% of total number of instruments offered for each model and type for the project or a minimum of one number, whichever is more.)	2 Lot	
NOTE			
1.	Unless stated otherwise, a "set" or "Lot" means items required for complete replacement in one equipment of each type / size/ range.		
2.	Wherever quantity has been specified as percentage (%), it shall mean percentage (%) of the		

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	population of the item required for one unit of 270 MW in the station (project), unless specified otherwise.
3.	In case of Bought Out items, itemised spares list may be vendor specific and may differ from the list of spares mentioned above. In such cases, The quoted price shall be considered for applicable items only without any change in the contract price.

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ANNEXURE-III

WATER ANALYSIS

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DESIGN CLARIFIED WATER ANALYSIS

SL. NO.	Constituent	Unit	Value
1.	pH	-	7.73
2.	Color and Odor	-	-
3.	Oil and grease	mg/l	-
4.	BOD	-	-
5.	COD	-	-
6.	Suspended solids	mg/l	≤10
7.	Turbidity	NTU	16
8.	Calcium as Ca	mg/l	60
9.	Magnesium as Mg	mg/l	34
10.	Sodium as Na	mg/l	-
11.	Potassium	mg/l	-
12.	Total Hardness as CaCO3	mg/l	94
12.	Chloride as Cl	mg/l	30
13.	Sulphate as SO4	mg/l	58
14.	Sulphide	mg/l	-
15.	Total Alkalinity as CaCO3	mg/l	140
16.	P-Alkalinity as CaCO3	mg/l	-
17.	Nitrates as No3	mg/l	-
18.	Nitrite	mg/l	-
19.	Silica as SiO2	mg/l	5.2
21.	Iron as Fe	mg/l	0.007
23.	Total dissolved solids	mg/l	218
24.	Conductivity at 25 degree C	Micro Siemens /cm	328
25.	Dissolved Oxygen as O2	mg/l	-
26.	Carbon dioxide free	mg/l	-

1. TEST REPORT BY ENVIRONMENT SUB-DIVISION (TSPGCL)
2. SAMPLE NAME:- GODAVARI RIVER WATER
2. LOCATION :- AT MANUGURU
3. SAMPLING DATE:- 09.10.2014
4. REPORTING DATE:- 10.10.2014

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ANNEXURE-IV

LIST OF TOOLS AND TACKELS

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