GSECL

1X800MW WANAKBORI TPS, UNIT#8

TECHNICAL SPECIFICATION
FOR

AUXILIARY STEAM PRESSURE REDUCING AND DESUPERHEATING STATION ALONGWITH ACCESSORIES

VOLUME - II B & III

SPECIFICATION No: **PE–TS –408-142–N101 (REV 00)**

BHARAT HEAVY ELECTRICALS LIMITED
POWER SECTOR
PROJECT ENGINEERING MANAGEMENT
PPEI, NOIDA, INDIA

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1.0 Volume – II B :

This volume is sub- divided into following sections: -

Section – A : This section outlines the scope of enquiry

Section – B : This section provides : " Project Information".

Section- C : This section indicates tech. Requirements specific to the contract, not covered in Section – D.

Section – D : This section comprises of tech. Specifications of equipments complete with data sheet A,B&C.

Data Sheet – A specifics data and other requirements pertaining to the equipment.

Data sheet – B specifics data to be filled by the bidder (Data Sheet B is contained in Volume – III.

Data Sheet – C indicates data/ documents to be furnished after the award of contract as per agreed schedule by the vendor (as applicable).

TITLE **AUXILIARY STEAM PRESSURE REDUCING & DESUPERHEATING STATION** **TSGENCO - 1x800 MW WANAKBORI TPS**	SPEC. NO.: PE-TS-408-142-N101	
	VOLUME **II-B**	
	SECTION **CONTENTS**	
	REV NO. **0**	DATE 19.09.15
	SHEET 1 OF 2	

CONTENTS

FILLED-UP QUALITY PLAN AS MINIMUM REQUIREMENTS IS INCLUDED FOR CONTROL VALVE.

SECTION – A

SCOPE OF ENQUIRY

1.1 This enquiry covers the Design, Manufacture, Assembly, Inspection and Testing at Vendor's and/or his sub-vendors works, painting and delivery to site of Auxiliary Steam Pressure Reducing & Desuperheating Stations, as mentioned in different sections of this specification for GSECL - 1X800MW WANAKBORI TPS.

The tenderer shall also quote separately for the following:-

a) Supervision of erection & commissioning of the equipment, if applicable.

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

1.3 The bidder may quote for his standard, proven design of equipment and shall indicate any deviations from this specification in the enclosed schedule. **In the absence of duly filled deviation schedule, it shall be presumed that the offer confirms exactly to this specification**. The bidder shall also furnish the performance feedback data of the equipment from similar installations. However, the acceptance of the deviations/options is not binding on the Engineer/Owner.

1.4 The bids shall be in English language and MKS Units.

1.5 Filled up quality Plans as minimum technical requirements, are included in this specification in Vol. IIB Sec D. Bidder is required to submit the enclosed Quality Plan, or bring out specific deviations on it, while submitting the bid.

1.6 Similar to Quality Plan, Bidder is required to furnish Field Quality Plan (FQP), if applicable. FQP shall indicate all inspection/test to be carried out at site covering the following:

i). Receipt of material.
ii). Storage or Conservation.
iii). Pre-Erection & Erection
iv). Pre-Commissioning, commissioning & post commissioning.

FQP shall furnish adequate instructions to be followed by erection & commissioning agency at site.

Bidder is requ ested to refer stand ard no PES-1 00-918 o n fie ld quality plan en closed in Volume III of this specification.

1.7 The omission of specific reference to any component / accessory necessary for the proper performance of the equipments sh all no t relieve the supp lier of th e respo nsibility of providing such facilities to complete the supply within the quoted prices.

1.8 BHEL's / GSECL's representatives sh all be giv en acce ss to the shop in which th e equipments are being manufactured or tested and all test records shall be made available to him.

1.9 The Equipment covered under this specification shall not be dispatched unless the same have been finally inspected, accepted and Material Dispatch Clearance Certificate (MDCC) is issued by BHEL / GSECL.

SECTION – B

PROJECT INFORMATION

1.0.0 Introduction

Gujarat State Electricity Corporation Limited (GSECL) has planned to install 1x800 MW SUPERCRITICAL THERMAL POWER PLANT UNIT NO. 8 AT WANAKBORI TPS.

The 800 MW power plant will consist of one Pulverized Coal Fired Boiler unit and one Steam Turbine unit and the auxiliaries. The proposed Power Plant will be installed in the vacant space available in GSECL's existing Wanakbori Thermal Power Station at District Kheda, Gujarat.

1.1.0 Approach to Site

The nearest railway station is Sevalia, 8 km away. The station has siding facilities suitable for handling project equipment. The railway track is broad gauge. The site is easily approachable by National Highway NH-08 at a distance of about 70 KM .The nearest town is Balasinor at a distance of approx 13 km. Nearest Airport is Vadodara at a distance of about 85 KM from site.

As is evident from the above, the site is conveniently located for inland transportation.

SECTION-C

SPECIFIC TECHNICAL REQUIREMENTS

1.0.0 BRIEF SYSTEM DESCRIPTION

1.1.0 Auxiliary steam system is designed to provide steam for the turbine auxiliaries, boiler auxiliaries and fuel oil heating system during start-up, low loads and normal running of unit.

1.2.0 The system comprises of One "High capacity PRDS" with tapping from Main steam line to meet auxiliary steam requirements during unit start-up, low loads and the other " Low Capacity PRV" with tapping off steam from CRH line to meet auxiliary steam requirements during normal running. Spray water required for desuperheating will be tapped off from CEP discharge.

1.3.0 The HCPRDS will reduce the pressure and temperature of the steam tapped off from main steam line to 16 kg/cm^2 (abs) & 290°C. The LCPRV shall reduce the pressure of steam tapped from CRH line to 16 kg/cm^2 (abs) and temperature in the range of 285 °C to 350°C, depending upon the CRH parameters at corresponding load.

2.0.0 EQUIPMENT TO BE PROVIDED BY TENDERER

2.1.0 AUXILIARY STEAM PRDS COMPRISING OF :

2.1.1 **Control Valves & Accessories**:

2.1.1.1 Combined Type High Capacity Pressure Reducing & desuperheating Valve (On MS line) (ASV-22) : One No.

2.1.1.2 Low Capacity PRV on CRH Line (ASV-26) : One No.

2.1.1.3 Spray Control Valve for HC-PRDS (CDV-138) : One No.

2.1.1.4 Each control valve shall be supplied with the accessories specified in the relevant data sheets at Section-D.

3.0.0 SPECIFIC TECHNICAL REQUIREMENTS

The requirements in this section are specific for this project and shall over-ride the specification under Section-D in case of any contradiction. However In case of any contradiction between this SPECIFIC TECHNICAL REQUIREMENTS and customer SPECIFICATION attached further, the customer SPECIFICATION shall prevail and BHEL's decision shall be final.

1) Bidder to note that data sheet-B, Format "Schedule of submission of Drawings/ Documents, Equipment Manufacture, Inspection and Dispatch" enclosed in Section-D, to be signed and stamped and submitted with the bid. Quality Plan enclosed in Volume-IIB should be furnished duly signed and stamped. NO DEVIATION IS ACCEPTABLE.

2) All the formats in Volume-III should be filled- up and furnished with the bid, complete in all respect. Catalogue, Leaflets related with the models of Control Valves/ Desuperheater as well as each Accessory must be furnished with the offer. In the absence of those, the bid would be considered incomplete and shall be liable for rejection.

3) The Hook-up diagram for Control valve is attached in Section-C. The Bidder's scope starts from isolation valve at Inst. Air Supply header. The suitable connector required for connection of pneumatic tubing to isolation valve at Instrument Air Header is also in bidder's scope.

4) Valve and Desuperheater Body Sizes shall be quoted to take care of the specification requirements like parameters, and limitations of Fluid outlet velocities, Noise Level etc. **However Port (Trim) Sizes shall be selected to suit CV requirement for achieving percentage valve lift as per Technical specification.**

5) Type of bonnet shall be according to the service condition. Extension bonnets shall be provided when the maximum temperature of the flowing fluid is greater than 280 Deg C.

6) Valve and actuator shall be designed for full differential pressure (Max. shut-off pressure).

7) Tolerances on end to end, center to center, center to face shall be in accordance with ASME B16.10.

8) **Anti-cavitation trims shall be provided for valves with cavitation services and hardened trims for flashing services.**

9) Valve type like cavitation/flashing/ high DP has been indicated in the data sheet. Bidder to offer the valve accordingly. However if process is cavitating, although not indicated in the valve type, bidder to offer Anti-cavitation trim.

10) Valve Body and trim design shall achieve Noise abatement. However if the required noise level is not achievable due to design constraint, external Low Noise Pack (Cartridge/Silencer) may be used in the downstream side of the valve. Low Noise pack and the expander/reducer between the valve outlet and the low noise pack shall be in Bidder's scope.

11) Control valve accessories shall be fitted on the valve body. Integral pneumatic tubing shall be ¼ "OD SS, and fittings shall be of SS. Applicable accessories shall be terminated at the junction box (mounted on the body).

12) Type of flow action ("under the seat" or "over the seat") will be selected by the bidder. However in cases where downstream side is subjected to vacuum, flow action shall be "flow to close" (over the seat). Specific mention for the same has not been made in the datasheets.

13) **Trim material and body material has been specified in the Datasheets-A. Bidder to offer body material & trim material combinations equivalent or better than the material specified in Datasheets-A. Wherever there is deviation from the datasheets, bidder to furnish the documentary proof for confirming superior trim material/ body material selection along with**

their offer. BHEL/Customer reserves the right to accept/reject any variation to the specification.

14) Trim supplied shall be suitable for quick changing and trim exit velocity shall be limited to avoid cavitation.

15) The sizing procedure followed shall be as per latest edition of ANSI/ISA or equivalent standard.

16) The End Connections Shall Be Socket Welded for Sizes up to 50 NB and Butt Welded For sizes above 50 NB.

17) Stem material for all Control Valves shall be as per the specification.

18) Facility to adjust the maximum travel of stem & starting point of travel shall be incorporated.

19) Bidder to furnish the list of all control valves for which Cv test is to be carried. Cv test shall be carried out for each type of control valve (of same size, Cv, trim characteristics). Cv test reports shall be verified by BHEL/Customer. Type test certificate shall also be acceptable.

    Bidder to note that only those type test reports for same type of control valves shall be offered for verification which are not older than 3 years from the date of Part 1 opening (receipt of technical unpriced offer).
    In case, Cv type test reports found not acceptable, Bidder to conduct Cv test for the same without any commercial implication.

20) Calculation of Cv, noise level, valve outlet velocity, trim exit velocity, actuator sizing, Data sheet-C in line with Datasheet-A of specification, dimensional drawings / edge preparation details, etc. shall be submitted for BHEL/Customer review and approval, to reach BHEL within 15 days after receipt of PO/LOI.

21) Bidder to note that **wherever downstream side of the valve is subjected to the vacuum service, bidder to offer double gland packing, and in that case, flow direction of working fluid shall be over the seat (as to close the valve)**. Separate indication for the same has not been made in the data sheets-A.

22) Selection of valves and actuators are bidder's responsibility. Any change in selection of type of valve / sizing / percentage opening, calculations, QP, etc., if desired by BHEL / customer during approval of the documents after award of contract, without major changes in process parameters as per tender specification, shall be carried out by bidder without any commercial implication and time delay.

23) Limit switch, position feedback shall be terminated up to JB by 0.5 mm2/PVC/Cu/1.1 KV/FRLS shielded control cables. Solenoid valve shall be terminated by 2.5 mm2 size cable.

24) SS name plate for control valve shall include tag no./KKS no./Sl. No./body material /size/press rating/trim material/trim type/action on air failure/diaphragm air pressure at full open and close condition.

25) Open to close and close to open time of pneumatic actuator (modulating type) shall be less than 10 sec. Bidder to include volume booster if required to achieve response time less than 10 sec. For ON/OFF type control valve also, the actuator shall have a response time less than 10 sec.

26) Hand wheel shall have open/close direction.

27) Air filter regulator shall be designed for an inlet pressure of 5-8 kg/cm2.

28) Limit switch shall be designed for 1, 00,000 operations.

29) Expander/reducer b/ w th e main pipe and th e v alve inlet and outlet s hall be in BHEL's s cope of supply. However, any expander/reducer comi ng b /w the valv e and l ow no ise p ack (as applicable) shall be in bidder's scope of supply.

30) JB shall be 36 ways as per enclosed hook-up diagram.

31) Inspection shall be carried out in li ne with approved drawin g/data sheet/Q P & specific technical requirements.

32) Third party inspection: Customer shall witness the inspection for control valves at the manufacturer's works/ FCRI, PALAKKAD as per the enclosed QAP. Bidder to inform 15 days before the da te of inspection.

33) In case during erection/commissioning of the control valve, any spares are required which have not been specified in the start-up/commissioning spares lis t, the sa me will have t o b e supplied b y the bidder free of cost.

34) The valve s izing shall be suitable for obtaining m aximum flow con ditions with val ve op ening at approximately 85% of t otal stem travel & minimum flow condition not less than 10% of total stem travel. All the valves shall be capable of handling at least 120% of required maximum flow. The stem travel range from minimum flow condition to m aximum flow shall no t be less than 50% of the total stem travel

35) Bidder to indicate the service lif e expectancy per iod f or th e spare parts u nder n ormal working conditions. T he s pares s hall be tre ated and packed fo r l ong s torage, u nder climatic conditions prevailing at site. Sm all item s shall be p acked in sealed transparent pl astic bags w ith desiccators' packs as necessary.

36) Specification of Electrical Actuator given in section-D shall not be considered.

37) In case o f multistage valves, p ressure drop across each stage shall ensure that th e valve do es not cavitate in any of the stages.

38) Bidder to use ep oxy based corrosion resistant paints for painting the valves. Paint of all accessories must comply with this requirement. Bidder to follow the painting procedure as per the specification of painting attached.

39) Bidder to furnish a certificate certifying that design of control valve body, bonnet, fittings shall be as per ASTM Standards & tests on Control Valve body shall be as per ANSI B 16.34.

40) Bidder t o pro vide di agnostic so ftware (for all tags) to be ins talled on HMS PC for communicating with the smart positioner and accessing the diagnostic features of the smart positioner. Bidder to offer latest version of calibration and diagnostic software which should be compatible with latest operating system at the time of commissioning of valve/positioner without any additional cost to BHEL.

41) SMART POSITIONER

a. The smart positioner shall accept 4-20 mA signal from the control system as input and provide a compatible signal for driving the pneumatic actuator.

b. In addition to the electrical-to-pneumatic signal conversion and positioning functions, it shall also perform detailed diagnostics & make available the actuator/control valve faults via hart interface. The hart signal for the detailed faults shall be superimposed on the 4-20 mA control signal itself. The faults to be covered shall include valve jamming, air supply failure, leakage etc.

c. It shall have facility of characterisation of the valve (i.e. equal percentage, quick opening, linear, etc.) in the positioners itself.

d. The positioner shall have the facility of detection of control signal failure and making the valve either stayput/open/close as per process requirement upon this condition.

e. The smart positioner shall have the fail-freeze feature.

4.0.0 SPARES, CONSUMABLE AND SPECIFIED TOOLS & TACKLES:

4.1.1 Commissioning Spares & Consumables

The bidder shall supply spares and consumables for all the above valves required during start-up. A list of all spares and consumables to be supplied shall be submitted along with the bid.

4.1.2 Special Tools & Tackles

The bidder shall supply one complete set of special tools & tackles required for the erection, assembly, disassembly & maintenance of the equipment. A list of such tools & tackles to be supplied shall be submitted along with the bid.

4.1.3 Bidder to indicate the service life expectancy period for the spare parts under normal working conditions. The spares shall be treated and packed for long storage under climatic conditions prevailing at site. Small items shall be packed in sealed transparent plastic bags with desiccators' packs as necessary.

5.0.0 SPARES: The following spares are required to be offered.

a) Stat-up & Commissioning spares:

i) Start-up and Commissioning spares are those spares, which may be required during the start-up and commissioning of the Control Valves. All start-up spares, which are supplied under this contract, shall be strictly interchangeable with the parts for which they are intended for replacements. The format for price schedule to be filled-up by the bidder is enclosed in Volume-III

ii) The Start-up and commissioning spares indicated by the bidder shall be a part of the main Control valves supply. However bidder to indicate prices separately. The list of these spares required to be supplied shall be submitted along with the bid.

LIST OF COMMISSIONING SPARES

S.No.	ITEM DESCRIPTION	QUANTITY REQUIRED (per unit)
1	Gaskets	One (1) set with each control valve Tag
2	Gland Packings	One (1) set with each control valve Tag
3	Cu Tubing	25 Meters of ¼ " PVC coated Cu. Tubing, with 1 set of Fittings for each CV

b) Mandatory Spares:

The items listed in list of mandatory spares to be offered by the bidder, and the price (Lump sum as well as individual) for each item to be quoted separately under the separate heading. The format for price schedule to be filled- up by the bidder is enclosed in Volume-III.

Each case/container containing Mandatory spares shall be clearly marked or labelled on the outside with the description of the spares contained in it. When more than one item of spare parts is (are) packed in a single case/carton, a general description of the contents shall be shown outside such case/container, and detailed list enclosed.

LIST OF MANDATORY SPARES

Sl. No.	ITEM DESCRIPTION	QUANTITY FOR 1 UNIT
1.	Stem Packing	2 sets for each control valve
2.	Trim (including cage,plug,stem,seat rings, guide bushings etc.)	1 set for each control valve
3.	Actuators	1 Set of each type and rating
4.	SMART positioner	10% of each type
5.	Limit Switch	10% of each type

6.0.0 INFORMATION TO BE FURNISHED ALONGWITH THE OFFER BY THE BIDDER.

The bidder shall submit four (04) sets of the following drawings and data along with the bid without which the offer will be deemed incomplete.

6.1.0. Un-prices Bill of Quantities (BOQ) for main package & mandatory Spares.

6.2.0. All Calculations like valve sizing, actuator sizing, valve velocities and noise level.

6.3.0. Dimensioned outline drawing giving overall dimensions, material, weight, edge preparation details etc.

6.4.0. **Duly filled BHEL technical data sheets 'B'** for each control valve in the format as enclosed in volume III of this specification.

6.5.0. Hook-up diagram of control valves with actuator & accessories.

6.6.0. Reference list, Catalogue & Technical bulletins for various items being offered.

6.7.0. Any deviations from the specification / data sheet & reasons thereof.

6.8.0. Schedules as in Vol. III.

6.9.0. Quality Plan for the equipment offered in the format enclosed with this specification.

6.10.0. Field quality plan, if applicable

6.11.0. List of spares.

6.12.0. List of tools & tackles, if applicable

6.13.0. List of consumables / lubricants, if applicable

6.14.0. Quality Plan duly signed and stamped.

6.15.0. Schedule of submission of Drg./Doc, Equip. Manufacture, Inspection and Dispatch.

7.0.0 DRAWING

For general arrangement and terminal point details refer enclosed drawings nos. PE-TS-408-142-N102 in Volume II B Sec. D.

8.0.0 QUALITY PLAN

The bidder shall furnish quality plan along with the offer and the same shall be finalized before the issue of LOI.

Detailed quality plan shall be submitted by the successful tenderer after the placement of order for each project during contract execution for final approval by BHEL / its customer. BHEL / its customer shall indicate Customer Hold Points (CHP) in the approved quality plan beyond which work shall not proceed without the approval of BHEL / its customer for any particular project during final execution.

The quality plans enclosed in volume-II-B 'D' of the specification are for bidder's guidance only and are not exhaustive. The bidder shall comply with these and other minimum requirements specified in the specification and shall furnish his own quality plan in BHEL/Customer formats in the event of order based on the guidance given as above for BHEL/Customer's approval.

DATA SHEET- A-1

SIZING DATA FOR COMBINED AUXILIARY STEAM PRDS (ASV-22) & SPRAY CONTROL VALVE (CDV-138)

SL.NO.	PARAMETERS	Cond.-1	Cond.-2	Cond.-3	Cond.-4	Cond.-5	MECH. DESIGN
1.0	**INLET OF COMBINED AUX. PRDS (ASV-22)**						
1.1	PRESSURE (kg/cm^2 (a))	64	89	247	84	94	272
1.2	TEMP. (^OC)	365	475	565	375	435	573
1.3	FLOW (T/Hr)	**BIDDER TO CALCULATE**					
2.0	**OUTLET OF COMBINED AUX. PRDS (ASV-22)**						
2.1	PRESSURE (kg/cm^2 (a))	16	16	16	16	16	21
2.2	TEMP. (^OC)	290	290	290	290	290	320
2.3	FLOW (T/Hr)	128.8	80.8	47.9	155.3	80.8	-
3.0	**INLET OF SPRAY CONTROL VALVE (CDV-138)**						
3.1	PRESSURE (kg/cm^2 (a))	40.5	40	38	40.5	40	46
3.2	TEMP. (^OC)	40	40	44	40	40	60
3.3	FLOW (T/Hr)	**BIDDER TO CALCULATE**					

NOTE:

1. Cond.-4 is the capability check point for PRV ASV-22. Cond.-2 is the capability check point for Spray Water control valves.
2. High capacity steam pressure reducing valve min. flow at 10% valve lift shall correspond to the passing capability of low capacity steam pressure reducing valve at 95% valve lift (refer datasheet A-2).
3. CV of ASV-22 valve shall be selected in such a way that at VWO condition it should not pass more than 650 TPH steam when u/s parameters are 272 kg/ cm2a & 573 deg C and d/s pressure is 22 kg/cm2a.
4. Bidder shall inform the flow at VWO condition also when u/s parameters are 247 kg/ cm2a & 565 deg C and d/s pressure is 22 kg/cm2a.

DATA SHEET- A-2

SIZING DATA FOR AUXILIARY STEAM PRDS (PRV (ASV-26))

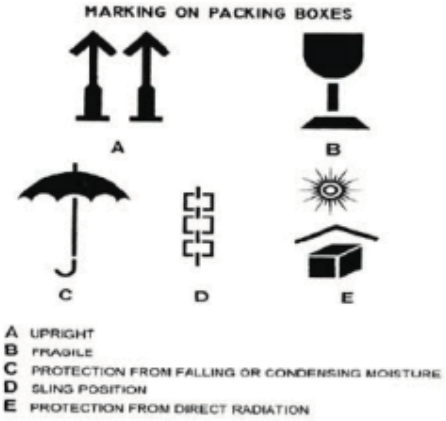
SL.NO.	PARAMETERS	Cond.-1	Cond.-2		MECH. DESIGN
1.0	**INLET OF PRV (ASV-26)**				
1.1	PRESSURE (kg/cm^2 (a))	20	60.61		74.5
1.2	TEMPERATURE (^OC)	350.4	344.7		360
1.3	FLOW (T/Hr)	11.5	11.5		-
2.0	**OUTLET OF PRV (ASV-26)**				
2.1	PRESSURE (kg/cm^2 (a))	16	16		21
2.2	TEMPERATURE (^OC)	**BIDDER TO CALCULATE**			360
2.3	FLOW (T/Hr)	11.5	11.5		-

NOTE:

1. High capacity steam pressure reducing valve min. flow at 10% valve lift shall correspond to the passing capability of low capacity steam pressure reducing valve at 95% valve lift (refer datasheet A-1).

9.0.0 GUIDELINES FOR PACKING

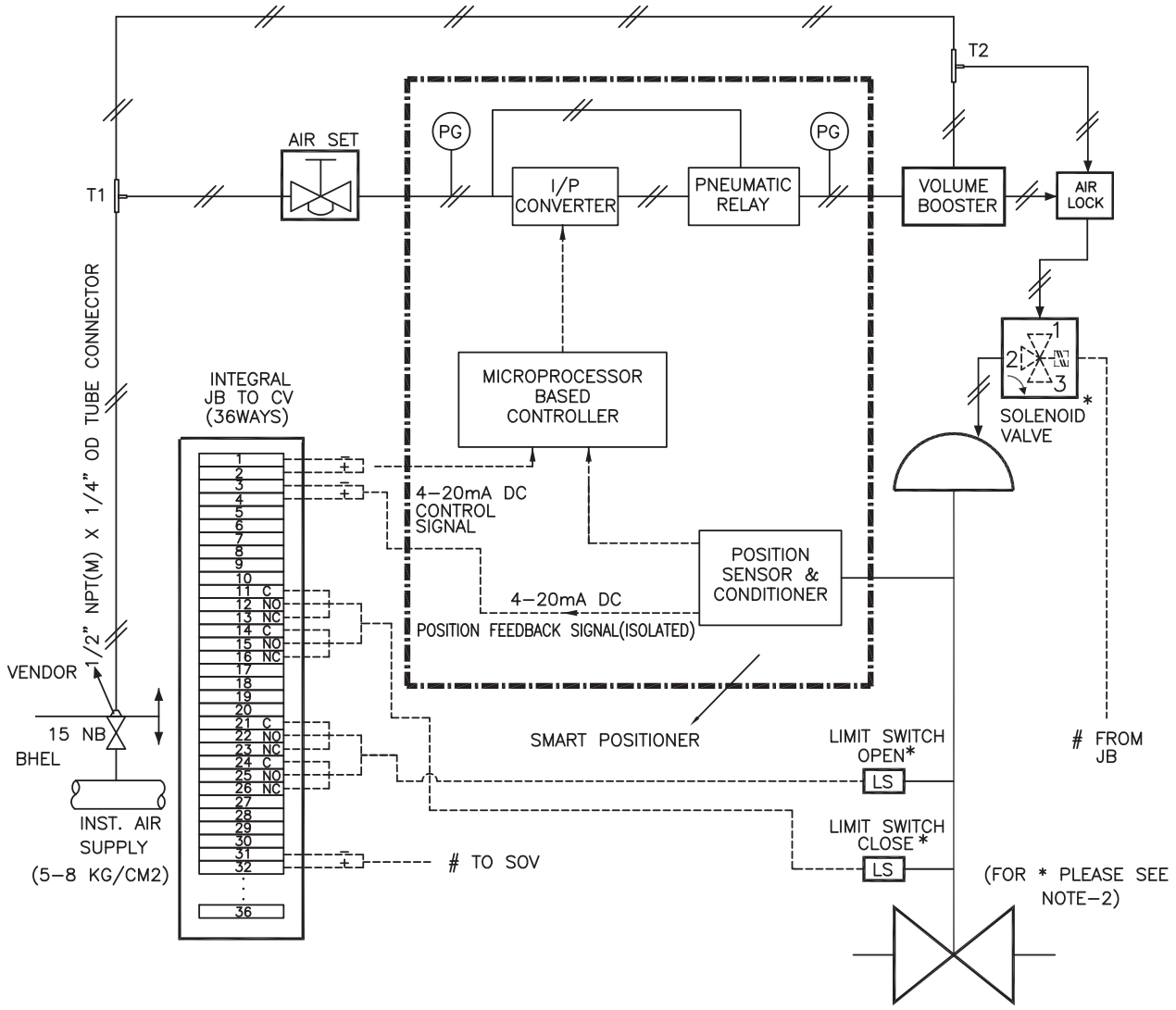
- ✓ After inspection of control valves assembly. Smart Positioner along with Pressure Gauge shall be disassembled & packed separately.
- ✓ Threaded connection of Smart Positioner & Pressure Gauge shall be shipped with the end caps fitted to avoid any damage.
- ✓ Instructions with sketch for mounting the Smart Positioner & Pressure Gauge shall be sent along with the aforesaid accessories.
- ✓ Packing of the control valves and Smart Positioner along with Pressure Gauge shall be done in separate wooden boxes/cases in order to avoid damage during transit and also during storage at site in tropical climatic conditions for a period of 18-24 months.
- ✓ All valves & smart positioner along with pressure gauges shall be packed properly with quality wooden planks with proper wooden frame support. Moreover the valves are internally covered with polythene sheets to protect from the water and moisture entry.
- ✓ Stronger shock absorbing cover material like expanded Polyurethane which can take any direct impact on it shall be used for packing
- ✓ Proper reaper support to be provided in the packing and Valve assembly to be aligned properly to avoid the damage of accessories during transit due to vibration effect.
- ✓ Marking for Fragile & Condensing environment shall be done on the packing box.



The Following Details are to be marked on the Packing Cases

- ✓ Address of consignee
- ✓ Purchase order no.
- ✓ Description of items or title of packing list
- ✓ Weight
- ✓ Dimension of the Box
- ✓ Marking showing upright position
- ✓ Marking showing sling position
- ✓ Marking showing umbrella (i.e. for machines/components to be stored under covered storage)

STANDARD CONTROL VALVE HOOK-UP DIAGRAM
(WITH SMART POSITIONER)



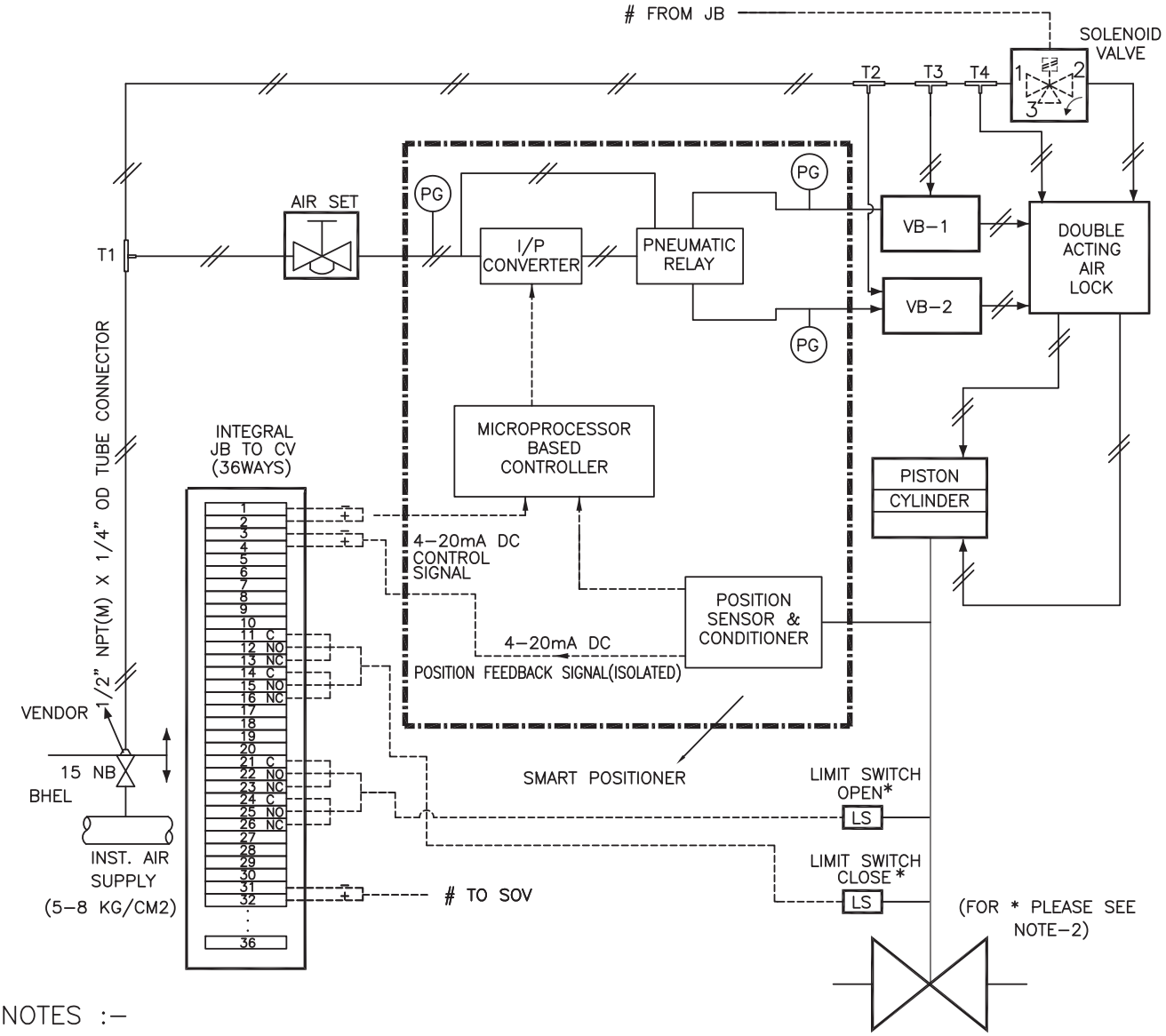
NOTES :-

1. POSITION OF EACH VALVE ON SUPPLY AIR FAILURE / ELECTRICAL SIGNAL FAILURE SHALL BE AS PER SPECIFICATION / DATA SHEET.
2. SOLENOID VALVE & LIMIT SWITCHES WILL BE PROVIDED ONLY FOR CONTROL VALVES IF INDICATED IN RESPECTIVE DATA SHEETS.
3. SOLENOID VALVES PORTS CONDITION:
   PORT 1 AND 2 SHALL BE CONNECTED UNDER DE-ENERGISED CONDITION.
   PORT 2 AND 3 SHALL BE CONNECTED UNDER ENERGISED CONDITION.
4. PRESSURE GAUGES REQUIRED FOR AIR SUPPLY & OUTPUT(S).
5. MOUNTING ACCESSORIES AS REQUIRED.
6. POSITION FEEDBACK SIGNAL SHALL BE 2 WIRE 4-20mA ISOLATED SIGNAL.
7. JB TERMINALS SHALL BE CAGE CLAMP TYPE SUITABLE FOR 2.5 SQ. MM COPPER WIRE. EXTERNAL CONNECTION, OF PLUG IN TYPE OR THROUGH CABLE GLAND, SHALL BE AS PER DATA SHEET
8. ALL APPLICABLE ACCESSORIES SHALL BE PROVIDED AS INDICATED IN THE INDIVIDUAL CONTROL VALVE DATA SHEET / ACCESSORIES DATA SHEET.
9. 12 METERS I/4" PVC COATED COPPER / SS TUBING (AS PER ACCESSORIES DATA SHEET) & 1 SET OF FITTINGS TO BE SUPPLIED FOR EACH CONTROL VALVE FOR CONNECTION TO ISO VLV AT INST AIR HEADER ON ONE END AND TO AIR LOCK RELAY/AIR FILTER REGULATOR ON THE OTHER END. ALL THE BRASS / SS FITTINGS SHALL BE DOUBLE COMPRESSION TYPE.
10. VOLUME BOOSTER (ALONG WITH TEE-T2 AND RELATED TUBING & CONNECTORS) SHALL BE PROVIDED IF REQUIRED. AIR CONNECTION TO VOLUME BOOSTER FROM TEE-T2 SHALL BE PROVIDED.

BHEL	STANDARD	DRG. No.	PES-145-06B		
	TITLE:- CONTROL VALVE HOOK-UP DIAGRAM	REV. No.	0	DATE	08.12.14
		SHEET	12 of 13		

L1

STANDARD CONTROL VALVE HOOK-UP DIAGRAM
(DOUBLE ACTING PISTON ACTUATOR WITH SMART POSITIONER)



NOTES :–

1. POSITION OF EACH VALVE ON SUPPLY AIR FAILURE / ELECTRICAL SIGNAL FAILURE SHALL BE AS PER SPECIFICATION / DATA SHEET. AIR LOCK SHALL BE PROVIDED ACCORDINGLY.
2. SOLENOID VALVE & LIMIT SWITCHES WILL BE PROVIDED ONLY FOR CONTROL VALVES IF INDICATED IN RESPECTIVE DATA SHEETS.
3. SOLENOID VALVES PORTS CONDITION:
   PORT 1 AND 2 SHALL BE CONNECTED UNDER DE–ENERGISED CONDITION.
   PORT 2 AND 3 SHALL BE CONNECTED UNDER ENERGISED CONDITION.
4. PRESSURE GAUGES REQUIRED FOR AIR SUPPLY & OUTPUT(S).
5. MOUNTING ACCESSORIES AS REQUIRED.
6. POSITION FEEDBACK SIGNAL SHALL BE 2 WIRE 4–20mA ISOLATED SIGNAL.
7. JB TERMINALS SHALL BE CAGE CLAMP TYPE SUITABLE FOR 2.5 SQ. MM COPPER WIRE. EXTERNAL CONNECTION, OF PLUG IN TYPE OR THROUGH CABLE GLAND, SHALL BE AS PER DATA SHEET
8. ALL APPLICABLE ACCESSORIES SHALL BE PROVIDED AS INDICATED IN THE INDIVIDUAL CONTROL VALVE DATA SHEET / ACCESSORIES DATA SHEET.
9. 12 METERS I/4" PVC COATED COPPER / SS TUBING (AS PER ACCESSORIES DATA SHEET) & 1 SET OF FITTINGS TO BE SUPPLIED FOR EACH CONTROL VALVE FOR CONNECTION TO ISO VLV AT INST AIR HEADER ON ONE END AND TO AIR LOCK RELAY/AIR FILTER REGULATOR ON THE OTHER END. ALL THE BRASS / SS FITTINGS SHALL BE DOUBLE COMPRESSION TYPE.
10. VOLUME BOOSTER (ALONG WITH TEE–T2 AND RELATED TUBING & CONNECTORS) SHALL BE PROVIDED IF REQUIRED. AIR CONNECTION TO VOLUME BOOSTER FROM TEE–T2 & TEE–T3 SHALL BE PROVIDED.

BHEL	STANDARD	DRG. No.	PES–145–06B		
	TITLE:– CONTROL VALVE HOOK–UP DIAGRAM	REV. No.	0	DATE	08.12.14
		SHEET	13 of 13		

SECTION – D

EQUIPMENT SPECIFICATIONS

SECTION – D

EQUIPMENT SPECIFICATIONS

FOR

CONTROL VALVE WITH PNEUMATIC ACTUATOR

4.00.00 **CONTROL VALVES, ACTUATORS & ACCESSORIES**

General Technical Guidelines for the Control Valves shall be as follows :

a) Bidder shall exercise caution in selecting severe service control valves like BFP recirculation valves, HP & LP bypass valves, superheater & reheater attemperator valves, PRDS valves for Boiler & Turbine, Soot blower steam pressure control valve, control valves whose down stream are connected to vacuum such as HP/LP heater emergency level control, condenser make up water control valve, separator level control and CEP minimum flow control valve. For such critical applications, Bidder shall offer valves which are proven for similar application. Above valves shall have leakage class equal or better than class-V with metal-to-metal seating.

b) Wherever, steam conditioning calls for Pressure reducing & desuperheating, combined PRDS type valves shall be offered.

4.01.00 General

4.01.01 Control valves for regulating service shall normally be globe body, preferably cage guided, metal-to-metal seated, pneumatically operated and shall be provided with characterized plugs having ANSI leakage class-IV except for the control valves indicated above.

4.01.02

4.01.03 Bonnet joints for all control valves shall be of flanged and bolted type.

4.01.04

4.01.05

4.01.06 Valve end to end dimension and connection shall be according to ANSI standard, straight through pattern. However, Bidder may offer angle body valve for high pressure drop applications. For high pressure drop applications, construction of the valve shall be such that the gland is not exposed to inlet pressure.

4.01.07

4.01.08

4.01.09 Control valve body shall be selected as per the ISA guideline. Generally control valve body shall be cast and machined for pressure rating up to 1500 lbs. Above 1500 lbs, valve body shall be of forged steel. For Demineralized Water application, valve body shall be Stainless Steel.

4.01.10 The direction of flow shall be clearly engraved on the body .

4.02.00 Valve Body Material (material shall match the process condition for super critical boiler)

SR. NO.	SERVICE		MATERIAL
1.	Non corrosive, non-flashing and non cavitating service for fluid temperature up to 275ºC	:	Cast carbon steel ASTM A216 Gr. WCB
2.	Non corrosive, non-flashing and non cavitating service for fluid temperature above 275ºC	:	Cast alloy steel ASTM A217 Gr. WC9
3.	Severe flashing / cavitating services	:	Cast alloy steel ASTM A217 Gr. WC9
4.	Low flashing / cavitating services	:	Cast alloy steel ASTM A217 Gr. WC6
5.	DM water application (condenser hotwell normal, emergency make up etc.)	:	Cast type 316 stainless steel ASTM A351 Gr. CF8M

4.03.00 Valve Size

The control valve sizing (Cv / Kv) shall be based on following guidelines :

a) The valves shall pass normal flow (MCR condition) with 60 to 70 percent opening for linear characterised valves and between 70 to 80 percent opening for equal percentage characterised valves.

b) The valves shall have adequate rangeability to pass the minimum and maximum flows at 10% and 85% of the valve opening respectively. Valve stem travel range from minimum to maximum flow condition shall not be less than 50% of the total valve stem travel.

c) Valve Cv shall be selected in such a way that the valve shall be capable of handling at least 120% of required maximum flow.

d) The valve selection shall be based on the highest size dictated by the above considerations unless noise, flashing or other factors dictate the final selection.

e) Trim outlet velocity for the control valves shall be no more than 7 m/sec for water service and Mach number less than 1/3 for steam and air service application.

f) The sizing procedure followed shall be as per latest edition of ANSI/ISA or equivalent standard.

4.04.00 Valve Top work

4.04.01 Top work shall be sized so that the valve shall operate properly when upstream pressure is 10 percent above maximum inlet pressure and downstream pressure is atmospheric.

4.04.02 Extended bonnet/Finned bonnet and high temperature packing shall be used for high temperature application.

4.04.03 The gland material shall be chosen to suit the operating temperature. PTFE may be chosen for lower temperature application (232ºC maximum) and for high temperature application graphited asbestos glands are to be provided. For vacuum services, the glands shall be of dry seal type.

4.05.00 Valve Trim

4.05.01 Valve trim for applications up to leakage class-V shall be stainless steel 316 SS for pressure drop up to 7 Kg/ Sq. cm. For pressure drops above 7 Kg/Sq. cm hard trim (stelliting or equivalent) shall be used. Other alloys or treatment such as nitride shall be used if severe erosion is expected.

4.05.02 Balanced trim valves shall be offered for high shut-off pressure or high pressure drop condition to reduce the size of the actuators.

4.05.03 For flashing services and two stage mixtures, the trim material shall be 17-4 PH SS or equivalent.

4.05.04 If cavitating condition is foreseen, Bidder shall offer multistage or labyrinth trims valves. Trim of severe service valves shall be of multistage and multipath design with number of discrete pressure drop stages to eliminate the chances of erosion, cavitation, noise and vibration throughout the control range of the valve.

4.05.05 Quick replacement type trim shall be considered for easy maintenance.

4.05.06 Trim Material

SR. NO.	SERVICE		MATERIAL
1.	Non corrosive, non-flashing and non cavitating service for fluid temperature up to 275ºC.	:	SS 316 stellited
2.	Non corrosive, non-flashing and non cavitating service for fluid temperature above 275ºC.	:	SS 316 stellited

SR. NO.	SERVICE		MATERIAL
3.	Severe flashing /cavitating services	:	440 C
4.	Low flashing /cavitating services	:	17-4 PH SS
5.	DM water application (condenser hotwell normal, emergency make up etc.)	:	17-4 PH SS

4.06.00 Noise Level

The equivalent sound level measured at 1.5M above nearest floor level in elevation and 1 M horizontally from the control valve expressed in decibels to a reference of 0.0002 microbar shall not exceed 85 dBA. If the calculated noise is more than the above limit, even with low noise trim design, diffusers shall be included. Diffusers shall be made of stainless steel and shall be integrally connected to the control valve with spool piece. The spool piece shall be in conformity with the main line piping specification.

4.07.00 Valve Actuators

Spring-diaphragm type actuators shall generally be used. Piston type actuators shall be offered in case of high shut-off pressure & quick response requirement.

4.07.01 The actuator shall be designed for 150% thrust required for the valve (at shut-off pressure) at an air line supply pressure of 5.5 Kg/Sq. cm.

4.07.02 Diaphragms shall be designed for 200% maximum operating pressure.

4.07.03 Nylon reinforced neoprene is preferred as diaphragm material.

4.07.04 Valve actuators shall be capable of operating at 80O C ambient, continuously.

4.07.05 Entire actuator assembly shall be painted with corrosion inhibiting paint.

4.07.06 Air connection size shall be 1/4" NPT (F) unless otherwise dictated by process response time. Integral tubing shall be stainless steel.

4.07.07 Bidder shall indicate the stroking time of the valve assemblies with positioner and ensure that the stroke time shall meet the process and equipment dynamics and shall be better than 20 seconds.

4.07.08 All actuators shall be of fail safe design signifying that the spring direction will tend to move the valve (open or close) in a direction safe for the process. “Failure to Open” or “Failure to Close” shall be marked on the actuator.

4.08.00 Valve Positioners

4.08.01 Regulating duty valves shall be offered with Electro Pneumatic Positioners to ensure accuracy and repeatability of response.

4.08.02 Positioners shall have integral non contact (LVDT) type position transmitter, input and output gauges, local keypad & display.

4.08.03 Positioners shall be capable of functioning under hot, humid and vibrating conditions.

4.08.04 Positioner casings shall be dust tight, corrosion resistant and weatherproof.

4.08.05 In general, positioner shall operate at signal range 4 - 20 mA DC for the full travel of the valve.

4.09.00 Valve Accessories

Accessories shall include side mounted hand wheels, limit switches, junction boxes, airlock relays etc.. Solenoid valve wherever required shall be furnished.

1.26.00 I/P Converter

01.	Type	:	Electro-pneumatic (Outdoor Type)
02.	Input level	:	4-20 mA DC
03.	Output range	:	0.2 to 1.0 Kg/Sq. cm With 'Fail Freeze' feature. (i.e in case of wire snapping the last good value of pneumatic signal out put will hold for at least six hours)
04.	Split range	:	For typical application wherever required.
05.	Control Action	:	Selectable air to close, air to open and fail freeze application
06.	Supply pressure	:	1.2 to 1.6 Kg/cm^2 (1.4 typical)
07.	Max. supply pressure	:	7 Kg/ sq.cm.
08	Response Time	:	5 Seconds for 0 to 90% output pressure
09.	Housing	:	IP 55
10.	Repeatability	:	$\pm$0.1% of span
11.	Accuracy	:	$\pm$ 0.25% of span
12.	Supply pressure effect	:	Less than 1%
13.	Span and Zero adjustments	:	Screw
14.	Pneumatic connection	:	¼" NPT

15.	Stability	:	Less than 0.25% of Span / Zero for six months.
16.	Cable connection	:	¾" ET
17.	Mounting	:	Field (pipe/wall mounting)
18.	Accessories	:	Air filter regulator, mounting accessories, cable gland etc.

1.27.00 Air Filter Regulator

01.	Filter Element	:	Sintered Bronze
02.	Filter Size	:	5 microns
03.	Input Air	:	10.0 Kg/Sq. cm (maximum)
04.	Output	:	Adjustable from 0-2.0 Kg / Sq. cm or 0-7.0 Kg / Sq. cm (continuous) as applicable for I/P converter, control drives and control valve
05.	Effect of Supply	:	Maximum 0.02 Kg/Sq. cm for a change pressure variation in supply pressure of 4 Kg/Sq. cm
06.	Bowl Material	:	Metallic cover around high temperature area / clear transparent polycarbonate with metallic cover for ordinary applications.
07.	Accessories	:	2" dial size output pressure gauge
08.	Desirable Feature	:	No perceptible drop of pressure on opening the drain port.

1.28.00 Solenoid Valve

01.	Operating Principle	:	Electromagnetic (noiseless)
02.	Coil voltage rating	:	240 V AC / 220 V DC/24 V DC/110 V (as required)
03.	Ways	:	Generally 3-ways other depending on requirement
04.	Port size	:	1/4" NPT all ports
05.	Body	:	SS bar stock
06.	Trim	:	SS-316
07.	Duty	:	Suitable for continuous energization
08.	Sealing	:	Airtight and leak proof
09.	Ambient Temperature	:	0 - 50 ^{O} C
10.	Fluid Temperature	:	0-150 ^{O} C (approx.)
11.	Coil Enclosure	:	Stainless Steel
12.	Insulation	:	Class-H
13.	Coil Casing	:	IP-65 (Explosion proof for NEC Class-1, Division-1 area)
14.	Mounting	:	On pipe or on panel
15.	Cable Connection	:	3/4" ET
16.	Accessories	:	Mounting brackets, nuts and bolts

17. Preferred feature	:	a) Solenoid valve directly integral to actuator body shall have NAMOOR interface for uniformity b) Local indication for power

5.13.04 Junction Box

Junction boxes of FRP construction with protection class conforming to IP 55.

a) Junction box shall be provided at a dry compartment at one side of the enclosure / rack with front opening type door. Earth stud shall be furnished at rack for safety grounding.

b) Terminals shall be screwless cage clamp type of reputed make and 20% spare terminals shall be furnished in the junction box.

1.0 GENERAL PAINTING REQUIREMENTS

1.1 Painting of equipment shall be carried out as per the specifications indicated below and attached annexures and shall conform to the relevant IS specification/ international standards for the material and workmanship.

1.2 The following latest Indian Standards may be referred to for carrying out the painting job:

IS:5	:	Colours for ready mixed paints and enamels
IS:1303	:	Glossary of terms relating to paints
IS:2379	:	Colour code for identification of pipelines
IS:1477	:	Code of practice for painting of ferrous metals in Buildings (Parts I & II)
IS:2524	:	Code of practice for painting of non-ferrous metals in buildings (Parts I & II)
IS:158	:	Ready mixed paint, brushing, bituminous, black, lead free, acid, alkali, water and heat resisting
IS:2074	:	Ready mixed paint, air drying, red Oxide Zinc Chrome, priming
IS:104	:	Ready mixed paint, brushing, Zinc Chrome, priming
IS: 2932	:	Enamel, synthetic, exterior (a) undercoating (b) Finishing
IS :2933	:	Specification for enamel synthetic exterior type II
IS:2339	:	Specification for Aluminium paints for general purpose

1

1.3 **Preparation of Surfaces**

All surfaces to be painted shall be thoroughly cleaned of all grease, oil, loose mill scale, dust, rust and any other foreign matter. Mechanical cleaning by power tool and scrapping with steel wire brushes shall be adopted to clear the surfaces. However, in certain locations where power tool cleaning cannot be carried out sand scrapping may be permitted with steel wire brushes and /or abrasive paper. Cleaning with solvents shall be resorted to only in such areas where other methods specified above have not achieved the desired results. Cleaning with solvents shall be adopted only after written approval of the OWNER/OWNER RESPRESENTATIVE.

The sheet steel of electrical and instrumentation panels shall be pre-treated through chemical cleaning (7 tank) process of rinsing, degreasing, rinsing, derusting, rinsing, phosphate and rinsing. However, in case mechanical cleaning is also required the Contractor shall carry out the same to get a smooth finish.

1.4 **Primer Paint**

After the surface is prepared one coat of Zinc Phosphate primer conforming to IS 2074 shall be applied.

1.5 Tie Paint

After the coat is dried up completely, second coat of Zinc Phosphate primer conforming to IS 2074 shall be applied by brushing, spray, roller as per manufacture recommendation to ensure a continuous film. The dry film thickness of each coat shall be as indicated in Ann-I & II enclosed. Insulated surfaces will have only primer coating and no finish painting.

1.6 **Finish Paint**

Synthetic enamel paint conforming to IS 2932 shall be used for finish coats. The colour /shade shall be as approved by the OWNER. After cleaning the dust on the dried up primer, first coat of synthetic enamel shall be applied. After this first coat dries up hard, the surface is wet scrubbed cutting down to a smooth finish and ensuring that at no place the first coat is completely removed. After allowing the water to get evaporated completely, the second finish coat of synthetic enamel paint shall be applied.

1 Note For structural painting, customer's specification V II/G2/8 Cl 3.03.11 shall be followed however DFT and coating system shall be followed in line with paint manufacturer's recommendation.

1.7 **Painting and Corrosion Protection for Pipes & Fittings**

1.7.1 All uninsulated piping systems, hangers and supports shall have two coats of Zinc Phosphate Primer (conforming to IS 2074) (One primer coat and one tie coat) and finish paint using synthetic enamel paint to give a finish coat. Shades shall be as per IS 5 or as indicated by PURCHASER/OWNER. Service of the pipeline designations shall be painted on all pipes at visible locations.

1.7.2 Before application of paint, Contractor shall clean the pipes of all mill scale, dirt dust, soot grease, rust etc.

1.7.3 All pipe lines, piping components shall be adequately protected against corrosion during manufacture, fabrication, shipment and storage by appropriate protective paint.

1.7.4 Shop fabricated equipment/items shall be dispatched with final paint. Necessary touch up shall be done at site. Site fabricated equipment/items shall be dispatched with primer painting only and final painting shall be applied at site.

1.8 **Painting and Corrosion Protection for Valves & Specialties**

1

Primer of thickness as indicated in Ann-II shall be applied to all steel and cast iron exposed surfaces as required to prevent corrosion before dispatch. The use of grease or oil, other than light grade mineral oil, for corrosion protection is prohibited. Bores of all vales shall be covered immediately after testing, draining and drying with suitable plastic end covers to avoid ingress of foreign materials.

1.9 **Suggested Colour Codes for Painting**

Suggested colour codes shall be furnished by the successful bidder after award of contract. Colour codes for piping shall be as per IS 2379 with necessary modifications. Where band colour is specified for piping, same shall be provided at 30 metre intervals on long uninterrupted lines and also adjacent to valves and junctions.

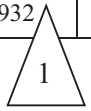
2.0 **Approved Paint Makes**

i) Asian Paints (I) Ltd.
ii) Berger Paints India Ltd
iii) Goodlass Nerolac
iv) Jenson & Nicholson (I) Ltd
v) CDC carboline (I) Ltd.
vi) Shalimar Paints Ltd.
vii) Addison Paints Ltd
viii) Grand Polycoat
ix) Bombay Paints
x) Hemple Paints (Singapore)
xi) Jotun Paints
xii) Akzonobel coatings

2.1 **PAINTING SCHEDULES**

2.1 Painting schedules for various systems/ items are furnished as per enclosed Annexures-I and II. Vendors of different packages/ items will furnish detailed painting schedule for customer approval during detail engineering as per this guide specification.

Annexure-I

Paint Reference Scheme	Surface Preparation Grade / Surface Profile	Primer Coat			Intermediate Coat			Finish Coat			Total DFT in microns
		Premier Paint	No. of Coats	DFT in Microns	Intermediate Paint	No. of Coats	DFT in Microns	Finish Paint (See Note)	No. of Coats	DFT in Microns	
Various type of equipment/valve, etc. (Temp. upto 90°C)	Degreasing and Mech. Cleaning with wire brushing/hand tool (Sa1/St2/St3 as applicable)	HB Zinc Phosphate (alkyd Medium) as per IS:2074	1	35-45 per coat	HB Zinc Phosphate (alkyd Medium) as per IS:2074	1	35-45 per coat	Synthetic enamel (alkyd med.) as per IS:2932	2	20 – 25 per coat	110 - 140
Structural 	- do -	Epoxy resin based HB Zinc phosphate (alkyd medium)	1	50 – 75 per coat	Epoxy based HB MIO pigmented polyamide cured paint	1	110-125 per coat	Polyamide cured epoxy finish coating + Polyurethane coat	1+1	50 – 60 per coat + 25 – 35 per coat	235 - 295
LP Piping/ Vessels, etc. (Temp. upto 90°)	- do -	HB Zinc Phosphate as per IS:2074 (alkyd medium)	1	35 – 45 per coat	HB Zinc Phosphate (alkyd Medium) as per IS:2074	1	35-45 per coat	Synthetic enamel (alkyd med.) as per IS:2932	2	20 – 25 per coat	110-140
Equipment with (Temp. upto 250°)	- do -	Heat resistant Al – paint	2	20 per coat	- NA	-	-	NA	Insulated	NA	40
Equipment in corrosive areas like CPU (regeneration) Dosing skid, etc.	Blast clean to Sa $2^1/2$	HB Epoxy resin based zinc phosphate primer	1	50 per coat	Epoxy based MIO pigmented paint	1	50 per coat	Polyamide cured Epoxy finish coat	2	25 – 35 per coat	150 - 170
Elect. / Control Panels, etc.	Seven tank process	HB Zinc phosphate (alkyd Medium) as per IS:2074	2	35 – 45 per coat	HB Zinc Phosphate (alkyd Medium) as per IS:2074	1	35-45 per coat	Synthetic enamel (alkyd med.) as per IS:2932 	2	20 – 25 per coat	110 – 140
Large dia pipes	As per customer specification for Large diameter piping CI. No. 9.00.00 of VII-I/S-5										

Notes:

1. Surface preparation shown above is as per Swedish Standards SIS 05-5900. Degreasing will be as per Standard SSPC-SP1.

2. In case of insulated surfaces, only primer coats shall be applied.

3. GM/SS items with piping and G.I. pipes will not be painted. Further SS/GI piping shall be given necessary colour banding for identification as per colour scheme.

4. All instruments shall be painted as per manufacturer standard practice.

5. All structural steel items shall be painted at site. Piping shall go with primer coating & finish Paint shall be applied at site. Equipment shall be finish painted at shop.

6. Method of painting application shall be as per paint manufacturer's recommendation.

1

7. Based on above painting schedule, detailed painting schedule will be prepared by respective Package supplier and approved painting schedule shall be submitted to GSECL/DCPL under information category.

8. This painting schedule is applicable for bought out equipment/packages of PEM. Painting specification for various piping/ equipment in scope of various other BHEL units like Power cycle piping, CW piping, LP piping, R.E. joints, Butterfly valves, Power cycle valve etc., shall be furnished by unit separately.

ANNEXURE –II

LDO/HFO Storage Tank			
	Internal	**External**	**Underneath**
Surface preparation	Wire bushing	ST2 (Wire Brushing/ Hand tool cleaning)	Blast clean to SA 2.5
Primer	NA	2 coats of red oxide zinc chromate primer (IS 2074) of 30 - 35 microns DFT each	1 coat of high build coal tar epoxy suitably pigmented, DFT : 80 – 100 microns
Finish	2 coats of double boiled linseed oil	2 coats of synthetic enamel (IS – 2932) paint of 20 – 25 microns (DFT) each	N.A
Total DFT		100 – 120 microns	80 – 100 microns

ANNEXURE-III

SUGGESTED COLOUR CODES FOR PAINTING

SL. NO.	ITEM/SERVICE	COLOUR	IS-5	COLOUR (BAND)	IS-5
1.0	Structures, platforms, galleries, ladders and handrails	Dark Admirality Grey	632	-	-
2.0	Fans, pumps, motors, compressors, Blowers	Light Grey	631	-	-
3.0	Tanks (without insulation and cladding)				
3.1	Outdoor, Stand pipes, vent pipes	Aluminum	-	-	-
3.2	Indoor	Aluminum	-	-	-
4.0	Vessels & all other proprietary equip-ment (without insulation & cladding)	Light grey	631	-	-
5.0	Switchgear	Light grey	631	-	-
6.0	Control & relay panels	Light grey	631/7078 of IS 1650	-	-
7.0	Transformers	Dark Admiralty Grey	632	-	-
8.0	Machinery guards	Signal red	537	-	-
9.0	Piping (without insulation and cladding)				
9.1	Water System				
a)	Boiler feed	Sea green	217	-	-
b)	Condensate	Sea green	217	Light brown	410
c)	D M Water	Sea Green	217	Light orange	557
d)	Soft water	Sea green	217	French blue	166
e)	Bearing cooling water	Sea green	217	French blue	166
f)	Potable & filtered water	Sea green	217	French blue	166
g)	Service & clarified water	Sea green	217	French blue	166
h)	Raw water	Sea green	217	White	-
i)	Cooling water	Sea green	217	French blue	166
9.2	Compressed Air System				
a)	Service air	Sky Blue	101	-	-
b)	Instrument air	blue	101	White	-
9.3	Oil system				
a)	Fuel oil	Light brown	410	French Blue	166
b)	Light oil	Dark Brown	412	Brilliant green	221
c)	Lubricating oil	Light brown	410	Light grey	631

SL. NO.	ITEM/SERVICE	COLOUR	IS-5	COLOUR (BAND)	IS-5
d)	Control oil	Light brown	410	Light orange	557
e)	Transformer oil	Light brown	410	Light orange	557
9.4	Gas system				
a)	Carbon dioxide	Canary yellow	309	Light grey	631
9.5	Fire services	Fire red	536	-	-
9.6	Drainage	Black	-	-	-
9.7	Stand pipes and all Vent pipes	Aluminum	-	-	-

Notes:

1. This color code basically refers to IS:2379 for piping with necessary modifications.

2. Where band color is specified, same shall be provided at 10 meter intervals on long uninterrupted lines and also adjacent to valves and junctions.

	SPECIFICATION FOR CONTROL VALVE (WITH PNEUMATIC / ACTUATOR)	SPECIFICATION NO.: PES – 145 – 06
		VOLUME II B
		SECTION D
		REV. NO. 05 DATE : 15/05/2007
		SHEET 1 OF 11

1.0 SCOPE

This specification covers the Design, Manufacture, Inspection and Testing at the manufacturer's works, proper packing for transportation and delivery to site of Control valve (with Pneumatic/Electric Actuator) for use in Utility/Captive Power Station/Combined Cycle Station.

2.0 CODES AND STANDARDS

2.1 All the equipments specified herein shall comply with the requirements of the latest issue of the relevant National and International standards.

2.2 The Design and Materials used for the components shall also comply with the relevant National and International standards.

2.3 As a minimum requirement, the following standards shall be complied with:-

Indian Boiler Regulation (IBR)		
Allowable Seat leakage	:	ANSI-B16.104 / FCI-70.2
Pressure & Temperature ratings	:	ANSI-B16.34
Enclosure class	:	IEC-144 / NEMA / IS-13947
Control Valves	:	ISA S-75
Electric Motor operated Actuators	:	IS-9334

3.0 TECHNICAL REQUIREMENTS

The Control valve, Actuator and the accessories shall be suitable for continuous operation under an ambient temperature of 0-55°C and Relative Humidity of 0-95% unless specified otherwise in volume IIB Section-B or Section-C.

3.1 Control Valve

The control valve shall be suitably designed for the operating conditions and system characteristics as specified in the Data Sheet-A.

3.1.1 The control valve shall be of globe body design with single port. The valve trim, shall be suitable for quick removal without any cutting or welding.

3.1.2 The material of body, internals and packing shall be as specified in the data sheets. Alternatives, considered more suitable for service specified may be given as alternative offer, along with adequate justification. However main offer shall totally meet specification requirements. Asbestos shall not be used for the packing or any other component.

3.1.3 The valve bonnet and packing shall be suitable for the service conditions as in Data Sheet-A. Gland sealed type bonnets are not acceptable. Double packing is mandatory for applications involving vacuum service. Bonnets having teflon packing shall have valve stem finished to 2-4 microns. Packing material requiring lubrication will not be acceptable. Justification for proper selection of bonnet & packing shall be furnished in the bid.

3.1.4 The valve end connection as specified in Data Sheet-A shall conform to ANSI B16.25 for Butt Weld connection and ANSI B16.5 for flanged ends. End to end dimension shall be as per ANSI 16.10.

3.1.5 The valve seat leakage shall be as per ANSI B16.104 / FCI-70.2. The leakage class shall be as per Data Sheet-A.

3.1.6 The valve body shall have the direction of flow embossed on all valves.

3.1.7 The sizing shall conform to the requirements of ANSI/ISA(S75- 01), and the valve capacity shall be selected so as to meet the following:

Valve with Linear characteristic.	-	Normal Flow (Design Point)	:	70-75% valve lift.
	-	Max. Flow	:	90% valve lift.
	-	Min. Flow	:	>10% valve lift.
Valve with Equipercentage Characteristic	-	Normal Flow (Design Point)	:	75-85% valve lift.
	-	Max. Flow	:	90% valve lift.
	-	Min. Flow	:	>10% valve lift.
ON/OFF Quick open Characteristic	-	1.1 times the CV calculated on the basis of maximum flow condition.		

3.1.8 Calculation for valve sizing, velocity and noise shall be subject to purchaser's approval during contract stage. However responsibility of proper selection and design for the duties specified lies with the vendor. Any modifications required to be done on the valves or actuators & accessories to achieve satisfactory performance of the control system shall be done without any commercial implication.

3.1.9 Suitable justification and evidence shall be furnished regarding proper selection of the valve.

3.1.10 The valve outlet velocities shall be limited to the following values, unless otherwise specified in the Data sheet-A.

i)	Liquid service	<=	7 Metres/Sec.
ii)	Steam service	<=	1/3 Sonic velocity in the flow medium.

3.1.11 For flashing duty, the trim design shall be such that the vapour bubbles are kept away from valve body.

3.1.12 For cavitation service, the trim design shall be of multistage pressure drop type, so as to avoid cavitation altogether, instead of keeping cavitation away from valve parts.

3.1.13 In case of predicted noise level above 85 dBA, suitable low noise trim or inbuilt diffusers shall be provided to bring down the noise level below 85dBA.

3.1.14 The equivalent weighted sound level measured at 1.5M. above floor level in elevation and one metre horizontally from the control valve expressed in decibels to a reference of 0.0002 microbar shall not exceed 85 dBA (without pipe insulation). The offer shall include noise prediction calculations for each valve.

3.1.15 In case of wrong selection/mal operation of valve and for associated actuator during guarantee period, the vendor shall replace the valve suitably with a modified/new valve of design as approved by purchaser and all the expenses for replacement, rectification/modification including transportation both ways will be at vendor's expenses.

3.2 Pneumatic Actuator

The pneumatic actuators shall be employed for modulating or open/close duty, as specified in Data Sheet-A. The bidder shall be responsible for proper selection and sizing of valve actuators in accordance with the pressure drops and shut off pressure.

3.2.1 The pneumatic spring opposed diaphragm actuator for modulating duty shall be capable of positioning the associated valve at desired opening for all the operating conditions specified.

3.2.2 The pneumatic actuator for open/close duty shall be suitable for fast opening/closing of the associated valve.

3.2.3 The actuator design shall allow valve assembly to be mounted at 45° inclination on either side in the vertical plane.

3.2.4 The actuators shall be suitably sized to ensure that the associated valve travel time from full open to full closed position and vice versa is less than 20 seconds under the most stringent service conditions.

3.2.5 The actuator shall be painted with epoxy based paint.

3.3 Accessories for Control valve with Pneumatic Actuator

The bidder shall offer all the accessories as specified in the Data Sheet - A for the Pneumatic Actuators under modulating or OPEN/CLOSE duty. The accessories specified shall be supplied duly mounted on the valve actuator and piped with PVC covered copper tube and flare less brass fittings (Refer typical hook up diagram in sheet 12 of 12).

3.3.1 Hand wheel

Hand wheel shall have OPEN & CLOSE direction marking and clockwise rotation as viewed from front shall close the valve. The hand wheel shall have a circular stainless steel plate with Tag number and service.

3.3.2 Local Position Indicator

Each actuator shall be provided with a mechanical pointer attached to stem, moving over a graduated scale with markings, for OPEN, 25%, 50%, 75%, CLOSE positions.

3.3.3 Position Transmitter

The position transmitter shall be supplied as indicated in Data Sheet-A. The electronic position transmitter shall be non-contact type with 4-20 mA DC 2-wire output suitable for 12-50V DC supply. The resistance type position transmitter shall have 0-100 ohm variation for valve position change of 0-100%. The position transmitters of both types shall have accuracy and enclosure class. Necessary cable glands shall be supplied.

3.3.4 Air Filter Regulator

Instrument quality air at suitable pressure of 5.5 Kg/Cm2(g) to 7 Kg/Cm2(g) shall be supplied to each valve through air filter regulator. The filter regulator shall include an inbuilt blow-down valve, 5 micron size filter. The design pressure for regulator shall be 7 Kg/cm2g. The Air filter regulator shall be selected to meet the requirements of positioner/actuator, E/P convertor and air-lock. The flow capacity of the Air filter regulator shall be variable with a knob. Output gauge shall be provided wherever pneumatic positioner is not specified for the valve.

3.3.5 Air Lock Relay

Air lock relay shall retain the valve position stayput, in case of air supply failure and shall reset automatically on resumption of air supply. Air lock shall have a threaded plug for evacuating diaphragm air if required for local manual operation.

3.3.6 Solenoid Valves

Solenoid valves are meant for interlock & protection purposes overriding the controller signal, and/or to result stayput action on controller signal failure. The Solenoid valve shall be 3-way Universal type and the valve internals shall be of stainless steel. The coil shall have class-H insulation and rated for continuous AC/DC duty as specified in Data sheet-A. The enclosure shall be to IP-55. Cable gland shall be provided for cable entry. The solenoid shall in general conform to IS-8935. The solenoid operation shall be universal type. The solenoid shall be suitable for 24V DC supply, unless specified otherwise in Data Sheet-A.

3.3.7 Limit Switches

Limit switches are required as specified in the data sheet-A. Each limit switch shall have 2NO+2NC contacts with contact rating of 5A at 240V AC/0.2A at 220V DC unless otherwise specified. The switch enclosure shall conform to IP-55. Each limit switch shall be supplied with cable glands.

3.3.8 I/P Converter

I/P Converters shall preferably be of force balance type and shall produce pneumatic output signal corresponding to input current signal, also specified in Data Sheet. Convertor electronics shall be protected against reverse connection of signal polarities and a separate external connection shall be provided to facilitate grounding of instrument casing. Cable glands with neoprene gromets suitable for PVC cables shall be provided. I/P convertor shall have span adjustment facility. I/P convertor enclosure shall conform to IP-55 enclosure class.

3.3.9 Positioner

Positioner shall be suitable for accepting controller output signal 0.2-1.0 Kg/cm2, 0.2-0.6 Kg/cm2 or 0.6-1.0 Kg/cm2 as specified and give an output suitable for the actuator. Pneumatic positioner shall have 3 gauges. All gauges shall have metric scales. The positioner input signal range shall be adjustable. Wherever applicable, it shall be possible to bypass the positioner by means of a switch. Linearity and Hysterisis shall be as indicated in Data sheet-A

3.3.10 Electro pneumatic Positioner

In place of separate E/P Converter and pneumatic positioner a combined electro pneumatic positioner can also be supplied. The electro pneumatic positioner shall have 2 gauges.

3.3.11 Junction Box

Wherever specified, an integral junction box with all electrical accessories conduited up to JB shall be supplied. The junction box shall have two (2) cable glands for outgoing cables. Junction box shall have enclosure class of IP-55.

3.4 Guarantee & Performance

3.4.1 The overall performance of the control valve with pneumatic actuator assembly shall be as follows:-

i)	Hysteresis	:	± 1% of span
ii)	Linearity	:	± 2% of span
iii)	Sensitivity	:	± 0.5% of span.
iv)	Repeatability	:	± 1% of span
v)	Accuracy (Overall)	:	± 2% of span

3.4.2 The guarantee for the control valve, pneumatic actuator & accessories shall be for 12 months continuous operation from the date of commissioning, unless specified otherwise in VOL-IIB Section-B or Section-C.

3.5 Electric Actuator

The electric actuator shall be employed for modulating duty.

3.5.1 The actuator assembly shall be complete with drive motors, gears, hand wheel, signaling & switching units, associated control, integral starter, (when specified) and other accessories as required.

3.5.2 The Electric Actuator shall be capable of positioning the associated valve at the desired opening for all the operating conditions.

3.5.3 The motor shall meet the requirements of Current, torque, Axial thrust, Accelerating & stall time as imposed by the driven equipment.

3.5.4 The motor shall be suitable for direct on line starting.

3.5.5 Motors shall be suitable for inching & plugging duty operations.

3.5.6 The motors shall be capable of starting and accelerating to rated speed at 85% of rated voltage.

3.5.7 The motors shall be rated for continuous operations for modulating duty.

3.5.8 The motor shall operate satisfactorily under the following conditions:

i) ±10% supply voltage variation at rated frequency.

ii) -5% to + 3% variation in frequency at rated supply voltage.

iii) Simultaneous variation in voltage and frequency, the sum of absolute percentage not exceeding 10%.

3.5.9 The Actuator shall be suitable for mounting directly on the valve and shall be suitable for mounting in any position. Supports required for inclined mounting shall form part of supply of valve assembly.

3.5.10 The actuator shall be capable of producing the required torque and thrust at the output shaft for satisfactory operation of the associated valve.

3.5.11 Each actuator shall have a hand wheel for emergency operation. The hand wheel shall be designed such that it is declutched automatically when the power supply to the motor is restarted.

3.5.12 The hand wheel shall be so arranged that when looking from hand wheel, the valve is closed by rotating the hand wheel in clockwise direction.

3.5.13 Motor shall be totally enclosed conforming to IP-65 or better as per data sheet. The enclosure shall be suitable to protect the motor from leakage steam, water or oil from valve joints and glands.

3.5.14 Where flameproof enclosures are specified, it shall meet the specification IS-2148.

3.5.15 Insulation shall be at least class-B or better and shall be tropicalised to withstand the atmospheric condition.

3.5.16 The actuator shall be provided with antifriction bearing in grease filled cartridge.

3.5.17 Each actuator shall be provided with a mechanical position indicator to indicate accurately the valve position.

3.5.18 The integral starter, if specified in data sheet-A, shall be provided in weatherproof enclosure with protection class not less than IP-65 or better as per data sheet.

The integral starter shall consist of:

i) Mechanical & Electrically interlocked reversing contractors suitable for class AC4 duty or Thyristor as pet data sheet.

ii) Thermal overload relay.

iii) Step down control transformer with fuses.

iv) Interposing relay.

v) Monitoring relay.

vi) Open, Close & Stop push buttons.

vii) Indicating lamps.

viii) Local-Remote lockable selector switch with spare potential free contacts, wired for remote interface.

ix) A potential free contact shall be provided for remote annunciation of power failure/overload condition. The contact shall be SPDT, rated for at 5A 240V AC or 0.2A at 220V DC.

3.5.19 The actuator shall be suitably time rated for the duty cycle involved with the necessary number of starts per hour, but in no case, less than 1200 starts per hour.

3.5.20 The actuator shall be provided with a suitable control unit for receiving 4-20 mA signal from remote controller.

3.5.21 The servomotor gear should have self locking or suitable brake so as to maintain it's last position as and when the motor power is switched off.

3.5.22 Thermostat/Thermistor as specified in the data sheet shall be provided for sensing the winding temperature and giving trip command. The trip contact shall be change over type. The contact shall be wired up to the actuator terminal box.

3.6 Accessories for Control Valve with Electric Actuator

3.6.1 Torque Switches

i) Each actuator shall be provided with at least one open and one close torque switches each with 2 NO+2 NC contacts. The contacts shall be rated for 5A at 240V AC or 0.2A at 220V DC.

ii) The torque switches shall have a minimum accuracy $\pm$ 3% of set value.

iii) The torque switches shall be provided with calibrated knobs for setting desired torque. Separate knobs shall be provided for close and open torque switches.

iv) The torque switches shall be provided with mechanical latching device to prevent operation when unsealing from the positions. The latching device shall unlatch as soon as the valve leaves the end position. If such provision is not possible, the torque switches shall be bypassed by end position limit switches, which open on valve leaving end position. These limit switches are additional to the number of limit switches specified elsewhere.

v) The torque switches or worm gear shall be self-locking type so that when torque switch operates it remains operated until the actuator is operated in the reverse.

vi) The torque switch enclosure shall conform to IP-55.

3.6.2 Limit Switches

Each limit switch shall have 2NO+2NC contact with contacts rated for 5A 240V AC/0.2A 220V DC unless otherwise specified. The switch enclosure shall conform to IP-55. Each limit switch shall be supplied with cable glands.

3.6.3 Space Heater

A space heater shall be provided in limit switch and starter compartments to prevent condensation. This shall be suitable for the power supply specified in the data sheet. Where integral starters are provided the space heaters shall be wired to control supply within the actuator.

3.6.4 Remote Position Transmitter

The position transmitter shall be supplied as indicated in Data Sheet-A. The electronic position transmitter shall be non-contact type with 4-20mA DC 2-wire output suitable for 12-50V DC supply. The resistance type position transmitter shall have 0- 100 ohm variation for valve position change of 0-100%. The position transmitters of both types shall have $\pm$ 1% accuracy. The enclosure shall conform to IP-55. Necessary cable glands shall be supplied.

3.6.5 Wiring

i) The actuator and the accessories will be neatly wired up to the terminal boxes.
ii) The internal wiring shall be minimum of 1 mm^2 stranded PVC insulated copper conductor.
iii) The wiring shall be identified by means of numbered ferrules on both ends of all wires.

3.7 Terminal and Terminal boxes

3.7.1 Motor Terminal Box

i) The terminals, terminal boards, terminal boxes, winding tails and associated equipment shall be suitable for connection to supply system having short circuit capacity specified in data sheet and clearance time determined by the associated fuses.

ii) The terminals shall be stud type insulated from the frame. The insulation shall not be porcelain. The studs shall be of brass or stainless steel or phosphor bronze of adequate size.

iii) The terminal box shall be totally enclosed conforming to degree of protection IP-65.

3.7.2 Actuator Terminal Box

i) All terminals of limit and torque switches, space heater, position transmitters, thermostat/thermister shall be brought to a common terminal box. The enclosure shall be to degree of protection IP-65.

ii) Terminal board with plug in connector shall be provided. Alternatively stud type or insertion type may be considered. Pinch screw type however will not be accepted. All terminals shall be shrouded to prevent accidental contact. Where stud type terminals are offered, it shall be as per clause 3.7.1 (ii).

iii) There shall be at least five terminals spare to terminate spare cores of cable.

3.7.3 Cable Glands

The motor terminal box and actuator terminal box shall be provided with required number of double compression nickel plated brass cable glands to suit cable type and associated size.

3.7.4 Earthing Terminal

Two earthing terminal shall be provided on either side of motor and actuator terminal box.

3.7.5 Painting

The Actuator shall be painted with epoxy-based paint.

4.0 TESTING AND INSPECTION

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

4.2 The bidder shall furnish the Quality Plan in the format enclosed in volume-III. In case the Quality Plan(s) is/are included in volume-IIB, the bidder shall furnish his Quality Plan strictly in line with the same. The Quality Plan shall be discussed and finalised with the technically accepted bidders before opening the price bid. The stages where purchaser would like to be associated for witnessing or verification of tests would be indicated by the purchaser in the Quality Plan before approval.

4.3 The following test shall be conducted as a minimum requirement.

4.3.1 Control Valve

i) Radiographic tests on castings.
ii) Dye penetrant tests on machined surface.
iii) Ultrasonic tests for the forgings & bars of all valves with 60 Kg/cm^2 & higher ratings.
iv) Hydrostatic tests as per ANSI B 16.34 prior to seat leakage tests.
v) Valve closure and seat leakage tests as per ANSI B 16.104 / FCI-70.2.

4.3.2 Pneumatic Actuators

Functional test of actuator and each accessory.

4.3.3 Electric Actuator

i) Routine tests on motors as per IS: 325.
ii) Functional test on actuator and each accessory.
iii) Insulation resistance and high voltage test.
iv) Stall current & Stall torque test.
v) Output shaft speed and torque of actuator and corresponding current tests.

4.3.4 Control valve with Actuator & Accessories fully assembled

i) Functional tests of control valve operation along with actuator & accessories.
ii) Dimension checks.

4.3.5 Type tests or Test Reports

i) Valve lift vs. Flow test (Cv Test)
ii) Degree of protection tests for the enclosures
ii) Temperature rise test (applicable for Electrical Actuator only).
iii) Type test for motor as per IS: 325.

4.4 Inspection will be conducted by BHEL and/or their authorised representatives as per the agreed inspection schedule. The inspection schedule will be submitted by the bidder, for BHEL's approval at contract stage. The cost of all tests and inspections will be deemed to have been included in the bid. For all the type tests covered under 4.3.5 above, "Type Test Certificates" as per agreed Quality Plan shall be furnished. In the absence of the same, such Type Tests shall be arranged at the Vendor's works in the presence of BHEL and/or their authorised representatives or in independent Test House/Laboratory approved by BHEL.

4.5 The Standard QP is included in this specification to enable bidder to understand the extent of inspection and testing requirements to execute this job. The successful bidder has to follow the agreed QP, taking care of customer requirements mentioned in Sec-C and submit QP for final approval by BHEL / Customer.

5.0 SPARES AND CONSUMABLES

5.1 Commissioning Spares and consumables

As part of the main equipment supply, the bidder shall supply all commissioning spares and consumables required during Start-up,

5.2 Mandatory Spares

The bidder shall offer along with main offer, the Mandatory Spares as specified in Volume IIB Section-C of 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 along with the normal service expectancy period and frequency of replacement; quantities recommended for 3 years operation along with unit rate against each item to enable BHEL / BHEL's Customer to place a separate order later, if required.

5.4 Special Tools & Tackles

The bidder shall furnish a list of Special Tools & Tackles included in the bid.

6.0 DRAWINGS AND DOCUMENTS

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

6.1.1 Data sheet-B, completely filled-up along with all enclosures.

6.1.2 Wiring diagrams for Electrical Actuators.

6.1.3 Hook up diagrams of Control Valve with Actuator & accessories.

6.1.4 Valve & actuator assembly dimensional drawings with weights.

6.1.5 Quality Plan

6.1.6 All relevant Catalogs with detailed technical information.

6.1.7 Bar-chart to indicate the time schedule for procurement, manufacture, testing and despatch.

6.2 The successful bidder shall furnish the following documents in required number of copies to BHEL during the contract stage:

6.2.1 For approval

i) Dimensional drawings.

ii) Installation drawings with overall dimensions of the completed equipment and clearances for operation and maintenance.

iii) Data sheet-C, completely filled-up along with all the enclosures including the sizing calculations & noise calculations.

iv) Quality Plan.

v) Test Certificates.

6.2.2 Final / As-built Drawings

Final / As-built drawings / CDs in required number of copies shall be submitted.

6.3 Operation & Maintenance Manuals

O&M Manuals in required number of copies shall be submitted. O&M manuals shall also contain storage and commissioning instructions.

7.0 MARKING AND PACKING

7.1 Marking

A stainless steel metal nameplate should be permanently fixed on each equipment giving its tag number and technical specifications.

7.2 Packing

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

55

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 Control Valve with Pneumatic Actuator : Data sheet no. PES-145-06-DS1-1
- Data sheet C for Control Valve with Pneumatic Actuator : Data sheet no. PES-145-06-DS2-1
- Data sheet A&B for Control Valve with Electric Actuator : Data sheet no. PES-145-06-DS3-1
- Data sheet C for Control Valve with Electric Actuator : Data sheet no. PES-145-06-DS4-1

1.0 Electrical

Input Signal	4-20mA
Power Supply	Loop Powered from the output card of Control System (12-30 V DC)
Hart Protocol	Compatibility For Remote Calibration & Diagnostic (Super-Imposed HART Signal On Input Signal (4-20mA)
Valve Position Feedback (4-20mA)	Position Sensing 4-20mA O/P Signal For Control System To Be Provided. If non contact type of Position feedback signal is required, Position transmitter to be separately provided.

2.0 Environment

Operating Temperature	(-) 30 To 80 Deg.C
Humidity	0-95%
Protection Class	IP-65 (Minimum)

3.0 Software For Configuration & Diagnostic

Software	Windows Based Software, Software Shall Meet The Requirement For Configuration, Diagnostics, Calibration And Testing Of the Actuator. Valve positioning timing, actuator leakage, and Valve Wear & tear, fault alarm to be offered as a minimum. Easily up gradable with same hardware and compatible with any HART management systems /AMS.
Diagnostic/Test Features (Optional)	Advanced Diagnostic Features Like Stroke On Line Partial Closure Test, Valve Signature Analysis (Online graphical representation), Step Response Test, Valve Friction/Jamming Detection Etc To Be Provided.

		Factory Valve Signature Tests Reports (Pr Vs Valve Travel And Travel Vs I/P Signal) Are To Be Provided.
Hardware	PC	For Configuration/Software (OPTIONAL)
Test Certificates		Test Certificates As Per Manufacture Standard/Relevant Standard Are To Be Submitted.

Configuration / Remote Calibration, Auto & Manual Calibration Shall Be Possible.

4.0 Modes

Valve Action	Direct & Reverse, Valve Action. (Same positioner for Single Acting or Double Acting And no separate relays required for changing from Single acting to double).
Flow Characterization	Possible to fit valve characteristic curve linear & Equal percentage
Fail Safe/Fail Freeze (Optional)	Fail Safe/Fail Freeze feature is to be provided.

5.0 Performance

Characteristic Deviation	<=0.75% of span
Ambient temp effect	<=0.01%/Deg C or better.
Dead Band	Adjustable 0.1 to 10%.
Scan Time	10ms
Resolution	<=0.05%
Sensitivity/Linearity	0.3-0.4% of FS
Repeatability	0.32% of FS
Auto-Tune	Yes

Leak Test	Yes

7.0 EMC & CE compliance

Required International Standard Like EN/IEC.	To En50081-2&En50082 or equivalent

8.0 Accessories

In Built Operator Panel	Display With Push Buttons For Configuration And Display On The Positioner Itself
Hand Held Hart Calibrator (Optional)	Universal Hart Calibrator To Be Provided, One Per Unit.
Press Gauge Block	For Supply & Output Pr., Filter Regulator Other Accessories Shall Be Provided As On Required Basis For Making System Complete.
Electrical cable entry	½-Npt, side or bottom entry to avoid water Ingress.

DATA SHEETS- A&B
FOR CONTROL VALVES

INDEX

Control Valve datasheets for

	DATA SHEET FOR CONTROL VALVES (WITH PNEUMATIC ACTUATOR) For GSECL - 1X800MW WANAKBORI TPS	SPECIFICATION NO.: PE-TS-408-142-N101	
		VOLUME II - B	
		SECTION D	
		REV. NO. 0	DATE : 19.09.15
		SHEET 3 OF 9	

Tag No.: **ASV-22** Qty.: **ONE** Data Sheet No. PES-145-06-DS1-0

DATA SHEET – A & B

	DATA SHEET – A FOR CONTROL VALVE (WITH PNEUMATIC ACTUATOR) (TO BE FILLED BY PURCHASER)		DATA SHEET – B (TO BE FILLED UP BY BIDDER)
GENERAL*	PROJECT	**GSECL - 1X800MW WANAKBORI TPS**	.....
	SERVICE	**COMBINED TYPE MAIN STEAM TO AUX. STEAM PRDS (HC PRDS)**	.....
	LOCATION		.....
	DUTY	[•] INDOOR [] OUTDOOR	.....
	PIPE SIZE (inlet / outlet)	[] ON/OFF [•] MODULATING	.....
	PIPE MATERIAL (inlet / outlet)	**Ø 219.1x 34 | Ø 457 x 9.53** **SA 335 P91 | SA 335 P22**	.....|.....
BODY*	MODEL NO.	BIDDER TO SPECIFY	.....
	TYPE OF BODY: GUIDING : NO. OF PORTS	[] GLOBE [•] ANGLE | [] TOP [•] CAGE | ONE	.....|.....|.....|...
	BODY SIZE: PORT SIZE: DESIGN CV		.....|.....|.....
	END CONNECTION & RATING (ANSI)	[•] BWE [] SWE [] FLANGED	.....
	BODY MATERIAL	[] A216 WCB [] A217 WC6 [•] SA182 F91 [] SS	.....
		[] A217 C5 [] A351 CF8M	.....
	PACKING: MATERIAL SINGLE / DOUBLE	[] PTFE [•] GRAFOIL [] DOUBLE [•] SINGLE	.....
	BONNET TYPE	[] STD [] EXTENDED [•] FINNED	.....
	TRIM FORM	[] LINEAR [•] EQ. PERCENTAGE	.....
		[] QUICK OPEN (ON/OFF)	
	TRIM MATERIAL: SEAT | PLUG	SS316 (ST) | SS316 (ST)	.....|.....
	: CAGE | GUIDE BUSH	SS316 (ST) | SS316 (ST)	.....|.....
	FLOW	[] BELOW SEAT [] ABOVE SEAT	.....
	OUTLET VELOCITY	[] < 7 M/SEC (WATER) | [•] <150M/SEC (STEAM)	.....|.....
	REQUIRED LEAKAGE CLASS	[] II [] III [] IV [•] V [] VI	.....
	NOISE LEVEL (dBA) (spec. 3.1.14)	LESS THAN 85 dBA (AT ONE METER DESTANCE)	.....
	VACUUM SERVICE	[] YES [•] NO	.....
	ANTI CAVITATION TRIM	[] YES [•] NO	.....
PNEUMATIC ACTUATOR	MODEL NO. & SIZE	PNEUMATIC PISTON TYPE	.....|.....
	CLOSE AT : OPEN AT (KG/CM2g)	0.2 | 1.0	.....|.....
	*TRAVEL TIME FOR OPEN TO CLOSE AND		.....
	CLOSE TO OPEN	LESS THAN 10 SECS.	.....
	*VALVE POSN. ON SIGNAL AIR FAILURE	[] TO OPEN [] STAYPUT [•] TO CLOSE	.....
	*VALVE POSN. ON SUPPLY AIR FAILURE	[•] STAYPUT	.....
ACCESSORIES	POSITIONER (SMART)	[•] REQUIRED [] NOT REQUIRED	
	AIR FILTER REGULATOR	[•] REQUIRED [] NOT REQUIRED	
	AIR LOCK RELAY	[•] REQUIRED [] NOT REQUIRED	
	POSITION LIMIT SWITCH	[•] REQUIRED [] NOT REQUIRED	
	POSITION TRANSMITTER	PART OF SMART POSITIONER	
	SOLENOID VALVE	[•] REQUIRED [] NOT REQUIRED	
	E/P CONVERTOR	PART OF SMART POSITIONER	
	JUNCTION BOX	[•] REQUIRED [] NOT REQUIRED	
	HAND WHEEL (SIDE MOUNTED)	[•] REQUIRED	
	LOCAL POSITION INDICATOR	[•] REQUIRED	

FORM NO. PEM-6666-0

	DATA SHEET FOR CONTROL VALVES (WITH PNEUMATIC ACTUATOR) For GSECL - 1X800MW WANAKBORI TPS	SPECIFICATION NO.: PE-TS-408-142-N101	
		VOLUME II - B	
		SECTION D	
		REV. NO. 0	DATE : 19.09.15
		SHEET 4 OF 9	

Tag No.: **ASV-22** Qty.: **ONE** Data Sheet No. PES-145-06-DS1-0

DATA SHEET – A & B

DATA SHEET – A FOR CONTROL VALVE (WITH PNEUMATIC ACTUATOR) (TO BE FILLED BY PURCHASER)			DATA SHEET – B (TO BE FILLED UP BY BIDDER)
PERFORMANCE OF VALVE	LINEARITY HYSTERISIS SENSITIVITY ACCURACY (OVERALL)	± 2% ± 1% ± 0.5% ± 2%	…… …… …… ……

	SL. No. +	LOAD	FLOW (T/HR)	INLET PR. KG/CM2(A)	OUTLET PR. KG/CM2(A)	TEMP DEG (C)	CALCU-LATED CV	% VALVE LIFT	VALVE O/L VELOCITY
SERVICE CONDITION*									
		Refer Sizing Data Sheet A-1 for Aux. Steam PRDS (Case-1 is the capability point for control valve ASV-22)							

	VALVE TYPE	[] CAVITATION [] FLASHING [•] HIGH DP
	* MAX SHUT OFF PRESS (KG/CM2(A) **272** * BODY DESIGN : PRESS (KG/CM2(A) | TEMP (DEG C) 272 | **573** * IBR FORM III-C [•] REQUIRED [] NOT REQUIRED	…… ……|…… ……
TOTAL WEIGHT (VALVE + ACTUATOR + ACCESSORIES) Kg		……

NOTES:

1. D ESIGN C_V SHALL BE BASED ON SERVICE CONDITIONS INDICATED AS PER SPECIFICATION CLAUSE NUMBER 3.1.7. OF SPECIFICATION NO. : PES – 145 – 06 VOL IIB SECTION D OF TECHNICAL SPECIFICATION

FORM NO. PEM-6666-0

BHEL	**DATA SHEET FOR CONTROL VALVES (WITH PNEUMATIC ACTUATOR) For GSECL - 1X800MW WANAKBORI TPS**	SPECIFICATION NO.: PE-TS-408-142-N101 VOLUME II - B SECTION D REV. NO. 0 DATE : 19.09.15 SHEET 5 OF 9

Tag No.: **ASV-26** Qty.: **ONE** Data Sheet No. PES-145-06-DS1-0

DATA SHEET – A & B

DATA SHEET – A FOR CONTROL VALVE (WITH PNEUMATIC ACTUATOR) (TO BE FILLED BY PURCHASER)			DATA SHEET – B (TO BE FILLED UP BY BIDDER)
GENERAL*	PROJECT	**GSECL - 1X800MW WANAKBORI TPS**	.....
	SERVICE	**COLD REHEAT STEAM TO AUXILIARY STEAM PR. REDUCING VALVE (LC PRV)**	.....
	LOCATION	[•] INDOOR [] OUTDOOR	.....
	DUTY	[] ON/OFF [•] MODULATING	.....
	PIPE SIZE (inlet / outlet)	**Ø 114.3x6.02 | Ø 219.1 x 12.7**	.....
	PIPE MATERIAL (inlet / outlet)	**SA 106 Gr. B | SA 106 Gr. B**	.....
BODY*	MODEL NO.	BIDDER TO SPECIFY	.....
	TYPE OF BODY: GUIDING : NO. OF PORTS	[•]GLOBE [] ANGLE |[] TOP [•]CAGE| ONE	.....
	BODY SIZE: PORT SIZE: DESIGN CV		.....
	END CONNECTION & RATING (ANSI)	[•] BWE [] SWE [] FLANGED	.....
	BODY MATERIAL	[] A216 WCC [•] A217 WC9 [] SS [] A217 C5 [] A351 CF8M	.....
	PACKING: MATERIAL SINGLE / DOUBLE	[] PTFE [•] GRAFOIL []DOUBLE [•]SINGLE	.....
	BONNET TYPE	[] STD [•] EXTENDED [] FINNED	.....
	TRIM FORM	[] LINEAR [•] EQ. PERCENTAGE [] QUICK OPEN (ON/OFF)	.....
	TRIM MATERIAL: SEAT | PLUG	SS316 (ST) | SS316 (ST)	.....
	: CAGE | GUIDE BUSH	SS316 (ST) | SS316 (ST)	.....
	FLOW	[] BELOW SEAT [] ABOVE SEAT	.....
	OUTLET VELOCITY	[] < 7 M/SEC (WATER) | [•]<150M/SEC (STEAM)	.....
	REQUIRED LEAKAGE CLASS	[] II [] III [] IV [•] V [] VI	.....
	NOISE LEVEL (dBA) (spec. 3.1.14)	LESS THAN 85 Dba (AT ONE METER DESTANCE)	.....
	VACUUM SERVICE	[] YES [•] NO	.....
	ANTI CAVITATION TRIM	[] YES [•] NO	.....
PNEUMATIC ACTUATOR	MODEL NO. & SIZE	BIDDER TO SPECIFY	.....
	CLOSE AT : OPEN AT (KG/CM2g)	1.0 | 0.2	.....
	*TRAVEL TIME FOR OPEN TO CLOSE AND CLOSE TO OPEN	LESS THAN 10 SECS.	.....
	*VALVE POSN. ON SIGNAL AIR FAILURE	[•] TO OPEN [] STAYPUT [] TO CLOSE	.....
	*VALVE POSN. ON SUPPLY AIR FAILURE	[•] STAYPUT	.....
ACCESSORIES	POSITIONER (SMART)	[•] REQUIRED [] NOT REQUIRED	
	AIR FILTER REGULATOR	[•] REQUIRED [] NOT REQUIRED	
	AIR LOCK RELAY	[•] REQUIRED [] NOT REQUIRED	
	POSITION LIMIT SWITCH	[•] REQUIRED [] NOT REQUIRED	
	POSITION TRANSMITTER	PART OF SMART POSITIONER	
	SOLENOID VALVE	[•] REQUIRED [] NOT REQUIRED	
	E/P CONVERTOR	PART OF SMART POSITIONER	
	JUNCTION BOX	[•] REQUIRED [] NOT REQUIRED	
	HAND WHEEL (SIDE MOUNTED)	[•] REQUIRED	
	LOCAL POSITION INDICATOR	[•] REQUIRED	

	DATA SHEET FOR CONTROL VALVES (WITH PNEUMATIC ACTUATOR) For GSECL - 1X800MW WANAKBORI TPS	SPECIFICATION NO.: PE-TS-408-142-N101	
		VOLUME II - B	
		SECTION D	
		REV. NO. 0	DATE : 19.09.15
		SHEET 6 OF 9	

Tag No.: **ASV-26** Qty.: **ONE** Data Sheet No. PES-145-06-DS1-0

DATA SHEET – A & B

DATA SHEET – A FOR CONTROL VALVE (WITH PNEUMATIC ACTUATOR) (TO BE FILLED BY PURCHASER)			DATA SHEET – B (TO BE FILLED UP BY BIDDER)
PERFORMANCE OF VALVE	LINEARITY HYSTERISIS SENSITIVITY ACCURACY (OVERALL)	± 2% ± 1% ± 0.5% ± 2%	…… …… …… ……

SERVICE CONDITION*	SL. No. +	LOAD	FLOW (T/HR)	INLET PR. KG/CM2(A)	OUTLET PR. KG/CM2(A)	TEMP DEG (C)	CALCU-LATED CV	% VALVE LIFT	VALVE O/L VELOCITY
		Refer Sizing Data Sheet A-2 for Aux. Steam PRDS Low Capacity Pressure Reducing Valve ASV-26							

	VALVE TYPE	[] CAVITATION [] FLASHING [•] HIGH DP
	* MAX SHUT OFF PRESS (KG/CM2(A) 74.5 BODY DESIGN : PRESS (KG/CM2(A) | TEMP (DEG C) 74.5 | **360** * IBR FORM III-C [•] REQUIRED [] NOT REQUIRED	…… ……|…… ……
	TOTAL WEIGHT (VALVE + ACTUATOR + ACCESSORIES) Kg	……

NOTES:

1. D ESIGN C_V SHALL BE BASED ON SERVICE CONDITIONS INDICATED AS PER SPECIFICATION CLAUSE NUMBER 3.1.7. OF SPECIFICATION NO. : PES – 145 – 06 VOL IIB SECTION D OF TECHNICAL SPECIFICATION

	DATA SHEET FOR CONTROL VALVES (WITH PNEUMATIC ACTUATOR) For GSECL - 1X800MW WANAKBORI TPS	SPECIFICATION NO.: PE-TS-408-142-N101	
		VOLUME II - B	
		SECTION D	
		REV. NO. 0	DATE : 19.09.15
		SHEET 7 OF 9	

Tag No.: **CDV-138** Qty.: **ONE** Data Sheet No. PES-145-06-DS1-0

DATA SHEET – A & B

	DATA SHEET – A FOR CONTROL VALVE (WITH PNEUMATIC ACTUATOR) (TO BE FILLED BY PURCHASER)		DATA SHEET – B (TO BE FILLED UP BY BIDDER)
GENERAL*	PROJECT	**GSECL - 1X800MW WANAKBORI TPS**	.....
	SERVICE	**SPRAY TO COMBINED PRDS CONTROL VALVE**	.....
	LOCATION	[•] INDOOR [] OUTDOOR	.....
	DUTY	[] ON/OFF [•] MODULATING	.....
	PIPE SIZE (inlet / outlet)	**Ø 88.9 x5.49 | Ø 88.9 x5.49**	.....
	PIPE MATERIAL (inlet / outlet)	**SA 106 Gr. B | SA 106 Gr. B**	.....|.....
BODY*	MODEL NO.	BIDDER TO SPECIFY	.....
	TYPE OF BODY: GUIDING : NO. OF PORTS	[•]GLOBE [] ANGLE |[] TOP [•] CAGE |ONE	.....|.....|.....|.....
	BODY SIZE: PORT SIZE: DESIGN CV	[•] BWE [] SWE [] FLANGED	.....|.....|.....
	END CONNECTION & RATING (ANSI)	[•] A216 WCB [] A217 WC6 [] SS [] A217 C5	.....
	BODY MATERIAL	[] A351 CF8M	.....
		[] PTFE [•]GRAFOIL []DOUBLE [•]SINGLE	.....
	PACKING: MATERIAL SINGLE / DOUBLE	[] STD [] EXTENDED [] FINNED	.....
	BONNET TYPE	[] LINEAR [•] EQ. PERCENTAGE	.....
	TRIM FORM	[] QUICK OPEN (ON/OFF)	.....
		SS316 (ST) | SS316 (ST)	
	TRIM MATERIAL: SEAT | PLUG	SS316 (ST) | SS316 (ST	.....|.....
	: CAGE | GUIDE BUSH	[] BELOW SEAT [] ABOVE SEAT	.....|.....
	FLOW	[•] < 7 M/SEC (WATER) | []<150M/SEC	.....
	OUTLET VELOCITY	(STEAM)	.....|.....
			.....
	REQUIRED LEAKAGE CLASS	[] II [] III [] IV [•] V [] VI	.....
	NOISE LEVEL (dBA) (spec. 3.1.14)	LESS THAN 85 dBA (AT ONE METER DESTANCE)	.....
	VACUUM SERVICE	[] YES [•] NO	.....
	ANTI CAVITATION TRIM	[] YES [•] NO	
PNEUMATIC ACTUATOR	MODEL NO. & SIZE	BIDDER TO SPECIFY	.....|.....
	CLOSE AT : OPEN AT (KG/CM2g)	0.2 | 1.0	.....|.....
	*TRAVEL TIME FOR OPEN TO CLOSE		.....
	AND CLOSE TO OPEN	LESS THAN 10 SECS.	.....
	*VALVE POSN. ON SIGNAL AIR FAILURE	[] TO OPEN [] STAYPUT [•] TO CLOSE	.....
	*VALVE POSN. ON SUPPLY AIR FAILURE	[•] STAYPUT	.....
ACCESSORIES	POSITIONER (SMART)	[•] REQUIRED [] NOT REQUIRED	
	AIR FILTER REGULATOR	[•] REQUIRED [] NOT REQUIRED	
	AIR LOCK RELAY	[•] REQUIRED [] NOT REQUIRED	
	POSITION LIMIT SWITCH	[•] REQUIRED [] NOT REQUIRED	
	POSITION TRANSMITTER	PART OF SMART POSITIONER	
	SOLENOID VALVE	[•] REQUIRED [] NOT REQUIRED	
	E/P CONVERTOR	PART OF SMART POSITIONER	
	JUNCTION BOX	[•] REQUIRED [] NOT REQUIRED	
	HAND WHEEL (SIDE MOUNTED)	[•] REQUIRED	
	LOCAL POSITION INDICATOR	[•] REQUIRED	

	DATA SHEET FOR CONTROL VALVES (WITH PNEUMATIC ACTUATOR) For GSECL - 1X800MW WANAKBORI TPS	SPECIFICATION NO.: PE-TS-408-142-N101	
		VOLUME II - B	
		SECTION D	
		REV. NO. 0	DATE : 19.09.15
		SHEET 8 OF 9	

Tag No.: **CDV-138** Qty.: **ONE** Data Sheet No. PES-145-06-DS1-0

DATA SHEET – A & B

DATA SHEET – A FOR CONTROL VALVE (WITH PNEUMATIC ACTUATOR) (TO BE FILLED BY PURCHASER)			DATA SHEET – B (TO BE FILLED UP BY BIDDER)
PERFORMANCE OF VALVE	LINEARITY HYSTERISIS SENSITIVITY ACCURACY (OVERALL)	± 2% ± 1% ± 0.5% ± 2%	…… …… …… ……

	SL. No. +	LOAD	FLOW (T/HR)	INLET PR. KG/CM2(A)	OUTLET PR. KG/CM2(A)	TEMP DEG (C)	CALCU-LATED CV	% VALVE LIFT	VALVE O/L VELOCITY
SERVICE CONDITION*									
		Refer Sizing Data Sheet A-1 for High Capacity PRDS							

	VALVE TYPE	[] CAVITATION [] FLASHING [] HIGH DP
	* MAX SHUT OFF PRESS (KG/CM2(A) 46 * BODY DESIGN : PRESS (KG/CM2(A) | TEMP (DEG C) 46 | **60** * IBR FORM III-C [] REQUIRED [•] NOT REQUIRED	…… ……|…… ……
	TOTAL WEIGHT (VALVE + ACTUATOR + ACCESSORIES) Kg	……

NOTES:

1. DESIGN C_V SHALL BE BASED ON SERVICE CONDITIONS INDICATED AS PER SPECIFICATION CLAUSE NUMBER 3.1.7. OF SPECIFICATION NO. : PES – 145 – 06 VOL IIB SECTION D OF TECHNICAL SPECIFICATION

FORM NO. PEM-6666-0

DATA SHEET FOR CONTROL VALVES (WITH PNEUMATIC ACTUATOR) For GSECL - 1X800MW WANAKBORI TPS

SPECIFICATION NO.	PE-TS-408-142-N101
VOLUME	II - B
SECTION	D
REV. NO. 00	DATE: 19.09.15
SHEET 9 OF 9	

Tag No……. **Quantity**……. Data Sheet No. PES-145-06-DS1-0

ITEMS SHALL BE APPLICABLE FOR TAG Nos. WHEREVER STATEMENT "REQUIRED" INDICATED IN THE INDIVIDUAL CV DATA SHEETS

DATA SHEET – A & B for ACCESSORIES

DATA SHEET – A FOR CONTROL VALVE (WITH PNEUMATIC ACTUATOR) (TO BE FILLED BY PURCHASER)							DATA SHEET – B (TO BE FILLED-UP BY BIDDER)
POSITIONER (SMART)	MFR. & MODEL NUMBER			TO BE INDICATED IN VENDOR'S DOCUMENT			
	BYPASS	GAUGES	ENCL. CLASS	☐ YES ■ NO	☐ THREE ■ TWO	■ IP-55	
	INPUT SIGNAL (ELECTRICAL)			4-20 mA DC			
	OUTPUT SIGNAL (PNEUMATIC)(Kg / Cm^2)			TO SUIT ACTUATOR			
AIR FILTER REGULATOR	MFR. & MODEL NUMBER			TO BE INDICATED IN VENDOR'S DOCUMENT			
	AIR SUPPLY PRESS (Kg / Cm^2 g)			■ 5.0 - 8.0			
	FILTER SIZE			5 MICRONS			
	OUTPUT PRESS (Kg / Cm2 g)			TO SUIT SMART POSITIONER			
	OUTPUT GAUGE			■ REQUIRED ☐ NOT REQUIRED			
AIR LOCK	MFR. & MODEL NUMBER			TO BE INDICATED IN VENDOR'S DOCUMENT			
	SET PRESS (Kg / Cm^2)			TO BE INDICATED IN VENDOR'S DOCUMENT			
	SUPPLY PRESS (Kg / Cm^2)			■ 5.0 - 8.0			
	RESET TYPE			AUTO			
	VENT PLUG			REQUIRED			
LIMIT SWITCH	MFR. & MODEL NUMBER			TO BE INDICATED IN VENDOR'S DOCUMENT			
	OPEN posn	INT posn	CLOSE posn	**1 NO.**	**---**	**1 NO.**	
	CONTACT TYPE			SPDT 2 NO + 2 NC			
	RATING (AC / DC)			5A 240V AC AND 0.2A 220V DC			
	ENCLOSURE CLASS			■ IP 55			
POSITION TRANSMITTER (IN BUILT IN SMART POSITIONER)	MFR. & MODEL NUMBER			NOT APPLICABLE			
	TYPE			■ Electronic (2-Wire Type),Non-Contact Type ☐ OTHER			
	SUPPLY			■ 24V DC ☐ 220V DC ☐ 110V AC ☐ 240V AC			
	OUTPUT RATING			■ 4-20mA ☐ 0-100 ohms			
	ACCURACY			± 1% FS			
	ENCLOSURE CLASS			■ IP 65			
SOLENOID VALVE	MFR. & MODEL NUMBER			TO BE INDICATED IN VENDOR'S DOCUMENT			
	RATING			■ 24V DC ☐ 220V DC ☐ 240V AC ☐			
	OPERATION	QUANTITY		☐ Stayput ■ Interlock	AS PER DATASHEET & HOOK UP		
	COIL INSULATION CLASS			CLASS - H			
	ENCLOSURE CLASS			■ IP 65			
HANDWHEEL	ORIENTATION			☐ TOP MOUNTED ■ SIDE MOUNTED			
JUNCTION BOX	NO. OF WAYS			☐ 24-WAYS ■ 36-Ways ☐ AS REQUIRED			
	SIZE			AS REQUIRED			
	CABLE GLANDS (Size / Quantity)			AS REQUIRED (Double Compression Type).			
	ENCLOSURE CLASS			■ IP 55			
I/P CONVERTER	MFR. & MODEL NUMBER			IN BUILT IN SMART POSITIONER			
	INPUT SIGNAL	POWER SUPPLY					
	SPLIT RANGE						
	ENCLOSURE CLASS						
SS Tubing & Fittings / per CV	**This is in addition to SS Tubing and fittings which are integral part of CV**			12 Meters of ¼ " SS Tubing, with 1 set of SS Fittings for each CV for connection to IA Header on one end and accessories on another end of CV.			

COMPANY SEAL

NAME

SIGNATURE

DATE

DATA SHEET-C

LIST OF DOCUMENTS AND DATA TO BE SUBMITTED AFTER AWARD OF CONTRACT

The list of documents and data to be submitted by the successful bidder after the award of the contract are specified in Data Sheet - C.

The supplier shall after award of contract submit following documents for purchaser's approval / vetting.

(i) Certified final drawings & data sheets as per cl. 4.0.0 of section-C.

(ii) Quality Plans, Inspection/Test Reports as agreed with the Purchaser.

(iii) Material and Hydraulic Test Certificates along with IBR form III C.

(iv) Performance Test Procedures and Reports.

(v) Field Quality Plan as agreed.

(vi) Storage Instructions.

(vii) List of Commissioning and Mandatory Spares.

(viii) List of Tools and Tackles required.

(ix) List of lubricants.

(x) Operation and Maintenance Instruction Manual.

NOTE: Above list is only tentative. Successful bidder shall prepare detailed schedule of Drawings/ Documents, which shall be mutually agreed and included in the contract document/ordering Specification.

FINAL DOCUMENTATION

S.NO.	DESCRIPTION	INITIAL SUBMISSION FOR APPROVAL TO BHEL	COPIES FOR GSECL APPROVAL AFTER BHEL CLEARANCE
1.	Vendor drawing / document for approval Note : ▪ Initial subm issions with Rev. No. P0, P1, P2 etc. ▪ After BHEL cleara nce, subm ission to **GSECL** with Rev. No. R0, R1, R2 etc.	04+Soft Copy	04+Soft Copy
2.	Release of finally approved drawings / documents (action A/E) i.e. distribution prints	14 + (04 CD) Soft Copy	
3.	O&M Manuals	1	14 + (04 CD) Soft Copy
4.	"As-Built" drawings	14 + (04 CD) Soft Copy	

QUALITY PLAN

PEM :: C&I

QUALITY PLAN
FOR
CONTROL VALVE (PNEUMATIC)

QUALITY PLAN NO.:	**PE-QP-408-145-I 006**
VOLUME	
SECTION	
REV. NO. 02	DATE: 10.06.15
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	
1.0	**MATERIAL**											
1.1	Body & Bonnet casting / forgings, plug, valve stem, seat ring/cage.	1. Physical, Chemical properties	MA	Physical, Chemical tests	One/ Heat(HT Batch)	Approved drg. / data sheet / BHEL specn.	Approved drg. / data sheet / BHEL specn.	Test Certificate	3	---	2,1	
		2. Heat Treatment	MA	Review of H.T. Chart	Each H.T.	Approved drg. / data sheet / BHEL specn.	Approved drg. / data sheet / BHEL specn.	Test Certificate	3/2	2	1	IBR Certification (if applicable) to be verified by BHEL
		3. Internal quality of castings	MA	RT for Body & UT for Bonnet(NDT)	100%	ASME B 16.34	ASME B 16.34	Test Report / FILM	3/2	2	1,4	Only for rating ANSI 900 and above. Applicable for Body and Bonnet only. For Lower rating only if called for in specification.
		4. Surface Quality	MA	1. Visual	100%	MSS-SP-55	MSS-SP-55	Test Certificate	3/2	---	2,1	
				2. MT/PT	100%	ASME B 16.34	ASME B 16.34	Test Certificate	3	2	1	After Machining on machined surface only

LEGEND: * CR - Critical characteristics; MA - Major characteristics; MI - Minor characteristics
RT- Radiographic Test; UT – Ultrasonic Test; PT – Dye penetrant Test; MT- Magnetic Test
$ P - Agency Performing the Test.; W - Agency Witnessing the Test.; V - Agency Verifying the Test.
1 - BHEL; 2 - Vendor; 3 - Sub-vendor; 4 – Customer/ Consultant

PEM :: C&I

QUALITY PLAN
FOR
CONTROL VALVE (PNEUMATIC)

QUALITY PLAN NO.:	**PE-QP-408-145-I 006**
VOLUME	
SECTION	
REV. NO. 02	DATE: 10.06.15
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	
		5. Pressure test for shell	MA	Hyd. Test	100%	ISA-S-75.19/ ASME B 16.34	ISA-S-75.19/ ASME B 16.34	Test Certificate	2	2	1	For Body & Bonnet after machining
1.2	Diaphragm	1. Surface Quality	MA	Visual	100%	Mfr. standard	Mfr. standard	Test Certificate	3/2	---	2,1	
		2. Hardness	MA	Measurement	100%	Mfr. standard	Mfr. standard	Test Certificate	3/2	---	2,1	
		3. Endurance / Life cycle	MA	Cyclic test 10,000 cycles	One / Type	10,000 cycles/ Mfr. standard.	No damage	Test Certificate	3/2		2,1	
1.3	Spring	1. Composition	MA	Chemical-Analysis	One sample/ Heat	Material spec. / Mfr. standard	Material spec. / Mfr. standard	Test Certificate	3	---	2,1	
		2. Mech. Properties	MA	Mech. Test	One sample/ Heat	Material spec. / Mfr. standard	Material spec. / Mfr. standard	Test Certificate	3	---	2,1	
		3. Performance	MA	1. Stiffness ratio	100%	Material spec. / Mfr. standard	Material spec. / Mfr. standard	Test Certificate	3	---	2,1	
				2. Scragging	100%	Material spec. / Mfr. standard	Material spec. / Mfr. standard	Test Certificate	3	---	2,1	
				3. Cyclic test (Endurance)	One / type	10,000 cycles	Material spec. / Mfr. standard	Test Certificate	3	---	2,1	
				4. Dimension (Measurement)	One sample/ Lot	Mfr. standard	Appd Drg	Record	3	---	2,1	

LEGEND: * CR - Critical characteristics; MA - Major characteristics; MI - Minor characteristics
RT- Radiographic Test; UT – Ultrasonic Test; PT – Dye penetrant Test; MT- Magnetic Test
$ P - Agency Performing the Test.; W - Agency Witnessing the Test.; V - Agency Verifying the Test.
1 - BHEL; 2 - Vendor; 3 - Sub-vendor; 4 – Customer/ Consultant

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	
1.4	Electrical items [Limit switches, Solenoids, Position Transmitter(if provided externally)]	1. Routine Test	MA	HV, IR, Continuity function	100%	Rele. Standards	Rele. Standards	Test Certificate	3	---	2,1	In case TC is not available, Actual test shall be conducted
		2. Degree of protection	MA	IP/NEMA Tests	One sample / type	Approved Data sheet	Approved Data sheet	Test Certificate	3	---	2,1	
1.5	Pressure Gauges	1. Performance	MA	Review of calibration certificates	100%	Mfr. Standard	Mfr. Standard	Test Certificate	3	---	2,1	Refer Note-7
		2. Marking	MA	Visual	100%	Mfr. standard	Mfr. standard	Records	3	---	2,1	
2.0	**IN PROCESS INSPECTION**											
2.1	After machining, i, Body ii Bonnet iii Plug iv Valve Stem v seat ring/cage	1. Surface flaws	MA	Visual & MT/PT	100% (on accessible surfaces)	ASME B 16.34	ASME B 16.34	Test Records	2	---	1	Butt weld ends shall be included.
		2. Dimensional checks	MA	Measurement	100%	Mfr. Standard	Mfr. Standard	Records	2	---	1	
		3. Hard facing (wherever applicable)	MA	Hardness Measurement	One sample/Lot	Mfr. Standard	Mfr. Standard	Records	2	---	1	
2.2	Lapping	Machining surface contact	MA	Blue Matching	One sample/lot	------	Proper Physical Contact	---	2	---	---	
3.0	**TESTS ON COMPLETED VALVE**											

LEGEND: * CR - Critical characteristics; MA - Major characteristics; MI - Minor characteristics
RT- Radiographic Test; UT – Ultrasonic Test; PT – Dye penetrant Test; MT- Magnetic Test
$ P - Agency Performing the Test.; W - Agency Witnessing the Test.; V - Agency Verifying the Test.
1 - BHEL; 2 - Vendor; 3 - Sub-vendor; 4 – Customer/ Consultant

PEM :: C&I

QUALITY PLAN
FOR
CONTROL VALVE (PNEUMATIC)

QUALITY PLAN NO.:	**PE-QP-408-145-I 006**
VOLUME	
SECTION	
REV. NO. 02	DATE: 10.06.15
SHEET 5	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	
3.1	Actuator Chamber	Leakage & Strength	MA	Pneumatic test	100%	Mfr. Standard	No Leakage	Test Certificate	2	1	1,4	Refer Note-4
3.2	Body	Leakage and Pressure test (Body Mount Leakage)	MA	Hydro test	100%	ISA - S-75.19	No Leakage	Test Certificate	2	1,4	1	Refer Note-4
3.3	Seat leakage test for completed valve	Seat Leakage	MA	Pneumatic Test	100%	FCI-70.2	FCI-70.2	Test Certificate	2	1,4	1	Refer Note-4
4.0	**OPERATION TEST ON COMPLETED VALVE (Final inspection)**	1. Valve Travel	MA	Measurement	100%	Approved drg. / data sheet	Approved drg. / data sheet	Test Report	2	1,4	1,4	Refer Note-4
		2. Opening/Closing time	MA	Measurement	100%	Approved drg. / data sheet	Approved drg. / data sheet	Test Report	2	1,4	1,4	Refer Note-4
		3. Linearity/cam characteristic	MA	Measurement	100%	Approved drg. / data sheet	Approved drg. / data sheet	Test Report	2	1,4	1,4	Refer Note-4
		4. Repeatability	MA	Measurement	100%	Approved drg. / data sheet	Approved drg. / data sheet	Test Report	2	1,4	1,4	Refer Note-4
		5. Hysteresis	MA	Measurement	100%	Approved drg. / data sheet	Approved drg. / data sheet	Test Report	2	1,4	1,4	Refer Note-4
		6. Sensitivity	MA	Measurement	100%	Approved drg. / data sheet	Approved drg. / data sheet	Test Report	2	1,4	1,4	Refer Note-4
		7. Accuracy (Overall)	MA	Measurement	100%	Approved drg. / data sheet	Approved drg. / data sheet	Test Report	2	1,4	1,4	Refer Note-4
		8. Control Valve characteristics / CV Test	MA	♦Measurement (Press. vs. discharge and discharge vs. opening 0-100% in steps of 10%)	One per type	As per specs/ Approved drg. / data sheet	As per specs/ Approved drg. / data sheet	Test Certificate	2	1,4	1,4	♦Size = Body & port size Or Body size & CV for non std port. Refer Note 1.

LEGEND: * CR - Critical characteristics; MA - Major characteristics; MI - Minor characteristics
RT- Radiographic Test; UT – Ultrasonic Test; PT – Dye penetrant Test; MT- Magnetic Test
$ P - Agency Performing the Test.; W - Agency Witnessing the Test.; V - Agency Verifying the Test.
1 - BHEL; 2 - Vendor; 3 - Sub-vendor; 4 – Customer/ Consultant

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. Operation of limit switch & solenoids and other accessories	MA	Function	100%	Approved drg. / data sheet	As per specs/ Approved drg. / data sheet	Test Report	2	1,4	1,4	On assembled valve Refer Note-4
		10. Overall dimensions	MI	Visual and dimensional	100%	Approved drg. / data sheet	As per specs/ Approved drg. / data sheet	Records	2	1,4	1,4	Refer Note-4
		11. Pre defined valve position in case of air failure	MA	Visual	100%	As per spec & Appd drg	As per spec & Appd drg	Test Certificate	2	1,4	1,4	
		12. Cleanliness, painting, stamping (for direction of flow), Tag No.	MA	Visual and dimensional	100%	Approved drg. / data sheet	As per specs/ Approved drg. / data sheet	Test Certificate	2	1,4	1,4	
		13. Manual Opening & Closing (Hand wheel Operation)	MI	Visual	One per type	------	-------	Test Certificate	2	1,4	1,4	
5.0	**AUXILIARY ITEMS (Performance test of auxiliary items shall be performed on the completely assembled valve)**											
5.1	Positioner	Overall leakage after assembly including Nozzles leakage	MA	Leak Test (in the steady state input signal)	100 %	Mfr. Standard	No leakage	Test Certificate	3/2	---	1,4	Overall leakage including tubing
5.2	Air filter regulator	1. Normal air consumption	MA	Measurement	Each type	Mfr. Standard	No leakage	Test Certificate	3/2	---	1,4	
		2. Overall leakage	MA	Visual (soap solution)	100 %	Mfr. Standard	No leakage	Test Certificate	3/2	---	1,4	
5.3	Air lock relay	Performance Test	MA	Leakage test	100%	Mfr. Standard	No leakage	Test Certificate	3/2	---	1,4	

LEGEND: * CR - Critical characteristics; MA - Major characteristics; MI - Minor characteristics
RT- Radiographic Test; UT – Ultrasonic Test; PT – Dye penetrant Test; MT- Magnetic Test
$ P - Agency Performing the Test.; W - Agency Witnessing the Test.; V - Agency Verifying the Test.
1 - BHEL; 2 - Vendor; 3 - Sub-vendor; 4 – Customer/ Consultant

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	
5.4	Electronic position transmitter(not applicable if provided integral to smart positioner)	1. Accuracy	MA	Operation	100%	Approved data sheet /	Approved data sheet /	Test Certificate	2	1	1,4	
5.5	Current to Pneumatic converter(not applicable for smart positioner)	1. Physical Verification Make/Model	MA	Visual	100%	Approved drg. / data sheet	Approved drg. / data sheet	Test Certificate	2	---	2,1, 4	
		2. Degree of Protection	MA	IP/NEMA test	Each type	Relevant Standard	Relevant Standard	Test Certificate	3	---	2,1, 4	
		3. Linearity	CR	Measurement	100%	Approved drg. / data sheet / BHEL specn.	Approved drg. / data sheet / BHEL specn.	Inspection Report	2	---	1,4	
		4. Hysterisis	CR	Measurement	100%	Approved drg. / data sheet / BHEL specn.	Approved drg. / data sheet / BHEL specn.	Inspection Report	2	---	1,4	
5.6	Smart Positioner (As Applicable)	1. Physical Verification Make/Model	MA	Visual	100%	Approved drg. / data sheet	Approved drg. / data sheet	Test Certificate	2	---	2,1, 4	
		2. Degree of Protection	MA	IP/NEMA test	Each type	Relevant Standard	Relevant Standard	Test Certificate	3	---	2,1, 4	
		3. Linearity	CR	Measurement	100%	Approved drg. / data sheet / BHEL specn.	Approved drg. / data sheet / BHEL specn.	Inspection Report	2	---	1,4	
		4. Hysterisis	CR	Measurement	100%	Approved drg. / data sheet / BHEL specn.	Approved drg. / data sheet / BHEL specn.	Inspection Report	2	---	1,4	
		5. Calibration with Hand Held Communicator	MA	Measurement	Each type	Approved data sheet / Mfr. Standard	Approved data sheet / Mfr. Standard	Test Certificate	2	1	1,4	

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	
6.0	**PAINTING**	Soundness of Painting	MA	Visual and Measurement	100%	BHEL specn. / Mfr. Standard	BHEL specn. / Mfr. Standard	Inspection Report	2	---	1,4	Refer Note-2
7.0	**PACKING**	Soundness of Packing against transit damage	MA	Visual	100%	Mfr. Standard	Mfr. Standard	Inspection Report	2	---	---	Refer Note-3

NOTES:

1. In case valid Cv test certificate for a similar control valve (Same type, Same size, Same Cv) is not submitted to BHEL by the vendor, Cv test shall be conducted at FCRI/ Any govt. approved laboratory/ BHEL approved Laboratory. Validity of the Cv test certificate shall not be more than 3 years.
2. In the absence of BHEL spec. for painting, vendor to obtain BHEL's approval on their painting specification / procedure.
3. Sea worthy packing shall be provided, if applicable.
4. The quantum of check shall be 100% for manufacturer and 10% for BHEL/BHEL nominated inspection agency and Customer.
5. IBR certificates in Form III-C shall be submitted if called for in the specification/datasheet.
6. Copies of all TC's (Test Certificates) for materials duly correlated with Heat Nos., TC's for electrical items and mechanical tests (Leak/Operation) shall be submitted to BHEL for verification and acceptance.
7. Calibrator used for calibration shall be approved by government agency & its calibration certificate shall be submitted.

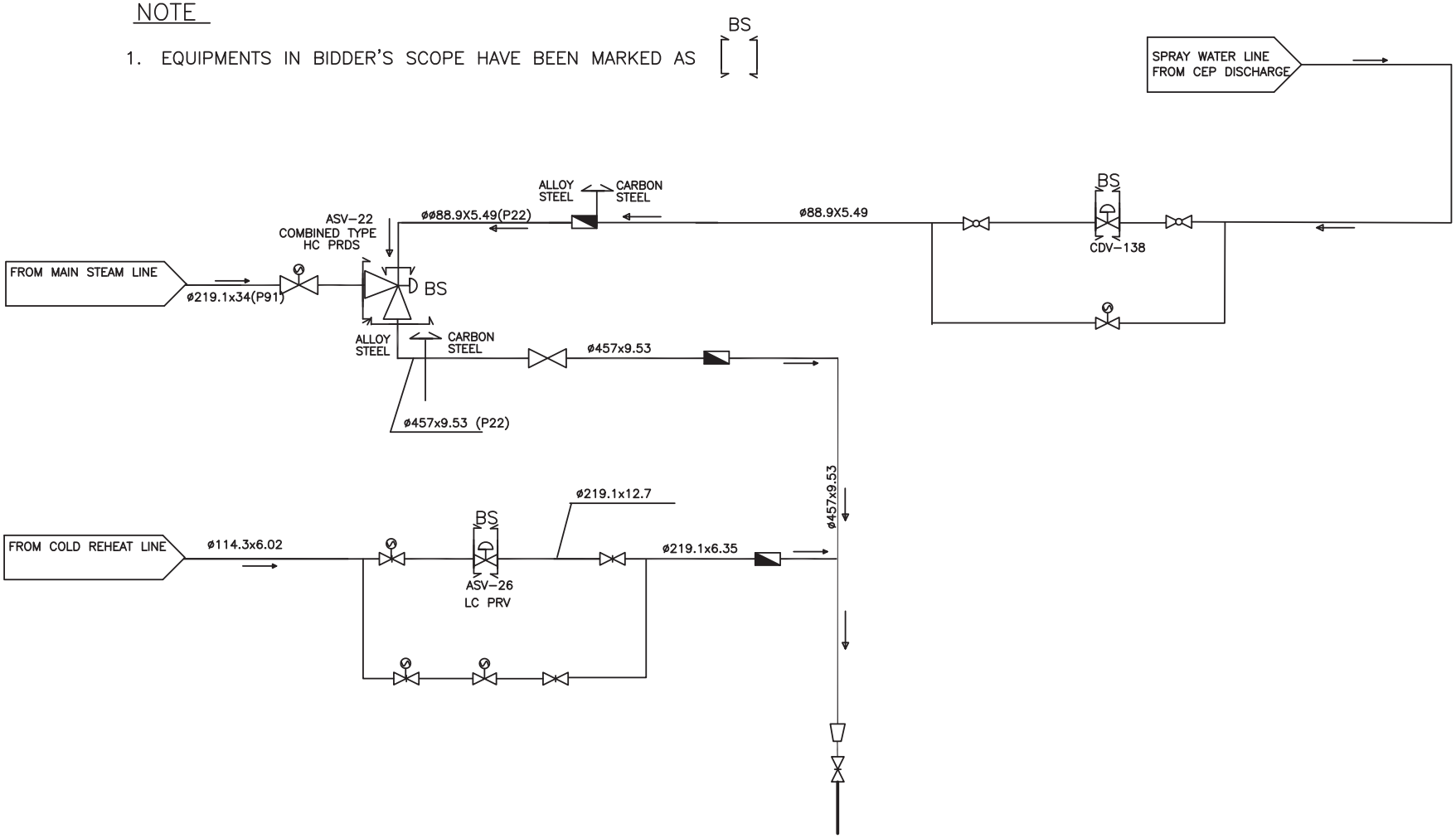
	TITLE **EQUIPMENT SPECIFICATIONS** **AUXILIARY STEAM PRESSURE REDUCING & DESUPERHEATING STATION** **GSECL - 1X800MW WANAKBORI TPS**	SPEC. NO.: PE-TS-408-142-N101 VOLUME **II-B** SECTION **D** REV NO. **00** DATE 19.09.15 SHEET 1 OF 1

TENDER DRAWINGS

DRAWING NO. PE-TS-408-142-N102

NOTE

1. EQUIPMENTS IN BIDDER'S SCOPE HAVE BEEN MARKED AS [BS]



GUJARAT STATE ELECTRICITY CORPORATION LIMITED
VADODARA, GUJARAT
1x800 MW Wanakbori Thermal Power Station Extn. Unit-8

DEVELOPMENT CONSULTANTS PVT. LTD.
CONSULTING ENGINEERS

JOB NO. 408

1X800 MW WANAKBORI TPP, UNIT 8

BHARAT HEAVY ELECTRICALS LTD.
POWER SECTOR
PROJECTS ENGINEERING MANAGEMENT
NEW DELHI

DEPT CODE		NAME	SIGN	DATE
	DESN	LG	Sd/-	19.09.15
	CHD	SSV	Sd/-	19.09.15
	APPD	CM/LJS	Sd/-	19.09.15

TITLE

TECH SPEC FOR AUXILIARY PRDS

PE-TS-408-142-N102

SHEET 1 OF 1 REV. 00

GSECL

1X800MW WANAKBORI TPS, UNIT#8

TECHNICAL SPECIFICATION
FOR

AUXILIARY STEAM PRESSURE REDUCING AND DESUPERHEATING STATION ALONGWITH ACCESSORIES

VOLUME - III

SPECIFICATION No: **PE–TS –408-142–N101 (REV 00)**

BHARAT HEAVY ELECTRICALS LIMITED
POWER SECTOR
PROJECT ENGINEERING MANAGEMENT
PPEI, NOIDA, INDIA

VOLUME – III TECHNICAL SCHEDULE

1.0 This volume contains technical schedules and Data Sheet - , which are to be duly filled by the bidder and the same shall be furnished with the technical bid as per instructions given in document no. PES-100-901 in volume III.

2.0 The requirements mentioned in section C/ data sheet A of section D shall prevail and govern in case of conflict between the same and corresponding requirements mentioned in the descriptive portion in section-D.

1.0 Volume III comprises of following: -

1.1 Data Sheet : Data Sheet(s) 'B' Section 'D'.

1.2 Schedules :

PART – A : Technical Schedules

PART – B : Price Schedules

(See clause 2 (b) below for unpriced schedules)

The Schedule and Data Sheets enclosed/indexed shall be completely filled up by the bidder and furnished with the bid duly signed and stamped by the bidder. Purchaser reserves the right to ask the bidder to fill additional schedules, which are not listed in the contents.

2.0 Form No. PEM-6020 is a 'Checklist', which is enclosed to facilitate the bidder to make sure that the necessary data/information is furnished by him in his bid. The remarks column of this schedule shall be filled up by the bidder as per the instructions given below:-

a) The bidder shall write 'Not Applicable' against those schedules / documents which are not listed in the contents.

b) The bidder shall write 'Enclosed' for the listed schedules / documents which are filled and furnished by the bidder with the bid. Otherwise 'Not Enclosed' shall be written.

c) Duly filled Part-A schedules as well as Data Sheet-B shall be furnished with the technical offer while Part-B (Price Schedules) shall be submitted with price offer in separate covers.

d) Wherever unpriced schedules are to be furnished with Part-A schedules in tech. bids. the same is indicated in the filling space of price schedule formats.

e) Other documents / information as required in the checklist shall also be furnished by the bidder.

3.0 The Data Sheet(s)-B shall be filled-up completely and typed written and shall be duly signed with Rev. No. and date. One copy of the same shall be furnished with the bid. The items, which deviate from the specification, shall be marked with an asterisk (*) in the data sheets and details shall also be given in the 'Schedule of deviations' from technical specification (Form No. PEM-6036).

4.0 Bidder shall fill specification No. in all schedules .

5.0 Schedules PEM – 6020 & PEM 6040 duly filled in shall be enclosed by bidder both in Technical and price offers.

CONTENTS

PART-A

* To be filled up by successful bidder after LOI.

CONTENTS

PART-B

* to be filled up by successful bidder after LOI.

	TITLE **AUXILIARY STEAM PRESSURE REDUCING & DESUPERHEATING STATION**	SPEC. NO.: PE-TS-408-142-N101 VOLUME **III** SECTION **PART-A** REV NO. **0** DATE 19.09.15 SHEET 1 OF 1

VOLUME-III
PART-A

SCHEDULES AND DATA SHEETS

	TITLE **EQUIPMENT SPECIFICATIONS** **AUXILIARY STEAM PRESSURE REDUCING & DESUPERHEATING STATION**	SPEC. NO.: PE-TS-408-142-N101 VOLUME **III** SECTION **Part-A** REV NO. **0** DATE 19.09.15 SHEET 1 OF 1

DATA SHEETS - C
AUXILIARY STEAM PRESSURE REDUCING & DESUPERHEATING STATION

(TO BE FILLED BY SUCCESSFUL VENDOR AFTER THE AWARD OF CONTRACT)

	Technical specification for **APRDS CONTROL VALVES** (Pneumatically Operated)	SPECIFICATION NO. **PE-TS-999-145-N101**
		VOLUME **II-B**
		SECTION **D**
		REV. NO. 00 | DATE: 19.09.15
		SHEET 1 of 3

	NAME
	SIGNATURE
	DATE

Tag No……. **Quantity**……. Data Sheet No. PES-145-06-DS2-0

DATA SHEET C

DATA SHEET – C FOR CONTROL VALVE (WITH PNEUMATIC ACTUATOR)
(TO BE FILLED BY THE BIDDER AFTER THE AWARD OF CONTRACT)

GENERAL*	PROJECT	
	SERVICE	
	LOCATION	
	DUTY	
	PIPE SIZE (inlet / outlet)	
	PIPE MATERIAL (inlet / outlet)	
BODY	MODEL NUMBER	
	TYPE OF BODY : GUIDING : NO. OF PORTS	
	BODY SIZE : PORT SIZE : DESIGN DV	
	END CONNECTION & RATING (ANSI)	
	BODY MATERIAL	
	PACKING MATERIAL SINGLE / DOUBLE	
	BONNET TYPE	
	TRIM FORM	
	TRIM MATERIAL : SEAT | PLUG	
	TRIM MATERIAL : CAGE | GUIDE	
	FLOW	
	OUTLET VELOCITY	
	REQUIRED LEAKAGE CLASS	
	NOISE LEVEL (dBA) (Spec. 3.1.14)	
	VACUUM SERVICE	
	ANTI CAVITATION TRIM	
PNEUMATIC ACTUATOR	MODEL NO. & SIZE	
	CLOSE AT : OPEN AT (Kg / Cm^2g)	
	*TRAVEL TIME FOR OPEN TO CLOSE, CLOSE TO OPEN	
	*VALVE POSN. ON SIGNAL AIR FAILURE	
	*VALVE POSN. ON SUPPLY AIR FAILURE	
ACCESSORIES	POSITIONER	
	AIR FILTER REGULATOR	
	AIR LOCK RELAY	
	POSITION LIMIT SWITCH	
	POSITION TRANSMITTER	
	SOLENOID VALVE	
	E / P CONVERTER	
	JUNCTION BOX	
	HAND WHEEL (SIDE MOUNTED)	
	LOCAL POSITION INDICATOR	
	ELECTRO PNEUMATIC POSITIONER	

Tag No…… **Quantity**…… Data Sheet No. PES-145-06-DS2-0

DATA SHEET C

DATA SHEET – C FOR CONTROL VALVE (WITH PNEUMATIC ACTUATOR)
(TO BE FILLED BY THE BIDDER AFTER THE AWARD OF CONTRACT)

PERFORMANCE OF VALVE	LINEARITY	
	HYTERSIS	
	SENSITIVITY	
	ACCURACY	

SERVICE CONDITION*	**SL.+ NO.**	**LOAD**	**FLOW (T/HR)**	**INLET PR. (KG/CM^2 (A)**	**OUTLET PR. (KG/CM^2 (A)**	**TEMP DEG. C**	**CALCULATED CV**	**% VALVE LIFT**	**VALVE O/L VELOCITY**

	VALVE TYPE
	* MAX SHUT OFF PRESS ((**KG/CM^{2}g)**
	* BODY DESIGN : PRESS ((**KG/CM^{2}g)** | **TEMP (DEG. C)**
	* IBR FORM III-C

TOTAL WEIGHT (VALVE + ACTUATOR + ACCESSORIES) KG.

FORM NO. PEM-6666-0

BHEL	Technical specification for **Control Valves with Accessories** (Pneumatically Operated)	SPECIFICATION NO. **PE-TS-408-142-N101** VOLUME **II-B** SECTION **D** REV. NO. 00 | DATE: 19.09.15 SHEET 1 of 1

Tag No: Applicable for all tag nos. **Quantity: As required** Data Sheet No. PES-145-06-DS1-0

Applicable for tag nos. wherever statement "REQUIRED" indicated in the individual CV data sheets

DATA SHEET – A & B for ACCESSORIES **DATA SHEET – A FOR CONTROL VALVE (WITH PNEUMATIC ACTUATOR)**							(TO BE FILLED UP BY BIDDER)
SMART POSITIONER	MFR. & MODEL NUMBER						
	BYPASS	GAUGES	ENCL. CLASS				
	INPUT SIGNAL						
	OUTPUT SIGNAL (Kg / Cm^2)						
AIR FILTER REGULATOR TWO (2) Nos./CV <=5MICRON (SINTERED BRONZE)	MFR. & MODEL NUMBER						
	AIR SUPPLY PRESS (MAX.) (Kg / Cm^2 g)						
	OUTPUT PRESS (Kg / Cm^2 g)						
	OUTPUT GAUGE						
AIR LOCK	MFR. & MODEL NUMBER						
	SET PRESS (Kg / Cm^2)						
	SUPPLY PRESS (MAX.) (Kg / Cm^2)						
	RESET TYPE						
	VENT PLUG						
LIMIT SWITCH	MFR. & MODEL NUMBER						
	OPEN posn	INT posn	CLOSE posn				
	CONTACT TYPE						
	RATING (AC / DC)						
	ENCLOSURE CLASS						
POSITION TRANSMITTER	MFR. & MODEL NUMBER						
	TYPE						
	SUPPLY						
	OUTPUT RATING						
	ACCURACY						
	ENCLOSURE CLASS						
SOLENOID VALVE	MFR. & MODEL NUMBER						
	RATING						
	OPERATION	QUANTITY					
	COIL INSULATION CLASS						
	ENCLOSURE CLASS						
JUNCTION BOX	NO. OF WAYS						
	SIZE						
	CABLE GLANDS (Size / Quantity)						
	ENCLOSURE CLASS						
I/P CONVERTER (Part of SMART Positioner)	INPUT SIGNAL	POWER SUPPLY					
	SPLIT RANGE						
	ENCLOSURE CLASS						
	Accuracy	Repeatability					
Cu. Tubing & Fittings / per CV	**This is in addition to cu. Tubing and fittings which are integral part of CV as per ASTM B68 to B75 (USA)**		25 Meters of ¼ " PVC coated anneled Cu. Tubing, with 1 set of Fittings for each CV for connection to IA Header on one end and accessories on another end of CV.				

FORM No. PEM - 6020-2

CHECKLIST — LIST OF SCHEDULES

Sl. No.	Form No.	Description	Tick Applicable Forms
1.	PEM-6024	Schedule of Drawings / Catalogues submitted with Bid	✓
2.	PEM-6025@	Schedule of Occurance of Key Events of Delivery,Erection& Commissioning	
3.	PEM-6026	Schedule of Equipment Manufacture, Despatch and Shipment to Site.	✓
4.	PEM-6027	Schedule of Weights & Dimensions	✓
5.	PEM-6028@	Schedule of Performance Guarantee	
6.	PEM-6030	Inspection Schedule	✓
7.	PEM-6031	Schedule of Cement and Steel and Quarterly Cement Requirement	
8.	PEM-6032	Schedule of Quarterly Requirement of Reinforcing Bars and Structural Steel	
9.	PEM-6033@	Bill of Quantities (Civil Works)	
10.	PEM-6035	Schedule of Bidder's Proposed Construction / Site Fabrication Facilities.	
11.	PEM-6036	Schedule of Deviations	✓
12.	PEM-6040	Schedule of Declaration	✓
13.	PEM-6041	Quality Plan	✓
14.	PEM-6042	Vendor's Drawings / Documents Schedule	✓
15.	PEM-6043@	Schedule of Occurance of Key Events for Civil / Structural Works	
16.	PEM-6046	Inspection Request	✓
17.	PEM-6051	Schedule of Prices	✓
18.	PEM-6052@	Schedule of Unit Prices	✓
19.	PEM-6053	Schedule of Prices for Commissioning & Mandatory Spares	✓
20.	PEM-6054	Schedule of Prices for Recommended Spares	✓
21.	PEM-6055	Schedule Prices for Erection and Maintenance Tools & Tackles	✓
22.	PEM-6056	Schedule of Bidder's Man-power for Supervision of E & C and their Charges.	✓
23.	PEM-6057	Schedule of Daily & Overtime Rates	
24.	PEM-6058	Schedule of Hire-charges for Construction / Site Fabrication Facilities	
For Forms marked with @ certain information to be filled by DEs - before issuing to bidder.			

FORM No. PEM - 6024-0

	TITLE	SPECIFICATION NUMBER PE-TS-408-142-N101
भा पे प्र नि	**SCHEDULE OF DRAWINGS / CATALOGUES SUBMITTED WITH BID**	VOLUME III PART - A
		SHEET ..... OF .....

Section C/D enclosed with the specification indicate the drawings / catalogues to be furnished with the bid. The bidder in addition to furnishing the same, can also include any other drawings / catalogues which he may desire to submit with the bid. This schedule duly lists out such drawings as enclosed by the bidder with the bid.

DRAWING./ CATALOGUE NUMBER	DESCRIPTION	NUMBER OF SHEETS

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

FORM No. PEM - 6026-0

	TITLE	SPECIFICATION NUMBER
भेल HEC	**SCHEDULE OF EQUIPMENT, MANUFACTURE, DESPATCH AND SHIPMENT TO SITE**	PE-TS-408-142-N101
		VOLUME III PART - A
		SHEET ..... OF .....

Equipment / Major Bought-out Items	Time for Manufacture/ Procurement from Date of Issue of Letter of Intent (Weeks)	Time for Test, Dismantling Packing & Ready for Despatch (Weeks)	Time required for Shipment to Site (Weeks)	Total Time from Date of Issue of Letter of Intent to Shipment to Site (Weeks)

We, the undersigned hereby undertake to meet the above time schedule in weeks for manufacture, despatch and shipment of each equipment and procurement of major boughtout items as listed above.

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

FORM No. PEM - 6027-0

	TITLE	SPECIFICATION NUMBER PE-TS-408-142-N101
	SCHEDULE OF WEIGHTS & DIMENSIONS	VOLUME III PART- A
		SHEET ..... OF .....

The bidder shall state below the weights and dimensions of various packages for shipment covering the complete scope.

Description of Package(s)	Dimensions (in meters)	Weight (in tonnes)

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

FORM No. PEM - 6030-0

INSPECTION SCHEDULE

SPECIFICATION NUMBER PE-TS-408-142-N101

P.O. NUMBER

VOLUME - III PART-A | SHEET OF

S. No.	ITEM / COMPONENT	PLACE & ADDRESS OF TEST / INSPECTION	Scheduled Date of Inspection	Duration of Test / Inspection (in days)

This schedule shall be in line with specification and quality plan requirements. The information in this form shall be furnished after receipt of LOI / PO.

PARTICULARS OF VENDOR' s / AUTHORISED REPRESENTATIVE			
NAME	SIGNATURE	DATE	**COMPANY SEAL**

FORM No. PEM - 6036-0

	TITLE	SPECIFICATION NUMBER
BHEL	*** SCHEDULE OF DEVIATIONS** ( ) From Conditions of Contract (Volume - I) ( ) From General Technical Conditions (Volume - II A) ( ) From Technical Specifications (Volume - II B)	PE-TS-408-142-N101 VOLUME III PART - A SHEET ..... OF .....

* Each type of deviation shall be listed on a seperate sheet. Tick the applicable ☑

We the undersigned hereby certify that the above mentioned are the only deviations.

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

DECLARATION

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 formal proposal number Dated.................................. and there is no deviation to the specification.

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

Biders Company Name ....

Authorised representative's Signature ....

Name ....

Bidder's Intent — The bidder hereby agrees to fully comply with the requirements and intent of this specifications for the price indicated.

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

* Bidder shall include this schedule both in technical and Price offers.

	QUALITY PLAN	CUSTOMER: GSECL	PROJECT: 1X800 MW WANAKBORI TPS	SPECIFICATION: **PE-TS-408-142-N101** NUMBR
		BIDDER/: VENDOR	QUALITY PLAN MUMBER	SPECIFICATION TITLE: **AUXILIARY STEAM P.R.D.S**
	SHEET OF	SYSTEM:	ITEM:	SECTION VOLUME III

SL. NO.	COMPONENT/ OPERATION	CHARACT-ERISTIC CHECK	CAT.	TYPE METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY			REMARKS
									P	W	V	
1	2	3	4	5	6	7	8	9	10			11

PARTICULARS	BHEL	BIDDER / VENDOR	
NAME			
SIGNATURE			
DATE			BIDDER'S/ VENDOR'S COMPANY SEALS

INSTRUCTIONS FOR FILLING QUALITY PLAN

(Form No. PEM-6042-0)

The Quality Plan shall include all the Quality Control Measures and Checks adopted by the Vendor to ensure that the material/ component/assembly/services supplied by him meet/will meet the requirements as per specifications and good practices. They shall include all stages of operation such as materials, processes, manufacture, assembly, packing and despatch. The following guide lines may be noted:

Column 1- Serial Number

Column 2- Component/Operation- The component and/or operation being checked shall be given here.

Column 3- Characteristics check- The characteristics being checked shall be given here, e.g., chemical composition, mechanical properties, leak tightness, surface defects etc..

Column 4- Category - 'CR' stands for critical characteristic - affecting safety of equipment and personnel
'MA' stands for major Characteristic - affecting safety of equipment and personnel
'MI' stands for minor characteristic - affecting appearance etc.

Column 5- Type/Method of check e.g. chemical analysis tensile testing, hydraulic test, visual examination radiography etc.

Column 6- Extent of check, such as, 100, 10, 1 per heat etc.

Column 7- Reference Documents - Documents, such as technical specification, drawings, standard specifications (IS, BS ETC.) procedure, etc. according to which check is done.

Column 8- Acceptance Norms - Standards etc. according to which acceptability or otherwise of the characteristics being checked is decided.

Column 9- Format of Record - Formats, log shets, reports, etc. in which the observations are recorded. Standard log sheets, reports, formats etc. of the Vendors shall be numbered and such reference numbers shall be included here.

Column 10- Agency - The agency which performs the test/instruction shall be written in sub-column 'W'
The agency which verifies test certificates/inspection records and carries out audit check of the components/ operation shall be written in sub-column 'V'

The agencies are codified as 1,2 & 3

'1' stands for (BHEL)
'1' * means the operation shall be cleared by BHEL before the start of the next operation.
'2' Stands for Vendor
'3' stands for sub-Vendor of the Vendor and so on.

Example :

Entry '3' in column 'P' means test./inspection to be performed by sub-Vendor's QC

Entry '2' in column 'W' means test./inspection to be witnessed by Vendor's QC

Entry '1' in column 'V' means verification shall be done by BHEL and next stage to be started only after the hold point is cleared by BHEL

Column II- Remarks - Any special remarks shall be given here.

NOTES :

1. In absence of correlation with the test certificate(s) (e.g. material identification) samples shall be drawn bgy BHEL and all tests as per relevent specifications shall be carried out in their presence or in recognized Government Laboratory.

2. When materials and components are initially identified and stamped by BHEL QS engineer, the identification marks shall be presserved till despatch. Wherever this is not possible, the identification mark shall be transferred to the components in the presence of BHEL QS Engineer unless other wise agreed.

3. For castings and forgings integral test specimens shall be provided, When this is not possible for casting, they shall be poured in the presence of BHEL QS Engineer unless otherwise, if witnessing of test by BHEL is called for.

4. When welders qualified by reputed inspection agencies or statutory bodies are not available, qualification tests shall be conducted in the presence of BHEL QS Engineer.

5. This Quality Plan is liable to be modified as per the requirements of approved drawings and changes in technical specifications/drawings. If there are contradictions in respect of column 7 & 8 between this Quality Plan and the approved drawings specifications, the latter shall prevail.

6. Wherever inspection by BHELs Purchaser/Third Party/Statutory authorities are mandatory, this shall be compiled with.

7. Inspection reports, log sheets, test reports/certificate. etc. shall be furnished to BHEL at the approproate stages or at the time of final inspection, as required.

8. This Quality Plan is also applicable to spares, if any, under scope of supply of Vendor.

9. The quality plan shall be submitted in septuplicate (7 Copies).

	VENDOR's DRAWINGS/DOCUMENTS SCHEDULE (Information in this form is to be furnished only after receipt of LOI/IPO)	SPEC. NO.: PE-TS-408-142-N101 VOLUME **III** SECTION **PART-A** REV NO. **0** DATE SHEET 1 OF 1

TITLE OF SPECIFICATION

.S. NO.	Vendor's Drawing/Document No. (VDN)	PEM's Drawing/Document No. (PDN)	First Submission Date
	TITLE Final		Approval Date
	VDN PDN		
	TITLE		
	VDN PDN		
	TITLE		
	VDN PDN		
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	TITLE		

PARTICULARS OF VENDOR's/AUTHORISED REPRESENTATIVE			
NAME	SIGNATURE	DATE	COMPANY SEAL

FORM NO PEM 6046-1

INSPECTION REQUEST

(From Vendor to BHEL Inspection Agency)

1 PROJECT TITLE:

2 NAME OF VENDOR:

3 BHEL'S LOI / PO NO: **DATE :**

4 SYSTEM / ITEM DESCRIPTION

5 ITEMS BEING OFFERED FOR INSPECTION WITH SL. NO. AS PER LOI / PO / BILLING SCHEDULE

6 DESCRIPTION AND SL. NO. OF INSPECTION AS PER QUALITY PLAN

7 QUANTITY OFFERED FOR INSPECTION

8 PLACE OF INSPECTION (FULL ADDRESS AND NAME OF SUB-VENDOR, IF ANY)

PLACE …….

ADDRESS ……..
……
……..

9 CONTACT PERSON (FOR SL. NO. 8 ABOVE).

NAME ……. DESIGNATION ……..

TELEPHONE ……. FAX …… TELEGRAM ……..
TELEX ……..

10 THE FOOLOWING DOCUMENTS ARE APPROVED BY BHEL AND AVAILABLE AT PLACT OF INSPECTION

(A) QUALITY PLAN (B) DRAWINGS (C) DATA SHEETS, CHARACTERISTIC CURVES ETC. (D) PLANT STANDARDS

11 REQUIRED DATE OF INSPECTION …… LIKELY DURATION (No of Working days)……..

WEEKLY OFF DAY ……. WORKING HOURS ……..

(At least 15 days prior notice shall be given by the Vendor to Inspection Agency)

We here by certify that the above items are complete in all respects and have been fully inspected/tested by us and are found to be as per technical specification/approved drawings/data sheets/characteristic curves and are a cceptable to our QC departm ent. The detailed inspection and test reports of our QC department are enclosed.

VENDOR'S PARTICULARS					
NAME	DESIGNATION	SIGNATURE	PLACE	DATE	COMPANY SEAL

VOLUME-III
PART-B

PRICE SCHEDULES

	TITLE	SPEC. NO.: PE-TS-408-142-N101
	SCHEDULE OF PRICES **AUXILIARY STEAM PRESSURE REDUCING & DESUPERHEATING STATION**	VOLUME **III** SECTION **PART-B** REV NO. **0** DATE 19.09.15 SHEET 1 OF 1

S.No.	Description of Works or Equipment/System	Price (in Lakhs of Rs.)
1.0	Total price for design, manufacture, assembly, inspection, testing, packing and dispatch to site of auxiliary steam pressure reducing and de superheating stations complete with combined type HC pressure reducing & desuperheating valve (ASV-22), LCP RV (ASV-26) & Spray control valve (CDV-138) and all accessories including commissioning spares and special tools & tackles as specified and necessary as per technical specification PE-TS-408-142-N101.	
2.0	Mandatory Spares price	
3.0	Optional price of supervision of erection and commissioning of equipments	
	Indicate all duties, taxes etc. Stating whether included/excluded in above price.	

-Bidder shall furnish this price schedule in his price offer only.

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PARTICULARS OF VENDOR's/AUTHORISED REPRESENTATIVE

NAME	SIGNATURE	DATE	COMPANY SEAL

	TITLE	SPEC. NO.: PE-TS-408-142-N101
BHEL	**SCHEDULE OF UNIT PRICES** **AUXILIARY STEAM PRESSURE REDUCING & DESUPERHEATING STATION**	VOLUME **III** SECTION **PART-B** REV NO. **0** DATE 19.09.15 SHEET 1 of 4

S.No.	Item Description	Unit Price (in Lakhs of Rs.)
1.0	Design, manufacture, inspection & t esting, packing and deliv ery for site for following as specified in Technical specification PE-TS-408-142-N101:	
1.1	Unit Price of Control valves a) Combined Type Au x. Steam H igh Cap acity p ressure reducing & desuperheating Valve (ASV-22) b) Low Capacity Pressure Reducing Valve (from CRH line) (ASV-26) c) HC PRDS Spray Control Valve (CDV-138)	

Bidder shall furnish unit prices for items as called for in this schedule above and shall furnish this schedule in his price offer only.

PARTICULARS OF VENDOR's/AUTHORISED REPRESENTATIVE			
NAME	SIGNATURE	DATE	COMPANY SEAL

FORM No. PEM - 6053-0

	TITLE	SPECIFICATION NUMBER
	*** SCHEDULE OF PRICES FOR COMMISSIONING AND MANDATORY SPARES**	PE-TS-408-142-N101
		VOLUME III
		SHEET ..... OF .....

The bidder shall incidate here the quantity required for erection / commissioning and mandatory spares for equipment as listed in Section-C / Section - D. If the listed spares are not adequate, then the bidder shall indicate those and additional spares considered necessary by him.

Type	Manufacturer's Drawing No. / Part of spare	Description	Material	Quantity per Unit / Equipment	Quantity Required	If set, Nos. Per set	Delivery period (Weeks)	Unit Price (Rs.)	Total Price (Rs.)
Erection and Commissioning									
Mandatory Spares									
Additional Spares Mandatory Erection / Commissioning									

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

* Unpriced schedule shall also be furnished along with Part-A Schedule in Technical Bid.

FORM No. PEM - 6055-0

	TITLE	SPECIFICATION NUMBER PE-TS-408-142-N101
	SCHEDULE OF PRICE FOR ERECTION AND MAINTENANCE TOOLS & TACKLES	VOLUME III
		SHEET ..... OF .....

The bidder shall be give below the list of erection and maintenance tools and tackles as offered by him. This shall also include the customer's list of maintenance tools, if specified in Section - C / Section - D.

S. No.	Description of Tools & Tackles	Quantity offered	Unit Price (Rs.)	Total Price (Rs.)

NOTE : The hire charges for vendor's equipment called for in this schedule shall include the cost of consumables, operation services, depreciation, wear and tear as well as vendor's over head and profit. (These rates will be payable by customer to the vendor, only if the customer's requires the use of this equipment for carrying out his own work out side the scope of this contract.)

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

FORM No. PEM - 6056-0

	TITLE	SPECIFICATION NUMBER PE-TS-408-142-N101
	SCHEDULE OF BIDDER's MAN POWER FOR SUPERVISION OF E & C AND THEIR CHARGES	VOLUME III
		SHEET ..... OF .....

The bidder shal indicate below, designation-wise, the personnel required for superivsion of erection and commissioning and their charges.

SUPERVISION OF ERECTION

S. No.	Designation	Normal rate per day of 8 hours	Overtime rate per hour

SUPERVISION OF COMMISSIONING

Sl. No.	Designation	Normal rate per day of 8 hours	Overtime rate per hour

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