useless, damaged or broken, as a result of poor packing and/or stowing, or due to corrosion, subsequent to insufficient or inadequate protection. All direct or indirect costs resulting thereof, will be back-charged to VENDOR.

SHIPPING INSTRUCTIONS

The scope covers the basis of design, system philosophy, equipment selection and Control Philosophy of **SEWAGE TREATMENT PLANT** for **400 MW MARIB GAS TURBINE POWER STATION PHASE II REPUBLIC OF YEMEN.**

1.0 SEWAGE TREATMENT PLANT (Ref. Drg. no. PE-DG- 372-673-A001)

Plant sewerage is collected in a septic tank. Overflow from the septic tank is collected in a collection chamber From the collection chamber overflow is pumped to the aerobic treatment chamber by means of 2x100 % overflow transfer pumps. Extended aeration is done in the aerobic treatment chamber with the help of air supply from blowers. The treated water after aerobic treatment is transferred to the N-Pit (DM Plant) by means of 2X100% treated water transfer pumps.

2.0 Control Philosophy.

The interlocks required for operation of pumps in various systems shall be PLC based.

The control of all pumps and blower is PLC. In addition, each pump will be provided with one local start/stop push button (lockable type) stations. Suitable weather protection shall be provided for LSSPB (Local start stop push button) located near each pump.

The sewage waste from buildings is collected in a septic tank through gravity. The overflow from septic tank is collected in a collection tank. Once the level in the collection tank is high, one out of the two overflow transfer pumps (1W+1S) shall be started remote/manually and the waste is transferred to aerobic treatment chamber. Overflow transfer pumps shall be interlocked to trip with the low/high level of the tank via level transmitter.

The aerobic process in the aerobic treatment chamber is a batch process. Once the waste enters the aerobic treatment chamber, one out of the two Air blowers (1W +1S) shall be started automatically/manually. The batch timing is around 8 hours. Once the process is completed after 8 hours, Air blowers shall be stopped automatically/ manually and one out of the two Treated water Transfer Pumps (1W+1S) shall be started automatically/ manually. Treated water transfer pumps shall be interlocked to trip with the low/high level of the tank via level transmitters.

ON/OFF/TRIP interlocks for submersible pumps and air blower shall be provided by providing suitable arrangement to meet the system requirement.

3.0 Sewage Treatment Plant is designed for the following sewage flow rate and characteristics:

Flow Rate : 0.5 m3/hr.
BOD : 300 mg/l

4.0 Effluent from Sewage Treatment Plant shall meet the following norms-

Parameter	Maximum value
BOD	20 ppm

Bharat Heavy Electricals Limited
International Operations - Projects Division
Integrated Office Complex,
Lodhi Road
New Delhi -110003

400 MW MARIB GAS TURBUINE POWER STATION PHASE-II

Following dispatch instructions for effecting supplies under the above contract are being issued for compliance by all the units involved in this project.

Sr. No.	Item No.	Details	Action By
01	01	**Purchaser's Name and Address:** Public Electricity Corporation Airport St P.O. Box 178 Sana'a Republic of Yemen Attention: Eng. Abdul Mumen M. Mutaher Managing Director Tel : (967 1) 328 141-142 Fax : (967 1) 328 150 E-mail : YPECNT@Y.net.ye	For information
02	01	**Delivery Terms:** DAP (Marib Site YEMEN) Public Electricity Corporation Airport St P.O. Box 178 Sana'a Republic of Yemen	Units to ensure proper marking on the boxes so as to Identify the final destination clearly.
03	01	**Seller's Name and Address:** Bharat Heavy Electricals Limited International Operations Division Lodhi Road Integrated Office Complex New Delhi –110003, INDIA	For information
04	01	**Payment Terms for Equipment Supply:** Contract Terms: Advance - 10% of the Contract price. Supply– 80% on submission of shipping documents 5% on the receipt of Taking over and Acceptance Certificate and 5% on the receipt of Final Acceptance Certificate	All Units
05	01	**Shipping Marks :** As Per LC (Copy Enclosed)	All Units
06	01	**Consignee:** As per LC (Copy Enclosed)	All Units
07	01	**Notifying Party :** As Per LC (Copy Enclosed)	All Units

08	**Packing Instructions & Inspection Prior to Dispatch by Supplying Units/Sub-Vendors:**		All Units & Suppliers
	01	Packing (tare) shall be part of the Equipment cost and shall not be subject to return. The packing should ensure integrity and cohesiveness of each delivery batch of Equipment during transportation. In case of Equipment assemblies and unit's delivery in the packing of glass, plastics or paper the specification of packing with the material and weight characteristics are to be indicated.	All Units/Suppliers
	02	**Special instructions from PEC Yemen :**	
	02.1	All equipment and instruments should be fully packed and protected from damage during transportation and field storage. All machine surfaces should be protected with planks or similar materials and reinforced with metal strips or plates from the outside.	All Units/Suppliers
	02.2	All electrical / electronics equipment such as motor, switch, control device, instrument and component should be sealed with polyethylene insulation and a corresponding drying agent should be provided.	All Units/Suppliers
	02.3	For all piping ends as well as pipes and tanks, the openings should be protected from damage and sealed to avoid getting affected by particulates, moisture and air. These Protection measures should be kept intact before the start of installation or moving for periodic inspection. The cost spent for the moving, modification and replacement of the packing and protection device would be paid by the BHEL.	All Units/Suppliers
	02.4	A waterproofed packing list should be provided in each planks or packing case. The name of articles in the packing case should be marked clearly on the packing list so as to be identified easily.	All Units/Suppliers
	02.5	The articles in the case should be supported by wooden bars in order to be fixed safely and it should not be wedged individually with wooden pad. The marks outside the case should be printed with climate proof materials or paints so as to be protected from being removed during transportation.	All Units/Suppliers
	02.6	All materials and equipment should be packaged according to the typical environmental conditions during storage. In case of severe conditions, these materials and equipment should be packaged carefully by taking a full and appropriate preventive measure to protect from any damage or wear. The marks should be painted or printed clearly and durably with characters of 40 mm height at minimum on both ends of the packing case. The labels should be well protected to prevent loss / tempering.	All Units/Suppliers
	02.7	A mark indicating the correct lifting position should be shown by an arrow on the packing case.	All Units/Suppliers
	02.8	**Preparation for Shipment of Operational Spare Parts**	
	02.8.1	Shipping preparations shall be of export quality and crating shall adequately protect the items against injurious corrosion, dampness, breakage, or vibration that might be encountered in their transportation and handling. **BHEL to submit a detailed packing and crating procedure to PEC on a parent equipment basis at least sixty calendar days prior to shipment.**	All Units
	02.8.2	Operational spare parts shall be crated on a parent equipment on exclusive basis and there shall be no common crating of unrelated spare parts. For items too small to be individually crated, they have to be crated on the same kind of equipment basis under condition that they are classified and packed in a vinyl bag or small box on a parent equipment basis.	All Units

	02.8.3	To the extent that BHEL intends to utilize containers in the shipment of operational parts, BHEL shall utilize good quality shipper owned or nonreturnable containers which should be conveyed to Owner before its receipt at the Site.	All Units/ROD
	02.8.4	All shipments of operational spare parts shall be consolidated prior to shipment and shall be transported to the Site in accordance with the contractual shipping schedule.BHEL shall not make partial or multiple shipments of operational spare parts for the same parent equipment item without prior approval of Owner.	All Units
	02.8.5	BHEL shall submit schedules identifying completion of fabrication, ship date and site delivery dates for the operational spare parts on a parent equipment basis.	All Units
	02.8.6	**To the greatest extent practicable , BHEL shall individually tag each Operational Spare Part.** The tagging data shall include the Contract number, Item number and the part identification number. Where such individual tagging is impracticable due to the size or quantity of certain operational spare parts the tagging data shall be fixed to the permanent packing of these operational spare parts.	All Units/Suppliers
	02.8.7	BHEL shall prepare packing lists in strict accordance with the tagging requirements and shall reference the Exhibit C, Section 3. Item numbers of the individual operational spare parts including required quantities. Contractor shall include on the packing list the net weight of operational spare parts exceeding 300 Kg. Packing lists shall also provide a certification verifying that the packing list quantities constitute “Partial” or “Complete” shipment of all required quantities of operational spare parts.	All Units/Suppliers
	02.8.8	**All packages to be wrapped in <u>Sealed transparent polythene</u> inside the crates for effective weather proofing**	All Units/Suppliers
	03	Each package should have the following inscriptions and signs stenciled with an indelible ink legibly and clearly: Destination Package number: BHEL/YMN/XXX/YYY/ZZZZZ where XXX stands for Unit abbreviation e.g. HWR , HYD ,EDN, PEM, RPT etc YYY stands for Vendor abbreviation Following series of ZZZZZ should be used by Different Units HWR (10000) ,HYD (20000),PSNR (30000),PEM (40000),BPL(50000),RUD(60000), TBG(70000),TRY(80000),EDN(90000) i.e. first package dispatched from HWR should be numbered : BHEL/YMN/HWR//10001 . Gross and Net weight Dimensions Lifting places Handling marks and the following delivery marking: CONTRACT Nr. 12/2008 PURCHASER: PEC YEMEN	All Units/Suppliers
	04	**<u>Completeness of Contents of each packing case:</u>**	
	04.1	Concerned CQA/Unit QC/Third Party Inspection Agency shall verify the completeness of contents of each package w.r.t packing list both in terms of quality and quantity before authorising dispatch of the consignment.	All Units/Suppliers
	04.2	Packing commensurate with **international standards** and accepted norms will be ensured by CQA/ Unit QC/Third Party Inspection Agency. Packing has to be sea-worthy and secure. As far as possible, the packing has to be rectangular in shape for optimum space utilization in the ship and economize on shipping costs. **Projections on packages are prohibited.**	CQA/All Units

	04.3	The packing list has to be checked and certified by the Inspection agency (ies) with due signatures. All packages shall be enclosed in suitable GI sheets on all sides.	CQA/All Units
	04.4	No loose items / Gunny bag packing are allowed for shipment. Proper pallets and crates are to be used for packing of Oil drums and Structures.	CQA/All Units
	05	**Routing of Packing Lists:** Packing list is an extremely important document, which forms a part of export documentation in connection with the processing of customs formalities. Packing List has to be generated by units/Unit vendors and sent to IO and ROD, Mumbai (both at the same time), two weeks in advance, for processing and obtaining shipping bills' clearances and avoiding octroi payment through 'N' form at Mumbai.	All Units/ suppliers
	06.1	**Advance intimation to ROD, Mumbai & IO** All supplying units/vendors will give at least 15 days advance intimation to ROD, Mumbai & IO along with package details before actual dispatches to arrange for storage/shipping arrangements by ROD Mumbai and customs invoicing by I0. Information must be sent to consolidate the details and arrange for shipments in time.	All Units
	06.2	**Telephonic Intimation to ROD Mumbai of Movement of Vehicles:** Vehicle drivers to be instructed by the units to contact ROD regarding movement of vehicles on daily basis for heavy lifts, especially 2 days before arrival at Mumbai so that suitable directives can be given to the driver of the vehicle for further transportation of the goods either to docks or godown.	All Units
	07	Excise Attestation at Works: To avoid opening of big cases for examination by customs at port of shipment, the supplying unit may arrange to get the packing cases sealed by local excise authorities/ self certification and to get the relevant invoices and packing lists endorsed from Superintendent, Central Excise. For this purpose, Units should send the packing lists to IO at least 2 weeks in advance to enable prepare Shipping Invoices for furnishing to the units for requisite attestation and sending the same to ROD Mumbai through fastest means for a smoother and faster customs clearance. Also Units to provide "specification of packing with the indication of the number of cargo packages, type of packing and weight of packing in English" along with the packing list.	All Units/ suppliers
	08	Provision of Inspection Windows on Packages: Unit/Vendors should provide inspection window of size 6" x 4" (glass perplex) for customs examination for all packages (above 1.5 x 1.5 x 1.5 cu m) involving panels of any kind. Care would be taken to ensure that all packages are properly sealed to avoid ingress of moisture, rodents etc. Packing slip folders shall be attached in each box.	All Units/ Suppliers
	09	Transportation Drawings for Heavy Weight/ODC consignment: For any package/item weighing above 20000 kgs and/or size greater than 2.5 X 2.5 X 4 m : Detailed engineering documents (at least 4 sets) for all items of the above category shall be furnished by respective units to issue shipment enquiries in a proper manner. This would include **Gas Turbine ,Transformers, Lube Oil tanks,Storage Tanks (Oil and Water) and Generator**. The drawing has to include center of gravity of the item clearly (Units to identify such items and notify IO as soon as the engineering documents are released).	All units

	10	Lifting Beams: **All heavy lifts for which safe handling is essential at the port of dispatch shall be accompanied by lifting beam on non-returnable basis**	All Units
09	01	Marking for Safe Handling: To ensure safe handling, packing case shall be marked to show the following: • Upright position. • Sling position and Centre of Gravity position. • Storage category. • Fragile components (to be marked properly with a clear warning for safe handling).	All Unit
10	01	Marine Insurance Policy: Insurance Policy for 110 percent value of the contract covering all risks including war and SRCC from Port of shipment in India/Third country direct dispatches, to site shall be taken by IO Insurance Policy and it shall indicate PEC as co-insured.	IO Projects
11	**Shipping Documentation including those covered by customs requirements:**		
	01	Customs Invoices: Values to be allocated by IO (Alternatively, Excise attested invoices where the package is sealed and dispatched by the units)	ROD/ IO Projects/ All Unit
	02	Packing List	All Units /Sub-vendors of units
	03	ARE1 forms/Excise Invoice corresponding to Unit invoice values and Delivery challans.	All Units /Sub-vendors of units
	04	Chartered Engineer's Certificate, applicable to be arranged by Units. Care should be taken to ensure that usage of the materials shown in C.E. certificate out of DEPB goods is not disproportionate.	All Unit/ROD
	05	Catalogues/literature/write-up in case of customs endorsement for discharging exports obligation in case of DEEC imports to be made available to ROD before arrival of goods in the city of port of dispatch.	All Unit
	06	Unit's sub-vendors, whose responsibility of supply is upto FOB, can make their own arrangements of Customs House Agents as well as Octroi clearance, apart from physical examination of the cargo at the port of dispatch and make arrangements of loading on BHEL's nominated vessel. BHEL, in such a case, through ROD would arrange to furnish a copy of the shipping invoice to CHA of sub-vendors. All units to keep ROD Mumbai informed in this regard about the arrangements made with sub-vendors.	All Units/ Suppliers/ROD
	07	To avoid any problem with Octroi post at Mumbai & Customs, the values appearing in Unit invoice sent with the cargo shall be preferably within ± 10% of IO-Projects shipping invoice value.	All Units/Rod
	08	**Octroi Clearance:** Drivers/Escorts carrying the export cargo for this project on behalf of the units to be advised to contact the agents at Octroi Naka:(To be intimated by RODMumbai) Copies of the dispatch documents must be sent to ROD Mumbai by i) Fax ii) e-mail through scanning of the documents with copy to IO	All Units/Rod
12		Full Set of Clean Multimodal Transport Document: Complete set of shipping B/L showing freight prepaid as per the rates of regular shipping lines. In case of Air Freighted consignment, one original of AWB is required together with three copies of the same.	ROD/ IO Projects

13		Certified Inspection Certificate Approved by Customer: The certificate signed by PEC inspector (if equipment tested in presence of PEC representative) is to be provided to IO . In case the Certificate is signed by BHEL/Third Party Inspection Agency,it is to be provided by Units/ suppliers to IO and IO will get it approved from PEC.	All Units/ Suppliers

14	**Shipping Carrier Specification and related Requirements:**		
	01	Certificate of Freight having been pre-paid as per the regular shipping lines is required on MTDs.	ROD/ IO Projects
	02	Subject cargo would be generally shipped under the deck. Specific confirmation/clearance of IO is needed for shipment on deck.	ROD/ IO Projects
	03	Vessel age to be restricted as per insurance policy in force Buyer's Reference (Contract No.) is required on B/Ls.	ROD/ IO Projects
	04	For Third Country Supplies , concerned units will ensure all the above certificates in addition to Certificate of Origin.	All Units/ Suppliers
15	**Guidelines for Dispatches from Units/Indian Vendors:**		
	01	Vehicle drivers shall carry ARE1 in photocopy (3 originals to be sent to ROD). Each consignment carried by the vehicle shall have a separate ARE1 and it must be ensured that materials under one ARE1 get transported in the same truck/trailer. In order to avoid any problems at port of dispatch from the point of view of i) shipping bill preparation and passing thereof ii) 'N' form at Octroi check post and iii) control and movement of cargo within Mumbai and iv) physical examination of cargo by customs, the materials under the same category e.g. a) DEEC cargo b) Free shipping bill cargo c) DEPB (duty entitlement pass book scheme) and d) duty drawback must be sent in the same truck/trailer. Units to ensure that ROD is communicated very clearly the type of shipping bills to be prepared, well before the materials are dispatched from the works.	All Units
	02	<u>All materials to be dispatched under intimation to:</u> Senior Manager(Exports) Bharat Heavy Electricals Limited Regional Operations Division 14th Floor, World Centre 1, Cuffe Parade Mumbai-400005 Attention: Mr.Sanjeev Shikhare Telephone No.: 22171302 (Mumbai)	All Units/Rod
	03	<u>Clearing Agents:</u> All materials to be dispatched to Mumbai on door delivery basis, freight prepaid to the address of the clearing agents(to be specified by ROD, from time to time)	All Units/Rod
16	01	<u>Customs formalities Period:</u> Packages arriving at the port shall have a minimum time of 3 working days for customs examination and other related formalities in respect of the cargo under shipment. The goods received after arrival of the ship may not be loaded if either sufficient time does not exist or space available in the ship is booked by the carrier for other exporters due to lack of availability of the goods at the port in time for shipment from BHEL. In cases, where the committed cargo to the carrier based upon information received from all the units does not reach in time of scheduled shipment at the port of dispatch, IO-Projects would be within its right to decide the priority of loading as per the project schedule requirements given the condition that adequate space in the ship is not available to accommodate the cargo.	For information
17	01	<u>Triplicate ARE1 forms for Cancellation of Bonds:</u> It is necessary that the units ensure that ARE1 forms are sent in Triplicate to ROD Mumbai. After ROD Mumbai effects the shipment, endorsement of customs on triplicate copy of ARE1 form would be obtained by ROD Mumbai and sent to the concerned unit within 6 to 8 weeks for cancellation of the excise bond.	Units/ ROD Mumbai

18	01	Formalities in Connection with 'N' form: After the shipment is effected, requisite formalities indicating physical export of the goods earlier exempted from payment of Octroi at Mumbai will have to be ensured. Units to ensure this from their sub-vendors because In past , Octroi notices from Mumbai municipal corporation were received and 'N' form facilities were withdrawn at times.	Units
19	01	Shipping Procedures and ROD Responsibilities: Consolidation of Packages and Storage in Warehouse: ROD Mumbai either themselves or through their CHA would ensure following: • Proper storage of goods at an elevated level if store is in open to avoid damages to the consignment during rainy season (All the packages to be covered with a proper tarpaulin in open storage). • All Electrical and C&I items to be stored indoors. • Consolidation of the goods as per summary packing lists. •Check marks and numbers on packages. Carry out the corrections, if necessary. • Label the packages linking to the proposed shipping carrier to ensure that package does not get left out.	ROD

KKS NUMBERING

13.0.0 POWER PLANT CODING SYSTEM

The Contractor shall apply a plant identification system showing the name and number of each item of plant and its respective arrangement drawing number and add any additional items necessary to fully identify the plant. The identification and numbering of equipment, systems, items, etc. of supply, as well as of all documents and drawings shall be in accordance with the KKS system (Kraftwerkskennzeichnungssystem = Power Plant Coding System PPCS)) or equal. The KKS system is available from

VGB-Kraftwerkstechnik GmbH,
Verlag technisch-wissenschaftlicher Schriften
Klinkestrasse 27 – 31, 45136 Essen, Germany.

There is to be only one description for any one item of plant and this must be used consistently for plant, electrical and instrumentation designations throughout.

The Contractor shall supply all labels, nameplates, instruction and warning plates necessary for the identification and safe operation of the plant, and all inscriptions shall be in English language as well as local language.

All labels, nameplates, instruction and warning plates shall be securely fixed to items of plant and equipment with stainless steel rivets, plated self tapping screws or other approved means. The use of adhesives will not be permitted.

Nameplates for plant and equipment identification and record purposes shall be manufactured from stainless steel or aluminum with a mat or satin finish, and engraved with black lettering of a size which is legible from the working position.

Warning plates shall be manufactured from stainless steel or aluminum engraved red white lettering on a white background and sited in the position where they afford maximum safety of personnel.

All equipment within panels and desks shall be individually identified by satin or mat finish stainless steel or aluminum labels, where approved.

Each circuit breaker panel, electrical control panel, relay panel, etc. shall have a circuit designation label on the front as well as on the rear panels engraved with black lettering in accordance with the circuit designation system. Circuit designations must be precise and convey complete information. There should be no doubt whatsoever for the operation as to which area of the plant a particular feeder is supplying with power. Labels such as interconnector 1, feeder 2 are not acceptable. Corridor type panels shall in addition have circuit designation labels within the panels.

Pipework systems shall be identified with a color identification systems in conformity with the colors according to the chosen standards, with colors at the nameplates and, if necessary by color bands and with KKS numbering and plain language. The direction of flow shall be shown.

Each valve shall be fitted with a stainless steel or aluminum nameplate indicating the valve service and reference number in accordance with the KKS system.

Where possible valve nameplates shall be circular and fitted under the handwheel captive nut. They have to be of such a diameter that there is no danger for persons operating the valve or that they do not prevent lock-off of this valve; on check valves and small valves the Contractor may provide rectangular nameplates fitted to brackets on the valve or attached to a wall or steelwork in a convenient position adjacent to the valve.

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

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

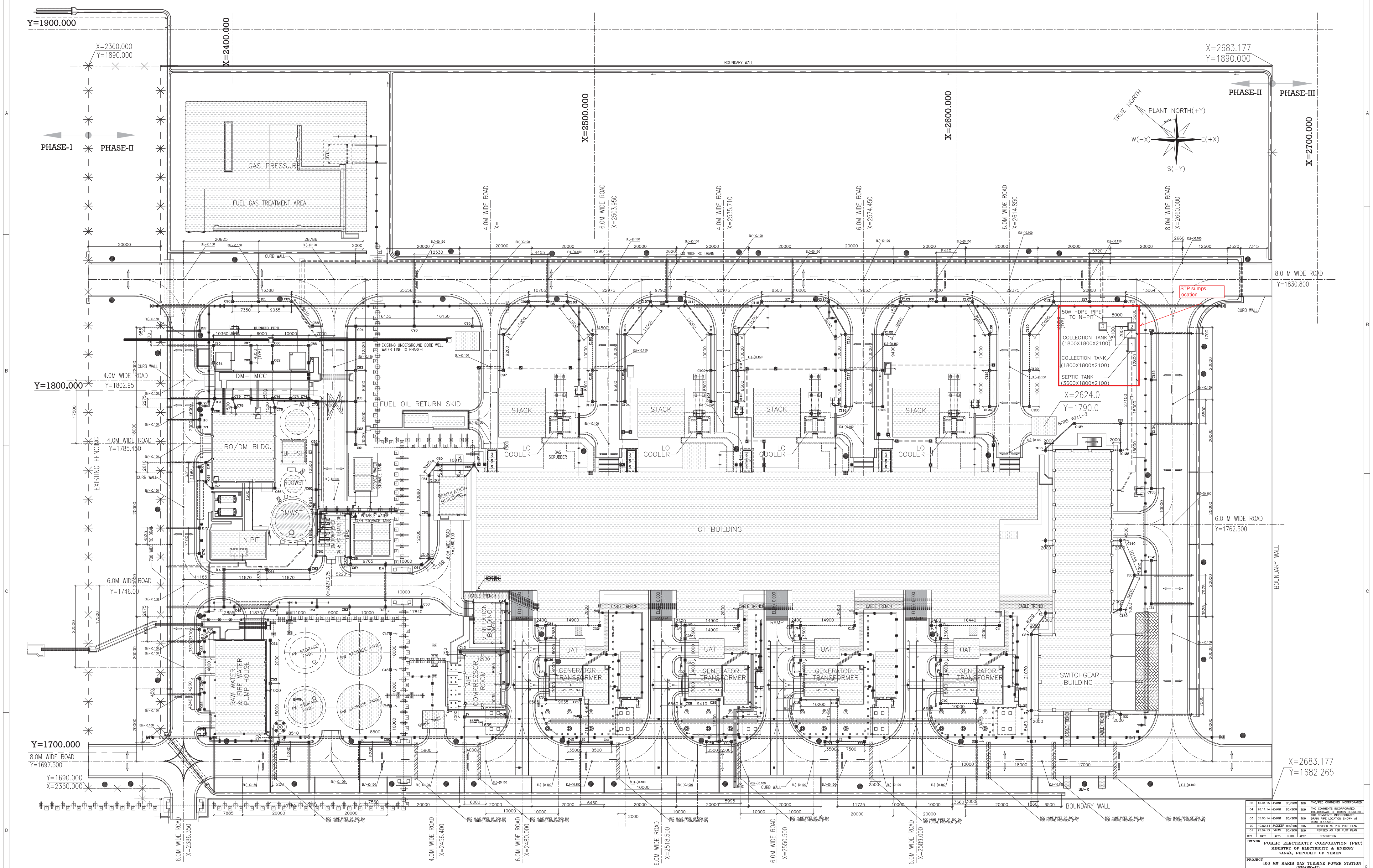
Field Transmitters & Analog Signals	-	0	01 to 99
Field Switches & Binary Signals	-	1	00 to 99
PG Test Point	-	4	00 to 99
Gauges	-	5	00 to 99
Automatic Turbine Tester (ATT)-HWR	-	2	00 to 99
(Reserved for protection Signals used by Hardwar)			

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.

REFERENCE DOCUMENTS

1. **Drain Layout : mentioning location and layout of STP sumps**
2. **Plant Drain Layout: mentioning STP sumps civil details for reference.**
3. **Control Room Layout**



LEGEND:

- RIGID PAVEMENT
- FLEXIBLE PAVEMENT
- PAVER BLOCK

GENERAL NOTES:

1. ALL DIMENSIONS ARE IN MILLIMETER AND LEVELS ARE IN METER.
2. ALL ELEVATIONS ARE W.R.T. FFL OF GT BUILDING WHICH IS EL(±)0.000M, WHICH CORRESPONDS TO 979.00 M ABOVE M.S.L.
3. FINISHED GRADED LEVEL OF THE PLANT SHALL BE (−)0.300M W.R.T. GT BUILDING FFL.
4. TOP OF ROAD SHALL BE 200MM ABOVE THE FGL.

DRAWING NUMBER	DESCRIPTION
PE-DG-372-603-C002 SH-2	PLANT ROAD LAYOUT
PE-DG-372-603-C004	PLANT DRAIN LAYOUT
PE-DG-372-600-C002	STANDARD NOTES ON RCC WORKS
PE-DG-372-606-C001	FENCING ON BOUNDARY – FENCING LAYOUT
PE-DG-372-100-M001	PLOT PLAN

REFERENCE DRAWINGS

REV	DATE	ALTD.	CHKD.	APPD.	DESCRIPTION
05	16.01.15	HEMANT	BD/SKM	TKM	TKC/PEC COMMENTS INCORPORATED.
04	26.11.14	HEMANT	BD/SKM	TKM	TKC COMMENTS INCORPORATED. CO-ORDINATE OF ROADS CORRECTED
03	05.05.14	HEMANT	BD/SKM	TKM	TKC COMMENTS INCORPORATED. DRAIN PIPE LOCATION SHOWN AT ROAD CROSSING
02	10.02.14	JAGDEEP	BD/SKM	TKM	REVISED AS PER PLOT PLAN
01	25.04.13	VIKAS	BD/SKM	TKM	REVISED AS PER PLOT PLAN

OWNER PUBLIC ELECTRICITY CORPORATION (PEC)
MINISTRY OF ELECTRICITY & ENERGY
SANA'A, REPUBLIC OF YEMEN

PROJECT 400 MW MARIB GAS TURBINE POWER STATION (PHASE-II)

CONSULTANT THE KULJIAN CORPORATION
ENGINEERS • ARCHITECTS • CONSULTANTS
PHILADELPHIA, PA, USA

CONTRACTOR BHARAT HEAVY ELECTRICALS LTD
POWER SECTOR
PROJECTS ENGINEERING MANAGEMENT
NOIDA

TITLE DRAIN LAYOUT
LAYOUT & DETAIL OF PIPE SLIPPER & DELUGE VALVE

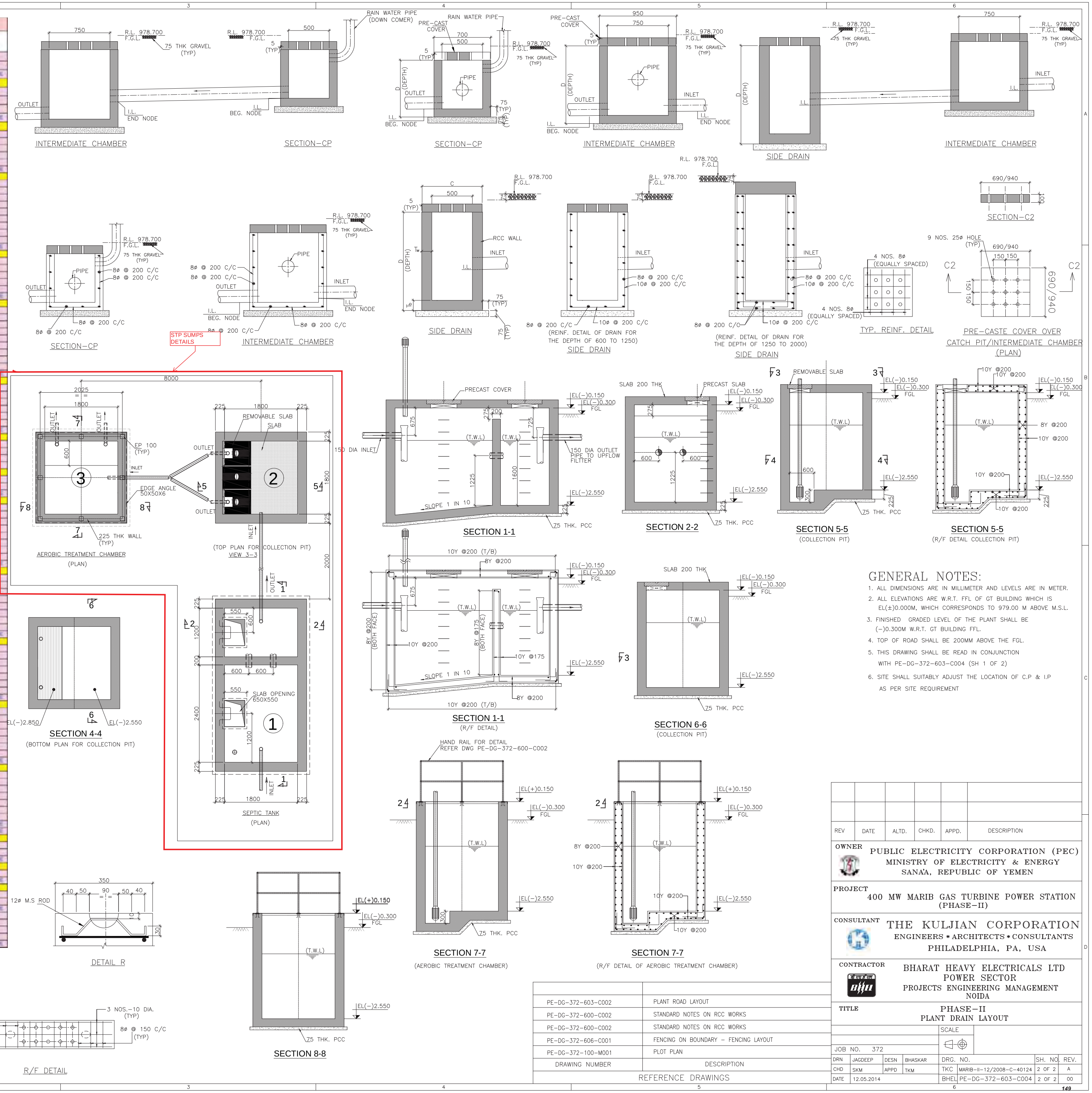
SCALE

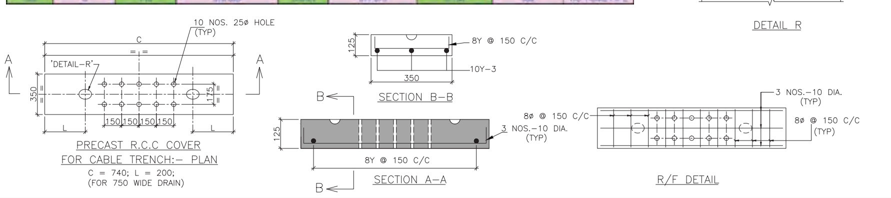
JOB NO. 372

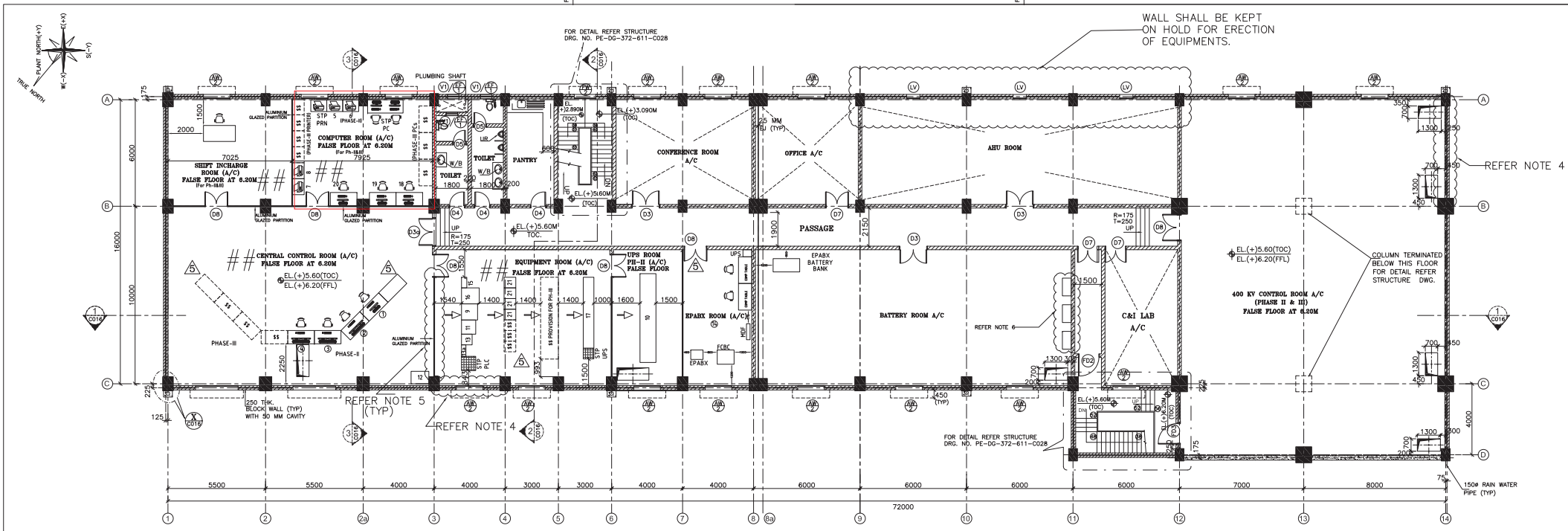
DRN	JAGDEEP	DESN	BHASKAR	DRG. NO.		SH. NO.	REV.
CHD	SKM	APPD	TKM	TKC	MARIB-II-12/2008-C-40124	1 OF 2	A
DATE	29.01.2015			BHEL	PE-DG-372-603-C004	1 OF 2	0

PRODUCED BY AN AUTODESK EDUCATIONAL PRODUCT

NETWORK -1								
Drain No.	Starting / continuous drain	Beginning Node	Invert Level At the Beginning	End Node	Invert Level at the End	Drain length, L (m)	Dia of Pipe D (mm)	Material
1	S	ROOF	978.600	C1			150	HDPE
2	C	C1	978.225	I1	978.175	6.500	150	HDPE
3	C	I1	978.125	DRAIN	978.050	15.000	300	RC HUME PIPE
1	S	ROOF	978.600	C2	978.225		150	HDPE
2	C	C2	978.225	C3	978.175	9.600	150	HDPE
3	C	C3	978.175	I-1A	978.100	22.500	150	HDPE
4	C	I-1A	978.100	DRAIN	978.000	18.685	300	RC HUME PIPE
5	S	ROOF	978.600	C4			150	HDPE
6	C	C4	978.225	C5	978.125	11.500	200	HDPE
7	C	C5	978.125	C6	978.075	7.850	200	HDPE
8	C	C6	978.075	C7	978.025	15.000	200	HDPE
9	C	C7	978.025	I-2	977.975	6.100	200	HDPE
10	C	I-2	977.975	DRAIN	977.925	14.150	300	RC HUME PIPE
11	S	ROOF	978.600	C12			150	HDPE
12	C	C12	978.225	C13	978.125	11.500	200	HDPE
13	C	C13	978.125	C14	978.075	7.850	200	HDPE
14	C	C14	978.075	C15	978.025	15.000	200	HDPE
15	C	C15	978.025	I3	977.975	8.100	200	HDPE
16	S	C8	978.225	C9	978.175	10.200	150	HDPE
17	C	C9	978.175	C10	978.125	14.000	150	HDPE
18	C	C10	978.125	C11	978.075	11.000	150	HDPE
19	C	C11	978.075	I3	977.975	14.250	150	HDPE
[illegible]	C	I3	977.975	DRAIN	977.925	14.150	300	RC HUME PIPE
17	S	ROOF	978.600	C16			150	HDPE
18	C	C16	978.225	C17	978.125	17.500	200	HDPE
19	C	C17	978.125	C18	978.075	7.850	200	HDPE
20	C	C18	978.075	C19	978.025	15.000	200	HDPE
21	C	C19	978.025	I4	977.975	5.100	200	HDPE
22	C	I4	977.975	DRAIN	977.925	14.150	300	RC HUME PIPE
23	S	ROOF	978.600	C24			150	HDPE
24	C	C24	978.225	C25	978.125	17.100	200	HDPE
25	C	C25	978.125	C26	978.075	7.850	200	HDPE
26	C	C26	978.075	C27	978.025	15.500	200	HDPE
27	C	C27	978.025	I5	977.975	6.100	200	HDPE
28	S	C22	978.225	C23	978.175	12.100	150	HDPE
29	C	C23	978.175	C20	978.125	12.500	150	HDPE
30	C	C20	978.125	C21	978.075	10.500	150	HDPE
31	C	C21	978.075	I5	977.975	14.400	150	HDPE
32	C	I5	977.975	DRAIN	977.925	14.150	300	RC HUME PIPE
33	S	C28	978.225	C29	978.175	9.000	150	HDPE
34	C	C29	978.175	C30	978.125	12.575	200	HDPE
35	C	C30	978.125	I6	978.050	13.550	200	HDPE
36	C	I6	978.050	I7	978.000	17.850	200	HDPE
37	S	C31	978.225	I7	978.125	9.000	150	HDPE
38	C	I7	978.000	I8	977.950	8.275	200	HDPE
39	C	I8	977.950	DRAIN	977.800	14.000	300	RC HUME PIPE
40	S	C33	978.225	C34	978.125	25.000	150	HDPE
41	C	C34	978.125	I9	978.025	15.100	150	HDPE
42	S	C32	978.225	I9	978.125	23.500	150	HDPE
43	C	I9	978.025	I8	977.925	15.000	150	HDPE
44	S	C82	978.225	I21	978.100	18.500	150	HDPE
45	C	C83	978.225	I21	978.100	9.200	150	HDPE
46	C	I21	978.100	DRAIN	978.000	11.000	300	RC HUME PIPE
47	S	C78	978.225	C80	978.150	6.250	150	HDPE
48	S	C79	978.225	C80	978.125	13.750	150	HDPE
49	C	C80	978.125	C81	978.075	18.250	150	HDPE
50	C	C81	978.075	C82	978.025	16.800	200	HDPE
51	C	C82	978.025	I20	977.975	10.400	200	HDPE
52	S	C75	978.225	C76	978.125	16.800	200	HDPE
53	C	C76	978.225	C77	978.125	10.000	200	HDPE
54	C	C77	978.125	I20	978.025	17.900	200	HDPE
55	C	I20	978.025	DRAIN	977.975	11.500	300	RC HUME PIPE
56	S	C70	978.225	C72	978.150	5.150	150	HDPE
57	S	C71	978.225	C72	978.125	8.500	150	HDPE
58	C	C72	978.125	C73	978.050	17.000	200	HDPE
59	C	C73	978.050	C74	978.000	16.600	200	HDPE
60	C	C74	978.000	I19	977.925	18.625	200	HDPE
61	S	C64	978.225	C65	978.125	18.000	200	HDPE
62	C	C65	978.225	C66	978.125	16.800	200	HDPE
63	C	C66	978.125	I19	978.025	16.625	200	HDPE
64	C	I19	977.925	DRAIN	977.875	11.000	300	RC HUME PIPE
65	S	C61	978.225	C62	978.075	30.000	200	HDPE
66	S	C62	978.225	C63	978.125	16.700	200	HDPE
67	C	C63	978.125	I16	978.025	23.500	200	HDPE
70	S	C57	978.225	C58	978.125	5.400	200	HDPE
71	C	C58	978.225	C59	978.075	30.000	200	HDPE
72	C	C59	978.075	C60	977.975	13.700	200	HDPE
73	C	C60	977.975	I18	977.875	27.500	200	HDPE
74	C	I18	977.875	DRAIN	977.825	11.000	300	RC HUME PIPE
76	S	C54	978.225	C55	978.090	30.000	200	HDPE
77	S	C55	978.090	C56	978.040	13.850	200	HDPE
78	C	C56	978.040	I17	977.915	25.400	200	HDPE
79	S	C50	978.225	C51	978.100	28.000	200	HDPE
80	C	C51	978.225	C52	978.090	30.000	200	HDPE
81	C	C52	978.090	C53	978.015	13.850	200	HDPE
82	C	C53	978.015	I17	977.890	25.400	200	HDPE
83	C	I17	977.890	DRAIN	977.840	11.000	300	RC HUME PIPE
84	S	C38	978.225	C39	978.150	9.050	150	HDPE
85	C	C39	978.150	I12	978.015	29.000	200	HDPE
86	C	I12	978.015	I13	977.880	30.000	200	HDPE
87	S	C37	978.225	I13	978.125	9.850	150	HDPE
88	C	C45	978.225	C48	978.125	14.600	150	HDPE
89	C	C48	978.125	C49	978.050	20.000	200	HDPE
90	C	C49	978.050	I11	977.900	30.000	200	HDPE
91	C	I11	977.900	I13	977.850	13.250	300	RC HUME PIPE
92	C	I13	978.225	DRAIN	978.175	16.050	300	RC HUME PIPE
93	S	C35	978.225	I10	978.150	5.900	150	HDPE
94	S	C36	978.225	I10	978.150	7.300	150	HDPE
95	C	I10	978.150	DRAIN	978.100	8.450	300	RC HUME PIPE
96	S	C41	978.225	I14	978.075	17.600	150	HDPE
97	C	I14	978.075	DRAIN	978.025	8.750	300	RC HUME PIPE
98	S	C42	978.225	C43	978.150	10.000	150	HDPE
99	C	C43	978.225	I15	978.125	16.350	150	HDPE
100	C	I15	978.125	I16	978.075	9.000	300	RC HUME PIPE
101	S	C44	978.225	C45	978.150	12.725	150	HDPE
102	C	C45	978.225	I16	978.125	15.200	150	HDPE
103	S	C46	978.225	C47	978.150	17.250	150	HDPE
104	C	C47	978.150	I16	978.025	17.900	150	HDPE
105	C	I16	978.025	DRAIN	977.975	8.750	300	RC HUME PIPE







FLOOR PLAN AT EL.(+)5.600M (TOC)

LIST OF EQUIPMENT WITH TABLE DIMENSIONS:

SL. NO.	DESCRIPTION	WIDTH (IN MM)	DEPTH (IN MM)	HEIGHT (IN MM)	HEAT DISS	SCOPE
1	OT FOR GT-1 : (MONITOR,KB,MOUSE) & PC	1500	750	740	500W	SEIMENS
2	OT FOR GT-2 : (MONITOR,KB,MOUSE) & PC	1500	750	740	500W	SEIMENS
3	OT FOR GT-3 : (MONITOR,KB,MOUSE) & PC	1500	750	740	500W	SEIMENS
4	OT FOR GT-4 : (MONITOR,KB,MOUSE) & PC	1500	750	740	500W	SEIMENS
5	ALARM PRINTER (A4 COLOR LASER)	900	600	740	450W	SEIMENS
6	ALARM PRINTER (A4 COLOR LASER)	900	600	740	450W	SEIMENS
7	ENGINEERING PRINTER (A4 B/W LASER)	900	600	740	450W	SEIMENS
8	WIN TS PRINTER (A3 COLOR LASER)	900	600	740	800W	SEIMENS
9	GAS DETECTION PANEL	825	823	2155	3500W	SEIMENS
10	UPS PANELS	5000	800	2200	13KW	BHEL-EDN
11	MASTER SLAVE CLOCK	800	800	2400	400W	BHEL-EDN
12	FAP & PC	1000	700	2345	1000W	BHEL-PEM
13	PA SYSTEM CENTRAL EXCHANGE	600	600	2355	400W	BHEL-PEM
13a	PA SYSTEM PDB	650	250	450	--	BHEL-PEM
14	EPABAX ROOM(2 PC, 1 MDF, 1 EPABX, 1 FCBC)	600	300	1000	2000W	BHEL-EDN
15	LAN NETWORK SWITCH RACK	600	300	1000	600W	SEIMENS
16	LAN SERVER CABINET (CRY01)	900	1000	2200	3500W	SEIMENS
17	ACDB	4000	600	2000	400W	BHEL-EDN
18	WIN-TS	1500	750	735	450W	SEIMENS
19	WIN-TS	1500	750	735	450W	SEIMENS
20	SWAP-OUT SERVER	1500	750	735	800W	SEIMENS
21	RTCC PANEL (4 NUMBERs)	660	600	2295	1000W	BHEL-BPL
$$	SPACE PROVISION FOR PH-III	--	--	--	13KW	PHASE-III

LEGENDS:

BRICK WALL.
GLASS PARTITION
MDF MAIN DISTRIBUTION FRAME
FCBC FLOAT CUM BOOSTER CHARGER

NOTE:-

1) SPACE PROVISION INDICATED THUS "$$" ARE FOR PHASE-III.
2) AREAS MARKED WITH '##' SHALL HAVE FALSE FLOOR AT 6.2M.
3) 400KV CONTROL ROOM SPACE FOR PH-II & PH-III PROVIDED AS PER CONTRACT.
4) BRICK WALL BETWEEN COL. (C-3 & C-4) AND (A-14 & B-14) SHALL BE CONSTRUCTED AFTER PLACEMENT OF PANELS.
5) GLASS WALL AT COL. C-3, C-6 & C-7 SHALL BE CONSTRUCTED AFTER PLACEMENT OF PANELS.
6) 3 NOs. WALL MOUNTED AIR COOLED DUCTABLE SPLIT AC UNITS SHALL BE PROVIDED IN BATTERY ROOM. OUTDOOR UNITS FOR THE SAME SHALL BE PLACED ON ROOF.
7) EPABX ROOM DETAILS:

EPABX	690(W)X530(D)X1880(H)
BATTERY BANK	1500(W)X750(D)X1175(H)
FCBC	950(W)X800(D)X1000(H)
MDF	900(W)X200(D)X1000(H)
UPS	400(W)X500(D)X400(H)
COMPUTER TABLE	1500(W)X750(D)X740(H)

REFERENCE DWG:-

1) PE-DG-372-100-MSK1 SWITCHGEAR & CONTROL ROOM LAYOUT
2) PE-DG-372-100-E002 LAYOUT OF SWITCHGEAR ROOM AT EL.(±) 0.000
3) PE-DG-372-611-C015 SWITCH GEAR BUILDING ARCHITECTURAL FLOOR PLAN AT EL(+)5.60M(FFL) & ROOF PLAN
4) PE-DG-372-100-E011 CABLING LAYOUT BELOW MAIN SWITCHGEAR ROOM

PROPOSED WITH STP PLC

REV	DATE	ALTD	CHD	APPD	DESCRIPTION
05	19.06.13	GA	MAM	AK/SHB	1. REVISED TO LOCATE RTCC PANELS AS PER INPUT RECD. FROM BHEL-PEM-ELEC ON 20.05.13. 2. AS PER REVISED PEM-CVL REF. DRG. NO. PE-DG-372-611-C015, R01 RECD. ON 17.06.13.
04	30.04.13	GA_sd-	MAM_sd-	AK/SHB_sd-	1. REVISED IN LINE WITH M/S TKC COMMENTS DTD 09.04.13. 2. REVISED IN LINE WITH SWITCH GEAR BUILDING ARCHITECTURAL FLOOR PLAN AT EL(+) 5.60M(FFL) & ROOF PLAN.
03	02.03.13	GA_sd-	MAM_sd-	AK/SHB_sd-	1. REVISED IN LINE WITH M/S TKC COMMENTS. 2. EPABX ROOM PROVIDED. 3. SWITCH GEAR ROOM FOR Ph-II & III (SIZE 15Mx20M) INCORPORATED.
02	14.12.12	GA_sd-	MAM_sd-	AK -sd-	1. REVISED IN LINE WITH M/S TKC COMMENTS DTD SEP 14, 2012 RECD. ON 16.11.2012 & LATEST INPUTs RECD. FROM BHEL-EDN/HWR.
01	16.10.12	GA-sd-	MAM-sd-	AK -sd-	GENERALLY REVISED.

CUSTOMER	PUBLIC ELECTRICITY CORPORATION(PEC) MINISTRY OF ELECTRICITY AND ENERGY SANA'A, REPUBLIC OF YEMEN
CUSTOMER'S CONSULTANT	THE KULJIAN CORPORATION ENGINEERS ARCHITECTS CONSULTANTS PHILADELPHIA, PA , U.S.A.
JOB No.	372
STATUS	CONTRACT
DISTRIBUTION	

400MW MARIB GAS TURBINE POWER STATION (PHASE-II)

BHARAT HEAVY ELECTRICALS LTD
POWER SECTOR
PROJECTS ENGINEERING MANAGEMENT
NOIDA

CODE I

	NAME	SIGN.	DATE
DRWN	GA	-sd-	03.08.12
DSGN	GA	-sd-	03.08.12
CHKD	MAM	-sd-	03.08.12
APRD	AK	-sd-	03.08.12

TITLE

CONTROL ROOM LAYOUT

MAX	MSE	CIVIL	ELEC.	DEPT.	SCALE: NTS
				SIGN	
				DATE	

BHEL DRG NO. PE-DG-372-145-1401
CUST. DRG NO. MARIB-II-12/2008-IC-45003
SHEET 1 OF 1 REV. 05

SECTION-D2

GENERAL TECHNICAL REQUIREMENT (ELECTRICAL)

GENERAL TECHNICAL REQUIREMENT FOR

ELECTRICAL MOTORS

8.8 ELECTRIC MOTORS

8.8.1 General

This specification covers the design, manufacture, supply, erection, testing and commissioning of Motors for various driven equipment and Actuators.

It is not the intent to specify completely herein all details of the equipment, nevertheless, the equipment shall be complete and operative in all respects and shall conform to the highest standard of engineering, design and workmanship.

Should the bidder wish to deviate from this specification in any way, he shall draw specific attention to such deviation by listing the deviations in the deviation schedule without which his offer will be considered in conformity with the specification in all respects.

8.8.2 Scope of work

The scope of work shall include but not limited to the following:

- AC & DC Motors required for various application
- Actuators required for various applications.
- ~~List of recommended spare parts as per Section 10.0, Vol. II.~~
- Commissioning spares.

8.8.3 Technical Requirements

Motors shall confirm to IEC and other applicable international standards amended upto date. Equivalent ANSI standards are also acceptable.

8.8.3.1 Motors

Design Features

All AC motors shall be squirrel cage three phase/ single phase induction motors. Lifts/Crane motors may be of slip ring type. DC motor shall generally be of shunt wound type rated for 220 V DC. DC motors shall be sized for operation with fixed resistance starter for maximum reliability. DC motors under GTG package may be rated for 220V DC. All motors shall be rated for continuous duty. Crane motors shall be rated for intermittent duty.

Inching type motors as per the requirement shall be provided.

The motor rating shall be at least 15% (service factor) over the maximum input power requirement of the driven equipment at rated point.

Continuously operating motors shall be of high efficiency type.

Power supply for AC motors shall be as follows:

- Motors less than and equal to 250 kW : 400 V, 3 Phase, 50 Hz solidly grounded system

- Motors larger than 250 kW : 6.6kV, 3 Phase, 50 Hz. resistance grounded system

Motors shall be capable of delivering the rated output with supply voltage variation of ± 10% and frequency variation of ±5% and absolute sum of 10%.

The motor characteristics shall match the requirements of the driven equipment so that adequate starting, accelerating, pull up, breakdown and full load torques are available for the intended service.

Squirrel cage induction motors shall be designed for direct on line starting. Starting current shall not exceed 600% of full load current with 20% tolerance for ratings upto and including 1000 kW. For motors rated above 1000 kW, starting current shall be limited to 600% of full load current without any tolerance.

The starting current of 220V motors shall be restricted to 200% of full load current whereas for 125V motors, the same shall be restricted to 160%.

The motor shall be capable of withstanding the stresses imposed if started at 110% rated voltage. Motor shall start with rated load and accelerate to full speed with 80% rated voltage at motor terminals. Motor shall be capable of operating satisfactorily at full load for 5 minutes without injurious heating with 75% rated voltage at motor terminals. Permissible number of starts per hour for continuous duty motors shall be as follows.

Starts	No. of Starts
No. of hourly startups uniformly distributed, starting from final steady working temperature (Hot)	3
No. of consecutive startups with initial temperature of motor at final steady working temperature (Hot)	2

Motors subject to reverse rotation shall be designed to withstand the stresses encountered when starting with non-energised shaft rotating at 125% of rated speed in reverse direction.

The locked rotor withstand time under hot condition at 110% rated voltage shall be more than motor starting time by at least 2.5 seconds for motors with 20 seconds starting time and by 5 seconds for motor with more than 20 seconds starting time. Starting time shall be at the minimum permissible voltage of 80% rated voltage. If the above conditions cannot be met in unavoidable cases, special provisions such as motor shaft speed switch, etc. shall be provided. Hot thermal withstand curve shall have 3 margin of at least 10% over the full load current of the motor to permit relay setting utilising motor rated capacity.

The motor may be subjected to sudden application of 150% rated voltage during bus transfer, due to the phase difference between the incoming voltage and motor residual voltage.

The motor shall be designed to withstand any torsional and / or high current stresses which may result during bus transfer, without experiencing any deterioration in the normal life & performance characteristics.

8.8.3.2 Constructional details

Enclosure

Motors located indoor shall have IP 44 degree of protection and those located outdoor shall have IPW 55 degree of protection for the enclosure. For hazardous areas, approved type of flameproof and increased safety enclosure shall be provided.

The motors shall generally be of self ventilated type totally enclosed fan cooled (TEFC). Alternatively for large motors, closed air Circuit Air Cooled (CACA) System shall be adopted.

Winding and Insulation

The winding for all the motors shall be of super enameled copper wire of suitable gauge or copper strip conductor depending on its rating. All motors shall be class F insulated limiting temperature rise to class B limit.

The windings, fittings and hardware shall be corrosion resistant. The windings shall be tropicalised and shall be impregnated to make them non-hygroscopic and oil resistant.

Main insulation and inter turn insulation of Motors shall be capable of withstanding switching surges as per IEC 34, Part 15.

Motors of rating 37 kW and above shall be provided with space heaters, suitably located for easy removal or replacement. The space heater shall be rated for 230 V, single phase, 50 Hz, and sized to maintain the motor internal temperature above dew point when the motor is idle.

All HT motors shall be provided with six (6) duplex type winding temperature detectors, two (2) per phase and the motor bearing shall be provided with 2 Nos. duplex type temperature detectors on driving end and non driving end. These temperature detectors shall be resistance type, 3 wire, platinum wound, 100 ohms at 0°C. The temperature detectors shall be connected to the DCS system.

Bearings

Motor shall be provided with antifriction bearings, unless sleeve bearings are required by the motor application. Vertical shaft motors shall be provided with thrust and guide bearings. Thrust bearing of tilting pad type are preferred.

Bearings shall be provided with seals to prevent leakage of lubricant or entrance of foreign matters like dirt, water etc. into the bearing area.

Provide one pt-100 RTD or chromed – constant type E thermocouple, temperature measurement thermocouples, on bearing or oil reservoir associated with an anti-friction on thrust bearing.

Lubricant shall not deteriorate under all service conditions. The lubricants shall be limited to normally available types.

Bearings shall be insulated as required to prevent shaft current and resultant bearing damage for a motor rating of above 1000 kW.

In case forced lubrication is adopted, a shaft driven oil pump shall be provided along with an electrical auxiliary pump. Alternatively, two motor driven pumps may be provided, one working and one standby. All necessary auxiliaries and accessories shall be provided to complete the system. A pressure gauge and pressure switch for low oil pressure warning and to start the standby oil pump automatically shall also be provided. A motor driven jacking oil pump may be provided, for heavy shaft loads.

Indicator/Switch

Dial type local indicator with alarm contacts shall be provided for the following:

- HT motor bearing temperature
- Hot and cold air temperatures of the closed air circuit for CACA motors.

Flow switches shall be provided for monitoring oil flow of forced lubrication bearings, if used. Alarm switch contact rating shall be minimum 0.5 A at 220 V D.C. and 5A at 230 V A.C.

Motor Terminal Box

Motor terminal boxes shall be provided with a detachable extension box (cable core splitter box). Terminal box shall be capable of being turned 360° in steps of 90°, unless otherwise approved. The terminal boxes shall be split type with removable cover with access to connections and shall have the same degree of protection as motor. The terminal box shall have sufficient space inside for termination/connection of cables.

Terminals shall be of stud type, substantially constructed and thoroughly insulated from the frame. The terminals shall be clearly identified by phase markings, with corresponding direction of rotation marked on the non-driving end of the motor. The terminal box shall be capable of withstanding maximum system fault current for 0.2 sec for all breaker operated motors and shall be provided with explosion vent. However for contactor operated motors, the terminal box shall be capable of withstanding the fault current for let through time of the fuse preceding it.

For 6600 V motor (if required), the terminal box shall be phase segregated type and neutral leads shall be brought out in a separate terminal box (not necessarily phase segregated type) with shorting links for star connection. For motors for 1000 kW and above, PS class current transformers shall be provided in the neutral side terminal box on all three connections for differential relay.

All accessory equipment such as space heater temperature detector, etc., shall be wired and terminated in a enclosure, separate from motor (power) terminal box. The degree of protection for accessory terminal box shall be same as that of motor. Terminal box shall be complete with double compression brass glands and stud type terminals and shall be suitably mounted on the side of the motor. If possible, the accessory terminal boxes shall be located on the same side of the motor as the main (power) terminal box.

Earthing Terminals

The frame of each motor shall be provided with two separate and distinct grounding pads complete with tapped hole, GI bolts and washer.

The cable terminal box shall have a separate grounding terminal.

Noise & Vibration

The noise level and vibration limits shall not exceed the limits specified in relevant ANSI / IEEE / IEC standards.

Rating Plate

The motors shall be provided with a rating plate of stainless steel.

In addition to the minimum information required by IEC, the following information shall be shown on motor rating plate:

- Temperature rise in °C under rated condition & method of measurement.
- Degree of protection.
- Bearing identification no. and recommended lubricant.
- Location of insulated bearings.

Lifting

All electric motors shall be provided with lifting lugs.

DATA SHEET C FOR MOTORS

8.8.6 Technical Data by the Tenderer

SECTION : ELECTRIC MOTORS		
8.8.6.1 MOTORS (Bidder to fill data for each type and rating of motor)		
General		
* Application	-	
* Quantity	Nos	
* Make & Country	-	
Frame size	-	
Applicable standard	-	
Type of motor	-	
* Service	-	
* Rating	kW	
Duty cycle/ designation	-	
Rated continuous output at max. ambient	kW	
Rated speed	rpm	
* Rated voltage and Voltage variation range	V %	
* Rated frequency and Frequency variation range	Hz %	
Full load current	A	
No load current	A	
Rated power factor	-	
Efficiency at rated voltage and frequency		
Full load	%	
Three quarter		
50% load	%	

FORMT9-P REV-B

Method of starting	-	
Starting current at rated voltage (as % of full load current)	%	
Starting current at 80% of rated voltage (as % of full load current)	%	
Starting torque (as % of full load torque)	%	
Time to attain full speed		
- with load	s	
- without load	s	
Locked rotor withstand time		
- from cold	s	
- from hot	s	
* Degree of protection of enclosure		
Method of cooling	-	
* Insulation class	-	
* Temperature rise over max. ambient	°C	
No. of hot starts		
Winding connection	-	
Bearing	-	
Make	-	
Type	-	
Recommended lubricant	-	
Motor Terminal Box		
Type	-	
Fault with-stand current and time	kA, s	
Number of grounding pads provided		
- On motor body	-	
- On terminal box	-	
Type of mounting	-	

FORMTS-P REV-B

Overall dimensions		
Length	mm	
Breadth	mm	
Height	mm	
Weight		
Stator	kg	
Rotor	kg	
Total	kg	
Moment of inertia		
Stator	kg.sq.m	
Rotor	kg.sq.m	
Total	kg.sq.m	
Dynamic load and foundation	-	
Drawings furnished	Yes/No	
General arrangements	Yes/No	
Terminal box details	Yes/No	
Torque vs speed (at 100% rated voltage, at 80% rated voltage at 110% rated voltage) with the driven equipment torque speed curve super imposed.	Yes/No	
Thermal withstand curves (hot & cold)	Yes/No	
Locked rotor curves (hot & cold)	Yes/No	
Starting characteristics (at 80% rated voltage and at 100% rated voltage.	Yes/No	
Performance curves (output vs efficiency, output vs current output vs slip	Yes/No	
10% margin considered for motor rating above the rated shaft power requirement.	Yes/No	
15% margin considered for BFP and GBC motor	Yes/No	

SPECIFICATION FOR
MISCELLEANEOUS ELECTRIC ITEMS

8.15 Miscellaneous Electrical Items

8.15.1 General

This specification covers the design, manufacture, supply, erection, testing and commissioning of Miscellaneous Electrical Items.

It is not the intent to specify completely herein all details of the equipment, nevertheless, the equipment shall be complete and operative in all respects and shall conform to the highest standard of engineering, design and workmanship.

8.15.2 Scope of work

The scope of work shall include but not limited to the following:

✓ Cable Trays and Accessories Applicable

✗ Cable termination and jointing kits. (Not Applicable)

✗ Cable ties, clamps and markers (Not Applicable)

✗ Receptacles. (Not applicable)

✓ Conduits and accessories. (Applicable)

✓ Junction boxes. (Applicable)

✓ Cable glands and cable lugs. (Applicable)

✗ Fire stop cable sealing system. (Not Applicable)

✓ List and supply of Maintenance tools and tackles. (As applicable for this package)

✓ List of recommended spare parts ~~as per Section 10 Vol II~~. NOT APPLICABLE

✓ Commissioning spares. (As applicable for this package)

All accessories, fittings, supports, anchor bolts etc. which form part of the equipment or which are necessary for safe and satisfactory installation and operation of the equipment shall be furnished.

8.15.3 Technical Requirements

All the items shall conform to latest edition of relevant IEC standards amended upto date. Equivalent ANSI standards are also acceptable.

Conduits & accessories

Conduits shall be of rigid steel, hot dip galvanized, furnished in standard lengths threaded at both ends.Minimum diameter of conduits shall be 20 mm. All conduits shall be heavy duty suitable for electrical installation. Sizing of conduits shall be based on maximum 40% fill criteria. conduits shall be complete with all accessories such as bends, ties, couples,inspection box etc.

Flexible conduits where required, near equipment terminations, shall be made with bright, cold rolled, annealed and electro-galvanized mild steel strips. In corrosive ares, epoxy coated conduits shall be provided.

8.15.3.5 Junction Box

Junction boxes shall be conforming to degree of protection IP55. The boxes shall be of die cast aluminium (LM 6) complete with removable cover plate with gaskets, two earthing terminals, terminal blocks etc.

The boxes shall have provision for wall, column, pole or structure mounting and shall be provided with cable/conduit entry knock outs & terminal blocks.

The terminal blocks shall be mounted securely on brackets welded to the back sheet of the box. The terminals shall be 650 V grade, one piece construction complete with terminals, insulation barriers, galvanised nuts, bolts and washers and provided with identification strips of PVC. The terminals shall be made of copper alloy and shall be of box clamp type.

The terminals for junction boxes shall be suitable for terminating two (2) nos. 2.5 mm^2 stranded copper conductors on each side.

8.15.3.6 Cable Glands

Cable glands shall be tinned brass, shrouded, double compression type, complete with necessary armour clamp and tapered washers etc. Cable glands shall match with the different cable sizes.

8.15.3.7 Cable Lugs

Cable lugs shall be tinned copper lugs suitable for termination of different sizes of HT/LT/ control cables. Lugs for power cables shall be of compression type, whereas lugs for control cables shall be of insulated terminal crimping type.

CABLE TRAYS AND CABLE TRAY SUPPORTS

Cable trays within Sewage treatment plant battery limit shall be in bidder's scope of work. The same shall be of tough FRP material with minimum thickness of 3mm. Suitable support for above cable trays shall also be in bidder's scope of work.

Cable trays shall be complete with all necessary accessories such as coupler plates, nuts, bolts, washers, clamps etc. Also necessary horizontal/ vertical bends, horizontal/ vertical Tees, Reducers, Horizontal crosspieces etc. shall be supplied by bidder to make the system complete.

Horizontal runs of cable trays shall be supported at intervals of 1500 mm approximately. Vertical runs (risers) shall also be supported at approximately every 1000 mm interval. Minimum level difference between two tiers of horizontal cable trays shall be 300 mm. In vertical raceways with multi-tiers the tiers shall be located at least with 300 mm intervals.

The cable trays & cable tray support system shall conform to latest edition of relevant IEC standards amended upto date.

QUALITY PLAN FOR MOTORS

BHEL	QUALITY PLAN		CUSTOMER :			PROJECT TITLE			SPECIFICATION : NUMBER :			
			BIDDER/ VENDOR :			QUALITY PLAN NUMBER PED-506-00-Q-006, REV-01			SPECIFICATION TITLE			
	SHEET 1 OF 2		SYSTEM			ITEM AC ELECT. MOTORS BELOW 55KW (LV)			SECTION			VOLUME III
SL. NO.	COMPONENT/OPERATION	CHARACTERISTICS CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY P	AGENCY W	AGENCY V	REMARKS
1	2	3	4	5	6	7	8	9	10			11
1.0	ASSEMBLY	1.WORKMANSHIP	MA	VISUAL	100%	MANUF'S SPEC	MANUF'S SPEC	-DO-	2	-	-	
		2.DIMENSIONS	MA	-DO-	-DO-	MFG. DRG./ MFG. SPEC.	MFG. DRG./ MFG. SPEC.	-DO-	2	-	-	
		3.CORRECTNESS COMPLETENESS TERMINATIONS/ MARKING/COLOUR CODE	MA	VISUAL	100%	MFG.SPEC./ RELEVANT IEC	MFG.SPEC. RELEVANT IEC	-DO-	2	-	-	
2.0	PAINTING	1.SHADE	MA	VISUAL	SAMPLE	MANUFR'S SPEC/BHEL SPEC./RELEVANT INTERNATIONAL STANDARD	BHEL SPEC. SAME AS COL.7	LOG BOOK	2	-	-	
3.0	TESTS	1.ROUTINE TEST INCLUDING SPECIAL TEST AS PER BHEL SPEC.	MA	-DO-	100%	RELEVANT IEC/ BHEL SPEC./ DATA SHEET	SAME AS COL.7	TEST REPORT	2	1		NOTE -1 & NOTE-3
		2.OVERALL DIMENSIONS & ORIENTATION	MA	MEASUREMENT & VISUAL	100%	APPROVED DRG/DATA SHEET	APPROVED DRG/DATA SHEET & RELEVANT IEC	INSPN. REPORT	2	1	-	NOTE -1 & NOTE-3

BHEL	PARTICULARS	BIDDER/VENDOR
	NAME	
	SIGNATURE	

BHEL	**QUALITY PLAN**		CUSTOMER :			PROJECT TITLE			SPECIFICATION : NUMBER :			
			BIDDER/ VENDOR :			QUALITY PLAN NUMBER PED-506-00-Q-006, REV-01			SPECIFICATION : TITLE :			
	SHEET 2 OF 2		SYSTEM			ITEM AC ELECT. MOTORS BELOW 55KW (LV)			SECTION			VOLUME III
SL. NO.	COMPONENT/OPERATION	CHARACTERISTICS CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY P	AGENCY W	AGENCY V	REMARKS
1	2	3	4	5	6	7	8	9	10			11
		3.NAMEPLATE DETAILS	MA	VISUAL	100%	RELEVANT IEC & DATA SHEET	RELEVANT IEC & DATA SHEET	INSPN. REPORT	2	1	-	

NOTES:

1 ROUTINE TESTS ON 100% MOTORS SHALL BE DONE BY THE VENDOR. HOWEVER, BHEL SHALL WITNESS ROUTINE TESTS ON RANDOM SAMPLES. THE SAMPLING PLAN SHALL BE MUTUALLY AGREED UPON

2 WHERE EVER CUSTOMER IS INVOLVED IN INSPECTION, (1) SHALL MEAN BHEL AND CUSTOMERS BOTH TOGETHER.

3 FOR EXHAUST/VENTILATION FAN MOTORS OF RATING UPTO 1.5KW , ONLY ROUTINE TEST CERTIFICATES SHALL BE FURNISHED FOR SCRUTINY.

Legends for Inspection agency

1. BHEL/CUSTOMER
2. VENDOR (MOTOR MANUFACTURER)
3. SUB-VENDOR (RAW MATERIAL/COMPONENTS SUPPLIER)

P. PERFORM
W. WITNESS
V. VERIFY

BHEL	PARTICULARS	BIDDER/VENDOR	
	NAME		
	SIGNATURE		
	DATE		BIDDER'S/VENDORS COMPANY SEAL

	QUALITY PLAN		CUSTOMER :			PROJECT TITLE			SPECIFICATION : NUMBER :			
			BIDDER/ VENDOR :			QUALITY PLAN NUMBER PED-506-00-Q-007, REV-03			SPECIFICATION : TITLE			
	SHEET 1 OF 9		SYSTEM			ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV & MV)			SECTION			VOLUME III
SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY P	W	V	REMARKS
1	2	3	4	5	6	7	8	9	10			11
1.0	RAW MATERIAL & BOUGHT OUT CONTROL											
1.1	SHEET STEEL, PLATES, SECTION, EYEBOLTS	1.SURFACE CONDITION	MA	VISUAL	100%	-	FREE FROM BLINKS, CRACKS, WAVINESS ETC	LOG BOOK	3	-	-	
		2.DIMENSIONS	MA	MEASUREMENT	SAMPLE	MANFR'S DRG./SPEC	MANFR'S DRG./SPEC	-DO-	3	-	-	
		3.PROOF LOAD TEST (EYE BOLT)	MA	MECH. TEST	-DO-	-DO-	-DO-	INSPEC. REPORT	3	-	2	
1.2	HARDWARES	1.SURFACE CONDITION	MA	VISUAL	100%		FREE FROM CRACKS, UN-EVENNESS ETC.	-DO-	3	-	-	
		2.PROPERTY CLASS	MA	VISUAL	SAMPLES	MANFR'S DRG./SPEC BOOK	RELEVENT IEC/SPEC.	SUPPLIERS TC & LOG	3	-	2	PROPERTY CLASS MARKING SHALL BE CHECKED BY THE VENDOR
1.3	CASTING	1.SURFACE CONDITION	MA	VISUAL	100%		FREE FROM CRACKS, BLOW HOLES ETC.	LOG BOOK	3	-	2	
		2.CHEM. & PHY. PROP.	MA	CHEM & MECH TEST	1/HEAT NO.	MANFR'S DRG./SPEC	RELEVENT IEC/	SUPPLIER'S TC	3	-	2	HEAT NO. SHALL BE VERIFIED
		3.DIMENSIONS	MA	MEASUREMENT	100%	MANUFR'S DRG.	MANUFR'S DRG.	LOG BOOK	3	-	2	
1.4	PAINT & VARNISH	1.MAKE, SHADE, SHELF LIFE & TYPE	MA	VISUAL	100% CONTINUOUS	MANFR'S DRG./SPEC	MANFR'S DRG./SPEC	LOG BOOK	3	-	2	

BHEL	**PARTICULARS**	**BIDDER/VENDOR**	
	NAME		
	SIGNATURE		
	DATE		BIDDER'S/VENDORS COMPANY SEAL

		QUALITY PLAN	CUSTOMER :			PROJECT TITLE			SPECIFICATION : NUMBER :			
			BIDDER/ VENDOR :			QUALITY PLAN NUMBER PED-506-00-Q-007, REV-03			SPECIFICATION : TITLE			
		SHEET 2 OF 9	SYSTEM			ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV & MV)			SECTION			VOLUME III
SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY P	AGENCY W	AGENCY V	REMARKS
1	2	3	4	5	6	7	8	9	10			11
1.5	SHAFT (FORGED OR ROLLED)	1. SURFACE COND.	MA	VISUAL	100%	-	FREE FROM VISUAL DEFECTS	-DO-	3	-	-	VENDOR'S APPROVAL IDENTIFICATION SHALL BE MAINTAINED
		2. CHEM. & PHYSICAL PROPERTIES	MA	CHEM. & PHYSICAL TESTS	1/HEAT NO. OR HEAT TREATMENT BATCH NO	MFG. DRG. SPEC.	RELEVANT IEC	SUPPLIER'S TC	3	-	2	
		3. DIMENSIONS	MA	MEASUREMENT	100%	-DO-	MANUFR'S DRG.	LOG BOOK	3	-	2	
		4.INTERNAL FLAWS	CR	UT	-DO-	ASTM-A388	MANUFR'S SPEC. BHEL SPEC.	-DO-	3	2	1	FOR DIA OF 55 MM & ABOVE
1.6	SPACE HEATERS, CONNEC-TORS, TERMINAL BLOCKS, CABLES, CABLE LUGS, CARBON BRUSH TEMP. DETECTORS, RTD, BTD'S	1. MAKE & RATING	MA	VISUAL	-DO-	MANUFR'S DRG. SPEC.	MANUFR'S DRG. SPEC.	-DO-	3	-	2	
		2. PHYSICAL COND.	MA	-DO-	-DO-	-	NO PHYS. DAMAGE, NO ELECTRICAL DISCONTINUITY	-DO-	3	-	2	
		3.DIMENSIONS (WHEREVER APPLICABLE)	MA	MEASUREMENT	SAMPLE	MANUFR'S DRG./ SPEC.	MANUFR'S DRG. / SPEC.	-DO-	3	-	2	
		4.PERFORMANCE/ CALIBRATION	MA	TEST	100%	-DO-	-DO-	INSP. REPORT	3	-	2	

BHEL	**PARTICULARS**	**BIDDER/VENDOR**	
	NAME		
	SIGNATURE		
	DATE		BIDDER'S/VENDORS COMPANY SEAL

		QUALITY PLAN	CUSTOMER :			PROJECT TITLE			SPECIFICATION : NUMBER :			
			BIDDER/ VENDOR :			QUALITY PLAN NUMBER PED-506-00-Q-007, REV-03			SPECIFICATION : TITLE			
		SHEET 3 OF 9	SYSTEM			ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV & MV)			SECTION			VOLUME III
SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY P	W	V	REMARKS
1	2	3	4	5	6	7	8	9	10			11
1.7	OTHER INSULATING MATERIALS LIKE SLEEVES, BINDINGS CORDS, PAPERS, PRESS BOARDS ETC.	1. SURFACE COND. ETC.	MA	VISUAL	100%	-	NO VISUAL DEFECTS	INSPT. REPORT	3	-	2	
		2. OTHER CHARACTERISTICS	MA	TEST	SAMPLE	MANUF'S SPEC.	MANUF'S SPEC.	LOG BOOK AND OR SUPPLIER'S TC	3	-	2	
1.8	SHEET STAMPING (PUNCHED)	1. SURFACE COND.	MA	VISUAL	100%	-	NO VISUAL DEFECTS (FREE FROM BURS)	LOG BOOK	3	-	-	
		2.DIMENSIONS INCLUDING BURS HEIGHT	MA	MEASUREMENT	SAMPLE	MANUFR'S DRG. .	MANUFR'S DRG.	-DO-	3	-	2	FOR MV MOTOR INSULA-TION/VARNISH THICKNESS SHALL BE MORE THAN THE BURS HEIGHT
		3. ACCEPTANCE TESTS	MA	ELECT. & MECH TESTS	-DO-	MANUF'S SPEC./ RELEVANT IEC	RELEVANT IEC	SUPPLIER'S TC	3	-	2	
1.9	CONDUCTORS	1. SURFACE FINISH	MA	VISUAL	100%	-	FREE FROM VISUAL DEFECTS	LOG BOOK	3*	-	2*	* MOTOR MANUFACTURER TO CONDUCT VISUAL CHECK FOR SURFACE FINISH ON RANDOM BASIS (10% SAMPLE) AT HIS WORKS AND MAINTAIN RECORD FOR VERIFICATION BY BHEL/CUSTOMER.
		2.ELECT. PROP, & MECH. PROP	MA	ELECT. & MECH.TEST	SAMPLES	RELEVANT IEC/ BS OR OTHER INTERNATIONAL STANDARDS	RELEVANT IEC/ BS OR OTHER INTERNATIONAL STANDARDS	SUPPLIERS TC & VENDOR'S INSPN. REPORTS	3	-	2	

BHEL	**PARTICULARS**	**BIDDER/VENDOR**	
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	SIGNATURE		
	DATE		BIDDER'S/VENDORS COMPANY SEAL

	QUALITY PLAN		CUSTOMER :			PROJECT TITLE			SPECIFICATION : NUMBER :			
			BIDDER/ VENDOR :			QUALITY PLAN NUMBER PED-506-00-Q-007, REV-03			SPECIFICATION : TITLE			
	SHEET 4 OF 9		SYSTEM			ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV & MV)			SECTION			VOLUME III
SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY P	AGENCY W	AGENCY V	REMARKS
1	2	3	4	5	6	7	8	9	10			11
		3.DIMENSIONS	MA	MEASUREMENT	-DO-	-DO-	-DO-	Log Book	3	-	2	
1.10	BEARINGS	1.MAKE & TYPE	MA	VISUAL	100%	MANFR'S DRG./ APPROVED DATASHEET	MANFR'S DRG./ APPROVED DATASHEET	-DO-	3	-	2	
		2.DIMENSIONS	MA	MEASUREMENT	SAMPLE	BHEL DATA SHEET	BHEL DATA SHEET BEARING MANUF'S CATALOGUES	-DO-	3	-	2	
		3.SURFACE FINISH	MA	VISUAL	100%	-	FREE FROM VISUAL DEFECTS	-DO-	3	-	2	
1.11	SLIP RING (WHEREVER APPLICABLE)	1.SURFACE COND.	MA	VISUAL	100%	-	-DO-	-DO-	3	-	-	
		2.DIMENSIONS	MA	MEASUREMENT	SAMPLE	MANUF'S DRG	MANUF'S DRG	-DO-	3	-	-	
		3.TEMP.WITH-STAND CAPACITY	MA	ELECT.TEST	-DO-	MANUF'S SPEC./ BHEL SPEC.	MANUF'S SPEC./ BHEL SPEC.	-DO-	3	-	2	
		4.HV/IR	MA	-DO-	100%	-DO-	-DO-	-DO-	3	-	2	
1.12	OIL SEALS & GASKETS	1.MATERIAL OF GASKET	MA	VISUAL	100%	MANUF'S DRG/SPECS	MANUF'S DRG./ SPECS.	-DO-	3	-	-	
		2.SURFACE COND.	MA	VISUAL	100%	-	FREE FROM VISUAL DEFECTS	-DO-	3	-	-	
		3.DIMENSIONS	MA	MEASUREMENT	SAMPLE	MANUF'S DRG	MANUF'S DRG	-DO-	3	-	-	

BHEL	**PARTICULARS**	**BIDDER/VENDOR**	
	NAME		
	SIGNATURE		
	DATE		BIDDER'S/VENDORS COMPANY SEAL

	QUALITY PLAN		CUSTOMER :			PROJECT TITLE			SPECIFICATION : NUMBER :			
			BIDDER/ VENDOR :			QUALITY PLAN NUMBER PED-506-00-Q-007, REV-03			SPECIFICATION : TITLE			
	SHEET 5 OF 9		SYSTEM			ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV & MV)			SECTION			VOLUME III
SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY P	AGENCY W	AGENCY V	REMARKS
1	2	3	4	5	6	7	8	9	10			11
2.0	IN PROCESS											
2.1	STATOR FRAME WELDING (IN CASE OF FABRICATED STATOR)	1.WORKMANSHIP & CLEANNESS	MA	VISUAL	100%	-DO-	GOOD FINISH	LOG BOOK	3/2	2	-	
		2.DIMENSIONS	MA	MEASUREMENT	-DO-	MANUF'S DRG	MANUF'S DRG	-DO-	2	-	-	
2.2	MACHINING	1.FINISH	MA	VISUAL	100%	-DO-	GOOD FINISH	LOG BOOK	2	-	-	
		2.DIMENSIONS	MA	MEASUREMENT	-DO-	MANUF'S DRG	MANUF'S DRG	-DO-	2	-	-	
		3.SHAFT SURFACE FLOWS	MA	PT	-DO-	RELEVENT SPEC./ ASTM-E165	MANUFR'S SPEC./ BHEL SPEC./	-DO-	2	-	1	
2.3	PAINTING	1.SURFACE PREPARATION	MA	VISUAL	100%	MANFR'S SPEC/BHEL SPEC./ RELEVANT STAND	BHEL SPEC. SAME AS COL.7	LOG BOOK	2	-	-	
		2.PAINT THICKNESS (BOTH PRIMER & FINISH COAT)	MA	MEASUREMENT BY ELCOMETER	SAMPLE	-DO-	-DO-	-DO-	2	-	-	
		3.SHADE	MA	VISUAL	-DO-	-DO-	-DO-	Log Book	2	-	-	
		4.ADHESION	MA	CROSS CUTTING & TAPE TEST	-DO-	-DO-	-DO-	Log Book	2	-	-	

BHEL	**PARTICULARS**	**BIDDER/VENDOR**	
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	SIGNATURE		
	DATE		BIDDER'S/VENDORS COMPANY SEAL

	QUALITY PLAN		CUSTOMER :			PROJECT TITLE			SPECIFICATION : NUMBER :			
			BIDDER/ : VENDOR			QUALITY PLAN NUMBER PED-506-00-Q-007, REV-03			SPECIFICATION : TITLE			
	SHEET 6 OF 9		SYSTEM			ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV & MV)			SECTION			VOLUME III
SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY P	AGENCY W	AGENCY V	REMARKS
1	2	3	4	5	6	7	8	9	10			11
2.4	SHEET STACKING	1.COMPLETENESS	MA	MEASUREMENT	SAMPLE	MANUFR'S SPEC.	MANUFR'S SPEC.	Log Book	2	-	-	
		2.COMPRESSION & TIGHTENING	MA	MEASUREMENT	100%	-DO-	-DO-	Log Book	2	-	-	
		3.CORE LOSS & HOTSPOT	MA	ELECT.TEST	-DO-	-DO-	-DO-	Log Book	2	1*	1	(FOR MOTORS OF 2MW AND ABOVE) * ON 10% RANDOM SAMPLE
2.5	WINDING	1.COMPLETENESS	CR	VISUAL	100%	MANUFR'S SPEC./BHEL SPEC.	MANUFR'S SPEC./BHEL SPEC.	Log Book	2	-	-	
		2.CLEANLINESS	CR	-DO-	-DO-	-DO-	-DO-	Log Book	2	-	-	
		3.IR-HV-IR	CR	ELECT. TEST	-DO-	-DO-	-DO-	Log Book	2	-	1	
		4.RESISTANCE	CR	-DO-	-DO-	-DO-	-DO-	Log Book	2	-	1	
		5.INTERTURN INSULATION	CR	-DO-	-DO-	-DO-	-DO-	Log Book	2	-	-	
		6.SURGE WITH STAND AND TAN. DELTA TEST	CR	-DO-	-DO-	-DO-	-DO-	Log Book	2	-	1	FOR MV MOTOR
2.6	IMPREGNATION	1.VISCOSCITY	MA	PHY. TEST	AT STARTING	-DO-	-DO-	Log Book	2	-	-	
		2.TEMP. PRESSURE VACCUM	MA	PROCESS CHECK	CONTINUOUS	-DO-	-DO-	Log Book	2	-	-	
		3.NO. OF DIPS	MA	-DO-	-DO-	-DO-	-DO-	Log Book	2	-	1	THREE DIPS TO BE GIVEN

BHEL	**PARTICULARS**	**BIDDER/VENDOR**	
	NAME		
	SIGNATURE		
	DATE		BIDDER'S/VENDORS COMPANY SEAL

		QUALITY PLAN	CUSTOMER :			PROJECT TITLE			SPECIFICATION : NUMBER :			
			BIDDER/ VENDOR :			QUALITY PLAN NUMBER PED-506-00-Q-007, REV-03			SPECIFICATION : TITLE			
		SHEET 7 OF 9	SYSTEM			ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV & MV)			SECTION			VOLUME III
SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY P	W	V	REMARKS
1	2	3	4	5	6	7	8	9	10			11
		4.DURATION	MA	-DO-	-DO-	-DO-	-DO-	Log Book	2	-	1	
2.7	COMPLETE STATOR ASSEMBLY	1.COMPACTNESS & CLEANLINESS	MA	VISUAL	100%	-DO-	-DO-	Log Book	2	-	-	
2.8	BRAZING/COMPRESSION JOINT	1.COMPLETENESS	CR	-DO-	-DO-	-DO-	-DO-	Log Book	2	-	-	
		2.SOUNDNESS	CR	MALLET TEST & UT	-DO-	-DO-	-DO-	Log Book	2		1	
		3.HV	MA	ELECT. TEST	-DO-	-DO-	-DO-	Log Book	2		1	
2.9	COMPLETE ROTOR ASSEMBLY	1.RESIDUAL UNBALANCE	CR	DYN. BALANCE	-DO-	MFG SPEC./ RELEVANT IEC	MFG. DWG.	Log Book	2		1	VERIFICATION FOR MV MOTOR ONLY
		2.SOUNDNESS OF DIE CASTING	CR	ELECT. (GROWLER TEST)	-DO-	MFG. SPEC.	MFG. SPEC.	Log Book	2		1	
2.10	ASSEMBLY	1.ALIGNMENT	MA	MEAS.	-DO-	-DO-	-DO-	Log Book	2	-	-	
		2.WORKMANSHIP	MA	VISUAL	-DO-	-DO-	-DO-	Log Book	2	-	-	
		3.AXIAL PLAY	MA	MEAS.	-DO-	-DO-	-DO-	Log Book	2	-	1	
		4.DIMENSIONS	MA	-DO-	-DO-	MFG.DRG./ MFG SPEC.	MFG. DRG/ RELEVANT IEC	Log Book	2	-	-	
		5.CORRECTNESS, COMPLETENESS TERMINATIONS/ MARKING/ COLOUR CODE	MA	VISUAL	100%	MFG SPEC. RELEVANT IEC	MFG SPEC. RELEVANT IEC	Log Book	2	-	-	
		6. RTD, BTD & SPACE HEATER MOUNTING.	MA	VISUAL	100%	MFG SPEC. RELEVANT IEC	MFG SPEC. RELEVANT IEC	Log Book	2		1	

BHEL	**PARTICULARS**	**BIDDER/VENDOR**	
	NAME		
	SIGNATURE		
	DATE		BIDDER'S/VENDORS COMPANY SEAL

		QUALITY PLAN	CUSTOMER :			PROJECT TITLE			SPECIFICATION : NUMBER :			
			BIDDER/ VENDOR :			QUALITY PLAN NUMBER PED-506-00-Q-007, REV-03			SPECIFICATION : TITLE			
		SHEET 8 OF 9	SYSTEM			ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV & MV)			SECTION			VOLUME III
SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY P	AGENCY W	AGENCY V	REMARKS
1	2	3	4	5	6	7	8	9	10	10	10	11
3.0	TESTS	1.TYPE TESTS INCLUDING SPECIAL TESTS AS PER BHEL SPEC.	MA	ELECT.TEST	1/TYPE/SIZE	RELEVANT IEC/ BHEL SPEC./ DATA SHEET	RELEVANT IEC/ BHEL SPEC./ DATA SHEET	TEST REPORT	2	1*	1	* NOTE - 1
		2.ROUTINE TESTS INCLUDING SPECIAL TEST AS PER BHEL SPEC.	MA	-DO-	100%	-DO-	-DO-	-DO-	2	1$	1	$ NOTE - 2
		3.VIBRATION & NOISE LEVEL	MA	-DO-	100%	RELEVANT IEC	RELEVANT IEC	-DO-	2	1$	1	$ NOTE - 2
		4.OVERALL DIMENSIONS AND ORIENTATION	MA	MEASUREMENT & VISUAL	100%	APPROVED DRG/DATA SHEET	APPROVED DRG/DATA SHEET & RELEVANT IEC	INSPC. REPORT	2	1	-	
		5.DEGREE OF PROTECTION	MA	ELECT. & MECH. TEST	1/TYPE/ SIZE	RELEVANT IEC	BHEL SPEC. AND DATA SHEET	TC	2	-	1	TC FROM AN INDEPENDENT LABORATORY, REFER NOTE-3
		6. MEASUREMENT OF RESISTANCE OF RTD & BTD	MA	-DO-	100%	-DO-	-DO-	-DO-	2	1$	1	$ NOTE - 2
		7. MEASUREMENT OF RESISTANCE, IR OF SPACE HEATER	MA	-DO-	100%	-DO-	-DO-	-DO-	2	1$	1	$ NOTE - 2
		8. NAMEPLATE DETAILS	MA	VISUAL	100%	RELEVANT IEC & DATA SHEET	RELEVANT IEC & DATA SHEET	INSPC. REPORT	2	1$	1	$ NOTE - 2
		9.EXPLOSION FLAME PROOF NESS (IF SPECIFIED)	MA	EXPLOSION FLAME PROOF TEST	1/TYPE	RELEVANT IEC STANDARDS	RELEVANT IEC STANDARDS	TC	2	-	1	TC FROM AN INDEPENDENT LABORATORY, REFER NOTE-3
		10. PAINT SHADE, THICKNESS & FINISH	MA	VISUAL & MEASUREMENT BY ELKOMETER	SAMPLE	BHEL SPEC. & DATA SHEET	BHEL SPEC. & DATA SHEET	TC	2	1$	1	SAMPLING PLAN TO BE DECIDED BY INSPECTION AGENCY $ NOTE - 2

BHEL	**PARTICULARS**	**BIDDER/VENDOR**	
	NAME		
	SIGNATURE		
	DATE		BIDDER'S/VENDORS COMPANY SEAL

	QUALITY PLAN		CUSTOMER :			PROJECT TITLE			SPECIFICATION : NUMBER :			
			BIDDER/ VENDOR :			QUALITY PLAN NUMBER PED-506-00-Q-007, REV-03			SPECIFICATION : TITLE			
	SHEET 9 OF 9		SYSTEM			ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV & MV)			SECTION			VOLUME III
SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY P	W	V	REMARKS
1	2	3	4	5	6	7	8	9	10			11

NOTES:

1 DEPENDING UPON THE SIZE AND CRITICALLY, WITNESSING BY BHEL SHALL BE DECIDED.

2 ROUTINE TESTS ON 100% MOTORS SHALL BE DONE BY THE VENDOR. HOWEVER, BHEL SHALL WITNESS ROUTINE TESTS ON RANDOM SAMPLES. THE SAMPLING PLAN SHALL BE MUTUALLY AGREED UPON.

3 IN CASE TEST CERTIFICATES FOR THESE TESTS ON SIMILAR TYPE, SIZE AND DESIGN OF MOTOR FROM INDEPENDENT LABORATORY ARE AVAILABLE, THESE TEST MAY NOT BE REPEATED.

4 WHEREVER CUSTOMER IS INVOLVED IN INSPECTION, AGENCY (1) SHALL MEAN BHEL AND CUSTOMERS BOTH TOGETHER.

Legends for Inspection agency

1. BHEL/CUSTOMER
2. VENDOR (MOTOR MANUFACTURER)
3. SUB-VENDOR (RAW MATERIAL/COMPONENTS SUPPLIER)

P. PERFORM
W. WITNESS
V. VERIFY

BHEL	**PARTICULARS**	**BIDDER/VENDOR**	
	NAME		
	SIGNATURE		
	DATE		BIDDER'S/VENDORS COMPANY SEAL

SECTION-D3

GENERAL TECHNICAL REQUIREMENT (C&I)

TECHNICAL SPECFICATION, DATA SHEET, QUALITY PLAN AND FAT FOR PLC

Form No. PEM-6666-0

	TITLE:	SPECIFICATION NO. PES-145-36
BHEL	**SPECIFICATION FOR PROGRAMMABLE LOGIC CONTROLLER SYSTEM**	VOLUME **II-B**
		SECTION **D**
		REV. NO. 02 DATE: June 25, 2012
		SHEET 1 OF 9

1. SCOPE

This specification covers the Design, Manufacture, Assembly, Inspection and Testing at manufacturer's works, proper packing and delivery to Mumbai port CHA Godown 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 equipments and accessories required for completeness of the system as mentioned in different sections of this specification.

2. GENERAL

2.1. 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).

2.2. The system shall be redundant in processor, power supply and communication interfaces unless otherwise specified. The system shall have self-diagnostic features. 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.

2.3. 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.

2.4. The mimic shall be displayed on the OWS screen and may also be provided on the control desk/panel (as per Data sheets).

2.5. 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.

2.6. It shall be possible to use the same OWS as programming station.

2.7. The PLC system shall be sized to meet process/system requirements as per the approved P&IDs and Control write-up.

2.8. The PLC system shall be designed to ensure that no single device failure should result in failure of any other device.

2.9. 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.

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: 1131

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

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 2.0 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.

3.2.4. 25 x 6 mm Copper ground bus to be provided for each panel.

3.2.5. 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.

3.2.6. 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.

3.2.7. The annunciation system shall be provided in OWS 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.

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 I/O replacement: All I/O 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. 10% spare capacity shall be ensured in each card channel assignment. Overall minimum 20% spare channels shall be provided.

3.4.4. 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.

3.4.5. 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.

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.

3.7. PRINTER

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

3.8. COMMUNICATION WITH PLANT DCS

3.8.1. The PLC system shall be provided with serial interface for communication with plant DCS.

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.

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 at PLC end 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-372-145-I001, Each UPS shall have 60 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 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(if applicable).

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
- Power distribution scheme.

- Block logic diagrams.
- Annunciation list.
- PLC control room layout drawing.
- List of soft signal exchange with Plant DCS.

- Quality plan
- 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.

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. 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.

7.3. Spares, Service support

Bidder shall provide availability of spares and service support for minimum 10 years after guarantee period.

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:

Sea worthy packing capable of performing all necessary functions like prevention of damage to the contents, sufficient to support frequent handling and lengthy period of outdoor storage in adverse weather conditions are required. Workmanship and materials used shall be of high standard meeting the technical requirements and in accordance with best commercial export packing practices. Vendor shall be responsible for sea worthy export packing. Equivalent or better packing methods may be deployed subject to approval of the BHEL. Vendor shall submit the packing procedure for its equivalent for BHEL's approval during detailed engineering.

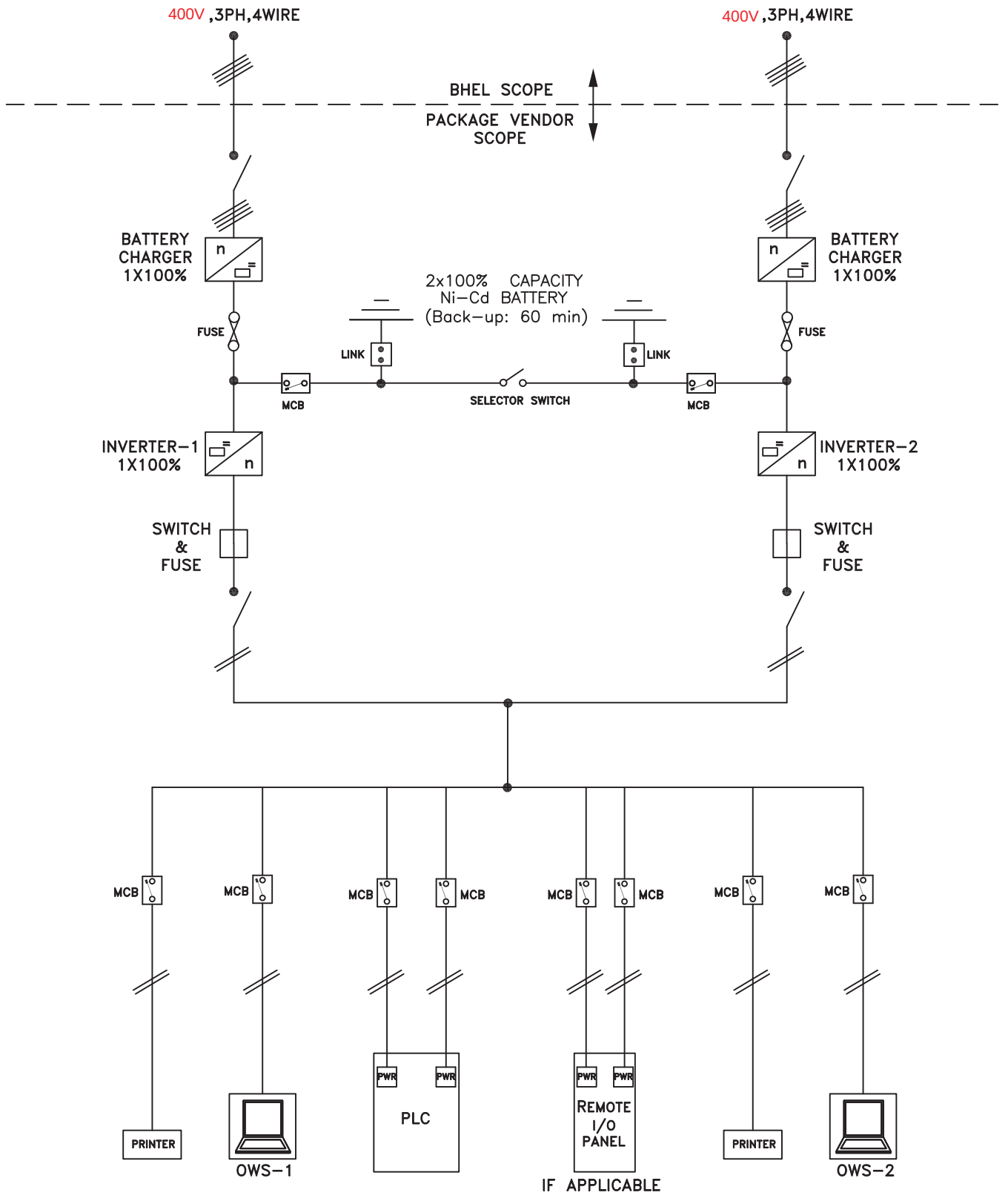
9. PERFORMANCE AND GUARNTEE

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-IIB 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 - PES-145-36-DS1-0
- Data Sheet C for PLC system - PES-145-36-DS2-0

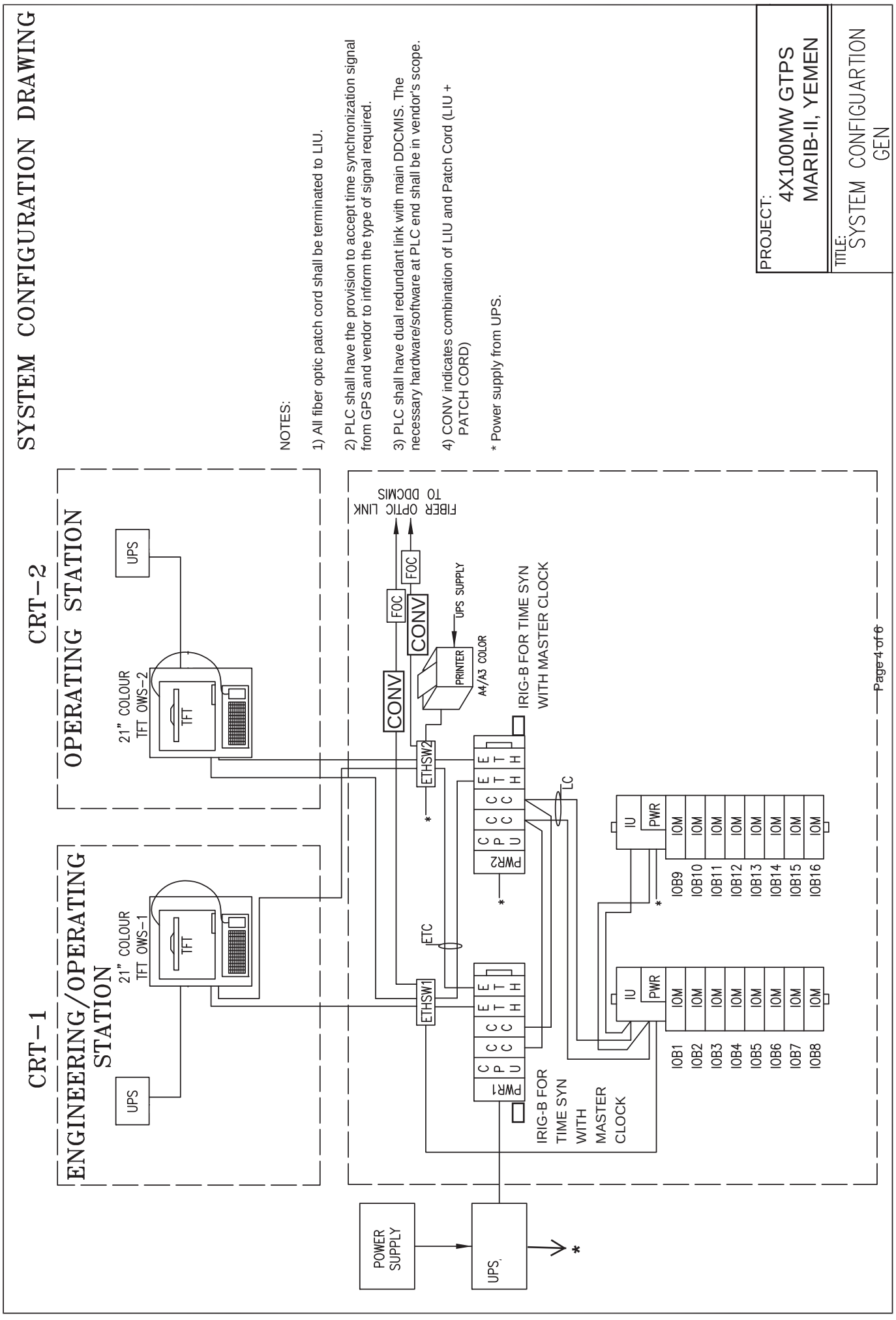


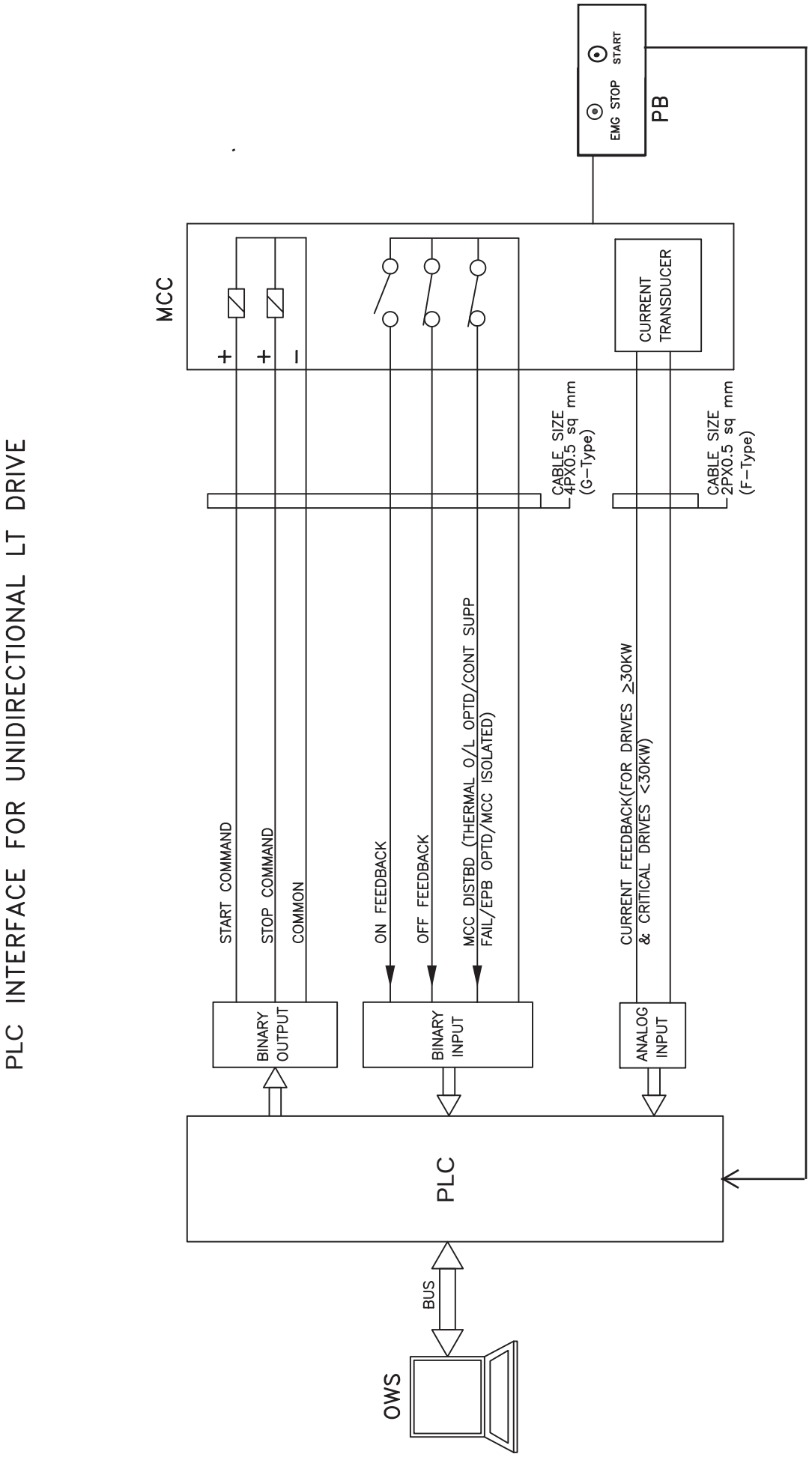
LEGEND:-

1) PWR – 24V,DC,POWER PACK

BHEL	400MW MARIB GTPS	DRG. NO.	PE-DG-372-145-I001
	TITLE:- TYPICAL POWER SUPPLY ARRANGEMENT FOR PLC BASED CONTROL SYSTEM	REV. No. 00	DATE 15.05.2013
		SHEET	01 OF 01

Layer1


SYSTEM CONFIGURATION DRAWING
CRT-1
ENGINEERING/OPERATING STATION
21" COLOUR TFT OWS-1
TFT
UPS
CRT-2
OPERATING STATION
21" COLOUR TFT OWS-2
TFT
UPS
NOTES:
1) All fiber optic patch cord shall be terminated to LIU.
2) PLC shall have the provision to accept time synchronization signal from GPS and vendor to inform the type of signal required.
3) PLC shall have dual redundant link with main DDCMIS. The necessary hardware/software at PLC end shall be in vendor's scope.
4) CONV indicates combination of LIU and Patch Cord (LIU + PATCH CORD)
* Power supply from UPS.
PROJECT:
4X100MW GTPS
MARIB-II, YEMEN
TITLE:
SYSTEM CONFIGUARTION
GEN
FIBER OPTIC LINK TO DDCMIS
FOC
FOC
CONV
CONV
UPS SUPPLY
PRINTER
A4/A3 COLOR
ETHSW2
ETHSW1
IRIG-B FOR TIME SYN WITH MASTER CLOCK
IRIG-B FOR TIME SYN WITH MASTER CLOCK
ETC
LC
CPU
PWR1
PWR2
ETH
IU
PWR
IOM
IOB1
IOB2
IOB3
IOB4
IOB5
IOB6
IOB7
IOB8
IOB9
IOB10
IOB11
IOB12
IOB13
IOB14
IOB15
IOB16
POWER SUPPLY
UPS
Page 4 of 6



PROJECT: 4X100 MW GTPS, MARIB-II

TITLE: PLC ; INTERFACE FOR UNIDIRECTIONAL LT DRIVE

FORM NO. PEM-6666-0

BHEL	**DATA SHEET FOR PLC SYSTEM**	SPECIFICATION NO.:
		VOLUME II B
		SECTION D
		REV. NO. 02 / DATE: 19.07.2008
		SHEET 1 OF 1

Data Sheet No.: **PES-145-36-DS1-0**

Data Sheet A & B

		DATA SHEET-A FOR PLC SYSTEM (TO BE FILLED BY PURCHASER)	DATA SHEET – B (TO BE FILLED BY BIDDER)
GENERAL	PROJECT	4X100MW MARIB GTPS-II	
	SERVICE		
	QUANTITY	☐ UNITISED ● COMMON	
	LOCATION	■ INDOOR ☐ OUTDOOR	
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 ☐ 48 V	
	LOCATION OF COUPLING RELAYS	● MCC ☐ PLC PANEL	
	DESKTOP OWS QUANTITY	☐ ONE ● TWO ☐ _____	
	DESKTOP MONITOR TYPE	☐ 19" ● 21" TFT	
	PRINTER (A3) - QUANTITY	INKJET LASER B/W COLOR INKJET COLOR LASER — A-3 size color laser-1 No.	
	PRINTER (A3) - MODEL	INKJET _____ LASER B/W _____ COLOR INKJET _____ COLOR LASER _____	
	PROGRAMMING / CONFIGURATION FACILITY	A) ☐ HAND HELD B) ENGINEERING SOFTWARE ● ONE OWS ☐ ALL OWS ☐ _____	
	SAFETY STANDARD	_____	
	COMPUTER FURNITURE	● YES ☐ NO	
PANEL	QUANTITY	BIDDER TO INDICATE	
	CLASS OF PROTECTION	■ IP-32	
	REMOTE I/O PANEL	☐ YES ☐ NO — As required	
	COLOUR	AS PER IS-5 SHADE _____	
	BACK-UP DESK	☐ YES ● NO	
	MIMIC	● YES ☐ NO	
	CONTROL HARDWARE	☐ PB ☐ INDICATORS ☐ FACIAS _____ Nos. ☐ OTHERS	
COMMUNICATION TO OTHER SYSTEM	HARDWIRED	☐ YES ■ NO	
	PURPOSE	☐ CONTROL ● MONITORING	
	MEDIUM	☐ UTP ● FIBRE OPTIC ☐ OTHERS	
	TIME SYNCRONIZATION SIGNAL FORMAT	☐ PULSE ☐ RS-485 ● IRIG-B	
	SOFTLINK	● MODBUS(TCP/IP) ☐ OPC	
	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	

FORM NO. PEM-6666-0

BHEL	**DATA SHEET FOR PLC SYSTEM**	SPECIFICATION NO.:
		VOLUME II B
		SECTION D
		REV. NO. 02 DATE: 19.07.2008
		SHEET 1 OF 1

Data Sheet No.: **PES-145-36-DS2-0**

Data Sheet C

DATA SHEET – C
(TO BE FILLED BY BIDDER AFTER AWARD OF CONTRACT)

GENERAL*	PROJECT	
	SERVICE	
	QUANTITY	
	LOCATION	
PLC EQUIPMENT	MAKE / MODEL NO.	
	PROCESSOR	
	DATA BUS (HMI)	
	DATA BUS (I/O - CPU)	
	DATA BUS (REMOTE I/O - CPU)	
	FIELD CONTACTS INTERROGATION VOLTAGE	
	LOCATION OF COUPLING RELAYS	
	DESKTOP OWS QUANTITY	
	DESKTOP MONITOR TYPE	
	PRINTER (A3) - QUANTITY	
	PRINTER (A3) - MODEL	
	PROGRAMMING / CONFIGURATION FACILITY	
	SAFETY STANDARD	
	COMPUTER FURNITURE	
PANEL	QUANTITY	
	CLASS OF PROTECTION	
	REMOTE I/O PANEL	
	COLOUR	
	BACK-UP DESK	
	MIMIC	
	CONTROL HARDWARE	
COMMUNICATION TO OTHER SYSTEM	HARDWIRED	
	PURPOSE	
	MEDIUM	
	TIME SYNCRONIZATION SIGNAL FORMAT	
	SOFTLINK	
	SERIAL LINK	
POWER SUPPLY INPUT FEEDER	PLC PANEL	
	REMOTE I/O PANEL	

STANDARD QUALITY PLAN
FOR
PROGRAMMABLE LOGIC CONTROLLER

QUALITY PLAN NO.:	**PE-QP-999-145-I036___**
VOLUME	IIB
SECTION	D
REV. NO.	01 DATE: 24.08.2007
SHEET	5 OF 8

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

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

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.

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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STANDARD QUALITY PLAN FOR PROGRAMMABLE LOGIC CONTROLLER

QUALITY PLAN NO.:	**PE-QP-999-145-I036___**
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
									P	W	V	
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	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 & Battery charger, Transformer, UPS.	Physical Inspection Physical Damages Dimensions Mounting Accessories	MA	Visual	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	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	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

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STANDARD QUALITY PLAN FOR PROGRAMMABLE LOGIC CONTROLLER

QUALITY PLAN NO.:	**PE-QP-999-145-I036___**
VOLUME	IIB
SECTION	D
REV. NO.	01 DATE: 24.08.2007
SHEET	2 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
									P	W	V	
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; MA - Major characteristics; MI - Minor characteristics

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STANDARD QUALITY PLAN FOR PROGRAMMABLE LOGIC CONTROLLER

QUALITY PLAN NO.:	**PE-QP-999-145-I036___**
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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
									P	W	V	
2.0	**Assembly**											
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	Powering 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%	FAT 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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1 - BHEL 2 - Vendor 3 - Sub-vendor

PEM :: C&I

STANDARD QUALITY PLAN FOR PROGRAMMABLE LOGIC CONTROLLER

QUALITY PLAN NO.: **PE-QP-999-145-I036___**

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 $			Remarks
									P	W	V	
3.0	**Factory Acceptance Test (FAT)**											
3.1	Input Output Functional Verification	I/O configuration, I/O operation	MA	Visual/ Eletrical	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/Desk 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	

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

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1 - BHEL 2 - Vendor 3 - Sub-vendor

Technical Specification, Quality plan for Instruments

BHARAT HEAVY ELECTRICALS LTD
POWER SECTOR
PROJECT ENGINEERING MANAGEMENT
NOIDA

General Instrumentation Design Requirements

• Field Instruments

a. Analog outputs signals from field instrumentation to the control systems are 4-20 mA dc signals. Instrumentation can be self-powered, or loop powered from the control systems. Self-powered analog signals shall be true “isolated from ground” signals.

b. Switch contacts for control system inputs shall be snap acting type, potential free with a maximum contact rating of 230V AC, 5A.

c. Transmitters will be used to provide the required 4 to 20mA signals for all controllers and receivers. Transmitters will be of the electronic, two-wire type, capable of driving an output impedance of 600 ohms minimum at 24 V dc, and will be generally powered from the control system I/O cards.

d. SMART transmitters’ calibration shall be carried out through a PC based System to be located in the computer room.

e. Pressure, flow, differential pressure, level, temperature, and other miscellaneous transmitter accuracy shall be within 0.1% of calibrated span and shall have repeatability of +0.1% of span or better. Errors caused by change in ambient temperature shall not exceed 0.01% of span per °C change. Temperature variations of +55°C shall not affect the 0.1% accuracy rating nor the 0.1% repeatability.

f. The plant instrument air supply pressure shall be:
1. Maximum supply pressure 7 kg/cm$_2$ (To be confirmed by PEC)
2. Minimum supply pressure 4.5 kg/cm$_2$

g. All instruments and analysers shall employ RF protection in the system design.

h. Instrument tags should be permanently attached to the device. If this is not possible, the instrument tag should be fastened to the instrument with stainless steel wire. The wired instrument tag should be supplied as ¾ inch by 3 inch, stainless steel instrument tags. Tag thickness is 1/16 of an Inch and stamped with instrument tag number. Tag number characters are 3/8 inch in height.

i. Speed switches and the actual device should drive transducers, if possible.

j. All instrumentation mounted inside, away fr om direct exposure to the elements, shall be as a minimum NEMA 4 construction unle ss it is in an environmentally controlled environment (e.g the control room). If the instrument is mounted in an environmentally controlled env ironment the instrument shall be as a minimum NEMA 1 construction.

k. All instrumentation mounted outside, exposed to the elements, shall be as a minimum NEMA 4X construction, unless it is enclo sed in a heated instrument enclosure. If the instrument is mounted in a heated instrument enclosure the instrument shall be as a minimum NEMA 4 construction

l. Transmitters and switches shall be grouped and mounted in open racks depending on the location. Individual instruments shall be mounted on stanchion or pipe mounted.

All field instruments junctions boxes & local panels located in hazardous area shall be explosion proof as per the area classification drawing.

m. The following metric engineering units shall be used for all instrumentation devices :

1. Pressure – bar (g)
2. Temperature - °C
3. Steam flow – kg/hr
4. Liquid flow – m^3/hr
5. Distance – meters (m) or millimeters (mm)
6. Differential pressure – mmH20

- **Pressure Instrumentation**

a. Pressure transmitters are electronic, analog 2-wire transmitters with isolated 4-20mAdc output signals.

b. Pressure transmitters will be supplied with integral mounted two valve manifolds.

c. All pressure transmitters shall be capable of withstanding their body rating conditions without permanent damage or loss of calibration.

d. Differential pressure transmitters of the capacitance type, regardless of the applied service, shall be capable of withstanding a differential pressure equal to full process pressure on either side of the measurement element without damage or loss of calibration.

e. Differential pressure transmitters will be supplied with integral mounted three valve manifolds.

f. Pressure gauges will be generally 150mm dial, solid front safety case type with blowout back, ½" NPT bottom connection, drawn stainless steel case, 316SS bourdon and socket, stainless steel movement, micrometer pointer. Pulsation dampers will be provided for pulsating pressure services. Liquid filled gauges shall be used for all pump discharges, vibrating or pulsating services.

g. Pressure switches will generally be snap acting type, DPDT action, with individual "on" and "off" points to be on a calibrated scale or dial.

h. Dual type control switches such as pre ssure switches having two sets of contacts with independently adjustable set points shall not be used where set point adjustment and deadband are a problem (e.g. low pressure and vacuum applications). If a potential problem exists, two single purpose switches shall be used.

i. The gauges shall have ± 1% accuracy and over range protection of 125%.

j. The switches shall have the following :

Max. Contact rating : 230V AC, 5A
Repeatability : ±0.5% FSR

- **Level Instrumentation**

a. Differential pressure transmitters will be used for general service level measurement of all tanks and other pressurized vessels.

b. Differential pressure type level transmitte rs are electronic, analog 2-wire transmitters with isolated 4-20 mA dc output signals. Displacer and ultrasonic level transmitters will be 24V DC powered, with isolated 4-20 mA dc output signals powered from the transmitters. Displacer type level transmitters are of torque tube type. Displacer type level transmitters shall be used for lub oil tanks.

c. Constant head chambers shall be furnished for all differential pressure-type level transmitters used with pressurised vessels. Reservoir piping connections shall be ½ inch outlet and a ½ inch inlet socket-welded type suitable for the pressure and temperature encountered.

d. Transparent gauge glasses will be used for low-pressure applications. Transparent or reflex gauges will be used for high-pressure applications. All gauge glasses will be equipped with gauge valves, including a safety ball check. Color less liquid shall be provided with reflex type level Gauges.

e. Level switches shall generally be cage float type, rated for ANSI B31.1 requirements.

f. DP Level transmitters : Accuracy-±0.1%
Level switch : Contact type – snap acting
Contact rating – 230 V AC, 5A,
Repeatability - ±0.5% FSR

Cable Selection

All cables shall be FRLS outer sheath, armoured, 7 strandard copper conductor, cable (for power cable -solid conductor).

Signal cable	:	Blue colour outer sheath, screened 1.0 Sq.mm for single pair 0.75 Sq.mm for 8/12 pair, individual pair and overall shielded
RTD cable	:	Black colour outer sheath, screened 1.0 Sq.mm for single triad 0.75 Sq.mm for 8 triad, individual triad & overall shielded
Control cable	:	Black colour outer sheath, screened 1.0 Sq.mm for 2 cores 0.75 Sq.mm for 8/12/24/48 cores
Power cable	:	Black colour outer sheath 2.5 Sq.mm For 2/ 3 cores.
Compensating cable	:	Type – KX, yellow colour outer sheath, screened individual and overall, 16 AWG 1/8/12 pair

9.7.0 Commissioning

The Contractor shall be responsible for installing, checking / calibrating of all the instruments and systems, laying and connecting of all interconnecting cables right from the field to the respective local control panel or central control / electronics rooms, termination of all cables, laying and connecting data high ways, testing the system, loop checking from field to receiver instruments / system and commissioning the instruments and systems.

C&I Spares :

The Contractor must indicate and include in his scope of supply the following:

a) All the necessary start up spares
b) Recommended spares for two (2) years of normal operation of the plant with unit & total prices.

Furthermore the contractor shall also provide a list of recommended spares for five (5) years operation including major overhaul along with the price schedules.

The Purchaser reserves the right to finalise the exact quantities of the recommended spare parts and effect price adjustment on the basis of the unit rates quoted by the Contractor.

The spares ordered by the Purchaser shall be delivered at the site not later than the date of issue of Taking over Certificate.

Price of the recommended spares will not be taken into consideration for the evaluation of the bids. They shall remain firm up to Twelve (12) months from the date of finalisation of EPC contract for the power plant. Purchase of these spares parts will be covered by a separate order which will be issued only after the receipt of the complete instruction manuals for the equipment from the Contractor. Instruction manuals for major plant / equipment shall be submitted by contractor within Six (6) months from date of finalisation of contract. If the submission of O & M manuals are delayed the validity of offer for recommended spares shall be correspondingly extended The bidder should confirm that the recommended spares shall be delivered at site within three months of the placement of order.

All spares supplied under this Contract shall be strictly interchangeable with the parts for which they are intended for replacements. The spares shall be treated and packed for long storage under the climatic conditions prevailing at site e.g small item shall be packed in sealed transparent plastic bags with dessicator packs as necessary.

Each spare shall be clearly marked or labelled on the outside of the packing with its description. When more than one spare part is packaged in a single case, a general description of the contents shall be shown on the outside of such case and a detailed list should be enclosed. All cases, containers and other packages must be suitably marked and numbered for the purpose of identification.

In the schedule of the recommended spares, the bidder shall clearly state and identify separately the spare parts manufactured by the supplier, the spare which are bought out locally from the indigenous manufacturers and the spares which are imported from other countries. The sources of the supplier of the spares not manufactured by the supplier shall be furnished. The complete details of such spares to enable the Purchaser to place orders directly for his future requirements, shall also be furnished.

All spare parts supplied shall be new and unused.

General Requirements

(1) **Tendering procedure of spare parts**

The tenderer shall prepare in his tender a complete list of recommended spares required for two (2) years of normal operation. The list shall give for each spare part, the number of equipment installed in the plant, the number of spares supplied, the unit price and the total price as well as the grand total. Also, the tenderer shall provide a list of recommended spares for five (5) years operation along with the price schedules.

(2) **Criteria for selection of Spare Parts**

The Tenderer shall recommend and propose spares for equipment parts in accordance with the following three categories :

Category - I - Spare parts that are subject to:

(a) Wear, tear, erosion and corrosion during normal operation.

(b) Failure that would result in shut down of the equipment.

(c) Failure that would cause troublesome operation of the equipment.

Category - II - Small parts that are subject to:

(a) Damage or breakage during routine maintenance or inspection such as gaskets, packings, bolts, t, etc. of general use (mechanical parts)

(b) Same, such as fuses, lamps, etc. of general use (electrical and instrument parts).

In preparing the spare parts list, the Tenderer shall critically examine the equipment Vendor's recommended spare parts list both to ensure completeness and eliminate items which combine low wear and breakage factors based on anticipated operating conditions (continuous, intermittent or occasional, severe or mild) and short delivery time.

Category - III - Recommended spare parts required for major overhaul, combustion path inspections.

Also the possible interchangeability of parts of similar equipment (pumps, motor, instruments, electrical, etc.) shall be given due consideration.

Fast consumable items like indicating lamps, fuses, etc. shall be easily replaceable by local sources.

(3) **Start - up Spare Parts:**

Start - up spares are those spares, which may be required during the start-up and commissioning of the equipment and/or system. All spares used until the plant is handed over to the Purchaser shall come under this category. The Contractor shall provide for adequate stock of such start-up spares to be brought by him to the site during the plant erection and commissioning. They must be available at site well in time and can be taken back from there only after the receipt of the Taking Over Certificate.

(4) **Spare Parts management System :**

It is the Purchaser's intention to implement a general spare part management system for phase-I & II plants . The basis for setting up the data base of this spare part management system is the "SPIR" form (Spare Parts list and Interchangeability Record**).**

The Contractor shall carefully prepare / fill in the SPIR forms for all spare parts supplied under this contract. Particular emphases shall be placed on :

(a) Indicating the prime manufacture's real part number.

(b) Attaching all manufacturer's drawings to the SPIR forms

(c) Providing a true interchangeability record.

(d) Giving realistic price information.

SPIR Forms shall be submitted in required copies at least four months before spare parts delivery. They shall be subject to the Purchaser's approval.

It is recommended that the forms are completed by the equipment manufacturer, for example, on the following items :

(a) Equipment registration number of tag number for each piece of equipment as stated in requisitions and/or purchase orders.

(b) Manufacturer's model, type or other positive identification reference of the equipment / instruments, ordered.

(c) Total number of pieces of identical equipment / instrument as quoted.

(d) Purchasing company's order reference number.

(e) List of all parts which should be carried in stock for normal operation and also list of slow-wearing parts. If an item is interchangeable between two or more units it should be listed once only.

(f) Drawing number of spare parts

(g) Reference numbers/letters or other information which identical each part. Interchangeability with identical parts within the manufacturer's range should be indicated.

(h) Material specification in terms of international codes standards and accepted conventions, not manufacturer's or sub-manufacturer's references.

(i) For each unit or group of identical units, the number of parts fitted in each unit of equipment of instrumentation.

(j) The total number of identical parts in all equipment specified.

(k) Approximate ex-works price per piece of each part in the currency shown at the top of the column.

17.4.0 General Control and Instrumentation (C&I) Requirements

17.4.1 General

This section applies to the design of the general Control & Instrumentation equipment for the whole plant. The following general requirements shall be strictly observed with regard to design and execution. In the event of contradictions the Contractor shall be responsible for obtaining written clarification from the Purchaser.

This specification does not, however, relieve the supplier of his responsibility for the detailed design and execution of the Control & Instrumentation system. The rules of good engineering practice and the relevant approved standards and regulations shall be observed.

The Control & Instrumentation equipment to be provided shall be suitable for faultless and safe control and supervision of the entire plant.

For specifying the technical requirements for the entire plant the terms ‘main systems’, ‘auxiliary systems’ and ‘package systems’ are used.

Main systems are designated as systems belonging to the main technological process and serving the main purpose of the plant. Generally they require higher control complexity and accuracy, remote control, adjustment and indication, shorter response time and higher reliability. For main systems even short functional interruptions have to be avoided. Examples of main systems are: Gas Turbine, Fuel Gas & Oil System etc.

Auxiliary systems are all such plants with local independent control and instrumentation systems, wherever required.

For the control of these systems preferably Programmable Logic Controllers (PLC) may be used. The PLC’s shall be interfaced to the data highway of the DCS to enable the data monitoring and the issue of commands from / to the CCR.

The equipment shall be installed within local cabinets to be housed in Local Control Rooms (LCR).

Air conditioned local control rooms shall be provided for various packages as applicable

For all items included under the general heading ‘main systems’, not more than one instrument sub-contractor of international standard shall supply, install and commission all Control & Instrumentation equipment. In order to achieve uniformity of measuring equipment and to restrict the number of different spare parts to a minimum, the Contractor shall, where possible use the same make and type of Control & Instrumentation equipment for similar applications throughout the entire plant, including auxiliary systems, but excluding package systems.

Where it is proposed to use equipment of different manufacturer to that supplied for the main systems, the Contractor must justify this on technical grounds.

As a general rule, measuring points and measuring equipment for protection purposes (e.g. Gas Turbine Protection), shall be separate from and not combined with measuring equipment for other Control & Instrumentation tasks. For flow measurement one common primary element can be used. Signals to be processed in several systems, shall be suitably repeated and mutually decoupled to avoid interaction.

The material used for all equipment shall correspond to the material of the relevant pipes, tanks etc. and shall fully meet the requirements regarding safety and operational conditions of the media to be measured. Instrument piping to transmitters and sample piping shall be stainless steel.

All field instruments and enclosures and junction boxes shall be weather proof (NEMA 4X) for non-hazardous area and explosion proof and weather proof (NEMA 4 & 7) for hazardous area.

All the equipment shall be suitable for the location in which it shall be mounted and in particular all outdoor equipment shall be suitable for the climatic conditions of Project location.

The spare capacities listed below shall be provided for the following items of the plant:

- 20% in each cabinet, modular frames related to the maximum capacity.

- 20% for multicore cables, terminals in junction boxes and marshalling racks.

- 20% for automation units related to :

* Maximum number of inputs / outputs.

- 40% capacity factor of data highway.

- 40% of maximum memory capacity

The above spare capacities shall be available after final commissioning of the plant and shall be suitably distributed. For example, the free space shall be distributed over the utilizable space in cabinets, racks, modular frames etc. in such a way that additional control equipment or modules may be added to any group of controls.

17.4.2 Field Instrumentation

17.4.2.1Transmitters, Field Switches

All transmitters shall have an impressed output signal of 4 - 20 mA, corresponding from Zero to full range input. The minimum burden of the output shall be 600 ohms. The transmitters shall be of smart type and shall be suitable for field bus connection and/or for digital integration into the DCS.

For all differential transmitters, designated as flow transmitters, integral square root extraction shall be incorporated into the transmitters, so that the transmitter output is linear with the flow.

An output signal indicator shall be provided on the transmitter.

Accuracy equal to or better than ± 0.2% of the full span.

Repeatability within a range of ± 0.1% of full span.

In the case of failure and return of the supply voltage to the transmitter no false signals endangering the system shall be issued.

All transmitters including temperature transmitters shall be suitable for field installation and shall be proven instruments. The protection class shall be NEMA 4X or better according to IEC 144. All field transmitters shall be suitably grouped and housed in field instrument enclosures.

Transmitters to be used in hazardous areas shall be explosion proof. Suitable active safety barriers shall be provided.

For the continuous remote position indication of valves, dampers, etc. also transmitters with impressed output signal of 4-20 mA shall be employed. The position sensing shall base on reluctance, capacitance or strain principle.

All transmitters potentially subjected to vacuum shall be capable of withstanding 1.013 bar vacuum without damage.

Diaphragm seals shall be provided to serve as a barrier for corrosive process fluids, slurries or highly viscous oils. The seal shall be of the flanged type, suitable for the same conditions as those for the transmitter. The material shall be minimum 316 SS. The seal shall be provided with a flushing connection.

The binary signals for alarms, interlocks, protection are to be taken from field switches e.g. temperature switches, pressure switches etc. Indicators with integrated limit switches are allowed within package units. Preferably limit switches shall be of the proximity type.

All switches shall be of robust design and reliable performance. Temperature switches, pressure switches, level switches, etc. shall be of snap action and changeover type. The switches shall have an adjustable switching hysteresis.

The set point of each switch shall be adjustable from inside the case, over the full range specified. The deadband (reset point) of each switch shall be adjustable from inside the case. The set point and reset point shall be indicated on the adjusting mechanism.

Each switch shall be housed in a durable metallic case with gasketed cover. The casing shall be NEMA 4X and for applications on the fuel gas or other hazardous areas explosion proof casing shall be used.

The performance of each switch shall be guaranteed to the values stated below. This guarantee shall apply with all accessories installed on the switch.

Accuracy:- All switches shall operate at the indicated set point with an accuracy within 1% of the full scale.

Repeatability:- All switches shall be repeatable within ± 0.5% of the adjustable range. Repeatability is defined as the maximum difference in operation for any given identically repeated stimulus with no change in other test conditions.

Drift:- Switches shall not drift due to ambient temperature by more than 0.5% adjustable range.

17.4.2.2 Pressure, Differential Pressure Measurements

Pressure gauges shall be located where they shall be easily observable or shall be combined in groups on local gauge boards or cubicles. Pressure gauges shall have moisture and dust-proof cases and shall be resistant against vibrations.

Tapping points shall generally be in accordance with the specification for the pipeline it belongs to. Tapping points shall be equipped with primary isolating valves mounted directly at the tapping point and having a nominal bore of at least 15 mm.

A gauge valve combination or multi-way cock shall be provided directly on the pressure gauge connection.

All transmitters for differential pressure shall be provided with:

a. Valve blocks to be mounted directly at the transmitter enabling isolation of the transmitter from the differential pressure and enabling checking of the transmitter zero point.

b. Separate blow-off valves for cleaning the active pressure tubes.

The above mentioned valves shall be capable of withstanding upto 1.5 times operating pressure.

Transmitters for remote measurements shall not be mounted directly on the tapping point but shall be arranged at a distance from the tapping point by means of gauge holders. The impulse line between tapping point and pressure gauge shall form a siphon loop, when steam pressure measurements are involved.

All pressure/differential pressure measuring points shall be equipped with a connection for test (thread M 20 x 1.5), which shall be capable of being shut off without isolating the service pressure gauge / transmitter.

Tapping points for pressure gauges, transmitters or pressure switches for heavy fuel oil shall be provided with seal pots, or with separating diaphragms. The tapping point and impulse piping shall be trace - heated upto and including the separating device.

All exhaust gas transmitters and gauges shall be provided with a supply of clean, dry purge air. All transmitters shall be suitably grouped and housed in field instrument enclosures.

17.4.2.3 Temperature Measurements

In general thermocouples shall be used for all remote temperature measurements.

All thermocouples shall be of the mineral insulated type, having insulated hot junctions and stainless steel sheaths. Chromel/alumel thermocouples (Type K) shall preferably be used. Resistance thermometers may be used for motor winding, cooling water and similar applications. All resistance thermometers shall be wired according to the three or four conductor principle.

All thermocouples shall be of the quick response type, ungrounded and of duplex type.

The thermocouples to be provided for exhaust gas temperature shall be so mounted as to be free from all exhaust duct vibration.

Thermometers and thermocouples shall be fitted in protective wells that shall be of the weld in or screwed in type in accordance with the pipeline / tank it belongs to.

The execution and dimensioning of the protective wells shall be in accordance with the approved standards and shall preferably comply with approved standards.

Where more than one temperature measurement task becomes necessary at one (1) single location, individual thermowells with sensors shall be provided at the common place of measurement.

Thermowells for unoccupied test measuring points shall be arranged with the opening inclined downwards wherever possible. Screw-on protection cover shall be provided for all unoccupied test measuring points.

As far as local conditions or extreme temperature do not necessitate other requirements, screw-in immersion wells for exhaust gas and air shall have a nominal length not less than 0.8 m.

The attachment of the well in the wall of the exhaust gas channel or air duct shall be gas-proof.

For close loop measurement shall be provided Temperature Transmitter for Temperature Element.

For the measurement of temperature of other media the following requirements shall be observed:

Well materials shall be SS 316 for all applications. For the combustion chamber a corrosion and temperature resistant material shall be used.

For all pipework a minimum immersion depth of 55 mm into the internal pipeline cross-section and a minimum distance of 15 mm from the opposite pipe wall shall be observed. If the diameter of the pipeline does not allow the thermometer to be inserted perpendicular to the pipe axis, another solution shall be found in consultation with the Purchaser. When determining the lengths of the insertion and connecting tubes the insulation thickness shall be taken into consideration.

Dial thermometers may only be used for local indication. They shall be mounted vibration free and independent of the equipment foundations. An adequate length of capillary shall be provided for this purpose.

Embedded Resistance Temperature Detectors (RTD's) shall be provided for measuring, winding and bearing temperatures for large drives. Excess temperatures are to be signalled. Also the individual selection and indication of any measuring point must be possible from the CCR.

17.4.2.4 Level Measurements

For the level measurement, transmitters for differential pressure input shall preferably be used, However, if the level measuring range allows level transmitter with a plunger these may be applied.

The requirements for transmitters and for differential pressure measurements are specified in Clauses 17.4.2.1, and 17.4.2.2.Local level indicators for water shall be provided with an illumination device in the case of a sight glass.

The sight glass shall be of robust design and shall be sufficiently protected against mechanical damage. The indication shall be designed so that the water column shall be seen as a whole, i.e. level indicators only showing the level as a point will not be accepted. For cold water tanks indicators using magnetically initiated indication, flags may be used. The level indicators shall be equipped with shut-off valves which enable exchange or replacement of glasses or sealing during operation.

The indicating range of level indicators shall preferably cover the whole vessel/tank, but as minimum requirement it shall cover all switching points of level switches mounted on the tank or vessel.

JUNCTION BOXES (JB)

01. The Junction box enclosures shall comprise of a case and cover/door constructed from cold rolled sheet steel of thickness 3 mm. The construction shall ensure adequate strength and rigidity. Junction boxes and pull boxes shall be hot dipped galvanized and confirm to meet IP 65 class as per IS : 2147 with providing all facilities as below .

02. The junction boxes shall also be meet the following minimum requirements :

a) Junction boxes shall be provided with lockable door on the front side. The locks of the junction boxes shall be(Industrial Type) identical and operable by one key . Top of the boxes shall be arranged to slope towards rear of the box. Junction box shall have gland plate of 3mm sheet at bottom for indoor mounted boxes with neoprene/synthetic gasket lining of 6mm thick including door lining also. Suitable industrial type hinges & MS handle shall be provided for opening of the boxes smoothly & able to take load of door without any trouble /hampering IP 65 protection class.

b) All the junction boxes shall be suitable for mounting on walls, columns, structures etc. The brackets, nuts, bolts, screws. Glands and lugs required for erection shall be included in Supplier's scope of supply.

c) M6 Ni plated brass earthing stud 3 nos (2 external & 1 inside the JB)shall be provided for each junction boxe.

d) Terminal blocks shall be of **Cage Clamp Terminal blocks of Wago/Phoenix Make suitable for 2.5 mm2 cable shall be** properly arranged inside JB with end plate & end clamp in DIN rail mounted & marked up with TB nos from top to bottom to facilitate easy termination of the cables. Adequate space from left/right hand ,top/bottom side of wall of JB to TB end & in between TB's shall be min. **100mm** gap all around shall be provided.

e) 20 % Spare terminals shall be provided for each of the junction boxes distributed overall terminal blocks.

f) Construction details shall be as per enclosed drawing attached in page 03 of 03 of this technical requirements. The exact size and dimensions of junction boxes shall be as decided during detailed during detailed engineering stage keeping in view the nos of terminals required etc. The same shall be subject to approval during detailed engineering stage.

g) The Supplier shall furnish general arrangement, cross section details of junction boxes and the same shall be subject to BHEL/CUSTOMER's approval during detailed engineering stage.

h) The color of the Junction Boxes shall be Exterior Epoxy based to shade **Opaline Green to shade 275 of IS 5(Semi glossy)** , interior **brilliant white**(Glossy) & paint thickness shall be 100-150 micron.

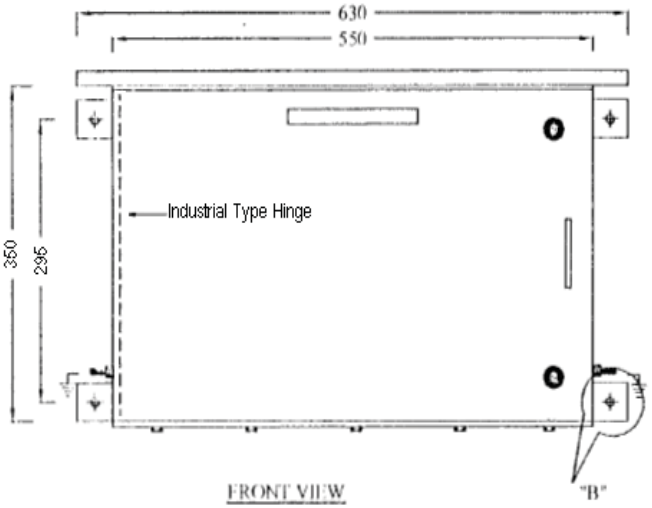
03 **REMARKS**

Subsequent to order, bidder to furnish filled in BOM schematics / GA drgs etc.

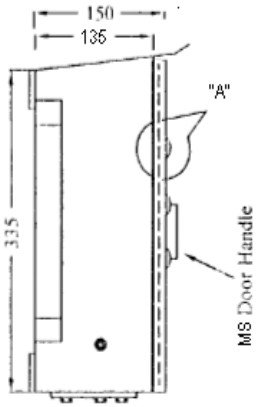
04 TESTING

High voltage & Insulation Resistance test. & IP 65 (if not conducted earlier)

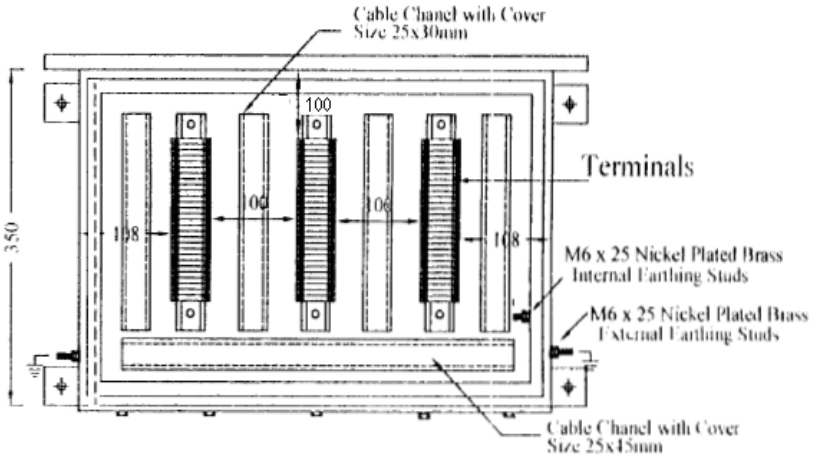
Typical Drg. for 72 Ways JB



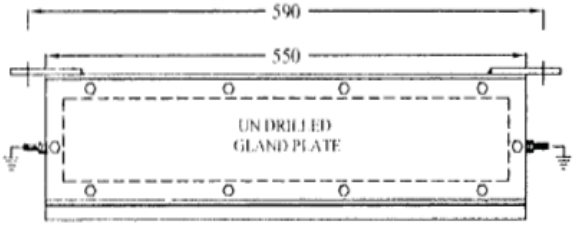
FRONT VIEW



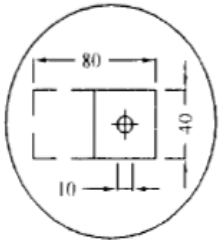
SIDE VIEW



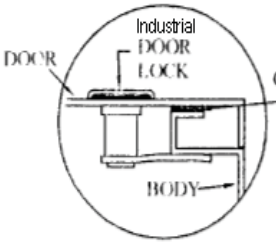
OPEN DOOR VIEW



BOTTOM VIEW



VIEW "B"



VIEW "A"

NOTE :

All Dimensions are in mm.

1) Sheet Thk . 3.0mm CRCA
2) Protection IP65
3) Paint :
   a) Hot Dip Galvanizing.
   b) External:- Epoxy based to shade Opaline Green to shade 275 of IS 5(Semi glossy)
   Internal:- Brilliant white(Glossy)
4) Panels are Wall mounting type with smooth finish.
5) All doors are open throughhinged with handle & lock arrangment.
6) All doors ,gland plate &removables are to be gasketed.
7) Fixing Bolts : 4 Set of zinc plated Fasterners each Set Consists of 1No - M10 x 60mm Bolt ,1 No - Spring washer, 2 Nos Plain washer & 1No - M10 nut.
8) Terminal blocks are be provided with number markers Continuously from top to Bottom
9) Paint thickness shall be 100-150 micron.80-100 micron for Powder coating.
10) Door locks for all the boxes will have identical with a common key
11) Quantity - As per scope of supply.

BILL OF MATERIAL

Sl	Description	Make	Qty
1	2.5 Sq.mm Cage Clamp type With 6.6 Polyamide Terminal block	WAGO / Phenix	87 Nos.

			Name	Date	Sign	Customer	
		Drw.				Project	
01		Ckd.				Title	GA FOR 72 WAY JUNCTION BOX
Rev.		Appd.					

Sheet No. - 01/01 Rev. 01
Scale - N.T.S.

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STANDARD QUALITY PLAN
FOR
PRESSURE AND DIFFERENTIAL PRESSURE GAUGES

QUALITY PLAN NO.:	PE-QP-999-145-I026
VOLUME	IIB
SECTION	D
REV. NO.	01 DATE: 16.05.2007
SHEET	1 OF 2

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	
1.0	**Material / Components**											
1.1	Casing, Bourdon tube and Movement	1. Chemical composition	MA	Chemical Test	One Sample from each lot	Approved drg. / data sheet / BHEL Spec.	Relevant raw material std.	Test Certificate	3/2	---	2,1#	# Compliance certificate to be verified.
		2. Workmanship, finish and dimensions	MA	Visual, Measurement	100%	Approved drg. / data sheet / BHEL Spec.	Approved drg. / data sheet / BHEL Spec.	Inspection Report / Log Book	3/2	---	2,1#	
1.2	Switch⊕	Contact type & number	MA	Visual	100%	Approved drg. / data sheet / BHEL Spec.	Approved drg. / data sheet / BHEL Spec.	Test Certificate/ Inspection Report	3	---	2,1#	⊕Applicable for gauge with switch device
2.0	**Assembly**	1. Marking – Tag No., Model, Range	MA	Visual	100%	- do -	- do -	Inspection Report	2	1	---	
		2. Workmanship	MA	Visual	100%	- do -	- do -	- do -	2	1	---	
		3. Dial size, scale graduation	MA	Visual	100%	- do -	- do -	- do -	2	1	---	
		4. End connections	MA	Measurement	100%	- do -	- do -	- do -	2	1**	1	**10% of total quantity with minimum of 2 piece / type & size
		⊕5. Switch – contact type & nos.	MA	Visual	100%	- do -	- do -	Inspection Report	2	1	---	
3.0	**Routine Test**	1. Calibration, accuracy, Hysteresis, overload, set point adjustment⊕ / repeatability	CR	Measurement	100%	- do -	- do -	- do -	2	1**	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

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STANDARD QUALITY PLAN FOR PRESSURE AND DIFFERENTIAL PRESSURE GAUGES

QUALITY PLAN NO.:	PE-QP-999-145-I026
VOLUME	IIB
SECTION	D
REV. NO.	01 DATE: 16.05.2007
SHEET	2 OF 2

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	
		2. Hydraulic Test	CR	Measurement	100%	Approved drg. / data sheet / BHEL Spec.	No Leakage	Inspection Report	2	1**	1	
		⊕3. IR, HV	CR	Measurement	100%	Relevant standard	Relevant standard	- do -	2	1**	1	
4.0	**Type Test**	1. Enclosure Protection Class	CR	Verification	Each type	Approved drg. / data sheet / BHEL Spec.	Approved drg. / data sheet / BHEL Spec.	Test Certificate	2	---	1•	•Type Test Certificate to be verified
		2. Blow out disc	CR	Verification	Each type	- do -	- do -	- do -	2	---	2•	
		⊕3. Switch contact rating	CR	Verification	Each type	- do -	- do -	- do -	2	---	2•	
5.0	**Painting**	Shade & Finish	MA	Visual	100%	Approved drg. / data sheet / BHEL Spec. / Manufacturer's std.	Approved drg. / data sheet / BHEL Spec. / Manufacturer's std.	Inspection Report	2	---	2	
6.0	**Packing**	Soundness	MA	Visual	100%	- do -	- do -	- do -	2	---	---	

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STANDARD QUALITY PLAN FOR PRESSURE / DP/LEVEL TRANSMITTER

QUALITY PLAN NO.:	**PE-QP-999-145-I001**
VOLUME	IIB
SECTION	D
REV. NO.	00 DATE: 12.10.99
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 $			Remarks
									P	W	V	
1.0	**RAW MATERIAL INSPECTION**											
1.1	Body/Casing, Cable Gland and Mounting Bracket	1. Chemical & Mech. Properties	MA	Analysis	1 / Lot	Tech. Specn. Data Sheet, Mfr. standard	Tech. Specn. Data Sheet, Mfr. standard	Test certificate	3	---	2	Compliance report verification by BHEL.
		2. Dimensions	MA	Measurement	10% Min. 3 Nos.	Manufacturer drg.	Manufacturer drg.	Log Book	2	---	---	
		3. Visual	MA	Visual	100%	BHEL Spec. / Approved data sheet	BHEL Spec. / Approved data sheet	Log Book	2	---	---	
		4. Degree of Protection (If applicable)	CR	IEC : 60529 IEC : 60079	1 / Type	BHEL Spec. / Approved data sheet	BHEL Spec. / Approved data sheet	Test certificate	3	---	2	
		5. Leak Tightness	MA	Hydro Test	100%	BHEL Spec. / Approved data sheet	BHEL Spec. / Approved data sheet	Log Book	2	---	---	
1.2	Sensor (Diaphragm, Capsule, Bellows, Strain, Gauge, Capacitance etc.)	1. Material Properties (Chemical & Mechanical)	MA	Analysis	1 / Lot	BHEL Spec. / Approved data sheet	BHEL Spec. / Approved data sheet	Test certificate	3/2	---	2	
		2. Dimension	MA	Measurement	1 / Lot	BHEL Spec. / Approved data sheet	BHEL Spec. / Approved data sheet	Test certificate	2	---	---	
		3. Performance	CR	Function	100%	BHEL Spec. / Approved data sheet	BHEL Spec. / Approved data sheet	Test certificate	2	---	---	
		4. Type Test	CR	Mech. & Elect.	1/Type	BHEL Spec. / Approved data sheet	BHEL Spec. / Approved data sheet	Test certificate	3/2	---	2	

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STANDARD QUALITY PLAN FOR PRESSURE / DP/LEVEL TRANSMITTER

QUALITY PLAN NO.:	**PE-QP-999-145-I001**
VOLUME	IIB
SECTION	D
REV. NO.	00 DATE: 12.10.99
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	
1.3	Gasket	1. Dimension	MA	Measurement	Sample	Manufacturer standard	Manufacturer standard	Test certificate	3/2	---	2	
		2. Sheer Hardness	MA	Analysis	Sample	Manufacturer standard	Manufacturer standard	Test certificate	3/2	---	2	
1.4	Electrical & Electronic Components	1. Marking & Rating	MA	Visual	10%	Manufacturer standard	Manufacturer standard	Log Book	2	---	---	
		2. Electrical Parameters	CR	Electrical Tests	10%	Manufacturer standard	Manufacturer standard	Log Book	2	---	---	
		3. Dimensions	MA	Measurement	10%	Manufacturer standard	Manufacturer standard	Log Book	2	---	---	
		4. Solderability	MA	Electrical	3 / Type	Manufacturer standard	Manufacturer standard	Log Book	2	---	---	
1.5	PCBs	1. Visual	MA	Visual	100%	---	---	---	3/2	---	2	
		2. Dimensions	MA	Measurement	10%	Manufacturer standard	Manufacturer standard	Log Book	3/2	---	2	
		3. Type Test	CR	Mech. & Elect. Tests	1 / Type / Batch	BS:4025	BS:4025	Test certificate	3/2	---	2	

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STANDARD QUALITY PLAN FOR PRESSURE / DP/LEVEL TRANSMITTER

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SECTION	D
REV. NO.	00 DATE: 12.10.99
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 $ P	Agency $ W	Agency $ V	Remarks
2.0	**In-Process Inspection**											
2.1	Electrical Unit											
2.1.1	Etched PCB	1. Dimension – Trade width, Gap etc.	MA	Measurement	Sample	Manufacturer standard	Manufacturer standard	Inspection report	2	---	---	
		2. Defect of undercuts	MA	Visual	Sample	Manufacturer standard	Manufacturer standard	Inspection report	2	---	---	
		3. Quality and plating of plating through holes.	CR	Visual	100%	Manufacturer standard	Manufacturer standard	Inspection report	2	---	---	
		4. Screen printing	CR	Visual	100%	Manufacturer standard	Manufacturer standard	Inspection report	2	---	---	Compliance verification report by BHEL
2.1.2	Component Mounting and soldering	1. Correctness of components	MA	Visual	100%	Manufacturer standard	Manufacturer standard	Inspection report	2	---	---	
		2. Mounting and orientation	MA	Visual	100%	Manufacturer standard	Manufacturer standard	Inspection report	2	---	---	
		3. Soldering defects and finish	CR	Visual	100%	Manufacturer standard	Manufacturer standard	Inspection report	2	---	---	
2.1.3	Assembled PCBs	Functional check	CR	Electrical checks before & after soaking*	100%	Manufacturer standard	Manufacturer standard	Inspection report	2	---	---	

*Soaking means subjecting PCB (Assembled) at 70 Deg. C for 72 hours at energised condition and rapid temperature cycle test at 70 Deg. C and (-) 20 Deg. C for 30 minutes at each temp. (Five such cycles).

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STANDARD QUALITY PLAN FOR PRESSURE / DP/LEVEL TRANSMITTER

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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	
2.1.4	Conformal coating	Uniformity and finish of conformal coating on both sides	CR	Visual	100%	Manufacturer standard	Manufacturer standard	Inspection report	2	---	---	
2.2	Mounting, Fitting, Assembly of various mechanical parts	1. Correct Mounting	MA	Visual	100%	Manufacturer standard	Manufacturer standard	Log Book	2	---	---	
		2. Defects	MA	Visual	100%	Manufacturer standard	Manufacturer standard	Log Book	2	---	---	Compliance verification report by BHEL
		3. Dimensions	MA	Measurement	100%	Manufacturer standard	Manufacturer standard	Log Book	2	---	---	
2.3	Interconnection – Sensor to Electronic unit	Correctness of Interconnection	MA	Visual	100%	Manufacturer standard	Manufacturer standard	Log Book	2	---	---	
2.4	Interconnection – Pneumatic unit / Electronic unit and output / Local indicator.	Correctness of Interconnection	MA	Visual	100%	Manufacturer standard	Manufacturer standard	Log Book	2	---	---	

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PEM :: C&I

STANDARD QUALITY PLAN FOR PRESSURE / DP/LEVEL TRANSMITTER

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REV. NO.	00 DATE: 12.10.99
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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 $ P	Agency $ W	Agency $ V	Remarks
3.0	**Complete Transmitter**	1. Workmanship	MA	Visual	100%	BHEL Spec. / Approved data sheet	BHEL Spec. / Approved data sheet	Inspection report / Log Book	2	1	---	
		2. Dimension	MA	Measurement	100%	BHEL Spec. / Approved data sheet	BHEL Spec. / Approved data sheet	Inspection report / Log Book	2	1	---	
		3. Type / Model	CR	Visual	10%	BHEL Spec. / Approved data sheet	BHEL Spec. / Approved data sheet	Inspection report / Log Book	2	1	---	
		4. Range	CR	Visual	100%	BHEL Spec. / Approved data sheet	BHEL Spec. / Approved data sheet	Inspection report / Log Book	2	1	---	
		5. Calibrated Range	CR	Visual	100%	BHEL Spec. / Approved data sheet	BHEL Spec. / Approved data sheet	Inspection report / Log Book	2	1	---	
		6. Local Indicator / Scale marking	MA	Visual	100%	BHEL Spec. / Approved data sheet	BHEL Spec. / Approved data sheet	Inspection report / Log Book	2	1	---	
		7. Process connection type	CR	Measurement	100%	BHEL Spec. / Approved data sheet	BHEL Spec. / Approved data sheet	Inspection report / Log Book	2	1	---	
		8. Wetted parts material	MA	Analysis (Chemical, Mechanical)	100%	BHEL Spec. / Approved data sheet	BHEL Spec. / Approved data sheet	Inspection report / Log Book	2	---	1	
		9. Mounting bracket type	MA	Visual / Dimension	10%	BHEL Spec. / Approved data sheet	BHEL Spec. / Approved data sheet	Inspection report / Log Book	2	1	---	
		10. Calibration	CR	Electrical / Pneumatic	100%	BHEL Spec. / Approved data sheet	BHEL Spec. / Approved data sheet	Inspection report / Log Book	2	1	---	
		11. Soaking	CR	Electrical	100%	BHEL Spec	BHEL Spec.	Inspection report / Log Book	2	1	---	

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

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PEM :: C&I

STANDARD QUALITY PLAN FOR PRESSURE / DP/LEVEL TRANSMITTER

QUALITY PLAN NO.:	**PE-QP-999-145-I001**
VOLUME	IIB
SECTION	D
REV. NO.	00 DATE: 12.10.99
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	
3.2	Acceptance Tests	1. Accuracy	CR	Electrical	100%	BHEL Spec. / Approved data sheet	BHEL Spec. / Approved data sheet	Inspection report	2	1	1	
		2. Repeatability	CR	Electrical	100%	BHEL Spec. / Approved data sheet	BHEL Spec. / Approved data sheet	Inspection report	2	1	1	
		3. Dead Band	CR	Electrical	100%	BHEL Spec. / Approved data sheet	BHEL Spec. / Approved data sheet	Inspection report	2	1	1	
		4. Hysterisis	CR	Electrical	100%	BHEL Spec. / Approved data sheet	BHEL Spec. / Approved data sheet	Inspection report	2	1	1	
		5. HV & IR	CR	Electrical	100%	Manufacturer standard	Manufacturer standard	Inspection report	2	1	1	
		6. Linearity	CR	Electrical	100%	BHEL Spec. / Approved data sheet	BHEL Spec. / Approved data sheet	Inspection report	2	1	1	
		7. Supply voltage variation effect	CR	Electrical	100%	BHEL Spec.	BHEL Spec.	Inspection report	2	1	1	
		8. Temperature variation effect over range	CR	Electrical	100%	BHEL Spec. / Approved data sheet	BHEL Spec. / Approved data sheet	Inspection report	2	1	1	
		9. Over range	CR	Electrical	100%	BHEL Spec. / Approved data sheet	BHEL Spec. / Approved data sheet	Inspection report	2	1	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 or their agent; 2 - Vendor; 3 - Sub-vendor

PEM :: C&I

STANDARD QUALITY PLAN FOR PRESSURE / DP/LEVEL TRANSMITTER

QUALITY PLAN NO.:	**PE-QP-999-145-I001**
VOLUME	IIB
SECTION	D
REV. NO.	00 DATE: 12.10.99
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	
3.3	Type Test	1. Surge withstand capability	CR	Elect. & Mech	1 / Type	ANSI-C.37	ANSI-C.37	Inspection Report	3	---	2,1	
		2. Radio frequency interference	CR	Elect. & Mech	1 / Type	ANSI-C.37	ANSI-C.37	Inspection Report	3	---	2,1	
		3. Vibration effect	CR	Elect. & Mech	1 / Type	BHEL Spec.	BHEL Spec.	Inspection Report	3	---	2,1	
		4. Electro Magnetic field effect	CR	Elect. & Mech	1 / Type	BHEL Spec.	BHEL Spec.	Inspection Report	3	---	2,1	
		5. Degree of protection	CR	Mech. & Elect.	1 / Type	IEC : 60529	BHEL Spec.	Inspection Report	3	---	2,1	
		6. Explosion proofnexx (If applicable)	CR	Mech. & Elect.	1 / Type	IEC : 60079	BHEL Spec.	Inspection Report	3	---	2,1	
		7. Dry Heat	CR	Thermal	1 / Type	IEC : 60068-2-78	ANSI-C.37	Inspection Report	3	---	2,1	85 Deg. C for 16 Hrs.
		8. Damp Heat	CR	Thermal	1 / Type	IEC : 60068-2-78	ANSI-C.37	Inspection Report	3	---	2,1	40 Deg. C; 6 cycle
4.0	**Packing**	1. Packing Material	MA	Visual	100%	Manufacturer standard	Manufacturer standard	Log Book	2	---	2	
		2. Packeging and Marking	MA	Visual & Measurement	100%	Manufacturer standard	Manufacturer standard	Log Book	2	---	2	

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STANDARD QUALITY PLAN FOR LEVEL GAUGES

QUALITY PLAN NO.: **PE-QP-999-145-I028**

VOLUME IIB

SECTION D

REV. NO. 00 DATE: 01.11.2000

SHEET 1 OF 2

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	
1.0	**Material / Components**											
1.1	Body, Cover, Interns, Flanges, Gaskets	1. Physical, Chemical Properties	MA	Physical, Chemical Test	One Sample from each lot	Approved drg. / data sheet / BHEL Spec.	Approved drg. / data sheet / BHEL Spec.	Test Certificate	3/2	---	2,1#	# Compliance certificate to be verified.
		2. Workmanship, finish and dimensions	MA	Visual, Measurement	100%	Manufacturing standards / drgs.	Manufacturing standards / drgs.	Inspection Report / Log Book	3/2	---	2,1#	
1.2	Glass Tube	Strength, Transparency, dimensions	MA	Toughness & Thermal shock, Visual, Measurement	one sample from each lot	Approved drg. / data sheet / BHEL Spec.	Approved drg. / data sheet / BHEL Spec.	Test Certificate/ Inspection Report	3	---	2,1#	
2.0	**Assembly**	1. Marking – Tag No., Model, Range	MA	Visual	100%	- do -	- do -	Inspection Report	2	1	---	
		2. Workmanship	MA	Visual	100%	- do -	- do -	- do -	2	1	---	
		3. Scale graduation	MA	Visual	100%	- do -	- do -	- do -	2	1	---	
		4. Glass Opaque painting	MA	Visual	100%	- do -	- do -	- do -	2	1	---	For Reflex type
		5. Dimensions and end connections	MA	Measurement	100%	- do -	- do -	- do -	2	1	---	
3.0	**Routine Test**	1. Calibration	CR	Measurement	100%	- do -	- do -	- do -	2	1**	1	**10% quantity with minimum of 1 piece / type & size
		2. Hydro Test	CR	Measurement	100%	- do -	No Leakage	- do -	2	1**	1	

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1 - BHEL 2 - Vendor 3 - Sub-vendor

PEM :: C&I

STANDARD QUALITY PLAN FOR LEVEL GAUGES

QUALITY PLAN NO.:	**PE-QP-999-145-I028**
VOLUME	IIB
SECTION	D
REV. NO.	00 DATE: 01.11.2000
SHEET	2 OF 2

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	
4.0	**Painting**	Shade & Finish	MA	Visual	100%	Approved drg. / data sheet / BHEL Spec.	Approved drg. / data sheet / BHEL Spec.	Inspection Report	2	1**	1	
5.0	**Packing**	Soundness	MA	Visual	100%	- do -	- do -	- do -	2	---	---	

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TECHNICAL SPECFICATION FOR

FIBRE OPTICAL CABLE

1. SCOPE OF SUPPLY

The Fiber Optic Cable is required for **4X100MW GTPS MARIB-II, YEMEN**. The scope of work involves supply, termination, supervision and testing of fiber optic network.

Following Items shall be provided by bidder at PLC end:

a. LIU
b. SC-SC Couplers
c. Patch Cord from LIU to Fiber port of Switch or module
d. Convertor
e. Ethernet switch at PLC end for soft connectivity with DCS

The scope of supply includes supply as per Bill of Material given in the Table – 1 "Bill of Material". Fiber Optic Cable has to be as per "Technical Specification", mentioned below in section 2.

Note: Fiber Optic Cable shall be in accordance with recommendation and practice of relevant IEC standard. FO cable and components should be suitable for operation at a speed of 100MBPS.

TABLE – 1: **Bill of Material**

Sl.no.	Description	Make	Quantity
1	4-core multi mode 62.5/125 µm outdoor armored fiber optic cable	Aksh Optifiber/ Birla Ericsson/ DigiLink/HFCL/ Molex/Finolex/ Terracom/RPG cables/Corning	In meters
2	HDPE Flexible Pipe (25mm minimum internal diameter), ISI Certified	Reputed Make	In meters
3	Multi Mode SC Pigtails. For terminating Fibers compatible with FO cable being supplied	Reputed Make	Actual requirement + 5% extra as spare
4	4-Fiber Break Out kit and all other consumables in required quantity for termination of FO cable	Reputed Make	As per requirement
5	HDPE coupling suitable for the conduits being supplied. Joints / Couplers required for complete termination, connections and	Reputed Make	As per requirement

	testing. ISI certified		
6	Any other items whether covered specifically or not but needed for successful installation and testing of all fiber cable segment	Reputed Make	As per requirement

2. TECHNICAL SPECIFICATION OF FIBER OPTIC CABLE

Four Fiber **Multi Tube** constructions with CST Armour provided with embedded steel wire strength members and outer Polyethylene jacket with sequential length marking suitable for direct burial or installation in duct on cable trays, with following specification:

A. Multi Mode Four Fiber Multi Tube Construction cable:

i) Fiber and Buffering :

a. Fiber Type - Graded index **Multi-Mode** fiber
b. Core Diameter - 62.5 ± 3.0 micron
c. Cladding diameter - 125 ± 2.0 micron
d. Numerical Aperture - 0.275±0.020 micron
e. Primary coating diameter - 245µm ± 15.0µm
f. Secondary buffer material - Gelly -filled loose tube
g. No. of Fiber per tube in multi tube design - 1 or 2

ii) Attenuation and bandwidth:

a. At 850 nm, Attenuation ≤ 3.5db/Km
b. At1310nm, attenuation ≤ 1db/Km

iii) Sub Cable:

a. Fiber strength member - Steel / Reinforce plastic rod
b. Color coded - Standard

iv) Cable Construction: Sub-cables with filler /dielectric central strength member

a. Inner jacket - HDPE/ Polyethylene
b. Color - Black / Supplier Standard
c. Armour - Corrugated steel tape
d. Outer jacket - High density polyethylene, anti-termite, Anti rodent, Suitable for direct burial Application

Note: for all other parameters refer the General Specifications.

B. General Specifications of Optical Fiber Cable:

i) Installation:

a.	Min Bend Radius	- 20 X outer Diameter
b.	Max. Tensile Load	- ≥ 2000 N
c.	Min Tensile Load	- ≥ 1000 N
d.	Outer Diameter of Cable	- ≥ 10.5 mm
e.	Location	- Trenches, Tubes, Aerial, or duct
f.	Pulling	- Ordinary cables grips

ii) Operating Temperature : -20 Deg.C to +70Deg. C

iii) Striping ability: All Layers easily removed with commercially available tools

iv) Fiber Identification: All the fibers in the loose tube are color coded for identification purpose with UV curable inks i.e., Blue, Orange, Green, and Natural. The tube color will be Natural.

v) Marking: The cables have identification marking at regular intervals of 1 meter, which will be of permanent nature. The accuracy of the sequential marking will be within +/- 0.5%.

vi) Immunity: The cables shall be immune to corrosive element found naturally in the ground.

vii) Cable Ends: Running end shall be provided with pulling eye and the other End shall be sealed with Thermal shrink cap.

viii) Cable drum Length: The length can be standard factory length and can be supplied in multiple of 2, 4 KMs etc.

ix) Make: Cable should be, in general, be ISO/IEC and EIA/TIA compliant and conform to Mechanical Condition as per IEC- 794-1 standards for Tensile Force, Crush Resistance, Impact Resistance, Torsion, Kink etc. Manufactured by **Aksh Optifiber Ltd./Birla Erricssion/Digi Link/Molex/Terracom/Finolex/HFCL/RPG Cables/Corning**. Vendor to enclose datasheet of the Brand of cable being offered.

3. ACCEPTANCE CRITERIA

i) Completeness of supply as per the Tables.
ii) Demonstration of proper working of network.
iii) Completeness of documentation as per specification.

4. WARRANTY

Supplier shall warrant that OFC cable will be free from defect in design, material and workmanship for a period of 12 months commencing upon the completion of commencing (include connection, termination and testing) of the cable (segment wise)or 18 months from the data of dispatch whichever is earlier. The liability will be limited to replacement of defective parts arising solely faulty design materials and / or workmanship.

Technical Specification, Datasheets, Quality Plan for Local Control Panel

BHEL	**SPECIFICATION FOR LOCAL PANELS**	SPECIFICATION NO.: PE-SS –999- 145 –054A
		VOLUME II B
		SECTION D
		REV. NO. 03 / DATE : 16-09-2013
		SHEET 1 OF 6

1.0 SCOPE

This specification covers the Design, Manufacture, Inspection and Testing at the manufacturer's works, proper packing for transportation and delivery to Mumbai port CHA Godown of the Local Control Panels required for control and monitoring of the Auxiliary Plant & Equipment.

2.0 CODES AND STANDARDS

2.1 All the equipments specified herein shall comply with the requirements of the latest issue of the relevant International standards. Control and relay panels shall conform to relevant IEC standards as amended upto date as per Section 8.13,Volume-V.Equivalent ANSI standards are also acceptable.

2.2 As a minimum requirement, the following latest edition of relevant standards shall be complied with for C&I Instruments and Local Control Panel: IEC/ISA/BS/ASME. The contractual Specification shall over ride this specification in case of any mismatches.

3.0 TECHNICAL REQUIREMENTS

Details of various Control panel components shall be as per Section 8.13, Volume-V attached. The contractual Specification shall over ride this specification in case of any mismatches.

3.1 Panel Construction

3.1.1 The local panels shall house the secondary instruments, annunciation system, Single loop controller, Control switches / push buttons, indicating lamps/LED cluster, relays, timers and other devices required for operation and monitoring of the equipment locally.

3.1.2 The panels shall be of free standing type either welded construction on angle iron (minimum section of 50 x 50 x 4 mm) structure or folded construction by sheet metal formation depending upon the equipments to be mounted on it. The panels shall be robustly built and stiffeners as necessary shall be provided.

3.1.3 The panel shall be suitably reinforced to ensure adequate support for all instruments mounted thereon. All welds on exposed panel surfaces shall be ground smooth.

3.1.4 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) 1.6 mm for doors and Not less than 2.0 mm for others
Panel Height: Not less than 2365 mm (Refer data sheet-A (No. PES-145A-DS1-0)
Gland plate thickness: 3.0mm
Base channel: ISMC 100 with anti-vibration mounting & foundation bolts.

3.1.5 The panel shall be provided with rear doors with integral lockable handle. The door when locked shall be held at minimum three places. The door width shall not be more than 550mm.The doors shall be provided with suitable stiffeners to prevent buckling. The handle shall be on the right side of the door. The door shall be removable type with concealed hinges to facilitate maintenance work. Suitable pocket inside the door shall be provided for keeping the drawings / documents. Double door shall be provided with suitable glass windows, as per the requirement.

3.1.6 Suitable neoprene gasket shall be provided on all doors and removable covers. Suitable ventilation system along with louvers shall be provided at bottom and top of the doors covered with removable wire mesh.

3.1.7 The class of protection shall be in accordance with IP-42 unless otherwise specified in the data sheet – A (No. PES-145-54A-DS1-0).

3.1.8 All steel surfaces shall be cleaned by sand / pellet blasting, treated for pickling, degreasing and phosphating etc. by seven tank method. The panel shall have a high quality finish and appearance. The panel shall be painted with two coats of primer followed by two coats of epoxy / synthetic enamel based final paint of color shade and finish as given in data sheet-A (No. PES-145A-DS1-0). Minimum thickness of the paint shall be 85 microns for external paint and 70 microns for internal paint.

3.1.9 The cable glands of the required size and type as given in data sheet-A (No. PES-145A-DS1-0) shall be supplied alongwith the Panel.

3.1.10 All operable and indicating devices shall be mounted on the front of the panel while aux. Relays / timers MCBs etc. required for realization of control logics shall be mounted on a mounting plate inside the panel. Auxiliary relays and timers etc. shall be grouped according to the control function.

No operable or indicating devices shall be mounted below 750 mm and above 1800 mm (w.r.t. finished ground level). The devices shall be located in such a way so as to ensure easy access for operation / maintenance.

3.1.11 Single / dual control power supply feeders of voltage class as specified in data sheet-A (No. PES-145A-DS1-0) shall be provided by the purchaser. In case redundant power supply feeders are provided then auto changeover unit shall be mounted on the panel are in the panel supplier's scope. Where DC control power supply is specified an additional 240V, 50 Hz AC supply feeder for powering of space heater and lighting shall be provided by the purchaser. Suitable arrangement shall be provided inside the panel to receive and terminate the power supply feeder(s). For this purpose MCBs of suitable current rating shall be provided by the vendor. A supervisory relay along with a pilot lamp to indicate control supply 'ON' shall be provided on the panel. Any other power supply required for the operation of the devices mounted in the panel shall be arranged by the vendor.

3.1.12 The internal wiring shall be carried out with 1100 volt grade PVC insulated copper multi strand wire / flexible of 1.5mm2 size. AC & DC wires shall be kept separate from each other. Separate coloured wires to be used for AC and DC circuits. All wires shall be properly numbered and identified with ferrules as per the Control scheme / wiring diagram. Wires shall be routed and run through PVC troughs.

3.1.13 Terminal blocks shall be clip on type, 1100 volts grade. Separate terminal blocks shall be used for AC & DC circuits. The terminals shall be suitable for terminating 0.5 mm2 to 2.5mm2 external cables. The TB points in terminal block shall be cage clamp type / screw type. The terminal for ammeters shall be provided with removable links for shorting CTs. Each terminal strip shall be provided with identification strip. The terminal shall not be mounted below 250 mm height from finished floor. The panel shall have ten (20) percent spare terminal.

3.1.14 The interior of each panel shall be suitably illuminated through fluorescent lamps / tube lights with shrouded cover of minimum 15W operable on 240V 50 Hz AC power supply through panel door switch.

A 15 Amp. 3-pin Power receptacle shall be provided.

3.1.15 Suitable space heaters operable on 240 Volts 50 Hz AC power system shall be provided at the panel bottom. These shall be designed to maintain the panel temperature five (5) deg. C above the ambient temperature during maintenance shutdown. Suitable isolating and control devices comprising of MCB, thermostat etc. shall be provided for the space heater.

3.1.16 The panel shall be provided with a copper earth bus of 25 x 6 mm size running throughout the width of the panel. It shall be terminated internally with 10 mm bolts at extreme ends for connection to; main station earth. The panel mounted equipments / devices shall be connected to earth bus through green coloured PVC insulated stranded copper conductor of 2.5 mm2 size.

3.1.17 Local Panel shall be provided with main name plate of 150 mm x 40 mm size having inscription of 20 mm height. The individual devices on the panels shall be as provided with separate name plate with inscription of 3 mm height. The instrument / devices shall be provided with stick on label plates inside the panel. The material of the main and individual labels shall be three (3) ply 3 mm thick Traffolyte Sheet / 2 mm Anodised Aluminium Plate. The inscription shall be with white letters on black background on traffolyte sheet. The labels shall be fixed by self tapping non-rusting screws.

3.1.18 Vendor shall furnish electric load and heat load list (in case panel is to be placed in ac environment) of each panel.

3.2 Hazardous Area Panel Requirement

3.2.1 The Local Panel located in hazardous area shall be pressurized as per NFPA-496 requirements to render it non-hazardous. Alarms shall be provided for local and remote annunciation when pressurisation falls below 2.5 mm of water column. Protection shall be of type Z of NFPA-496. It shall not be possible to switch ON the power of purged section unless it is purged as per the recommendation of NFPA-496. Vendor must provide a protective device on the panel to protect the panel from over pressurisation.

3.2.2 Vendor shall supply pressurisation kit consisting of valves, restriction orifices, dual filter regulation, pressure gauges, pressure switches, rotameter etc. Pressurisation kit shall be surface mounting on a metal board and located outside the local panel. Pressurisation kit shall further consist of solenoid valve flow switch, timer blow off safety device etc., so as to make purging fully automatic. However final start shall be manual. Panel protection against over pressure to be provided as per NFPA-496.

3.2.3 Pressurised local control panel pressurization kit assembly design shall provide minimum leakage flow through the Local Control Panel. Panel venting shall be as per NFPA-496.

3.2.4 All components in the local panel like indicating instruments, push buttons switches, lamps etc., which are required to be energized without panel pressurization or before completion of purge cycle shall be explosion proof as per NEMA-7 & suitable for area classification.

3.2.5 All push buttons etc. requiring frequent operation during machine running shall have good positive sealing. Weatherproof housing or cover to be provided wherever necessary. Vendor shall provide pressurisation bypass switch outside explosion proof enclosure of pressurized panel with lamp indication. This shall be used only during maintenance. All hinges, screws, other non-painted metallic parts shall be of stainless steel material.

3.2.6 Provision to switch off manually all types of power shall be provided in the panel. In addition, it shall also be possible to switch off power circuits / components which are powered from motor control centre or control room manually in case of pressurization failure. All such cables from MCC and main control room shall be terminated in explosion proof boxes (NEMA-7).

3.3 Control & Monitoring devices

3.3.1 Instruments like Indicators, recorders, single loop controllers etc. as applicable and specified elsewhere for the plant / equipment shall be supplied and mounted on the panel.

3.3.2 Alarm Annunciator System

It shall be solid state discrete facia type having a sequence of ISA-S18.1A or as specified, opaque facia windows of 70 mm x 50 mm size, having two (2) lamps per window, and hooter of 10W, and provision for repeat group alarm at remote. The annunciator shall be provided with ten (10) percent spare windows or minimum two (2) windows along with electronics.

3.3.3 Relays

The relays shall be electromagnetic type suitable for specified control supply. Its contact configuration and rating shall be suitable for the specified control function. However minimum contact rating shall be 5 Amp AC & 2 Amp DC as applicable. There shall be ten (10) percent spare contacts.

3.3.4 Timers

The timers shall be electronic type suitable for specified control supply. Its contact configuration and rating shall be suitable for the specified control function. However, minimum contact rating shall be 5 Amp AC & 2 Amp DC as applicable.

3.3.5 Control / Selector Switches

Switches shall be Rotary Cam type with minimum of 5 Amps AC & 2 Amp DC continuous current rating. Selector switches shall be stay put type while control switches shall be spring-return-to-neutral type. Contact configuration and rating shall be as per the control function requirement. The switches shall be lockable type wherever specified. Each switch shall be provided with engraved plates indicating the switch position / functions.

3.3.6 Push Buttons / Indicating Lights

The push buttons shall be momentary action self-resetting type, however stop P.B. for unidirectional drives shall be provided with manual reset facility. Its contact configuration & rating shall be as required for the control function but minimum 2 NO + 2 NC of 5 Amp. AC rating. It shall have round coloured projecting tab and engraved escutcheon plate / inscription plate. Colour coding of push buttons shall be as under:

RED	Motor OFF / Valve CLOSE	YELLOW	Alarm acknowledge	Left Hand Side
GREEN	Motor ON / Valve OPEN	BLACK	Lamp test	Right Hand Side

Indicating lights shall be suitable for direct connections across specified power supplies. It shall be fitted with built in resistance to prevent circuit tripping on shorting of lamp filament. It shall be fitted with LED cluster type lamp replaceable from front.

GREEN	Motor OFF / Valve CLOSED condition	AMBER	Motor tripped	Left Hand Side
RED	Motor ON / Valve OPEN condition	WHITE	Normal / healthy	Right Hand Side

3.3.7 Ammeters

Ammeter shall be 96 x 96 mm size, 90 deg. deflection, 1.5% accuracy, 1 Amp. CT operated or with 4-20mA input and Flush mounting type as called for in the data sheet-A (No. PES-145-54A-DS1-0). Ammeters for motors shall have six (6) times folded scale at upper end to enable motor starting current indication

3.3.8 Miniature Circuit Breaker (MCB)

These shall be instantaneous magnetic trip type for short circuit in addition to current time inverse delayed thermal trip feature for over current protection. The housing of MCB shall be made of non-ignitable, high impact material. It shall have minimum short circuit rating of 9 KA for AC Voltages and 4 KA for DC Voltages.

3.3.9 Makes of various instruments / devices shall be as given below

1.	Alarm Annunciators	:	Procon / IIC
2.	Ammeters	:	AEP / IMP
3.	Control / Selector Switches	:	Alsthom / Kaycee / Siemens / L&T
4.	Push Buttons / Indicating Lamps	:	Siemens / L&T / Teknic / Alsthom
5.	Auxiliary Relays	:	Jyoti / Siemens / L&T / OEN
6.	Timers	:	L&T / Alsthom / Bhartiya Cutler Hammer
7.	MCBs	:	S&S Power Engg. / Indo Asian / MDS
8.	Terminal Blocks	:	Jyoti / Elmex

4.0 TESTING AND INSPECTION

4.1 The bidder shall adopt suitable quality assurance program to ensure that the equipments offered will meet the specification requirements in full.

4.2 BHEL's standard Quality Plan for LCP 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.

4.3 The vendor shall conduct the following tests as a minimum requirement:

4.3.1 Routine Tests

1. High Voltage (H.V.)
2. Insulation Resistance (I.R.)
3. Functional

4.3.2 Type Tests

1. Enclosure Class Test

5.0 SPARES AND CONSUMABLES

5.1 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.

5.2. Mandatory Spares

The bidder shall offer alongwith 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.

5.3. 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 alongwith unit rate against each item to enable BHEL/BHEL's Customer to place a separate order later, if required.

6.0 DRAWINGS AND DOCUMENTS

6.1 The bidder shall furnish the following documents in required number of copies along with the bid :

1. Data Sheet no. PES-145A-DS1-0
2. General Arrangement Drawing.
3. Catalogue and technical information for instruments and devices.
4. Quality Plan.

6.2 The vendor shall furnish the following documents in required number as agreed after the award of contract:

1. Data Sheet No. PES-145A-DS2-0
2. GA Drawing indicating layout of instruments, construction details, foundation details, cable gland plate alongwith cable glands and all details mentioned in this specification.
3. Control Schematic Diagram along with grouping of different terminals for various functions.
4. Catalogue and technical information for instruments and devices with selected options clearly marked.
5. O&M Manuals.
6. "As Built" Drawing.
7. CDs

7.0 MARKING AND PACKING

7.1 Marking:

A stainless steel name –plate shall be permanently fixed on each equipment giving its tag/serial number and salient technical specification.

7.2 Packing:

Sea worthy packing capable of performing all necessary functions like prevention of damage to the contents, sufficient to support frequent handling and lengthy period of outdoor storage in adverse weather conditions are required. Workmanship and materials used shall be of high standard meeting the technical requirements and in accordance with best commercial export packing practices. Vendor shall be responsible for sea worthy export packing. Equivalent or better packing methods may be deployed subject to approval of the BHEL. Vendor shall submit the packing procedure for its equivalent for BHEL's approval during detailed engineering.

8.0 APPLICABLE DATA SHEET FORMS

This document shall be read with one or more of the following data sheet forms :

- Data sheet A&B for Local Panels : Data sheet no. PES-145A-DS1-0
- Data sheet C for Local Panels : Data sheet no. PES-145A-DS2-0

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 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)	

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 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:

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.)			

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:

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

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	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 $ P	Agency $ W	Agency $ V	Remarks
		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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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	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	

LEGEND:
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MA - Major characteristics
MI - Minor characteristics

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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	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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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	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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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	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 $ P	Agency $ W	Agency $ V	Remarks
		5. Dimensions	MA	Measurement	100%	BHEL approved drg. / Spec., BOM	BHEL approved drg. / Spec., BOM	Inspection Report	2	1	1	
		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	

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**
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	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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Specification for Paint system

FOR CONTROL AND INSTRUMENTATION ITEMS

17.4.7 Painting

Inside housed desks, panels, cabinets, racks and other control equipment are to be supplied with the same colour of final painting. External surfaces shall be semi-gloss.

Local mounted cabinets, housing Control & Instrumentation equipment shall be protected against rust and corrosion by a protective coating such as galvanized zinc, which shall be applied as a first factory coat.

In all cases where site erection work exposes bare metal, such as the drilling or punching out of holes for cable or pipe entry, these areas shall be protected by the immediate application of a protective first coat similar to the original.

The shade and grade of paint are to be agreed to by the Purchaser and must harmonize with the overall architectural design.

Any machined or bright faces and parts which are not painted (e.g. of valves, fittings or accessories) must be protected against corrosion by suitable agents prior to installation.

After completion of installation and commissioning but before provisional taking over the Contractor shall make good all marks, scratches and damage to the painted surface of all desks, panels and cabinets irrespective of the cause. The Contractor shall also take every reasonable precaution to prevent damage during the course of erection and commissioning. Repairs to paintwork shall be carried out in such a way so as to restore the equipment to its original factory condition and shall be to the satisfaction of the Purchaser.

LIST OF DELIVERABLES REQUIRED
for MARIB STP

BHARAT HEAVY ELECTRICALS LTD
POWER SECTOR
PROJECT ENGINEERING MANAGEMENT
NOIDA

LIST OF DELIVERABLES REQUIRED BY C&I DEPARTMENT FOR MARIB-II STP

Sl.No.	DRAWING/DOCUMENT TITLE	FROM	USER	REMARKS
	INSTRUMENTATION			
1	INSTRUMENT DATA SHEETS	VENDOR	C&I	
2	INSTRUMENT SCHEDULE	VENDOR	C&I	
3	INSTRUMENT HOOK UP	VENDOR	C&I	
4	FIELD JB TERMINATIONS	VENDOR	C&I	
5	DATA SHEETS OF ELECT VALVE ACTUATOR, FLOW ELEMENT, CONTROL VALVE, SOLENOID VALVE AND JB	VENDOR	C&I	
6	QUALITY PLANS (FE, TRANSMITTERS)	VENDOR	C&I	
	PLC PANEL			
1	PLC CONFIGURATION DRAWING	VENDOR	C&I	
2	PLC PANEL GA (INTERNAL & EXTERNAL)	VENDOR	C&I	
3	CONTROL SCHEMES (BLOCK LOGIC)	VENDOR	C&I	
4	PLC INPUT / OUTPUT SIGNAL LIST	VENDOR	C&I	
5	UPS BATTERY CHARGER/ BATTERY DATASHEET & SLD	VENDOR	C&I	
6	UPS SIZING CALCULATIONS	VENDOR	C&I	
7	BATTERY SIZING CALCULATIONS	VENDOR	C&I	
9	PLC-OWS/PRINTER FURNITURE BOM	VENDOR	C&I	
10	PLC CONTROL ROOM LAYOUT DRAWING	VENDOR	C&I	
11	PLC CATALOGUE	VENDOR	C&I	
12	PLC QUALITY PLAN & FAT PROCEDURE	VENDOR	C&I	
13	LIST OF SIGNAL EXCHANGE WITH DCS SERIAL INTERFACE IN BHEL FORMAT)	VENDOR	C&I	
14	PROCESS GRAPHIC MANUSCRIPTS PLC	VENDOR	C&I	
15	PROCESS GRAPHIC MANUSCRIPTS FOR DDCMIS	VENDOR	C&I	
16	CABLE SCHEDULE & INTERCONNECTION VENDO	R	C&I	
17	PANEL & ELECTRONIC EARTHING REQUIREMENT	VENDOR	C&I	
18	PANEL HEAT DISSIPATION DATA	VENDOR	C&I	
19	PLC O & M MANUAL	VENDOR	C&I	
20	COMPUTER FURNITURE OGA	VENDOR	C&I	

SCHEDULE OF PRE-BID CLARIFICATION

All clarification from the Technical Specification shall be filled in by the BIDDER clause by clause in this format only.

VOLUME	SECTION	CLAUSE NO.	PAGE NO.	SPECIFICATION REQUIREMENT	CLARIFICATION	REASONS FOR CLARIFICATION

SCHEDULE OF DEVIATIONS WITH COST OF WITHDRAWL

PROJECT:-400 MW MARIB GTPS, PHASE II PEC

PACKAGE:- SEWAGE TREATMENT PLANT

TENDER ENQUIRY REFERENCE:-

NAME OF VENDOR:-

SL NO	VOULME/ SECTION	PAGE NO.	CLAUSE NO.	TECHNICAL SPECIFICATION/ TENDER DOCUMENT	COMPLETE DESCRIPTION OF DEVIATION	COST OF WITHDRAWL OF DEVIATION	REFERENCE OF PRICE SCHEDULE ON WHICH COST OF WITHDRAWL OF DEVIATION IS APPLICABLE	NATURE OF COST OF WITHDRAWL OF DEVIATION (POSITIVE/ NEGATIVE)	REASON FOR QUOTING DEVIATION
TECHNICAL DEVIATIONS									
COMMERCIAL DEVIATIONS									

PARTICULARS OF BIDDERS/ AUTHORISED REPRESENTATIVE

NAME	**DESIGNATIONS**	**SIGN & DATE**	

NOTES:

1. For self manufactured items of bidder, cost of withdrawl of deviation will be applicable on the basic price (i.e. excluding taxes, duties & freight) only.
2. For directly dispatchable items, cost of withdrawl of deviation will be applicable on the basic price including taxes, duties & freight.
3. All the bidders have to list out all their Technical & Commercial Deviations (if any) in detail in the above format.
4. Any deviation not mentioned above and shown separately or found hidden in offer, will not be taken cognizance of.
5. Bidder shall submit duly filled unpriced copy of above format indicating "quoted" in "cost of withdrawl of deviation" column of the schedule above along with their Techno-commercial offer, wherever applicable.
6. Bidder shall furnish price copy of above format along with price bid.
7. The final decision of acceptance/ rejection of the deviations quoted by the bidder shall be at discretion of the Purchaser.
8. Bidders to note that any deviation (technical/commercial) not listed in above and asked after Part-I opening shall not be considered.
9. For deviations w.r.t. Payment terms, Liquidated damages, Firm prices and submission of E1/ E2 forms before claiming 10% payment, if a bidder chooses not to give any cost of withdrawl of deviation loading as per Annexure-VIII of GCC, Rev-06 will apply. For any other deviation mentioned in un-priced copy of this format submitted with Part-I bid but not mentioned in priced copy of this format submitted with Priced bid, the cost of withdrawl of deviation shall be taken as NIL.
10. Any deviation mentioned in priced copy of this format, but not mentioned in the un-priced copy, shall not be accepted.
11. All techno-commercial terms and conditions of NIT shall be deemed to have been accepted by the bidder, other than those listed in unpriced copy of this format.
12. Cost of withdrawl is to be given seperately for each deviation. In no event bidder should club cost of withdrawl of more than one deviation else cost of withdrawl of such deviations which have been clubbed together shall be considered as NIL.
13. In case nature of cost of withdrawl (positive/negative) is not specified it shall be assumed as positive.
14. In case of descrepancy in the nature of impact (positive/ negative), positive will be considered for evaluation and negative for ordering.

COMPLIANCE CERTIFICATE

The bidder shall confirm compliance with following by signing/ stamping this compliance certificate and furnishing same with the offer:

1. The scope of supply, technical details, construction features, design parameters etc. shall be as per technical specification & there are no exclusions/ deviations with regard to same.

2. QP/ test procedures shall be submitted in the event of order based on the guidelines given in the specification & QP enclosed therein.
   QP will be subject to BHEL/Customer approval in the event of order & customer hold points for inspection/ testing shall be marked in the QP at the contract stage. Inspection/ testing shall be witnessed as per same apart from review of various test certificates/ Inspection records etc.
   The charges for 3rd party inspection (Lloyds, TUV or equivalent) for imported components shall be included in the base price of the equipment by the bidder.

3. All drawings/data – sheets etc. to be submitted during contract shall be subject to BHEL/Customer review/ approval. GA drawings, as submitted with offer at tender stage are for reference purpose only and shall be subject to approval during contract stage.

4. There are no other deviations with respect to specification other than those furnished in the 'Schedule of Deviations'.

5. The offered materials shall be either equivalent or superior to those specified. Also for components where material is not specified it shall be suitable for intended duty, materials shall be subject to approval in the event of order.

6. The commissioning spares (if any) are supplied on 'As Required Basis' & prices for same included in the base price (If bidders reply to this is "No commissioning spares are required" and if some spares are actually required during commissioning same shall be supplied by bidder without any cost to BHEL).

7. All sub vendors shall be subject to BHEL/CUSTOMER approval.

8. Any special tools & tackles, if required, shall be in bidder's scope.

9. Performance demonstration and trail run parameters shall stand valid till the satisfactory completion of Performance demonstration and trail test and its acceptance by BHEL/Customer.

PARTICULARS OF BIDDER / AUTHORISED REPRESENTATIVE				
NAME	DESIGNATION	SIGNATURE	DATE	COMPANY SEAL

FORM NO PEM 6040-1

BHEL	**TECHNICAL SPECIFICATION FOR SEWAGE TREATMENT PLANT 400 MW, MARIB GTPS, PHASE II** *** SCHEDULE OF DECLARATIONS**	SPECIFICATION NO. PE-TS-372-673-A001 VOL III SHEET…….. OF……

DECLARATIONS

I ……..……certify that all the technical data and information pertaining to this specification are correct and are true representation of the equipment/system covered by our format proposal number Dated …… and there is no deviation to the specification.

I hereby certify that I am duly authorized representative of the Bidder's company whose name appears above my signature.

Bidders Company Name …….

Authorized representative's Signature ……..

Name …….

Bidder's Name The bidder hereby agrees to fully comply with

the requirements and intent of this specification for the price indicated

PARTICULARS OF BIDDER / AUTHORISED REPRESENTATIVE				
NAME	DESIGNATION	SIGNATURE	DATE	COMPANY SEAL

SUGGESTIVE PRICE FORMAT FOR SEWAGE TREATMENT PLANT FOR 400 MW MARIB GAS TURBINE POWER STATION PHASE II REPUBLIC OF YEMEN

Sl. No.	DESCRIPTION OF EQUIPMENT / ITEM	QTY.	UNIT PRICE EX-WORKS (DULY PACKED)	TOTAL PRICE EX-WORKS (DULY PACKED)	EXCISE DUTY @ %	SALES TAX @ %	FREIGHT CHARGES	INSURANCE CHARGES	TOTAL PRICE (FREE DELIVERY ON CHA GODOWN MUMBAI PORT)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1.0	Total lump sum firm price for design, engineering, manufacture, fabrication, painting, assembly, inspection / testing at manufacturers works , complete with all accessories including start up and commissioning spares, seaworthy packing, and delivery to CHA Godown Mumbai Port / mumbai Port including Supervision of erection and commissioning, site testing, trial run, performance demonstration for the Sewage Treatment Plant as per the total scope defined in BHEL technical specification no-PE-TS-372-673-A001, Rev 01 for 400 MW MARIB GAS TURBINE POWER STATION PHASE II REPUBLIC OF YEMEN								
	NOTES:								
a)	Bidder to note that total price indicated above at 1.0 shall be considered for evaluation and hence should be complete in all respect for the full scope defined and considering all terms and conditions agreed.								
b)	In case, price indicated above does not match with the break-up given at 2.0, the highest price so calculated shall be considered for evaluation but in case of order, the same shall be placed at the lowest price.								
2.0	**MAJOR BREAK-UP OF PRICES GIVEN IN 1.0 ABOVE**								
2.1	Total lumpsum firm price for EQUIPMENT (SUPPLY) i.e. manufacture, fabrication, assembly, inspection, testing at manufacturer's works, packing, complete with all accessories including start up and commissioning spares, forwarding etc for complete scope of supply of SEWAGE TREATMENT PLANT defined in the BHEL technical specification no-PE-TS-372-673-A001, Rev 01 for delivery upto CHA Godown Mumbai Port / Mumbai Port.								
2.2	Total lump sum firm price for supervision of erection and commissiong, site testing, trial run and performance demonstration required for 7 man days for completion of SEWAGE TREATMENT PLANT, as per BHEL technical specification no-PE-TS-372-673-A001, Rev 01	7 days							
3.0	**Total of 2.1 and 2.2**								

NOTES:-

1.0	Unit rate per manday mentioned against clause no. 2.2 above will be taken for price adjustment due to change in number of mandays required for supervision of E&C, if any, at actual site condition than mentioned here.