





BELLARY TPS Unit#3, 1x700MW

TECHNICAL SPECIFICATION  
FOR CONTROL VALVES WITH ACCESSORIES  
(Pneumatically operated)

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|   |   |                              |      |      |   |            |
|---|---|------------------------------|------|------|---|------------|
| JOB NO.<br>367  | TITLE<br>TECHNICAL SPECIFICATION<br>FOR CONTROL VALVES WITH ACCESSORIES<br>(Pneumatically operated) | DOC. NO. PE-TS-367-145-I 004 |      |      |   |            |
|  | BHARAT HEAVY ELECTRICALS LTD<br>POWER SECTOR<br>PROJECT ENGINEERING MANAGEMENT<br>NOIDA             | DEPT<br>CODE<br><br>1        |      | NAME | SIGN  | DATE       |
|   |   |                              | DESN | MS   |  | 05.08.2013 |
|   |   |                              | CHD  | MK   |  | 05.08.2013 |
|   |   |                              | APPD | ABS  |  | 05.08.2013 |

|   |                 |                                       |
|---|-----------------|---------------------------------------|
|  | <b>PREAMBLE</b> | SPECIFICATION NO. PE-SS-999-100-Q-001 |
|   |                 | VOLUME                                |
|   |                 | SECTION                               |
|   |                 | REV. NO.                      DATE    |
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1.0 The tender document contains three (3) volumes. The bidder shall meet the requirements of all the three volumes.

1.1 **Volume-I (CONDITIONS OF CONTRACT)**

This consists of four parts as below :-

Volume-IA : This part contains instructions to bidders for making bids to BHEL.

Volume-IB : This part contains general commercial conditions of the tender & includes provision that vendor is responsible for the quality of item supplied by their sub-vendors.

Volume-IC : This part contains special conditions of contract.

Volume-ID : This part contains commercial conditions for erection & commissioning site work, as applicable.

1.2 **Volume-II TECHNICAL SPECIFICATIONS**

Technical requirements are stipulated in Volume-II which comprises of :-

Volume-IIA : General Technical Conditions

Volume-IIB : Technical Specification including Drawings, if any.

1.2.1 **Volume-IIB**

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 technical requirements specific to the contract, not covered in Section-D.

Section-D : This section comprises of technical specifications of equipments complete with data sheet A, B and C.

**Data Sheet - A** specifies data and other requirements pertaining to the Equipment.

**Data Sheet - B** Specifies 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).

1.2.2 **Volume-III TECHNICAL SCHEDULES**

This volume contains technical schedules and Data Sheets-B, 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. PE-SS-999-100-Q-002 in Volume-III.

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

|              |             |             |
|--------------|-------------|-------------|
| PARTICULARS  | PREPARED BY | APPROVED BY |
| NAME         | V M RAO     | C L ABBEY   |
| DESIGNATION  | DGM         | AGM & MR    |
| SIGN. & DATE |             |             |

**KARNATAKA POWER CORPORATION LIMITED  
BELLARY TPS Unit#3, 1x700MW**


**TECHNICAL SPECIFICATION  
FOR  
CONTROL VALVES WITH ACCESSORIES  
(Pneumatically Operated)**

**VOLUME II-B**

**SPECIFICATION No: PE-TS-367-145-I 004**



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

|   |  |          |                                      |              |
|---|--|----------|--------------------------------------|--------------|
|  | <b>Technical specification for<br/>Control Valves with Accessories</b><br>(Pneumatically Operated) |          | SPEC NO.: <b>PE-TS-367-145-I 004</b> |              |
|   |  |          | VOLUME II B                          |              |
|   | <b>Bellary TPS Unit#3, 1x700MW - KPCL</b>  |          | SECTION                              |              |
|   |  |          | REV. NO.                             | 00           |
|   |  |          | DATE                                 | : 05.06.2013 |
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|         | Typical Hook-up Diagram for Control valve   | 1               |
|         | Customer Specification  | 1               |
| D       | Equipment specification (PES-145-06)  | 15              |
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|         | Data sheets C for Control Valves & Accessories  | 3               |
|         | Quality Plan for Control Valves   | 5               |
|         | Bill of Quantity  | 1               |
|         | Spares  | 1               |
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|---|--|--|--------------------------------------|-------------------|
|  | <b>Technical specification for<br/>Control Valves with Accessories</b><br>(Pneumatically Operated) |  | SPEC NO.: <b>PE-TS-367-145-I 004</b> |                   |
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Technical specification for  
**Control Valves with Accessories**  
(Pneumatically Operated)

**Bellary TPS Unit#3, 1x700MW - KPCL**

SPEC NO.: **PE-TS-367-145-I 004**

VOLUME II B

SECTION A

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# SECTION – A

## SCOPE OF ENQUIRY

|   |  |  |                                      |                   |
|---|--|--|--------------------------------------|-------------------|
|  | <b>Technical specification for<br/>Control Valves with Accessories</b><br>(Pneumatically Operated) |  | SPEC NO.: <b>PE-TS-367-145-I 004</b> |                   |
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|   | <b>Bellary TPS Unit#3, 1x700MW - KPCL</b>  |  | SECTION A                            |                   |
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## SCOPE OF ENQUIRY

### 1.0 SCOPE

- .1 This specification covers the Design, Manufacture, Inspection and Testing at manufacturer's works, proper packing for transportation and delivery to site of the Control Valves with Pneumatic Actuator along with Accessories, Start-up/Commissioning and Mandatory Spares as mentioned in different sections of this specification for **Bellary TPS Unit#3, 1x700MW - KPCL**
- .2 The quality plan enclosed forms the minimum requirement but not limited to be adhered to by the bidder.
- .3 The enquiry shall be operated in "**COMPLAINE MODE**" means bidder to comply with the requirement of specification, quality plan, delivery schedule, quantities, start-up/commissioning spares, mandatory spares, recommended spares etc, and as a token of acceptance of the same, following formats to be signed, stamped with company seal and submitted for the project.
  - a) Compliance certificate
  - b) Quality plan
  - c) Schedule of price, unit prices, inspection schedule
  - d) Schedule of submission of drawings / documents, equipment manufacture inspection and dispatch
- .4 **No separate technical offer, data sheets to be submitted with the bid. Any such document shall not be taken cognizance of, and document (Compliance certificate) at 3 above shall be final and binding. Data sheets shall be furnished by the successful bidder (vendor), only after the award of contract & shall be subject to Purchaser's Approval.**
- .5 **Bidder to note that CV test is required to be conducted on one type per size, CV value. Bidder to group such valves and indicates the same along with the price bid. Unpriced portion to be submitted to engineering.**

### 2.0 GENERAL TECHNICAL INSTRUCTIONS

- 1 It is not the intent here to specify all the details of design and manufacture. However, the equipment shall conform in all respects to high standard of design, engineering and workmanship and shall be capable of performing the required duties in a manner acceptable to the customer / consultant, who will interpret the meaning of drawing and specification and shall be entitled to reject any component or material which in his judgment is not in full accordance herewith.
- 2 The omission of specific reference to any component / accessory necessary for the proper performance of the equipments shall not relieve the supplier of the responsibility of providing such facilities to complete the supply within the quoted prices.
- 3 BHEL's / Customer's representatives shall be given access to the shop in which the equipments are being manufactured or tested and all test records shall be made available to them.
- 4 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 / CUSTOMER.



Technical specification for  
**Control Valves with Accessories**  
(Pneumatically Operated)

Bellary TPS Unit#3, 1x700MW - KPCL

SPEC NO.: **PE-TS-367-145-I 004**

VOLUME II B

SECTION B


REV. NO. 00 DATE : 05.06.2013

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## SECTION – B

### PROJECT INFORMATION




| KPCU/BTPS/03/EPC  |  | KARNATAKA POWER CORPORATION LIMITED   |  | SECTION: B   |
|---|--|---|--|--------------|
|   |  | BELLARY TPS, UNIT-3 OF 700 MW   |  | VOLUME-II    |
|  |  | TITLE   |  | SHEET 1 OF 2 |
|   |  | PROJECT INFORMATION   |  |              |
| 1.0   | Owner  | Karnataka Power Corporation Ltd<br>Shakthi Bhavan<br>No.82, Race Course Road<br>Bangalore-560 001<br>Karnataka, India |  |              |
| 2.0   | Project Title  | 1x700 MW Bellary Thermal Power Station<br>Unit No3, Stage-3   |  |              |
| 3.0   | Location   | Kudatini Village<br>Bellary Dist<br>Karnataka state INDIA   |  |              |
| 4.0   | Latitude and Longitude   | 15° 11' 58" N Latitude<br>76° 43' 23" E Longitude   |  |              |
| 5.0   | Elevation above mean sea level   | 478 meters  |  |              |
| 6.0   | <u>Climatic Conditions</u>   |   |  |              |
|   | (a) <u>Temperature</u>   |   |  |              |
|   | i. <u>Monthly basis</u>  |   |  |              |
|   | Mean of daily maximum temperature  | 42.5° C (in the month of April)   |  |              |
|   | Mean of daily minimum temperature  | 19.5° C (in the month of Dec)   |  |              |
|   | ii. <u>Monthly basis</u>   |   |  |              |
|   | Mean of daily maximum  | 37.5° C   |  |              |
|   | Mean of daily minimum  | 19.5° C   |  |              |
|   | iii. Highest temperature recorded  |   |  |              |
|   | Lowest temperature recorded  | 14.6° C   |  |              |
|   | (b) Relative Humidity  | Varies between 11% and 70%  |  |              |
|   | (c) <u>Rainfall</u>  |   |  |              |
|   | Annual average rain  | 492 to 846 mm most of which occurs during August to October   |  |              |
|   | (d) <u>Wind Speed</u>  |   |  |              |
|   | i. Annual mean wind speed  | 8.4 km / hr   |  |              |
|   | ii. Maximum mean wind speed  | 19 km / hr in the month of July.  |  |              |
| 8.0   | Wind Load  |   |  |              |
|   | (a) Basic wind speed of 39 m/sec as given in Fig.1 of the code.  |   |  |              |
|   | (b) Factor K1 shall be taken as 1.06   |   |  |              |
|   | (c) Terrain category shall be 2 and corresponding values shall be taken for K2   |   |  |              |
|   | (d) Factor K3 shall be taken as 1.0  |   |  |              |
| 9.0   | Wind Loading for Stack   |   |  |              |
|   | (a) For wind pressure as per clause 8.0 above  |   |  |              |
|   | (b) For RC stacks as per IS: 4998  |   |  |              |
| 10.0  | Seismic data (as per IS:1893 latest issue)   |   |  |              |
|   | (a) Zone   |   |  |              |
|   | (b) Importance factor (I)  |   |  |              |
| 11.0  | Auxiliary power supply   |   |  |              |
|   | Auxiliary electrical equipment to be supplied against this specification shall be suitable for operation on the following supply system. |   |  |              |



|   |   |                                      |              |
|---|---|--------------------------------------|--------------|
|  | <p>Technical specification for<br/><b>Control Valves with Accessories</b><br/>(Pneumatically Operated)</p> <p><b>Bellary TPS Unit#3, 1x700MW - KPCL</b></p> | SPEC NO.: <b>PE-TS-367-145-I 004</b> |              |
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|   |   | SECTION                              | C            |
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## SECTION – C

### SPECIFIC TECHNICAL REQUIREMENTS

|   |   |                                      |              |
|---|---|--------------------------------------|--------------|
|  | <p>Technical specification for<br/><b>Control Valves with Accessories</b><br/>(Pneumatically Operated)</p> <p><b>Bellary TPS Unit#3, 1x700MW - KPCL</b></p> | SPEC NO.: <b>PE-TS-367-145-I 004</b> |              |
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| 1.    | Specific Technical Requirements   | 3               |
| 2.    | Hook-up Diagram for Control valve                                       | 1               |
| 3.    | Customer Specification: Section D3.4, Volume-IV<br>(Sheet 66, 67 of 73) | 2               |

|   |  |  |                               |    |
|---|--|--|-------------------------------|----|
|  | <b>Technical specification for<br/>Control Valves with Accessories</b><br>(Pneumatically Operated) |  | SPEC NO.: PE-TS-367-145-I 004 |    |
|   |  |  | VOLUME II B                   |    |
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### **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.

1. **All the formats in Volume-III, SCHEDULE OF SUBMISSION OF DRG./DOC. and QUALITY PLAN (BHEL Format) should filled-up and furnished with the bid, complete in all respect. In the absence of those, the bid would be considered incomplete and liable for rejection.** Catalogue, Leaflets related with the models of Control Valves as well as each Accessory must be furnished with the offer.
2. The Hook-up diagram for Control valve, attached in Section-C. the scope demarcation as indicated should be adhered. The connection details at Instrument Air valve shall be furnished to successful bidder after the award of contract.
3. Valve 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.**
4. 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 to close the valve.** Separate indication for the same has not been made in the data sheets-A.
5. For valves subjected to cavitation service, anti-cavitation trim shall be provided.
6. In case during erection/commissioning of the control valve, any spares are required which have not been specified in the Start-up/commissioning spares list, the same will have to be supplied by the bidder free of cost
7. Facility to adjust the maximum travel of the stem & starting point of travel shall be incorporated.
8. SS nameplate to 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 press at full open and close condition
9. Hand wheel shall have open/ close direction.
10. Limit switch shall be designed for 1,00,000 operations.
11. JB shall be 36 ways as per enclosed hook-up diagram.
12. The material of filter for Air Filter Regulator shall be Sintered bronze.
13. Bidder to indicate pick-up & drop out voltage for all solenoid valves.
14. Protection class for Smart positioner shall be IP-65 only.

|   |  |                   |                               |      |
|---|--|-------------------|-------------------------------|------|
|  | <b>Technical specification for<br/>Control Valves with Accessories</b><br>(Pneumatically Operated) |                   | SPEC NO.: PE-TS-367-145-I 004 |      |
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|   |  | DATE : 05.06.2013 |                               |      |

15. All JBs and valves shall be with double compression type Ni plated brass cable glands.
16. Solenoid valve class of protection shall be IP-65.
17. All local cabling upto JBs shall be in Conduit (Flexible/Rigid) & shall be in Bidders scope.
18. Any hardware for connection b/w cv positioner & hms system at positioner end (RS-232/485 converter, multiplexer & hart modem, etc.)
19. SPARES: The following spares are required to be offered

**(A) Mandatory Spares:**

The items listed in list of mandatory spares attached at section-D, of this specification, are the essential spares required to be offered by the bidder, and the price for which (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

The prices for Mandatory spares indicated by the bidder shall be used for bid evaluation purposes.

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 items of spare parts are packed in a single Case / Carton, a general description of the contents shall be shown outside of such case, and detailed list enclosed. All Cases, Containers and Packages must be suitably marked and numbered for the purpose of identification.

**(B) Recommended Spares:**

In addition to the Mandatory spares mentioned, the bidder shall also furnish a List of Recommended spares for 3 years of normal operation of the Control valves / Accessories. The BHEL/Customer reserves the right to buy any or all of the recommended spares.


The prices of these spares will remain valid for a period of minimum 6 months after the placement of order.

**(C) Start-up & Commissioning Spares:**

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

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 is enclosed in the section-D of this specification.

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 desiccator's packs as necessary.

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## 20. Documentation:

### (A) Along with the bids: following documents for the project

- Signed and stamped compliance certificates in attached format(VOL.-III).
- "Schedule of prices" and "Schedule of unit Prices" in attached format (VOL.-III).
- Schedule of submission of Drg. / Doc, Equip. Manufacture, Inspection and Dispatch.
- Inspection schedule
- Quality Plan Duly signed and Stamped

### (B) After the award of contract:

The documentation as listed below for the project

6 sets of the following documents + 3 sets of CDs to be enclosed with the bids for Approval:

- Assembly (dimensional) drawings.
- Valve Edge preparation details.
- Data sheet-C completely filled-up.
- Hook-up diagram of Control Valve with Actuator & Accessories.
- Valve & Actuator assembly dimensional drawings with weights.
- Quality Plan duly signed and stamped.
- All calculations like CV, Noise Level, Valve Outlet Velocity, Actuator sizing etc.
- All relevant catalogues for the models of the valves as well as accessories finalized.
- Bar chart to indicate the time schedule for procurement, manufacture, testing and dispatch.

### (B) Final documentation:

The documentation as listed below will separate for respective projects

- Category -I & IV Approved final drawings/data sheets, - 20 sets with 4 CD-ROMS  
Valve sizing calculations, Noise level calculations and  
Valve Outlet Velocity calculations.
- Test certificates - 20 sets.
- Operation & Maintenance Manuals - 20 sets with 4 CD-ROMS  
for Control Valve, Actuator and all the  
Accessories.



Technical specification for  
**Control Valves with Accessories**  
(Pneumatically Operated)

**Bellary TPS Unit#3, 1x700MW - KPCL**

SPEC NO.: **PE-TS-367-145-I 004**

VOLUME II B

SECTION C

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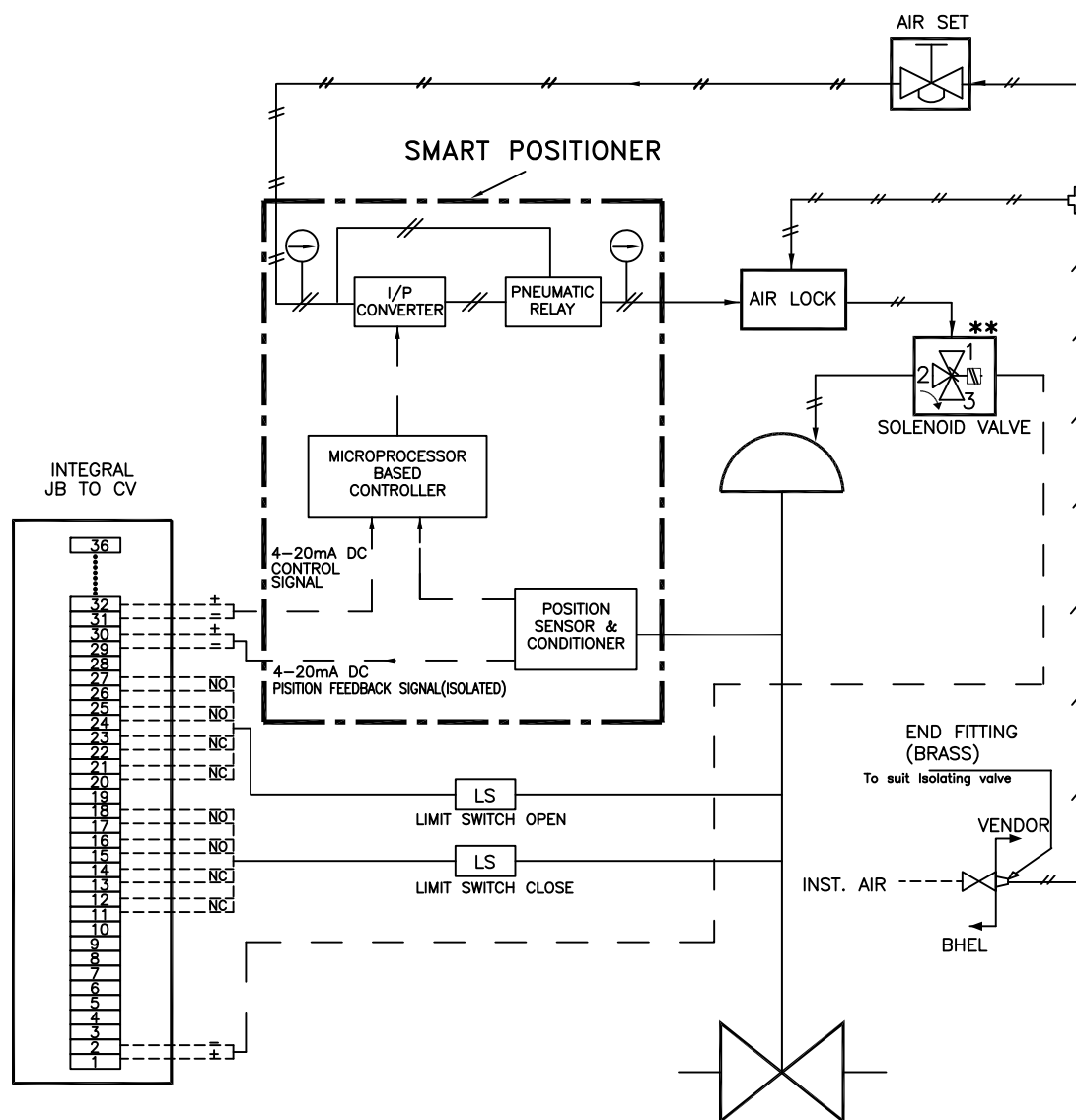
## SECTION – C

## HOOK-UP DIAGRAM



## CONTROL VALVE HOOK-UP DIAGRAM WITH SMART POSITIONER

KPCL-BELLARY#3, (1 x 700 MW)



NOTE:—


1. SOLENOID VALVE WILL BE PROVIDED AS INDICATED IN RESPECTIVE DATA SHEETS.
2. SOLENOID VALVES PORT CONDITION:  
PORT 1 & 2 SHAL BE CONNECTED UNDER DE--ENERGISED CONDITION.  
PORT 2 & 3 SHAL BE CONNECTED UNDER ENERGISED CONDITION.
3. FOR ONLY ON/OFF DUTY PNEUMATIC CONTROL VALVE, SMART POSITIONER SHALL NOT BE APPLICABLE.
4. JB TERMINALS SHALL BE CAGE CLAMP TYPE SUITABLE FOR 2.5 SQ. MM COPPER WIRE.
5. 15 METERS 1/4 " PVC COATED COPPER TUBING AND 1 SET OF FITTINGS TO BE SUPPLIED FOR EACH CONTROL VALVE FOR CONNECTION TO ISO VALVE AT INST AIR HEADER ON ONE END AND TO AIR LOCK RELAY/AIR FILTER REGULATOR ON THE OTHER END.
6. VOLUME BOOSTER IF REQUIRED SHALL BE PROVIDED.


\*\*\* AS PER DATASHEET.


|   |   |  |                                      |                   |
|---|---|--|--------------------------------------|-------------------|
|  | <p>Technical specification for<br/> <b>Control Valves with Accessories</b><br/> (Pneumatically Operated)</p> <p><b>Bellary TPS Unit#3, 1x700MW - KPCL</b></p> |  | SPEC NO.: <b>PE-TS-367-145-I 004</b> |                   |
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## SECTION – C

### CUSTOMER SPECIFICATION

|   |  |  |  |
|---|--|--|--|
|   | KARNATAKA POWER CORPORATION LIMITED<br>BELLARY TPS, UNIT-3 OF 700 MW   |  | SECTION: D3.4<br>VOLUME-IV<br>SHEET 67 OF 73 |
|   | TITLE SPECIFICATIONS FOR DDCMIS/INSTRUMENTS TO BE SUPPLIED   |  |  |
| welded for sizes 50 NB and above. Flanged connection shall be provided for DM water services, with suitable rubber lined interfaces. Water seal shall be provided for valves that could be subjected to below atmospheric conditions. |  |  |  |
| 49.00.05  | Generally stem and guide material(trim) shall be SS 316 sterilized, and plug and seat material will be 17-4 PH SS, except for specific applications like DM water, HP bypass services. Refer to Table-5 for selection of control valve body material and actuator type. The noise abatement shall be obtained by valve body and trim design and not by use of silencer. The trims supplied shall be suitable for quick changing. Actuator housing shall be of pressed steel construction.  |  |  |
| 49.00.06  | In Vibration prone areas, positioners shall be located away from the control valve/damper and location shall be approved by OWNER/ENGINEER. Position transmitter shall be non-contact type.  |  |  |
| 49.00.07  | The control valve design shall be suitable for the required fail-safe conditions, of process / equipment. The valves shall be supplied and commissioned as per the fail-safe philosophy required for the process. Wherever the required turnaround is not possible with a standard single valve, specially designed trims shall be customised and used. Pressure regulators upstream of control valves would not be envisaged.   |  |  |
| 49.00.08  | All final Control elements (Control valves & control dampers) shall be with pneumatic or electric actuators. All actuators would be sized so that the final control elements operate properly even when the upstream pressure exceeds 110% of maximum value. Pneumatic actuators would be provided with air failure lock and remote release, limit switches, adjustable minimum and maximum stops, load position indicators, positioners, non-contact type electronic position transmitters and solenoid valves in accordance with the system requirements.  |  |  |
| 49.00.09  | SMART positioners shall be provided for all pneumatic operated control valves/dampers. For the services in heat prone area Integral type positioners shall be offered.<br>The type of actuator shall be pneumatic type except Governing valves, HP/LP bypass services for which hydraulic actuator shall be used.  |  |  |
| 50.00.00  | <b>Programmable Logic Controllers (PLC):</b> For systems mentioned in Table-I: The microprocessor shall be based on 32 bit processing. The programme memory shall be non volatile memory. The PLC shall perform protection logic, interlock and sequential control functions such as binary logic operation, set/reset operation, timers, counters, logic blocks, maths functions, boolean functions & timer functions. PLC shall complete with processor, I/O cards, memory modules, racks, mounting accessories. The scan time for digital inputs shall not be more than 60msec and execution 120msec. The system shall be loaded to maximum 60% under worst loading conditions. |  |  |
| 50.00.01  |  |  |  |

|  |   |  |  |  |
|--|---|--|--|--|
| KPC/IBTPS03/EPC  |    | KARNATAKA POWER CORPORATION LIMITED<br>BELLARY TPS, UNIT-3 OF 700 MW |  | SECTION: D3.4<br>VOLUME-IV<br>SHEET 66 OF 73 |
|  |   | TITLE SPECIFICATIONS FOR DDCMIS/INSTRUMENTS TO BE SUPPLIED           |  |  |
| displayed in the form of bar charts and alarms shall be generated on occurrence of tube leakage. One speaker, power supply failure alarm and steam leak alarm shall be provided.   |   |  |  |  |
| The system shall be capable of operating in presence of soot blowers in operation and insensitive to the presence of nearby echo-inducing surfaces. Separately isolated 4-20mA DC analogue signals shall be provided for monitoring acoustic level for tube leaks. Bidder shall provide necessary acoustic signal generator, signal receiver, transducer with microphone, amplifier, required cables/junction box, remote control panel, 24" TFT monitor, alarm contacts to DDCMIS and all other accessories, air purging system, signal processor & controller, dust, water & weather proof control cabinet, connecting cables and interface to SBC system. |   |  |  |  |
| 48.00.00   | <b>Master Clock System:</b><br>The existing master clock system of unit-1 shall be used for providing synchronising signal to DDCMIS. Provision of additional 20 ports and 20 nos slave display units shall be provided. The required hard ware and software including cables for connectivity from unit-1 and slave display units shall be considered.   |  |  |  |
| 49.00.00   | <b>Control Valves:</b><br>Multistage, anticavitation, Balanced, modulating, globe type, cage guided, single ported, diaphragm type of actuator with hand wheel, Pneumatic positioners, air filter regulator, air lock device, solenoid valve, limit switches and position transmitters completely tubed with junction box. E/P converters suitable for accepting 4-20mA DC signal. Pneumatic (copper) tubing complete with accessories, fittings, positioners shall be provided with input/output/bypass gauges. Local position indicator & LVDT type position transmitter with 2 wire, 4-20mA DC output. All limit switches/position transmitters, E/P converter signals etc., shall be wired out to external block of actuator and respective junction boxes. |  |  |  |
| 49.00.02   | Control valves shall be sized to have an opening of 15% at minimum flow condition and 85% at maximum flow condition. Noise level shall not exceed 85 dB at a distance of about 1.5 M from the valve. In case of predicted noise level above 85dBA, suitable low noise trim shall be provided.   |  |  |  |
| 49.00.03   | Leakage class for double seated valve shall not exceed 0.05%, and single seated valve shall not exceed 0.01%. Either extended type bonnet or cooling fin type bonnet shall be provided for service above 200°C and for other service the bonnet type shall be standard.   |  |  |  |
| 49.00.04   | The end connections shall be socket welded for sizes below 50 NB and butt   |  |  |  |

|   |   |  |                                      |                   |
|---|---|--|--------------------------------------|-------------------|
|  | Technical specification for<br><b>Control Valves with Accessories</b><br>(Pneumatically Operated) |  | SPEC NO.: <b>PE-TS-367-145-I 004</b> |                   |
|   |   |  | VOLUME II B                          |                   |
|   | Bellary TPS Unit#3, 1x700MW - KPCL  |  | SECTION D                            |                   |
|   |   |  | REV. NO. 00                          | DATE : 05.06.2013 |
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## SECTION-D

**EQUIPMENT SPECIFICATION**  
**DATA SHEETS - A&B**  
**DATA SHEETS - C**  
**QUALITY PLAN**  
**BILL OF QUANTITY**  
**SPARES**  
**SUBMISSION OF DRAWING**

|   |   |       |                                      |              |
|---|---|-------|--------------------------------------|--------------|
|  | <p>Technical specification for<br/> <b>Control Valves with Accessories</b><br/> (Pneumatically Operated)</p> <p><b>Bellary TPS Unit#3, 1x700MW - KPCL</b></p> |       | SPEC NO.: <b>PE-TS-367-145-I 004</b> |              |
|   |   |       | VOLUME                               | II B         |
|   |   |       | SECTION                              | D            |
|   |   |       | REV. NO.                             | 00           |
|   |   |       | DATE                                 | : 05.06.2013 |
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# SECTION – D

## EQUIPMENT SPECIFICATION



## SPECIFICATION FOR CONTROL VALVE (WITH PNEUMATIC / ELECTRIC ACTUATOR)

SPECIFICATION NO.: PES – 145 - 06

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

### 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.



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- 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.



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### 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.





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### 3.3.4 Air Filter Regulator

Instrument quality air at suitable pressure of 5.5 Kg/Cm<sup>2</sup>(g) to 7 Kg/Cm<sup>2</sup>(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/cm<sup>2</sup>g. 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/cm<sup>2</sup>, 0.2-0.6 Kg/cm<sup>2</sup> or 0.6-1.0 Kg/cm<sup>2</sup> 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 Hysteresis 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.



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### 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         | : | $\pm 1\%$ of span    |
| ii)  | Linearity          | : | $\pm 2\%$ of span    |
| iii) | Sensitivity        | : | $\pm 0.5\%$ of span. |
| iv)  | Repeatability      | : | $\pm 1\%$ of span    |
| v)   | Accuracy (Overall) | : | $\pm 2\%$ 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)  $\pm 10\%$  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.



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- 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 per 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.



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- 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.



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### 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<sup>2</sup> 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.



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### 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-II B, 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<sup>2</sup> & 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.



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## 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.~~



## SPECIFICATION FOR CONTROL VALVE (WITH PNEUMATIC / ELECTRIC ACTUATOR)

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### 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.

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## 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





# **SPECIFICATION FOR CONTROL VALVE (WITH PNEUMATIC / ELECTRIC ACTUATOR)**

SPECIFICATION NO.: PES – 145 - 06

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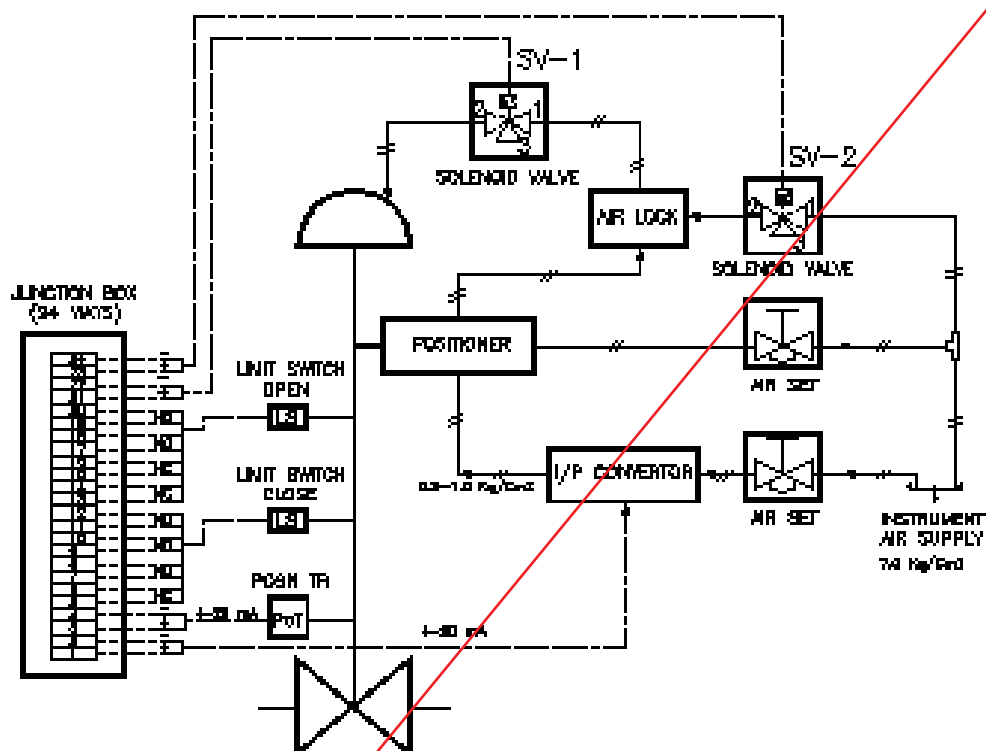
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## **NOTES:-**

- 1 SOLENOID VALVE SV-1 WILL BE PROVIDED, IF SPECIFIED IN DATA SHEETS, FOR OVER-RIDING THE CONTROLLER SIGNAL.
- 2 SOLENOID VALVE SV-2 WILL BE PROVIDED, IF SPECIFIED IN DATA SHEET, FOR VALVE STOP/PUT POSITION REQUIREMENT ON CONTROLLER SIGNAL FAILURE.
- 3 SOLENOID VALVES PORT CONDITION  
PORT 1 AND 2 SHALL BE CONNECTED UNDER DE-ENERGISED CONDITION.  
PORT 2 AND 3 SHALL BE CONNECTED UNDER ENERGISED CONDITION.
- 4 FOR ON/OFF DUTY PNEUMATIC CONTROL VALVE THE FOLLOWING ACCESSORIES SHALL NOT BE APPLICABLE:-
  - 1 POSITIONER
  - 2 POSITION TRANSMITTER
  - 3 I/P CONVERTER
  - 4 AIR LOCK



## SPECIFICATION FOR MICROPROCESSOR BASED ELECTRONIC POSITIONER (SMART )

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### 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 to positioner (4-20mA) |
| Valve Position Feedback | 4-20mA output signal for Position Feedback is to be provided to control system.                                     |

### 2.0 Environment :

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

### 3.0 Diagnostic Features :

|   |  |
|---|--|
| <b>Diagnostic / Test Features</b><br>(to be available in Smart Positioner and shall be accessible through any HMS software) | <b>Minimum Diagnostic Features Like</b> <ul style="list-style-type: none"> <li>• Measurement of Valve positioning timing,</li> <li>• Detection of actuator leakage,</li> <li>• Display of fault alarm.</li> <li>• Logging of alarms and history.</li> <li>• Valve friction/jamming detection.</li> <li>• Detection of valve wear &amp; tear,</li> <li>• Valve stroke length and timing.</li> </ul> |
|   | <b>Advanced Diagnostic Features Like (OPTIONAL)</b> <ul style="list-style-type: none"> <li>• On line partial closure test.</li> <li>• Valve signature analysis (online graphical/tabular representation of input signal Vs valve travel).</li> <li>• Step response test.</li> </ul>  |

### 4.0 Software :

|  |  |
|--|--|
| <b>Software</b><br>(to be supplied alongwith smart positioner) | <ul style="list-style-type: none"> <li>• Windows based software to meet the requirement for configuration, diagnostics, calibration and testing of Valve and actuator.</li> <li>• Easily up-gradable with same hardware and compatible with any Hart Management Systems (HMS).</li> <li>• Shall be capable to cater to all the tags in the specification at the same time without change in wiring.</li> </ul> |
|--|--|



## SPECIFICATION FOR MICROPROCESSOR BASED ELECTRONIC POSITIONER (SMART )

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### 5.0 Hardware :

|                                  |   |
|----------------------------------|---|
| <b>Hardware</b><br>(As required) | 1. PC with software for configuring and accessing diagnostic features of the positioners. |
|                                  | 2. Multiplexers for interfacing smart positioner with PC.                                 |
|                                  | 3. Communication cable for interconnecting multiplexers with PC.                          |
|                                  | 4. RS232/RS485 converter (if required)  |

**Note :** Power supply for Multiplexer shall be arranged by the owner.

### 6.0 Valve Action :

|                     |   |
|---------------------|---|
| <b>Valve Action</b> | <b>Direct &amp; Reverse.</b><br>(Same positioner for Single Acting or Double Acting And no separate relays required for changing from Single acting to double). |
|                     | During Failure of input Electrical signal (4-20 mA), valve to attain fail Freeze position without any external hardware. (Sol valve, Power Supply etc.)         |

### 7.0 Flow Characterization :

|                              |  |
|------------------------------|--|
| <b>Flow Characterization</b> | Possible to fit valve characteristic curve linear & Equal percentage |
|------------------------------|--|

### 8.0 Performance:

|                          |                                  |
|--------------------------|----------------------------------|
| Characteristic Deviation | $\leq 0.75\%$ of span            |
| Ambient temp effect      | $\leq 0.01\%$ / Deg C or better. |
| Dead Band                | Adjustable 0.1 to 10%.           |
| Scan Time                | 10ms                             |
| Resolution               | $\leq 0.05\%$                    |
| Sensitivity/Linearity    | 0.3-0.4% of FS                   |
| Repeatability            | 0.32% of FS                      |

### 9.0 Test Certificates:

Test Certificates/Test Reports for degree of protection, Accuracy and calibration test (as a minimum) to be submitted as per Manufacture Standard / Relevant Standard.

### 10.0 EMC & CE compliance

International Standard Like EN/IEC.

To EN 50081-2 & EN 50082 or equivalent



**SPECIFICATION FOR MICROPROCESSOR BASED  
ELECTRONIC POSITIONER (SMART )**

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## 11.0 Accessories

|                           |   |
|---------------------------|---|
| In Built Operator Panel   | Display with push buttons for Configuration and display on the positioner itself                                    |
| Hand Held Hart Calibrator | Universal Hart Calibrator To Be Provided, Two No.s Per Unit.  |
| Press Gauge Block         | For Supply & Output Pr., Filter Regulator Other Accessories Shall Be Provided As per Control valve hook-up diagram. |
| Electrical cable entry    | ½ - NPT, side or bottom entry to avoid water Ingress.   |

|   |   |                                      |              |
|---|---|--------------------------------------|--------------|
|  | <p>Technical specification for<br/><b>Control Valves with Accessories</b><br/>(Pneumatically Operated)</p> <p><b>Bellary TPS Unit#3, 1x700MW - KPCL</b></p> | SPEC NO.: <b>PE-TS-367-145-I 004</b> |              |
|   |   | VOLUME                               | II B         |
|   |   | SECTION                              | D            |
|   |   | REV. NO.                             | 00           |
|   |   | DATE                                 | : 05.06.2013 |
|   |   | SHEET                                | 1 OF 52      |

# SECTION – D

## DATA SHEETS – A & B

|                     |                               |                 |                    |
|---------------------|-------------------------------|-----------------|--------------------|
| <b>BHEL<br/>PEM</b> | DOCUMENT TITLE :-             | DOCUMENT NUMBER | PE-DC-367-100-I104 |
|                     | DATA SHEET FOR CONTROL VALVES | REVISION NUMBER | 00 DATE 05.06.2013 |
|                     | KPCL-BELLARY#3, (1 x 700 MW)  | SHEET           | 2 OF 52            |

### Notes:

1. All general technical requirements including material & construction, leakage class, body sizing and Cv sizing etc. shall be as per customer specifications.
2. 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 °C.
3. If the downstream is subjected to vacuum, flow direction of the fluid shall be to close. Separate indication for the same has not been made in the data sheet.
4. Valve and actuator shall be designed for full differential pressure (Max. shut-off pressure).
5. Mandatory spares for control valves, shall be as per contract.
6. Testing & other requirements shall be as per customer's specifications.
7. Quantity indicated is for one unit.
8. Tolerances on end to end, center to center, center to face shall be in accordance with ASME B16.10.
9. For valves subjected to cavitation service, anti cavitation trim shall be provided.
10. Control valves shall be sized based on allowable pressure drop at maximum flow condition and to provide 90% opening at max. flow and 15% opening at min. flow.
11. Actuator shall be sized for 110% of maximum upstream pressure.

|                     |                               |                 |                    |
|---------------------|-------------------------------|-----------------|--------------------|
| <b>BHEL<br/>PEM</b> | DOCUMENT TITLE :-             | DOCUMENT NUMBER | PE-DC-367-100-I104 |
|                     | DATA SHEET FOR CONTROL VALVES | REVISION NUMBER | 00 DATE 05.06.2013 |
|                     | KPCL-BELLARY#3, (1 x 700 MW)  | SHEET           | 4 OF 52            |

### INDEX

| S.No. | SERVICE   | Qty. for 1 Unit |
|-------|---|-----------------|
| 1.    | D/A Pegging from Aux. Steam Header (ASV-8)                | 01              |
| 2.    | D/A Pegging from CRH Line (CRHV-6)                        | 01              |
| 3.    | Main Condensate Control (CDV-22 & CDV-25)                 | 02              |
| 4.    | CEP A/B/C Minimum Recirculation (CDV-10, CDV-12 & CDV-14) | 03              |
| 5.    | GSC min. flow recirculation (CDV-39)                      | 01              |
| 6.    | Excess Dump Control (CDV-43)                              | 01              |
| 7.    | Condensate for SD F/T (CDV-67)                            | 01              |
| 8.    | Condensate for Valve Gland Sealing (CDV-72)               | 01              |
| 9.    | HPH-7A/7B Normal Drain to HPH-6A/6B (DRV-2 & DRV-8)       | 02              |
| 10.   | HPH-7A/7B Alt.Drain to HP Drain F/T (DRV-5 & DRV-11)      | 02              |
| 11.   | HPH-6A/6B Normal Drain to Deaerator (DRV-15 & DRV-22)     | 02              |
| 12.   | HPH-6A/6B Alt. Drain to HP Drain F/T (DRV-18 & DRV-25)    | 02              |
| 13.   | LPH-3 Normal Drain to LPH-2 (DRV-28)                      | 01              |
| 14.   | LPH-3 Alt. Drain to LP Drain F/T (DRV-31)                 | 01              |
| 15.   | LPH-2 Normal Drain to LPH-1 (DRV-34)                      | 01              |
| 16.   | LPH-2 Alt. Drain to LP Drain F/T (DRV-37)                 | 01              |
| 17.   | Deaerator Overflow (DRV-48)                               | 01              |
| 18.   | HPH-8A/8B Normal Drain to HPH-7A/7B (DRV-53 & DRV-59)     | 02              |
| 19.   | HPH-8A/8B Alt. Drain to SD F/T (DRV-56 & DRV-62)          | 02              |
| 20.   | LPH-4 Normal Drain to LPH-3 (DRV-65)                      | 01              |
| 21.   | LPH-4 Alt. Drain to LP Drain F/T (DRV-68)                 | 01              |
| 22.   | DM Normal Makeup to Hotwell (DMV-2)                       | 01              |
| 23.   | Emergency MU to Hotwell (DMV-9)                           | 01              |
| 24.   | Low Load Feed Control (FDV-14)                            | 01              |

|  |      |                   |
|--|------|-------------------|
| SPECIFICATION NO.: <b>PE-TS-367-145-I104</b> |      |                   |
| VOLUME                                       | II-B |                   |
| SECTION                                      | D    |                   |
| REV. NO.                                     | 03   | DATE : 05.06.2013 |
| SHEET  | 4    | OF 52             |


Data Sheet No. PES-145-06-DS1-0

## DATA SHEET – A & B


DATA SHEET – B  
(TO BE FILLED UP  
BY BIDDER)

|                    |  |  |  |
|--------------------|--|--|--|
| GENERAL            | PROJECT<br>SERVICE<br>LOCATION<br>DUTY<br>PIPE SIZE (inlet / outlet)<br>PIPE MATERIAL (inlet / outlet)   | KPCL-BELLARY#3, (1X700MM)<br>D/A PEGGING FROM AUX. STEAM HEADER<br><input type="checkbox"/> INDOOR <input type="checkbox"/> OUTDOOR<br><input type="checkbox"/> ON/OFF <input checked="" type="checkbox"/> MODULATING<br>323.9 x 9.53                                   559 x 10<br>SA 106 GR B                                   SA 672 GR B70  |  |
| BODY               | MODEL NO.<br>TYPE OF BODY: GUIDING : NO. OF PORTS<br>BODY SIZE: PORT SIZE: DESIGN CV<br>END CONNECTION & RATING (ANSI)<br>BODY MATERIAL<br><br>PACKING: MATERIAL SINGLE / DOUBLE<br>BONNET TYPE<br>TRIM FORM<br><br>TRIM MATERIAL: SEAT   PLUG<br>: CAGE   GUIDE BUSH<br><br>FLOW<br>OUTLET VELOCITY<br>REQUIRED LEAKAGE CLASS<br>NOISE LEVEL (dBA) (spec. 3.1.14)<br>VACUUM SERVICE<br>ANTI CAVITATION TRIM | <b>Bidder To Specify</b><br><input checked="" type="checkbox"/> GLOBE <input type="checkbox"/> ANGLE   <input type="checkbox"/> TOP <input checked="" type="checkbox"/> CAGE   ONE<br><b>Bidder To Specify</b><br><input checked="" type="checkbox"/> BWE <input type="checkbox"/> SWE <input type="checkbox"/> FLANGED<br><input checked="" type="checkbox"/> A216 WCB <input type="checkbox"/> A217 WC6 <input type="checkbox"/> SS <input type="checkbox"/> A217 CS<br><input type="checkbox"/> A351 CF8M<br><input type="checkbox"/> PTFE <input checked="" type="checkbox"/> GRAFOIL <input type="checkbox"/> DOUBLE <input checked="" type="checkbox"/> SINGLE<br><input type="checkbox"/> STD <input type="checkbox"/> EXTENDED <input type="checkbox"/> FINNED<br><input checked="" type="checkbox"/> LINEAR <input type="checkbox"/> EQ. PERCENTAGE<br><input type="checkbox"/> QUICK OPEN (ON/OFF)<br>SS 316 STELLITED   SS 316 STELLITED<br>SS 316 STELLITED   SS 316 STELLITED<br><br><input type="checkbox"/> BELOW SEAT <input type="checkbox"/> ABOVE SEAT<br><input type="checkbox"/> < 7 M/SEC(WATER)   <input checked="" type="checkbox"/> MAC NO. < 1/3 (STM)<br><input type="checkbox"/> II <input type="checkbox"/> III <input checked="" type="checkbox"/> IV <input type="checkbox"/> V <input type="checkbox"/> VI<br>LESS THAN 85 dBA<br><input type="checkbox"/> YES <input checked="" type="checkbox"/> NO<br><input type="checkbox"/> YES <input checked="" type="checkbox"/> NO |  |
| PNEUMATIC ACTUATOR | MODEL NO. & SIZE<br>CLOSE AT : OPEN AT (KG/CM2g)<br>TRAVEL TIME FOR<br>OPEN TO CLOSE, CLOSE TO OPEN<br>VALVE POSN. ON SIGNAL AIR FAILURE<br>VALVE POSN. ON SUPPLY AIR FAILURE  | <b>Bidder To Specify</b><br>1.0                                        0.2<br>< 10 Seconds<br> <br><input checked="" type="checkbox"/> TO OPEN <input type="checkbox"/> STAYPUT <input type="checkbox"/> TO CLOSE<br><input checked="" type="checkbox"/> STAYPUT   |  |
| ACCESSORIES        | POSITIONER ( <b>SMART</b> )<br>AIR FILTER REGULATOR<br>AIR LOCK RELAY<br>POSITION LIMIT SWITCH<br>POSITION TRANSMITTER<br>SOLENOID VALVE<br>E/P CONVERTER<br>JUNCTION BOX<br>HAND WHEEL (SIDE MOUNTED)<br>LOCAL POSITION INDICATOR   | <input checked="" type="checkbox"/> REQUIRED <input type="checkbox"/> NOT REQUIRED<br><input checked="" type="checkbox"/> REQUIRED <input type="checkbox"/> NOT REQUIRED<br><input checked="" type="checkbox"/> REQUIRED <input type="checkbox"/> NOT REQUIRED<br><input checked="" type="checkbox"/> REQUIRED <input type="checkbox"/> NOT REQUIRED<br>PART OF POSITIONER<br><input checked="" type="checkbox"/> REQUIRED <input type="checkbox"/> NOT REQUIRED<br>PART OF POSITIONER<br><input checked="" type="checkbox"/> REQUIRED <input type="checkbox"/> NOT REQUIRED<br><input checked="" type="checkbox"/> REQUIRED<br><input checked="" type="checkbox"/> REQUIRED   |  |



|   |   |                 |             |                     |  |              |  |   |                  |
|---|---|-----------------|-------------|---------------------|--|--------------|--|---|------------------|
|    | <b>DATA SHEET FOR CONTROL VALVES<br/>(WITH PNEUMATIC ACTUATOR)</b>  |                 |             |                     |  |              | SPECIFICATION NO.: <b>PE-TS-367-145-I104</b>   |   |                  |
|   |   |                 |             |                     |  |              | VOLUME II-B  |   |                  |
|   |   |                 |             |                     |  |              | SECTION D  |   |                  |
|   |   |                 |             |                     |  |              | REV. NO. 03  | DATE : 05.06.2013                             |                  |
|   |   |                 |             |                     |  |              | SHEET 5 OF 52  |   |                  |
| Tag No. :...ASV-8... Qty.: ...1 per Unit ... <span style="float: right;">Data Sheet No. PES-145-06-DS1-0</span>   |   |                 |             |                     |  |              |  |   |                  |
| <b>DATA SHEET – A &amp; B</b>   |   |                 |             |                     |  |              |  |   |                  |
| DATA SHEET – A FOR CONTROL VALVE (WITH PNEUMATIC ACTUATOR)<br>(TO BE FILLED BY PURCHASER)   |   |                 |             |                     |  |              |  | DATA SHEET – B<br>(TO BE FILLED UP BY BIDDER) |                  |
| PERFORMANCE OF VALVE  | LINEARITY<br>HYSTERESIS<br>SENSITIVITY<br>ACCURACY (OVERALL)  |                 |             |                     | $\pm 1\%$<br>$\pm 1\%$<br>$\pm 0.5\%$<br>$\pm 2\%$ |              | .....<br>.....<br>.....<br>.....   |   |                  |
| SERVICE CONDITION   | SL. No. +   | LOAD            | FLOW (T/HR) | INLET PR. KG/CM2(A) | OUTLET PR. KG/CM2(A)                               | TEMP DEG (C) | CALC ULATED CV   | % VLV LIFT                                    | VLV O/L VELOCITY |
|   | 1.  | 7.5% BMCR       | 17.8        | 16                  | 1.65   | 210          |  |   |                  |
|   | 2.  | 25% BMCR (COLD) | 59.3        | 16                  | 1.7  | 210          |  |   |                  |
|   | 3.  | 15% BMCR (HOT)  | 50.9        | 16                  | 3.7  | 210          |  |   |                  |
|   | 4.  | 35% BMCR (COLD) | 83          | 16                  | 1.7  | 210          |  |   |                  |
|   | 5.  | START-UP        | 94.82       | 16                  | 1.7  | 210          |  |   |                  |
|   | VALVE TYPE  |                 |             |                     |  |              | <input type="checkbox"/> CAVITATION <input type="checkbox"/> FLASHING<br><input checked="" type="checkbox"/> HIGH DP |   |                  |
|   | MAX SHUT OFF PRESS (KG/CM2g) 20<br>BODY DESIGN : PRESS (KG/CM2g)   TEMP (DEG C) 20   240<br>IBR FORM III-C <input checked="" type="checkbox"/> REQUIRED <input type="checkbox"/> NOT REQUIRED |                 |             |                     |  |              | .....<br>.....<br>.....  |   |                  |
| TOTAL WEIGHT (VALVE + ACTUATOR + ACCESSORIES) Kg  |   |                 |             |                     |  |              | .....  |   |                  |
| NOTES:<br>1.        +        DESIGN CV SHALL BE BASED ON SERVICE CONDITION INDICATED AT SL. NO. 3 AND SHALL BE CHECKED FOR ALL SPECIFIED CONDITIONS AS PER SPECIFICATION CLAUSE NUMBER 3.1.7. |   |                 |             |                     |  |              |  |   |                  |



|   |   |                         |             |                     |  |              |  |   |                  |  |
|---|---|-------------------------|-------------|---------------------|--|--------------|--|---|------------------|--|
|    | <b>DATA SHEET FOR CONTROL VALVES<br/>(WITH PNEUMATIC ACTUATOR)</b>  |                         |             |                     |  |              | SPECIFICATION NO.: <b>PE-TS-367-145-I104</b>   |   |                  |  |
|   |   |                         |             |                     |  |              | VOLUME II-B  |   |                  |  |
|   |   |                         |             |                     |  |              | SECTION D  |   |                  |  |
|   |   |                         |             |                     |  |              | REV. NO. 03  | DATE : 05.06.2013                             |                  |  |
|   |   |                         |             |                     |  |              | SHEET 7 OF 52  |   |                  |  |
| Tag No. ....CRHV-6... Qty.: ...1 per Unit... <span style="float: right;">Data Sheet No. PES-145-06-DS1-0</span>   |   |                         |             |                     |  |              |  |   |                  |  |
| <b>DATA SHEET – A &amp; B</b>   |   |                         |             |                     |  |              |  |   |                  |  |
| DATA SHEET – A FOR CONTROL VALVE (WITH PNEUMATIC ACTUATOR)<br>(TO BE FILLED BY PURCHASER)   |   |                         |             |                     |  |              |  | DATA SHEET – B<br>(TO BE FILLED UP BY BIDDER) |                  |  |
| PERFORMANCE OF VALVE  | LINEARITY<br>HYSTERESIS<br>SENSITIVITY<br>ACCURACY (OVERALL)  |                         |             |                     | $\pm 1\%$<br>$\pm 1\%$<br>$\pm 0.5\%$<br>$\pm 2\%$ |              | .....<br>.....<br>.....<br>.....   |   |                  |  |
| SERVICE CONDITION   | SL. No. +   | LOAD                    | FLOW (T/HR) | INLET PR. KG/CM2(A) | OUTLET PR. KG/CM2(A)                               | TEMP DEG (C) | CALC ULATED CV   | % VLV LIFT                                    | VLV O/L VELOCITY |  |
|   | 1.  | 15% BMCR                | 45.6        | 14.4                | 3.65   | 340.7        |  |   |                  |  |
|   | 2.  | 60% BYPASS MDBFP        | 191         | 36.97               | 3.65   | 354.1        |  |   |                  |  |
|   | 3.  | HP/LP BYPASS HOUSE LOAD | 206         | 38.9                | 3.65   | 372.6        |  |   |                  |  |
|   | 4.  | START-UP                | 83          | 14.4                | 1.65   | 340.7        |  |   |                  |  |
|   |   |                         |             |                     |  |              |  |   |                  |  |
|   | VALVE TYPE  |                         |             |                     |  |              | <input type="checkbox"/> CAVITATION <input type="checkbox"/> FLASHING<br><input checked="" type="checkbox"/> HIGH DP |   |                  |  |
|   | MAX SHUT OFF PRESS (KG/CM2g) 74.6<br>BODY DESIGN : PRESS (KG/CM2g)   TEMP (DEG C) 74.6   380<br>IBR FORM III-C <input checked="" type="checkbox"/> REQUIRED <input type="checkbox"/> NOT REQUIRED |                         |             |                     |  |              | .....<br>..... .....<br>.....  |   |                  |  |
| TOTAL WEIGHT (VALVE + ACTUATOR + ACCESSORIES) Kg  |   |                         |             |                     |  |              | .....  |   |                  |  |
| NOTES:<br>1.        +        DESIGN CV SHALL BE BASED ON SERVICE CONDITIONS INDICATED AT SL. NO. <u>  2  </u> AND SHALL BE CHECKED FOR ALL OTHER CONDITIONS AS PER SPECIFICATION CLAUSE NUMBER 3.1.7. |   |                         |             |                     |  |              |  |   |                  |  |

SPECIFICATION NO.: **PE-TS-367-145-I104**

|        |      |
|--------|------|
| VOLUME | II-B |
|--------|------|

|         |   |
|---------|---|
| SECTION | D |
|---------|---|

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SHEET

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Tag No. : CDV-10, CDV-12 Qty.: 3 per Unit (One against each Tag No.) Data Sheet No. PES-145-06-DS1-0  
CDV-14

## 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)

[illegible]

|   |   |        |             |                     |  |              |   |   |                  |
|---|---|--------|-------------|---------------------|--|--------------|---|---|------------------|
|    | <b>DATA SHEET FOR CONTROL VALVES<br/>(WITH PNEUMATIC ACTUATOR)</b>  |        |             |                     |  |              | SPECIFICATION NO.: <b>PE-TS-367-145-I104</b>  |   |                  |
|   |   |        |             |                     |  |              | VOLUME II-B   |   |                  |
|   |   |        |             |                     |  |              | SECTION D   |   |                  |
|   |   |        |             |                     |  |              | REV. NO. 03   | DATE : 05.06.2013                             |                  |
|   |   |        |             |                     |  |              | SHEET 9 OF 52   |   |                  |
| Tag No. : CDV-10, CDV-12 Qty.: 3 per Unit (One against each Tag No.) Data Sheet No. PES-145-06-DS1-0<br>CDV-14  |   |        |             |                     |  |              |   |   |                  |
| <b>DATA SHEET – A &amp; B</b>   |   |        |             |                     |  |              |   |   |                  |
| DATA SHEET – A FOR CONTROL VALVE (WITH PNEUMATIC ACTUATOR)<br>(TO BE FILLED BY PURCHASER)   |   |        |             |                     |  |              |   | DATA SHEET – B<br>(TO BE FILLED UP BY BIDDER) |                  |
| PERFORMANCE OF VALVE  | LINEARITY<br>HYSTERESIS<br>SENSITIVITY<br>ACCURACY (OVERALL)  |        |             |                     | $\pm 1\%$<br>$\pm 1\%$<br>$\pm 0.5\%$<br>$\pm 2\%$ |              | .....<br>.....<br>.....<br>.....  |   |                  |
| SERVICE CONDITION   | SL. No. +   | LOAD   | FLOW (T/HR) | INLET PR. KG/CM2(A) | OUTLET PR. KG/CM2(A)                               | TEMP DEG (C) | CALC ULATED CV  | % VLV LIFT                                    | VLV O/L VELOCITY |
|   | 1.  | MIN.   | 30          | 37.5                | 0.6  | 53.8         |   |   |                  |
|   | 2.  | NORMAL | 300         | 37.5                | 0.6  | 53.8         |   |   |                  |
|   | 3.  | MAX.   | 310         | 37.1                | 1.5  | 53.8         |   |   |                  |
|   |   |        |             |                     |  |              |   |   |                  |
|   |   |        |             |                     |  |              |   |   |                  |
|   | VALVE TYPE  |        |             |                     |  |              | <input type="checkbox"/> CAVITATION <input type="checkbox"/> FLASHING<br><input type="checkbox"/> HIGH DP |   |                  |
|   | MAX SHUT OFF PRESS (KG/CM2g) 43<br>BODY DESIGN : PRESS (KG/CM2g)   TEMP (DEG C) 43/VACUUM   55<br>IBR FORM III-C <input type="checkbox"/> REQUIRED <input checked="" type="checkbox"/> NOT REQUIRED |        |             |                     |  |              | .....<br>.....<br>.....   |   |                  |
| TOTAL WEIGHT (VALVE + ACTUATOR + ACCESSORIES) Kg  |   |        |             |                     |  |              | .....   |   |                  |
| NOTES:<br>1.        +        DESIGN CV SHALL BE BASED ON SERVICE CONDITIONS INDICATED AT SL. NO. <u>  2  </u> AND SHALL BE CHECKED FOR ALL OTHER CONDITIONS AS PER SPECIFICATION CLAUSE NUMBER 3.1.7. |   |        |             |                     |  |              |   |   |                  |



|   |   |                 |             |                     |  |              |  |   |                   |  |
|---|---|-----------------|-------------|---------------------|--|--------------|--|---|-------------------|--|
|   | <b>DATA SHEET FOR CONTROL VALVES<br/>(WITH PNEUMATIC ACTUATOR)</b>  |                 |             |                     |  |              | SPECIFICATION NO.: <b>PE-TS-367-145-I104</b>   |   |                   |  |
|   |   |                 |             |                     |  |              | VOLUME II-B  |   |                   |  |
|   |   |                 |             |                     |  |              | SECTION D  |   |                   |  |
|   |   |                 |             |                     |  |              | REV. NO. 03  |   | DATE : 05.06.2013 |  |
|   |   |                 |             |                     |  |              | SHEET 11   |   | OF 52             |  |
| Tag No. : CDV-22 & CDV-25 Qty.: 2 per Unit (One against each Tag No.) Data Sheet No. PES-145-06-DS1-0   |   |                 |             |                     |  |              |  |   |                   |  |
| <b>DATA SHEET – A &amp; B</b>   |   |                 |             |                     |  |              |  |   |                   |  |
| DATA SHEET – A FOR CONTROL VALVE (WITH PNEUMATIC ACTUATOR)<br>(TO BE FILLED BY PURCHASER)   |   |                 |             |                     |  |              |  | DATA SHEET – B<br>(TO BE FILLED UP BY BIDDER) |                   |  |
| PERFORMANCE OF VALVE  | LINEARITY<br>HYSTERESIS<br>SENSITIVITY<br>ACCURACY (OVERALL)  |                 |             |                     | $\pm 1\%$<br>$\pm 1\%$<br>$\pm 0.5\%$<br>$\pm 2\%$ |              | .....<br>.....<br>.....<br>.....   |   |                   |  |
| SERVICE CONDITION   | SL. No. +   | LOAD            | FLOW (T/HR) | INLET PR. KG/CM2(A) | OUTLET PR. KG/CM2(A)                               | TEMP DEG (C) | CALC ULATED CV   | % VLV LIFT                                    | VLV O/L VELOCITY  |  |
|   | 1.  | DESIGN POINT    | 1900        | 26.68               | 24   | 45.8         |  |   |                   |  |
|   | 2.  | 60% LOAD        | 924.2       | 29.83               | 13   | 40.7         |  |   |                   |  |
|   | 3.  | 100% MCR        | 1578        | 24.35               | 21   | 45           |  |   |                   |  |
|   | 4.  | VWO             | 1692        | 26.98               | 22.5   | 45.8         |  |   |                   |  |
|   | 5.  | MIN. (10% LOAD) | 151.8       | 34.9                | 8.5  | 53.8         |  |   |                   |  |
|   | VALVE TYPE  |                 |             |                     |  |              | <input type="checkbox"/> CAVITATION <input type="checkbox"/> FLASHING<br><input checked="" type="checkbox"/> HIGH DP |   |                   |  |
|   | MAX SHUT OFF PRESS ( KG/CM2g) 43<br>BODY DESIGN : PRESS (KG/CM2g)   TEMP (DEG C) 43   55<br>IBR FORM III-C <input type="checkbox"/> REQUIRED <input checked="" type="checkbox"/> NOT REQUIRED |                 |             |                     |  |              | .....<br>.....<br>.....  |   |                   |  |
| TOTAL WEIGHT (VALVE + ACTUATOR + ACCESSORIES) Kg  |   |                 |             |                     |  |              | .....  |   |                   |  |
| NOTES:<br>1.        +        DESIGN CV SHALL BE BASED ON SERVICE CONDITIONS INDICATED AT SL. NO. <u>  4  </u> AND SHALL BE CHECKED FOR ALL OTHER CONDITIONS AS PER SPECIFICATION CLAUSE NUMBER 3.1.7. |   |                 |             |                     |  |              |  |   |                   |  |

|  |      |                   |
|--|------|-------------------|
| SPECIFICATION NO.: <b>PE-TS-367-145-I104</b> |      |                   |
| VOLUME                                       | II-B |                   |
| SECTION                                      | D    |                   |
| REV. NO.                                     | 03   | DATE : 05.06.2013 |
| SHEET  | 12   | OF 52             |


Data Sheet No. PES-145-06-DS1-0

## DATA SHEET – A & B

DATA SHEET – B  
(TO BE FILLED UP  
BY BIDDER)

[illegible]



|   |  |      |             |                     |  |              |   |   |                  |
|---|--|------|-------------|---------------------|--|--------------|---|---|------------------|
|    | <b>DATA SHEET FOR CONTROL VALVES<br/>(WITH PNEUMATIC ACTUATOR)</b>   |      |             |                     |  |              | SPECIFICATION NO.: <b>PE-TS-367-145-I104</b>  |   |                  |
|   |  |      |             |                     |  |              | VOLUME II-B   |   |                  |
|   |  |      |             |                     |  |              | SECTION D   |   |                  |
|   |  |      |             |                     |  |              | REV. NO. 03   | DATE : 05.06.2013                             |                  |
|   |  |      |             |                     |  |              | SHEET 13 OF 52  |   |                  |
| Tag No. ....CDV-39... Qty.: ...1 per Unit ... <span style="float: right;">Data Sheet No. PES-145-06-DS1-0</span>  |  |      |             |                     |  |              |   |   |                  |
| <b>DATA SHEET – A &amp; B</b>   |  |      |             |                     |  |              |   |   |                  |
| DATA SHEET – A FOR CONTROL VALVE (WITH PNEUMATIC ACTUATOR)<br>(TO BE FILLED BY PURCHASER)   |  |      |             |                     |  |              |   | DATA SHEET – B<br>(TO BE FILLED UP BY BIDDER) |                  |
| PERFORMANCE OF VALVE  | LINEARITY<br>HYSTERESIS<br>SENSITIVITY<br>ACCURACY (OVERALL)   |      |             |                     | $\pm 1\%$<br>$\pm 1\%$<br>$\pm 0.5\%$<br>$\pm 2\%$ |              | .....<br>.....<br>.....<br>.....  |   |                  |
| SERVICE CONDITION   | SL. No. +  | LOAD | FLOW (T/HR) | INLET PR. KG/CM2(A) | OUTLET PR. KG/CM2(A)                               | TEMP DEG (C) | CALC ULATED CV  | % VLV LIFT                                    | VLV O/L VELOCITY |
|   | 1.   | MIN. | 32.4        | 35.61               | 0.3  | 53.8         |   |   |                  |
|   | 2.   | MAX  | 324         | 35.02               | 0.7  | 53.8         |   |   |                  |
|   |  |      |             |                     |  |              |   |   |                  |
|   |  |      |             |                     |  |              |   |   |                  |
|   |  |      |             |                     |  |              |   |   |                  |
|   | VALVE TYPE   |      |             |                     |  |              | <input type="checkbox"/> CAVITATION <input type="checkbox"/> FLASHING<br><input type="checkbox"/> HIGH DP |   |                  |
|   | MAX SHUT OFF PRESS (KG/CM2g) 43<br>BODY DESIGN : PRESS (KG/CM2g)   TEMP (DEG C) 43/VACUUM   55<br>IBR FORM III-C <input type="checkbox"/> REQUIRED <input type="checkbox"/> NOT REQUIRED |      |             |                     |  |              | .....<br>..... .....<br>.....   |   |                  |
| TOTAL WEIGHT (VALVE + ACTUATOR + ACCESSORIES) Kg  |  |      |             |                     |  |              | .....   |   |                  |
| NOTES:<br>1.        +        DESIGN CV SHALL BE BASED ON SERVICE CONDITIONS INDICATED AT SL. NO. <u>  2  </u> AND SHALL BE CHECKED FOR ALL OTHER CONDITIONS AS PER SPECIFICATION CLAUSE NUMBER 3.1.7. |  |      |             |                     |  |              |   |   |                  |


|  |      |                   |
|--|------|-------------------|
| SPECIFICATION NO.: <b>PE-TS-367-145-I104</b> |      |                   |
| VOLUME                                       | II-B |                   |
| SECTION                                      | D    |                   |
| REV. NO.                                     | 03   | DATE : 05.06.2013 |
| SHEET  | 14   | OF 52             |

Data Sheet No. PES-145-06-DS1-0

## DATA SHEET – A & B

DATA SHEET – B  
(TO BE FILLED UP  
BY BIDDER)

[illegible]

|   |  |      |             |                     |  |              |   |   |                  |
|---|--|------|-------------|---------------------|--|--------------|---|---|------------------|
|    | <b>DATA SHEET FOR CONTROL VALVES<br/>(WITH PNEUMATIC ACTUATOR)</b>   |      |             |                     |  |              | SPECIFICATION NO.: <b>PE-TS-367-145-I104</b>  |   |                  |
|   |  |      |             |                     |  |              | VOLUME II-B   |   |                  |
|   |  |      |             |                     |  |              | SECTION D   |   |                  |
|   |  |      |             |                     |  |              | REV. NO. 03   | DATE : 05.06.2013                             |                  |
|   |  |      |             |                     |  |              | SHEET 15 OF 52  |   |                  |
| Tag No. ....CDV-43... Qty.: ...1 per Unit ... <span style="float: right;">Data Sheet No. PES-145-06-DS1-0</span>  |  |      |             |                     |  |              |   |   |                  |
| <b>DATA SHEET – A &amp; B</b>   |  |      |             |                     |  |              |   |   |                  |
| DATA SHEET – A FOR CONTROL VALVE (WITH PNEUMATIC ACTUATOR)<br>(TO BE FILLED BY PURCHASER)   |  |      |             |                     |  |              |   | DATA SHEET – B<br>(TO BE FILLED UP BY BIDDER) |                  |
| PERFORMANCE OF VALVE  | LINEARITY<br>HYSTERESIS<br>SENSITIVITY<br>ACCURACY (OVERALL)   |      |             |                     | $\pm 1\%$<br>$\pm 1\%$<br>$\pm 0.5\%$<br>$\pm 2\%$ |              | .....<br>.....<br>.....<br>.....  |   |                  |
| SERVICE CONDITION   | SL. No. +  | LOAD | FLOW (T/HR) | INLET PR. KG/CM2(A) | OUTLET PR. KG/CM2(A)                               | TEMP DEG (C) | CALC ULATED CV  | % VLV LIFT                                    | VLV O/L VELOCITY |
|   | 1.   | MIN. | 40          | 37.9                | 4.0  | 53.8         |   |   |                  |
|   | 2.   | MAX  | 400         | 30                  | 5.0  | 53.8         |   |   |                  |
|   |  |      |             |                     |  |              |   |   |                  |
|   |  |      |             |                     |  |              |   |   |                  |
|   |  |      |             |                     |  |              |   |   |                  |
|   | VALVE TYPE   |      |             |                     |  |              | <input type="checkbox"/> CAVITATION <input type="checkbox"/> FLASHING<br><input type="checkbox"/> HIGH DP |   |                  |
|   | MAX SHUT OFF PRESS (KG/CM2g) 43<br>BODY DESIGN : PRESS (KG/CM2g)   TEMP (DEG C) 43   55<br>IBR FORM III-C <input type="checkbox"/> REQUIRED <input checked="" type="checkbox"/> NOT REQUIRED |      |             |                     |  |              | .....<br>..... .....<br>.....   |   |                  |
| TOTAL WEIGHT (VALVE + ACTUATOR + ACCESSORIES) Kg  |  |      |             |                     |  |              | .....   |   |                  |
| NOTES:<br>1.        +        DESIGN CV SHALL BE BASED ON SERVICE CONDITIONS INDICATED AT SL. NO. <u>  2  </u> AND SHALL BE CHECKED FOR ALL OTHER CONDITIONS AS PER SPECIFICATION CLAUSE NUMBER 3.1.7. |  |      |             |                     |  |              |   |   |                  |


|  |      |                   |
|--|------|-------------------|
| SPECIFICATION NO.: <b>PE-TS-367-145-I104</b> |      |                   |
| VOLUME                                       | II-B |                   |
| SECTION                                      | D    |                   |
| REV. NO.                                     | 03   | DATE : 05.06.2013 |
| SHEET  | 16   | OF 52             |

Data Sheet No. PES-145-06-DS1-0


## DATA SHEET – A & B

DATA SHEET – B  
(TO BE FILLED UP  
BY BIDDER)

|                    |  |  |  |
|--------------------|--|--|--|
| GENERAL            | PROJECT<br>SERVICE<br>LOCATION<br>DUTY<br>PIPE SIZE (inlet / outlet)<br>PIPE MATERIAL (inlet / outlet)   | KPCL-BELLARY#3, (1X700MM)<br>CONDENSATE SPRAY TO SD FLASH TANK<br><input checked="" type="checkbox"/> INDOOR <input type="checkbox"/> OUTDOOR<br><input checked="" type="checkbox"/> ON/OFF <input type="checkbox"/> MODULATING<br>33.4 x 4.55   33.4 x 4.55<br>SA 106 GR B   SA 106 GR B  |  |
| BODY               | MODEL NO.<br>TYPE OF BODY: GUIDING : NO. OF PORTS<br>BODY SIZE: PORT SIZE: DESIGN CV<br>END CONNECTION & RATING (ANSI)<br>BODY MATERIAL<br><br>PACKING: MATERIAL SINGLE / DOUBLE<br>BONNET TYPE<br>TRIM FORM<br><br>TRIM MATERIAL: SEAT   PLUG<br>: CAGE   GUIDE BUSH<br><br>FLOW<br>OUTLET VELOCITY<br>REQUIRED LEAKAGE CLASS<br>NOISE LEVEL (dBA) (spec. 3.1.14)<br>VACUUM SERVICE<br>ANTI CAVITATION TRIM | <b>Bidder To Specify</b><br><input checked="" type="checkbox"/> GLOBE <input type="checkbox"/> ANGLE   <input type="checkbox"/> TOP <input checked="" type="checkbox"/> CAGE   ONE<br><b>Bidder To Specify</b><br><input type="checkbox"/> BWE <input checked="" type="checkbox"/> SWE <input type="checkbox"/> FLANGED<br><input type="checkbox"/> A216 WCB <input checked="" type="checkbox"/> A217 WC6 <input type="checkbox"/> SS <input type="checkbox"/> A217 CS<br><input type="checkbox"/> A351 CF8M<br><input type="checkbox"/> PTFE <input checked="" type="checkbox"/> GRAFOIL <input checked="" type="checkbox"/> DOUBLE <input type="checkbox"/> SINGLE<br><input type="checkbox"/> STD <input type="checkbox"/> EXTENDED <input type="checkbox"/> FINNED<br><input type="checkbox"/> LINEAR <input type="checkbox"/> EQ. PERCENTAGE<br><input checked="" type="checkbox"/> QUICK OPEN (ON/OFF)<br>17-4 PH SS   17-4 PH SS<br>17-4 PH SS   17-4 PH SS<br><br><input type="checkbox"/> BELOW SEAT <input type="checkbox"/> ABOVE SEAT<br><input checked="" type="checkbox"/> < 7 M/SEC (WATER)   <input type="checkbox"/> MAC NO. < 1/3(STM)<br><input type="checkbox"/> II <input type="checkbox"/> III <input type="checkbox"/> IV <input checked="" type="checkbox"/> V <input type="checkbox"/> VI<br>LESS THAN 85 dBA<br><input checked="" type="checkbox"/> YES <input type="checkbox"/> NO<br><input checked="" type="checkbox"/> YES <input type="checkbox"/> NO |  |
| PNEUMATIC ACTUATOR | MODEL NO. & SIZE<br>CLOSE AT : OPEN AT (KG/CM2g)<br>TRAVEL TIME FOR<br>OPEN TO CLOSE, CLOSE TO OPEN<br>VALVE POSN. ON SIGNAL AIR FAILURE<br>VALVE POSN. ON SUPPLY AIR FAILURE  | <b>Bidder To Specify</b><br>1.0   0.2<br>< 10 Seconds<br> <br><input checked="" type="checkbox"/> TO OPEN <input type="checkbox"/> STAYPUT <input type="checkbox"/> TO CLOSE<br><input checked="" type="checkbox"/> STAYPUT  |  |
| ACCESSORIES        | POSITIONER ( <b>SMART</b> )<br>AIR FILTER REGULATOR<br>AIR LOCK RELAY<br>POSITION LIMIT SWITCH<br>POSITION TRANSMITTER<br>SOLENOID VALVE<br>E/P CONVERTER<br>JUNCTION BOX<br>HAND WHEEL (SIDE MOUNTED)<br>LOCAL POSITION INDICATOR   | <input type="checkbox"/> REQUIRED <input checked="" type="checkbox"/> NOT REQUIRED<br><input checked="" type="checkbox"/> REQUIRED <input type="checkbox"/> NOT REQUIRED<br><input checked="" type="checkbox"/> REQUIRED <input type="checkbox"/> NOT REQUIRED<br><input checked="" type="checkbox"/> REQUIRED <input type="checkbox"/> NOT REQUIRED<br><input type="checkbox"/> REQUIRED <input checked="" type="checkbox"/> NOT REQUIRED<br><input checked="" type="checkbox"/> REQUIRED <input type="checkbox"/> NOT REQUIRED<br><input type="checkbox"/> REQUIRED <input checked="" type="checkbox"/> NOT REQUIRED<br><input checked="" type="checkbox"/> REQUIRED <input type="checkbox"/> NOT REQUIRED<br><input checked="" type="checkbox"/> REQUIRED <input type="checkbox"/> NOT REQUIRED<br><input type="checkbox"/> REQUIRED <input checked="" type="checkbox"/> NOT REQUIRED   |  |

|  |  |      |             |                     |   |                               |   |   |                  |
|--|--|------|-------------|---------------------|---|-------------------------------|---|---|------------------|
|   | <b>DATA SHEET FOR CONTROL VALVES<br/>(WITH PNEUMATIC ACTUATOR)</b> |      |             |                     |   |                               | SPECIFICATION NO.: <b>PE-TS-367-145-I104</b>  |   |                  |
|  |  |      |             |                     |   |                               | VOLUME II-B   |   |                  |
|  |  |      |             |                     |   |                               | SECTION D   |   |                  |
|  |  |      |             |                     |   |                               | REV. NO. 03   | DATE : 05.06.2013                             |                  |
|  |  |      |             |                     |   |                               | SHEET 17 OF 52  |   |                  |
| Tag No. ....CDV-67... Qty.: ...1 per Unit ... <span style="float: right;">Data Sheet No. PES-145-06-DS1-0</span>   |  |      |             |                     |   |                               |   |   |                  |
| <b>DATA SHEET – A &amp; B</b>  |  |      |             |                     |   |                               |   |   |                  |
| DATA SHEET – A FOR CONTROL VALVE (WITH PNEUMATIC ACTUATOR)<br>(TO BE FILLED BY PURCHASER)  |  |      |             |                     |   |                               |   | DATA SHEET – B<br>(TO BE FILLED UP BY BIDDER) |                  |
| PERFORMANCE OF VALVE   | LINEARITY<br>HYSTERESIS<br>SENSITIVITY<br>ACCURACY (OVERALL)       |      |             |                     | $\pm 5\% \#$<br>$\pm 5\%$<br>$\pm 0.5\%$<br>$\pm 2\%$ |                               | .....<br>.....<br>.....<br>.....  |   |                  |
| SERVICE CONDITION  | SL. No. +  | LOAD | FLOW (T/HR) | INLET PR. KG/CM2(A) | OUTLET PR. KG/CM2(A)                                  | TEMP DEG (C)                  | CALC ULATED CV  | % VLV LIFT                                    | VLV O/L VELOCITY |
|  | 1.   | MAX. | 10          | 34                  | 0.5   | 53.8                          |   |   |                  |
|  |  |      |             |                     |   |                               |   |   |                  |
|  |  |      |             |                     |   |                               |   |   |                  |
|  |  |      |             |                     |   |                               |   |   |                  |
|  |  |      |             |                     |   |                               |   |   |                  |
|  |  |      |             |                     |   |                               |   |   |                  |
|  | VALVE TYPE   |      |             |                     |   |                               | <input type="checkbox"/> CAVITATION <input type="checkbox"/> FLASHING<br><input type="checkbox"/> HIGH DP |   |                  |
| MAX SHUT OFF PRESS (KG/CM2g) 43<br>BODY DESIGN : PRESS (KG/CM2g)   TEMP (DEG C) 43/VACUUM   55<br>IBR FORM III-C <input type="checkbox"/> REQUIRED <input checked="" type="checkbox"/> NOT REQUIRED  |  |      |             |                     |   | .....<br>..... .....<br>..... |   |   |                  |
| TOTAL WEIGHT (VALVE + ACTUATOR + ACCESSORIES) Kg   |  |      |             |                     |   |                               | .....   |   |                  |
| NOTES:<br>1.        +        DESIGN CV SHALL BE BASED ON SERVICE CONDITIONS INDICATED AT SL. NO. <u>  1  </u> AND SHALL BE CHECKED FOR ALL OTHER CONDITIONS AS PER SPECIFICATION CLAUSE NUMBER 3.1.7.<br>2.        #        WITHOUT POSITIONER, LINEARITY SHALL BE $\pm 5\%$ ONLY. |  |      |             |                     |   |                               |   |   |                  |



|   |  |      |             |                     |  |              |  |   |                  |
|---|--|------|-------------|---------------------|--|--------------|--|---|------------------|
|    | <b>DATA SHEET FOR CONTROL VALVES<br/>(WITH PNEUMATIC ACTUATOR)</b>   |      |             |                     |  |              | SPECIFICATION NO.: <b>PE-TS-367-145-I104</b>   |   |                  |
|   |  |      |             |                     |  |              | VOLUME II-B  |   |                  |
|   |  |      |             |                     |  |              | SECTION D  |   |                  |
|   |  |      |             |                     |  |              | REV. NO. 03  | DATE : 05.06.2013                             |                  |
|   |  |      |             |                     |  |              | SHEET 19 OF 52   |   |                  |
| Tag No. ....CDV-72... Qty.: ...1 per Unit ... <span style="float: right;">Data Sheet No. PES-145-06-DS1-0</span>  |  |      |             |                     |  |              |  |   |                  |
| <b>DATA SHEET – A &amp; B</b>   |  |      |             |                     |  |              |  |   |                  |
| DATA SHEET – A FOR CONTROL VALVE (WITH PNEUMATIC ACTUATOR)<br>(TO BE FILLED BY PURCHASER)   |  |      |             |                     |  |              |  | DATA SHEET – B<br>(TO BE FILLED UP BY BIDDER) |                  |
| PERFORMANCE OF VALVE  | LINEARITY<br>HYSTERESIS<br>SENSITIVITY<br>ACCURACY (OVERALL)   |      |             |                     | $\pm 1\%$<br>$\pm 1\%$<br>$\pm 0.5\%$<br>$\pm 2\%$ |              | .....<br>.....<br>.....<br>.....   |   |                  |
| SERVICE CONDITION   | SL. No. +  | LOAD | FLOW (T/HR) | INLET PR. KG/CM2(A) | OUTLET PR. KG/CM2(A)                               | TEMP DEG (C) | CALC ULATED CV   | % VLV LIFT                                    | VLV O/L VELOCITY |
|   | 1.   | MAX. | 4           | 34                  | 3.0  | 53.8         |  |   |                  |
|   |  |      |             |                     |  |              |  |   |                  |
|   |  |      |             |                     |  |              |  |   |                  |
|   |  |      |             |                     |  |              |  |   |                  |
|   |  |      |             |                     |  |              |  |   |                  |
|   | VALVE TYPE   |      |             |                     |  |              | <input type="checkbox"/> CAVITATION <input type="checkbox"/> FLASHING<br><input checked="" type="checkbox"/> HIGH DP |   |                  |
|   | MAX SHUT OFF PRESS (KG/CM2g) 43<br>BODY DESIGN : PRESS (KG/CM2g)   TEMP (DEG C) 43   55<br>IBR FORM III-C <input type="checkbox"/> REQUIRED <input checked="" type="checkbox"/> NOT REQUIRED |      |             |                     |  |              | .....<br>..... .....<br>.....  |   |                  |
| TOTAL WEIGHT (VALVE + ACTUATOR + ACCESSORIES) Kg  |  |      |             |                     |  |              | .....  |   |                  |
| NOTES:<br>1.        +        DESIGN CV SHALL BE BASED ON SERVICE CONDITIONS INDICATED AT SL. NO. __1__ AND SHALL BE CHECKED FOR ALL OTHER CONDITIONS AS PER SPECIFICATION CLAUSE NUMBER 3.1.7.<br>2.        VALVE MATERIAL SHALL BE A217WC6 AND ANTI-CAVITATION TYPE TRIM IN CASE THE VALVE IS SUBJECTED TO CAVITATION FOR THE GIVEN CONDITION. |  |      |             |                     |  |              |  |   |                  |

SPECIFICATION NO.: **PE-TS-367-145-I104**

|        |      |
|--------|------|
| VOLUME | II-B |
|--------|------|

|         |   |
|---------|---|
| SECTION | D |
|---------|---|

REV. NO.

03

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SHEET

---

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OF 52

Tag No. : DRV-2 & DRV-8 Qty.: 2 per Unit (One against each Tag No.) 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)

[illegible]



|   |   |          |             |                     |  |              |  |   |                  |
|---|---|----------|-------------|---------------------|--|--------------|--|---|------------------|
|    | <b>DATA SHEET FOR CONTROL VALVES<br/>(WITH PNEUMATIC ACTUATOR)</b>  |          |             |                     |  |              | SPECIFICATION NO.: <b>PE-TS-367-145-I104</b>   |   |                  |
|   |   |          |             |                     |  |              | VOLUME II-B  |   |                  |
|   |   |          |             |                     |  |              | SECTION D  |   |                  |
|   |   |          |             |                     |  |              | REV. NO. 03  | DATE : 05.06.2013                             |                  |
|   |   |          |             |                     |  |              | SHEET 21 OF 52   |   |                  |
| Tag No. : DRV-2 & DRV-8 Qty.: 2 per Unit (One against each Tag No.) Data Sheet No. PES-145-06-DS1-0   |   |          |             |                     |  |              |  |   |                  |
| <b>DATA SHEET – A &amp; B</b>   |   |          |             |                     |  |              |  |   |                  |
| DATA SHEET – A FOR CONTROL VALVE (WITH PNEUMATIC ACTUATOR)<br>(TO BE FILLED BY PURCHASER)   |   |          |             |                     |  |              |  | DATA SHEET – B<br>(TO BE FILLED UP BY BIDDER) |                  |
| PERFORMANCE OF VALVE  | LINEARITY<br>HYSTERESIS<br>SENSITIVITY<br>ACCURACY (OVERALL)  |          |             |                     | $\pm 1\%$<br>$\pm 1\%$<br>$\pm 0.5\%$<br>$\pm 2\%$ |              | .....<br>.....<br>.....<br>.....   |   |                  |
| SERVICE CONDITION   | SL. No. +   | LOAD     | FLOW (T/HR) | INLET PR. KG/CM2(A) | OUTLET PR. KG/CM2(A)                               | TEMP DEG (C) | CALC ULATED CV   | % VLV LIFT                                    | VLV O/L VELOCITY |
|   | 1.  | 40% MCR  | 43.2        | 24.72               | 9.4  | 177.3        |  |   |                  |
|   | 2.  | 60% MCR  | 77          | 36.53               | 11.5   | 194.6        |  |   |                  |
|   | 3.  | 100% MCR | 171.6       | 59.95               | 22   | 219.7        |  |   |                  |
|   | 4.  | VWO      | 189.5       | 63.99               | 23.5   | 223.3        |  |   |                  |
|   | 5.  | BMCR     | 195.3       | 63.27               | 23   | 222.4        |  |   |                  |
|   | VALVE TYPE  |          |             |                     |  |              | <input type="checkbox"/> CAVITATION <input checked="" type="checkbox"/> FLASHING<br><input type="checkbox"/> HIGH DP |   |                  |
|   | MAX SHUT OFF PRESS (KG/CM2g) 74.6<br>BODY DESIGN : PRESS (KG/CM2g)   TEMP (DEG C) 74.6   240<br>IBR FORM III-C <input type="checkbox"/> REQUIRED <input checked="" type="checkbox"/> NOT REQUIRED |          |             |                     |  |              | .....<br>.....<br>.....  |   |                  |
| TOTAL WEIGHT (VALVE + ACTUATOR + ACCESSORIES) Kg  |   |          |             |                     |  |              | .....  |   |                  |
| NOTES:<br>1. + DESIGN CV SHALL BE BASED ON SERVICE CONDITIONS INDICATED AT SL. NO. <u>4</u> AND SHALL BE CHECKED FOR ALL OTHER CONDITIONS AS PER SPECIFICATION CLAUSE NUMBER 3.1.7. |   |          |             |                     |  |              |  |   |                  |

SPECIFICATION NO.: **PE-TS-367-145-I104**

|        |      |
|--------|------|
| VOLUME | II-B |
|--------|------|

|         |   |
|---------|---|
| SECTION | D |
|---------|---|

REV. NO.

03

DATE : 05.06.2013

SHEET

22

OF 52


Tag No. : DRV-5 & DRV-11 Qty.: 2 per Unit (One against each Tag No.) 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<br>SERVICE<br>LOCATION<br>DUTY<br>PIPE SIZE (inlet / outlet)<br>PIPE MATERIAL (inlet / outlet)   | KPCL-BELLARY#3, (1X700MW)<br>HPH-7A/7B ALT. DRAIN TO HPD F/T<br><input checked="" type="checkbox"/> INDOOR <input type="checkbox"/> OUTDOOR<br><input type="checkbox"/> ON/OFF <input checked="" type="checkbox"/> MODULATING<br>273 x 12.7   323.9 x 12.7<br>SA 106 GR C   SA 106 GR C  |  |
| BODY*              | MODEL NO.<br>TYPE OF BODY: GUIDING : NO. OF PORTS<br>BODY SIZE: PORT SIZE: DESIGN CV<br>END CONNECTION & RATING (ANSI)<br>BODY MATERIAL<br><br>PACKING: MATERIAL SINGLE / DOUBLE<br>BONNET TYPE<br>TRIM FORM<br><br>TRIM MATERIAL: SEAT   PLUG<br>: CAGE   GUIDE BUSH<br><br>FLOW<br>OUTLET VELOCITY<br>REQUIRED LEAKAGE CLASS<br>NOISE LEVEL (dBA) (spec. 3.1.14)<br>VACUUM SERVICE<br>ANTI CAVITATION TRIM | <b>Bidder To Specify</b><br><input checked="" type="checkbox"/> GLOBE <input type="checkbox"/> ANGLE   <input type="checkbox"/> TOP <input checked="" type="checkbox"/> CAGE   ONE<br><b>Bidder To Specify</b><br><input checked="" type="checkbox"/> BWE <input type="checkbox"/> SWE <input type="checkbox"/> FLANGED<br><input type="checkbox"/> A216 WCB <input checked="" type="checkbox"/> A217 WC9 <input type="checkbox"/> SS <input type="checkbox"/> A217 CS<br><input type="checkbox"/> A351 CF8M<br><input type="checkbox"/> PTFE <input checked="" type="checkbox"/> GRAFOIL <input checked="" type="checkbox"/> DOUBLE <input type="checkbox"/> SINGLE<br><input type="checkbox"/> STD <input type="checkbox"/> EXTENDED <input type="checkbox"/> FINNED<br><input checked="" type="checkbox"/> LINEAR <input type="checkbox"/> EQ. PERCENTAGE<br><input type="checkbox"/> QUICK OPEN (ON/OFF)<br>440 C   440 C<br>440 C   440 C<br><br><input type="checkbox"/> BELOW SEAT <input type="checkbox"/> ABOVE SEAT<br><input checked="" type="checkbox"/> < 7 M/SEC (WATER)   <input type="checkbox"/> MAC NO. < 1/3(STM)<br><input type="checkbox"/> II <input type="checkbox"/> III <input type="checkbox"/> IV <input checked="" type="checkbox"/> V <input type="checkbox"/> VI<br>LESS THAN 85 dBA<br><input checked="" type="checkbox"/> YES <input type="checkbox"/> NO<br><input checked="" type="checkbox"/> YES <input type="checkbox"/> NO |  |
| PNEUMATIC ACTUATOR | MODEL NO. & SIZE<br>CLOSE AT : OPEN AT (KG/CM2g)<br>TRAVEL TIME FOR<br>OPEN TO CLOSE, CLOSE TO OPEN<br>VALVE POSN. ON SIGNAL AIR FAILURE<br>VALVE POSN. ON SUPPLY AIR FAILURE  | <b>Bidder To Specify</b><br>1.0   0.2<br>< 10 Seconds<br> <br><input checked="" type="checkbox"/> TO OPEN <input type="checkbox"/> STAYPUT <input type="checkbox"/> TO CLOSE<br><input checked="" type="checkbox"/> STAYPUT  |  |
| ACCESSORIES        | POSITIONER ( <b>SMART</b> )<br>AIR FILTER REGULATOR<br>AIR LOCK RELAY<br>POSITION LIMIT SWITCH<br>POSITION TRANSMITTER<br>SOLENOID VALVE<br>E/P CONVERTER<br>JUNCTION BOX<br>HAND WHEEL (SIDE MOUNTED)<br>LOCAL POSITION INDICATOR   | <input checked="" type="checkbox"/> REQUIRED <input type="checkbox"/> NOT REQUIRED<br><input checked="" type="checkbox"/> REQUIRED <input type="checkbox"/> NOT REQUIRED<br><input checked="" type="checkbox"/> REQUIRED <input type="checkbox"/> NOT REQUIRED<br><input checked="" type="checkbox"/> REQUIRED <input type="checkbox"/> NOT REQUIRED<br>PART OF POSITIONER<br><input checked="" type="checkbox"/> REQUIRED <input type="checkbox"/> NOT REQUIRED<br>PART OF POSITIONER<br><input checked="" type="checkbox"/> REQUIRED <input type="checkbox"/> NOT REQUIRED<br><input checked="" type="checkbox"/> REQUIRED<br><input checked="" type="checkbox"/> REQUIRED   |  |

|   |  |          |             |                     |  |              |   |   |                  |
|---|--|----------|-------------|---------------------|--|--------------|---|---|------------------|
|    | <b>DATA SHEET FOR CONTROL VALVES<br/>(WITH PNEUMATIC ACTUATOR)</b>   |          |             |                     |  |              | SPECIFICATION NO.: <b>PE-TS-367-145-I104</b>  |   |                  |
|   |  |          |             |                     |  |              | VOLUME II-B   |   |                  |
|   |  |          |             |                     |  |              | SECTION D   |   |                  |
|   |  |          |             |                     |  |              | REV. NO. 03   | DATE : 05.06.2013                             |                  |
|   |  |          |             |                     |  |              | SHEET 23 OF 52  |   |                  |
| Tag No. : DRV-5 & DRV-11 Qty.: 2 per Unit (One against each Tag No.) Data Sheet No. PES-145-06-DS1-0  |  |          |             |                     |  |              |   |   |                  |
| <b>DATA SHEET – A &amp; B</b>   |  |          |             |                     |  |              |   |   |                  |
| DATA SHEET – A FOR CONTROL VALVE (WITH PNEUMATIC ACTUATOR)<br>(TO BE FILLED BY PURCHASER)   |  |          |             |                     |  |              |   | DATA SHEET – B<br>(TO BE FILLED UP BY BIDDER) |                  |
| PERFORMANCE OF VALVE  | LINEARITY<br>HYSTERESIS<br>SENSITIVITY<br>ACCURACY (OVERALL)   |          |             |                     | $\pm 1\%$<br>$\pm 1\%$<br>$\pm 0.5\%$<br>$\pm 2\%$ |              | .....<br>.....<br>.....<br>.....  |   |                  |
| SERVICE CONDITION   | SL. No. +  | LOAD     | FLOW (T/HR) | INLET PR. KG/CM2(A) | OUTLET PR. KG/CM2(A)                               | TEMP DEG (C) | CALC ULATED CV  | % VLV LIFT                                    | VLV O/L VELOCITY |
|   | 1.   | 40% MCR  | 43.2        | 25.14               | 0.3  | 220.6        |   |   |                  |
|   | 2.   | 60% MCR  | 77          | 36.91               | 0.3  | 242.6        |   |   |                  |
|   | 3.   | 100% MCR | 171.587     | 60.3                | 0.3  | 273.4        |   |   |                  |
|   | 4.   | VWO      | 189.5       | 64.32               | 0.3  | 277.7        |   |   |                  |
|   | 5.   | BMCR     | 195.3       | 63.61               | 0.5  | 276.9        |   |   |                  |
|   | VALVE TYPE   |          |             |                     |  |              | <input checked="" type="checkbox"/> CAVITATION <input checked="" type="checkbox"/> FLASHING<br><input type="checkbox"/> HIGH DP |   |                  |
|   | MAX SHUT OFF PRESS (KG/CM2g) 74.6<br>BODY DESIGN : PRESS (KG/CM2g)   TEMP (DEG C) 74.6/VACUUM   275<br>IBR FORM III-C <input type="checkbox"/> REQUIRED <input checked="" type="checkbox"/> NOT REQUIRED |          |             |                     |  |              | .....<br>.....<br>.....   |   |                  |
| TOTAL WEIGHT (VALVE + ACTUATOR + ACCESSORIES) Kg  |  |          |             |                     |  |              | .....   |   |                  |
| NOTES:<br>1.        +        DESIGN CV SHALL BE BASED ON SERVICE CONDITIONS INDICATED AT SL. NO. <u>  4  </u> AND SHALL BE CHECKED FOR ALL OTHER CONDITIONS AS PER SPECIFICATION CLAUSE NUMBER 3.1.7. |  |          |             |                     |  |              |   |   |                  |

SPECIFICATION NO.: **PE-TS-367-145-I104**

|        |      |
|--------|------|
| VOLUME | II-B |
|--------|------|

|         |   |
|---------|---|
| SECTION | D |
|---------|---|

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SHEET

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Tag No. : DRV-15 & DRV-22 Qty.: 2 per Unit (One against each Tag No.) 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)

60

|   |   |          |             |                     |  |              |  |   |                  |
|---|---|----------|-------------|---------------------|--|--------------|--|---|------------------|
|    | <b>DATA SHEET FOR CONTROL VALVES<br/>(WITH PNEUMATIC ACTUATOR)</b>  |          |             |                     |  |              | SPECIFICATION NO.: <b>PE-TS-367-145-I104</b>   |   |                  |
|   |   |          |             |                     |  |              | VOLUME II-B  |   |                  |
|   |   |          |             |                     |  |              | SECTION D  |   |                  |
|   |   |          |             |                     |  |              | REV. NO. 03  | DATE : 05.06.2013                             |                  |
|   |   |          |             |                     |  |              | SHEET 25 OF 52   |   |                  |
| Tag No. : DRV-15 & DRV-22 Qty.: 2 per Unit (One against each Tag No.) Data Sheet No. PES-145-06-DS1-0   |   |          |             |                     |  |              |  |   |                  |
| <b>DATA SHEET – A &amp; B</b>   |   |          |             |                     |  |              |  |   |                  |
| DATA SHEET – A FOR CONTROL VALVE (WITH PNEUMATIC ACTUATOR)<br>(TO BE FILLED BY PURCHASER)   |   |          |             |                     |  |              |  | DATA SHEET – B<br>(TO BE FILLED UP BY BIDDER) |                  |
| PERFORMANCE OF VALVE  | LINEARITY<br>HYSTERESIS<br>SENSITIVITY<br>ACCURACY (OVERALL)  |          |             |                     | $\pm 1\%$<br>$\pm 1\%$<br>$\pm 0.5\%$<br>$\pm 2\%$ |              | .....<br>.....<br>.....<br>.....   |   |                  |
| SERVICE CONDITION   | SL. No. +   | LOAD     | FLOW (T/HR) | INLET PR. KG/CM2(A) | OUTLET PR. KG/CM2(A)                               | TEMP DEG (C) | CALC ULATED CV   | % VLV LIFT                                    | VLV O/L VELOCITY |
|   | 1.  | 40% MCR  | 53          | 7.2                 | 6.4  | 160.5        |  |   |                  |
|   | 2.  | 60% MCR  | 94.11       | 11.4                | 7.6  | 174.1        |  |   |                  |
|   | 3.  | 100% MCR | 204.88      | 19.8                | 13.5   | 197.4        |  |   |                  |
|   | 4.  | VWO      | 222.85      | 21.24               | 12.8   | 200.5        |  |   |                  |
|   | 5.  | BMCR     | 233.2       | 20.81               | 13.4   | 199.3        |  |   |                  |
|   | VALVE TYPE  |          |             |                     |  |              | <input type="checkbox"/> CAVITATION <input checked="" type="checkbox"/> FLASHING<br><input type="checkbox"/> HIGH DP |   |                  |
|   | MAX SHUT OFF PRESS (KG/CM2g) 30<br>BODY DESIGN : PRESS (KG/CM2g)   TEMP (DEG C) 30   210<br>IBR FORM III-C <input type="checkbox"/> REQUIRED <input checked="" type="checkbox"/> NOT REQUIRED |          |             |                     |  |              | .....<br>.....<br>.....  |   |                  |
| TOTAL WEIGHT (VALVE + ACTUATOR + ACCESSORIES) Kg  |   |          |             |                     |  |              | .....  |   |                  |
| NOTES:<br>1. + DESIGN CV SHALL BE BASED ON SERVICE CONDITIONS INDICATED AT SL. NO. <u>4</u> AND SHALL BE CHECKED FOR ALL OTHER CONDITIONS AS PER SPECIFICATION CLAUSE NUMBER 3.1.7. |   |          |             |                     |  |              |  |   |                  |

SPECIFICATION NO.: PE-TS-367-145-I104

|        |      |
|--------|------|
| VOLUME | II-B |
|--------|------|

|         |   |
|---------|---|
| SECTION | D |
|---------|---|

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SHEET

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Tag No. : DRV-18 & DRV-25 Qty.: 2 per Unit (One against each Tag No.) 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<br>SERVICE<br>LOCATION<br>DUTY<br>PIPE SIZE (inlet / outlet)<br>PIPE MATERIAL (inlet / outlet)   | KPCL-BELLARY#3, (1X700MW)<br>HPH-6A/6B ALT. DRAIN TO HPD F/T<br><input checked="" type="checkbox"/> INDOOR <input type="checkbox"/> OUTDOOR<br><input type="checkbox"/> ON/OFF <input checked="" type="checkbox"/> MODULATING<br>273 x 6.35   323.9 x 9.53<br>SA 106 GR B   SA 106 GR B  |  |
| BODY               | MODEL NO.<br>TYPE OF BODY: GUIDING : NO. OF PORTS<br>BODY SIZE: PORT SIZE: DESIGN CV<br>END CONNECTION & RATING (ANSI)<br>BODY MATERIAL<br><br>PACKING: MATERIAL SINGLE / DOUBLE<br>BONNET TYPE<br>TRIM FORM<br><br>TRIM MATERIAL: SEAT   PLUG<br>: CAGE   GUIDE BUSH<br><br>FLOW<br>OUTLET VELOCITY<br>REQUIRED LEAKAGE CLASS<br>NOISE LEVEL (dBA) (spec. 3.1.14)<br>VACUUM SERVICE<br>ANTI CAVITATION TRIM | <b>Bidder To Specify</b><br><input checked="" type="checkbox"/> GLOBE <input type="checkbox"/> ANGLE   <input type="checkbox"/> TOP <input checked="" type="checkbox"/> CAGE   ONE<br><b>Bidder To Specify</b><br><input checked="" type="checkbox"/> BWE <input type="checkbox"/> SWE <input type="checkbox"/> FLANGED<br><input type="checkbox"/> A216 WCB <input checked="" type="checkbox"/> A217 WC9 <input type="checkbox"/> SS <input type="checkbox"/> A217 CS<br><input type="checkbox"/> A351 CF8M<br><input type="checkbox"/> PTFE <input checked="" type="checkbox"/> GRAFOIL <input checked="" type="checkbox"/> DOUBLE <input type="checkbox"/> SINGLE<br><input type="checkbox"/> STD <input type="checkbox"/> EXTENDED <input type="checkbox"/> FINNED<br><input checked="" type="checkbox"/> LINEAR <input type="checkbox"/> EQ. PERCENTAGE<br><input type="checkbox"/> QUICK OPEN (ON/OFF)<br>440 C   440 C<br>440 C   440 C<br><br><input type="checkbox"/> BELOW SEAT <input type="checkbox"/> ABOVE SEAT<br><input checked="" type="checkbox"/> < 7 M/SEC (WATER)   <input type="checkbox"/> MAC NO. < 1/3(STM)<br><input type="checkbox"/> II <input type="checkbox"/> III <input type="checkbox"/> IV <input checked="" type="checkbox"/> V <input type="checkbox"/> VI<br>LESS THAN 85 dBA<br><input checked="" type="checkbox"/> YES <input type="checkbox"/> NO<br><input checked="" type="checkbox"/> YES <input type="checkbox"/> NO |  |
| PNEUMATIC ACTUATOR | MODEL NO. & SIZE<br>CLOSE AT : OPEN AT (KG/CM2g)<br>TRAVEL TIME FOR<br>OPEN TO CLOSE, CLOSE TO OPEN<br>VALVE POSN. ON SIGNAL AIR FAILURE<br>VALVE POSN. ON SUPPLY AIR FAILURE  | <b>Bidder To Specify</b><br>1.0   0.2<br>< 10 Seconds<br> <br><input checked="" type="checkbox"/> TO OPEN <input type="checkbox"/> STAYPUT <input type="checkbox"/> TO CLOSE<br><input checked="" type="checkbox"/> STAYPUT  |  |
| ACCESSORIES        | POSITIONER ( <b>SMART</b> )<br>AIR FILTER REGULATOR<br>AIR LOCK RELAY<br>POSITION LIMIT SWITCH<br>POSITION TRANSMITTER<br>SOLENOID VALVE<br>E/P CONVERTER<br>JUNCTION BOX<br>HAND WHEEL (SIDE MOUNTED)<br>LOCAL POSITION INDICATOR   | <input checked="" type="checkbox"/> REQUIRED <input type="checkbox"/> NOT REQUIRED<br><input checked="" type="checkbox"/> REQUIRED <input type="checkbox"/> NOT REQUIRED<br><input checked="" type="checkbox"/> REQUIRED <input type="checkbox"/> NOT REQUIRED<br><input checked="" type="checkbox"/> REQUIRED <input type="checkbox"/> NOT REQUIRED<br>PART OF POSITIONER<br><input checked="" type="checkbox"/> REQUIRED <input type="checkbox"/> NOT REQUIRED<br>PART OF POSITIONER<br><input checked="" type="checkbox"/> REQUIRED <input type="checkbox"/> NOT REQUIRED<br><input checked="" type="checkbox"/> REQUIRED<br><input checked="" type="checkbox"/> REQUIRED   |  |

|   |  |          |             |                     |  |              |   |   |                  |
|---|--|----------|-------------|---------------------|--|--------------|---|---|------------------|
|    | <b>DATA SHEET FOR CONTROL VALVES<br/>(WITH PNEUMATIC ACTUATOR)</b>   |          |             |                     |  |              | SPECIFICATION NO.: <b>PE-TS-367-145-I104</b>  |   |                  |
|   |  |          |             |                     |  |              | VOLUME II-B   |   |                  |
|   |  |          |             |                     |  |              | SECTION D   |   |                  |
|   |  |          |             |                     |  |              | REV. NO. 03   | DATE : 05.06.2013                             |                  |
|   |  |          |             |                     |  |              | SHEET 27 OF 52  |   |                  |
| Tag No. : DRV-18 & DRV-25 Qty.: 2 per Unit (One against each Tag No.) Data Sheet No. PES-145-06-DS1-0   |  |          |             |                     |  |              |   |   |                  |
| <b>DATA SHEET – A &amp; B</b>   |  |          |             |                     |  |              |   |   |                  |
| DATA SHEET – A FOR CONTROL VALVE (WITH PNEUMATIC ACTUATOR)<br>(TO BE FILLED BY PURCHASER)   |  |          |             |                     |  |              |   | DATA SHEET – B<br>(TO BE FILLED UP BY BIDDER) |                  |
| PERFORMANCE OF VALVE  | LINEARITY<br>HYSTERESIS<br>SENSITIVITY<br>ACCURACY (OVERALL)   |          |             |                     | $\pm 1\%$<br>$\pm 1\%$<br>$\pm 0.5\%$<br>$\pm 2\%$ |              | .....<br>.....<br>.....<br>.....  |   |                  |
| SERVICE CONDITION   | SL. No. +  | LOAD     | FLOW (T/HR) | INLET PR. KG/CM2(A) | OUTLET PR. KG/CM2(A)                               | TEMP DEG (C) | CALC ULATED CV  | % VLV LIFT                                    | VLV O/L VELOCITY |
|   | 1.   | 40% MCR  | 53          | 9.5                 | 0.3  | 174          |   |   |                  |
|   | 2.   | 60% MCR  | 94.11       | 13.6                | 0.3  | 190.9        |   |   |                  |
|   | 3.   | 100% MCR | 204.88      | 21.8                | 0.3  | 214.9        |   |   |                  |
|   | 4.   | VWO      | 222.86      | 23.4                | 0.3  | 218.3        |   |   |                  |
|   | 5.   | BMCR     | 233.2       | 23                  | 0.5  | 217.3        |   |   |                  |
|   | VALVE TYPE   |          |             |                     |  |              | <input checked="" type="checkbox"/> CAVITATION <input checked="" type="checkbox"/> FLASHING<br><input type="checkbox"/> HIGH DP |   |                  |
|   | MAX SHUT OFF PRESS (KG/CM2g) 30<br>BODY DESIGN : PRESS (KG/CM2g)   TEMP (DEG C) 30/VACUUM   230<br>IBR FORM III-C <input type="checkbox"/> REQUIRED <input checked="" type="checkbox"/> NOT REQUIRED |          |             |                     |  |              | .....<br>.....<br>.....   |   |                  |
| TOTAL WEIGHT (VALVE + ACTUATOR + ACCESSORIES) Kg  |  |          |             |                     |  |              | .....   |   |                  |
| NOTES:<br>1.        +        DESIGN CV SHALL BE BASED ON SERVICE CONDITIONS INDICATED AT SL. NO. <u>4</u> AND SHALL BE CHECKED FOR ALL OTHER CONDITIONS AS PER SPECIFICATION CLAUSE NUMBER 3.1.7. |  |          |             |                     |  |              |   |   |                  |

|  |      |                   |
|--|------|-------------------|
| SPECIFICATION NO.: <b>PE-TS-367-145-I104</b> |      |                   |
| VOLUME                                       | II-B |                   |
| SECTION                                      | D    |                   |
| REV. NO.                                     | 03   | DATE : 05.06.2013 |
| SHEET  | 28   | OF 52             |

Data Sheet No. PES-145-06-DS1-0

## DATA SHEET – A & B

DATA SHEET – B  
(TO BE FILLED UP  
BY BIDDER)

[illegible]



|   |  |           |             |                     |  |              |  |   |                  |
|---|--|-----------|-------------|---------------------|--|--------------|--|---|------------------|
|   | <b>DATA SHEET FOR CONTROL VALVES<br/>(WITH PNEUMATIC ACTUATOR)</b>   |           |             |                     |  |              | SPECIFICATION NO.: <b>PE-TS-367-145-I104</b>   |   |                  |
|   |  |           |             |                     |  |              | VOLUME II-B  |   |                  |
|   |  |           |             |                     |  |              | SECTION D  |   |                  |
|   |  |           |             |                     |  |              | REV. NO. 03  | DATE : 05.06.2013                             |                  |
|   |  |           |             |                     |  |              | SHEET 29 OF 52   |   |                  |
| Tag No. ....DRV-28... Qty.: ...1 per Unit ... <span style="float: right;">Data Sheet No. PES-145-06-DS1-0</span>  |  |           |             |                     |  |              |  |   |                  |
| <b>DATA SHEET – A &amp; B</b>   |  |           |             |                     |  |              |  |   |                  |
| DATA SHEET – A FOR CONTROL VALVE (WITH PNEUMATIC ACTUATOR)<br>(TO BE FILLED BY PURCHASER)   |  |           |             |                     |  |              |  | DATA SHEET – B<br>(TO BE FILLED UP BY BIDDER) |                  |
| PERFORMANCE OF VALVE  | LINEARITY<br>HYSTERESIS<br>SENSITIVITY<br>ACCURACY (OVERALL)   |           |             |                     | $\pm 1\%$<br>$\pm 1\%$<br>$\pm 0.5\%$<br>$\pm 2\%$ |              | .....<br>.....<br>.....<br>.....   |   |                  |
| SERVICE CONDITION   | SL. No. +  | LOAD      | FLOW (T/HR) | INLET PR. KG/CM2(A) | OUTLET PR. KG/CM2(A)                               | TEMP DEG (C) | CALC ULATED CV   | % VLV LIFT                                    | VLV O/L VELOCITY |
|   | 1.   | 40% MCR   | 50.1        | 0.7                 | 0.5  | 79.4         |  |   |                  |
|   | 2.   | 60% MCR   | 80.2        | 1.1                 | 0.8  | 88.5         |  |   |                  |
|   | 3.   | 100% MCR  | 153.5       | 1.83                | 1.2  | 100.7        |  |   |                  |
|   | 4.   | VWO       | 167.3       | 1.9                 | 1.3  | 102.4        |  |   |                  |
|   | 5.   | LPH-1 OUT | 174         | 1.6                 | 1.2  | 92.2         |  |   |                  |
|   | VALVE TYPE   |           |             |                     |  |              | <input type="checkbox"/> CAVITATION <input checked="" type="checkbox"/> FLASHING<br><input type="checkbox"/> HIGH DP |   |                  |
|   | MAX SHUT OFF PRESS (KG/CM2g) 7<br>BODY DESIGN : PRESS (KG/CM2g)   TEMP (DEG C) 7/VACUUM   110<br>IBR FORM III-C <input type="checkbox"/> REQUIRED <input checked="" type="checkbox"/> NOT REQUIRED |           |             |                     |  |              | .....<br>.....<br>.....  |   |                  |
| TOTAL WEIGHT (VALVE + ACTUATOR + ACCESSORIES) Kg  |  |           |             |                     |  |              | .....  |   |                  |
| NOTES:<br>1.            +            DESIGN CV SHALL BE BASED ON SERVICE CONDITIONS INDICATED AT SL. NO. <u>  4  </u> AND SHALL BE CHECKED FOR ALL OTHER CONDITIONS AS PER SPECIFICATION CLAUSE NUMBER 3.1.7. |  |           |             |                     |  |              |  |   |                  |


|  |      |                   |
|--|------|-------------------|
| SPECIFICATION NO.: <b>PE-TS-367-145-I104</b> |      |                   |
| VOLUME                                       | II-B |                   |
| SECTION                                      | D    |                   |
| REV. NO.                                     | 03   | DATE : 05.06.2013 |
| SHEET  | 30   | OF 52             |

Data Sheet No. PES-145-06-DS1-0

## DATA SHEET – A & B

DATA SHEET – B  
(TO BE FILLED UP  
BY BIDDER)

|                    |  |  |  |
|--------------------|--|--|--|
| GENERAL            | PROJECT<br>SERVICE<br>LOCATION<br>DUTY<br>PIPE SIZE (inlet / outlet)<br>PIPE MATERIAL (inlet / outlet)   | KPCL-BELLARY#3, (1X700MM)<br>LPH-3 ALT. DRAIN TO LP DRAIN F/T<br><input checked="" type="checkbox"/> INDOOR <input type="checkbox"/> OUTDOOR<br><input type="checkbox"/> ON/OFF <input checked="" type="checkbox"/> MODULATING<br>273 x 6.35   323.9 x 9.53<br>SA 106 GR B   SA 106 GR B   |  |
| BODY               | MODEL NO.<br>TYPE OF BODY: GUIDING : NO. OF PORTS<br>BODY SIZE: PORT SIZE: DESIGN CV<br>END CONNECTION & RATING (ANSI)<br>BODY MATERIAL<br><br>PACKING: MATERIAL SINGLE / DOUBLE<br>BONNET TYPE<br>TRIM FORM<br><br>TRIM MATERIAL: SEAT   PLUG<br>: CAGE   GUIDE BUSH<br><br>FLOW<br>OUTLET VELOCITY<br>REQUIRED LEAKAGE CLASS<br>NOISE LEVEL (dBA) (spec. 3.1.14)<br>VACUUM SERVICE<br>ANTI CAVITATION TRIM | <b>Bidder To Specify</b><br><input checked="" type="checkbox"/> GLOBE <input type="checkbox"/> ANGLE   <input type="checkbox"/> TOP <input checked="" type="checkbox"/> CAGE   ONE<br><b>Bidder To Specify</b><br><input checked="" type="checkbox"/> BWE <input type="checkbox"/> SWE <input type="checkbox"/> FLANGED<br><input type="checkbox"/> A216 WCB <input checked="" type="checkbox"/> A217 WC9 <input type="checkbox"/> SS <input type="checkbox"/> A217 CS<br><input type="checkbox"/> A351 CF8M<br><input type="checkbox"/> PTFE <input checked="" type="checkbox"/> GRAFOIL <input checked="" type="checkbox"/> DOUBLE <input type="checkbox"/> SINGLE<br><input type="checkbox"/> STD <input type="checkbox"/> EXTENDED <input type="checkbox"/> FINNED<br><input checked="" type="checkbox"/> LINEAR <input type="checkbox"/> EQ. PERCENTAGE<br><input type="checkbox"/> QUICK OPEN (ON/OFF)<br>440 C   440 C<br>440 C   440 C<br><br><input type="checkbox"/> BELOW SEAT <input type="checkbox"/> ABOVE SEAT<br><input checked="" type="checkbox"/> < 7 M/SEC (WATER)   <input type="checkbox"/> MAC NO. < 1/3(STM)<br><input type="checkbox"/> II <input type="checkbox"/> III <input type="checkbox"/> IV <input checked="" type="checkbox"/> V <input type="checkbox"/> VI<br>LESS THAN 85 dBA<br><input checked="" type="checkbox"/> YES <input type="checkbox"/> NO<br><input checked="" type="checkbox"/> YES <input type="checkbox"/> NO |  |
| PNEUMATIC ACTUATOR | MODEL NO. & SIZE<br>CLOSE AT : OPEN AT (KG/CM2g)<br>TRAVEL TIME FOR<br>OPEN TO CLOSE, CLOSE TO OPEN<br>VALVE POSN. ON SIGNAL AIR FAILURE<br>VALVE POSN. ON SUPPLY AIR FAILURE  | <b>Bidder To Specify</b><br>1.0   0.2<br>< 10 Seconds<br> <br><input checked="" type="checkbox"/> TO OPEN <input type="checkbox"/> STAYPUT <input type="checkbox"/> TO CLOSE<br><input checked="" type="checkbox"/> STAYPUT  |  |
| ACCESSORIES        | POSITIONER ( <b>SMART</b> )<br>AIR FILTER REGULATOR<br>AIR LOCK RELAY<br>POSITION LIMIT SWITCH<br>POSITION TRANSMITTER<br>SOLENOID VALVE<br>E/P CONVERTER<br>JUNCTION BOX<br>HAND WHEEL (SIDE MOUNTED)<br>LOCAL POSITION INDICATOR   | <input checked="" type="checkbox"/> REQUIRED <input type="checkbox"/> NOT REQUIRED<br><input checked="" type="checkbox"/> REQUIRED <input type="checkbox"/> NOT REQUIRED<br><input checked="" type="checkbox"/> REQUIRED <input type="checkbox"/> NOT REQUIRED<br><input checked="" type="checkbox"/> REQUIRED <input type="checkbox"/> NOT REQUIRED<br>PART OF POSITIONER<br><input checked="" type="checkbox"/> REQUIRED <input type="checkbox"/> NOT REQUIRED<br>PART OF POSITIONER<br><input checked="" type="checkbox"/> REQUIRED <input type="checkbox"/> NOT REQUIRED<br><input checked="" type="checkbox"/> REQUIRED<br><input checked="" type="checkbox"/> REQUIRED   |  |

|   |  |           |             |                     |  |              |   |   |                  |
|---|--|-----------|-------------|---------------------|--|--------------|---|---|------------------|
|    | <b>DATA SHEET FOR CONTROL VALVES<br/>(WITH PNEUMATIC ACTUATOR)</b>   |           |             |                     |  |              | SPECIFICATION NO.: <b>PE-TS-367-145-I104</b>  |   |                  |
|   |  |           |             |                     |  |              | VOLUME II-B   |   |                  |
|   |  |           |             |                     |  |              | SECTION D   |   |                  |
|   |  |           |             |                     |  |              | REV. NO. 03   | DATE : 05.06.2013                             |                  |
|   |  |           |             |                     |  |              | SHEET 31 OF 52  |   |                  |
| Tag No. ....DRV-31... Qty.: ...1 per Unit ... <span style="float: right;">Data Sheet No. PES-145-06-DS1-0</span>  |  |           |             |                     |  |              |   |   |                  |
| <b>DATA SHEET – A &amp; B</b>   |  |           |             |                     |  |              |   |   |                  |
| DATA SHEET – A FOR CONTROL VALVE (WITH PNEUMATIC ACTUATOR)<br>(TO BE FILLED BY PURCHASER)   |  |           |             |                     |  |              |   | DATA SHEET – B<br>(TO BE FILLED UP BY BIDDER) |                  |
| PERFORMANCE OF VALVE  | LINEARITY<br>HYSTERESIS<br>SENSITIVITY<br>ACCURACY (OVERALL)   |           |             |                     | $\pm 1\%$<br>$\pm 1\%$<br>$\pm 0.5\%$<br>$\pm 2\%$ |              | .....<br>.....<br>.....<br>.....  |   |                  |
| SERVICE CONDITION   | SL. No. +  | LOAD      | FLOW (T/HR) | INLET PR. KG/CM2(A) | OUTLET PR. KG/CM2(A)                               | TEMP DEG (C) | CALC ULATED CV  | % VLV LIFT                                    | VLV O/L VELOCITY |
|   | 1.   | 40% MCR   | 50.1        | 1.5                 | 0.3  | 96.4         |   |   |                  |
|   | 2.   | 60% MCR   | 80.2        | 1.95                | 0.3  | 107.2        |   |   |                  |
|   | 3.   | 100% MCR  | 153.5       | 2.7                 | 0.3  | 120.7        |   |   |                  |
|   | 4.   | VWO       | 167.3       | 2.8                 | 0.3  | 122.6        |   |   |                  |
|   | 5.   | LPH-2 OUT | 209         | 2.24                | 0.5  | 113.1        |   |   |                  |
|   | VALVE TYPE   |           |             |                     |  |              | <input checked="" type="checkbox"/> CAVITATION <input checked="" type="checkbox"/> FLASHING<br><input type="checkbox"/> HIGH DP |   |                  |
|   | MAX SHUT OFF PRESS (KG/CM2g) 7<br>BODY DESIGN : PRESS (KG/CM2g)   TEMP (DEG C) 7/VACUUM   130<br>IBR FORM III-C <input type="checkbox"/> REQUIRED <input checked="" type="checkbox"/> NOT REQUIRED |           |             |                     |  |              | .....<br>.....<br>.....   |   |                  |
| TOTAL WEIGHT (VALVE + ACTUATOR + ACCESSORIES) Kg  |  |           |             |                     |  |              | .....   |   |                  |
| NOTES:<br>1.        +        DESIGN CV SHALL BE BASED ON SERVICE CONDITIONS INDICATED AT SL. NO. <u>  4  </u> AND SHALL BE CHECKED FOR ALL OTHER CONDITIONS AS PER SPECIFICATION CLAUSE NUMBER 3.1.7. |  |           |             |                     |  |              |   |   |                  |

|  |      |                   |
|--|------|-------------------|
| SPECIFICATION NO.: <b>PE-TS-367-145-I104</b> |      |                   |
| VOLUME                                       | II-B |                   |
| SECTION                                      | D    |                   |
| REV. NO.                                     | 03   | DATE : 05.06.2013 |
| SHEET  | 32   | OF 52             |

Data Sheet No. PES-145-06-DS1-0

## DATA SHEET – A & B

DATA SHEET – B  
(TO BE FILLED UP  
BY BIDDER)

[illegible]

|  |      |                   |
|--|------|-------------------|
| SPECIFICATION NO.: <b>PE-TS-367-145-I104</b> |      |                   |
| VOLUME                                       | II-B |                   |
| SECTION                                      | D    |                   |
| REV. NO.                                     | 03   | DATE : 05.06.2013 |
| SHEET  | 33   | OF 52             |

Data Sheet No. PES-145-06-DS1-0

**DATA SHEET – A FOR CONTROL VALVE (WITH PNEUMATIC ACTUATOR)**  
**(TO BE FILLED BY PURCHASER)**

DATA SHEET – B  
(TO BE FILLED UP BY  
BIDDER)

|                    |             |
|--------------------|-------------|
| LINEARITY          | $\pm 1\%$   |
| HYSTERESIS         | $\pm 1\%$   |
| SENSITIVITY        | $\pm 0.5\%$ |
| ACCURACY (OVERALL) | $\pm 2\%$   |

| SL. No. +   | LOAD        | FLOW (T/HR) | INLET PR. KG/CM2(A) | OUTLET PR. KG/CM2(A) | TEMP DEG (C) | CALC ULATED CV  | % VLV LIFT | VLV O/L VELOCITY |
|---|-------------|-------------|---------------------|----------------------|--------------|---|------------|------------------|
| 1.  | 40% MCR     | 70.4        | 0.45                | 0.3                  | 58.4         |   |            |                  |
| 2.  | 60% MCR     | 113.47      | 0.63                | 0.4                  | 65.6         |   |            |                  |
| 3.  | 100% MCR    | 217.5       | 1.0                 | 0.6                  | 75.5         |   |            |                  |
| 4.  | VWO         | 236.8       | 1.05                | 0.6                  | 76.9         |   |            |                  |
| 5.  | ALL HPH OUT | 241.2       | 1.1                 | 0.5                  | 77.9         |   |            |                  |
| VALVE TYPE  |             |             |                     |                      |              | <input type="checkbox"/> CAVITATION <input type="checkbox"/> FLASHING<br><input type="checkbox"/> HIGH DP |            |                  |
| MAX SHUT OFF PRESS ( KG/CM2g) 7<br>BODY DESIGN : PRESS (KG/CM2g)   TEMP (DEG C) 7/VACUUM   85<br>IBR FORM III-C <input type="checkbox"/> REQUIRED <input type="checkbox"/> NOT REQUIRED |             |             |                     |                      |              | .....<br>..... .  |            |                  |

TOTAL WEIGHT (VALVE + ACTUATOR + ACCESSORIES) Kg

1. + DESIGN CV SHALL BE BASED ON SERVICE CONDITIONS INDICATED AT SL. NO. 4 AND SHALL BE CHECKED FOR ALL OTHER CONDITIONS AS PER SPECIFICATION CLAUSE NUMBER 3.1.7.

|  |      |                   |
|--|------|-------------------|
| SPECIFICATION NO.: <b>PE-TS-367-145-I104</b> |      |                   |
| VOLUME                                       | II-B |                   |
| SECTION                                      | D    |                   |
| REV. NO.                                     | 03   | DATE : 05.06.2013 |
| SHEET  | 34   | OF 52             |

Data Sheet No. PES-145-06-DS1-0

## DATA SHEET – A & B

DATA SHEET – B  
(TO BE FILLED UP  
BY BIDDER)

[illegible]

|  |  |           |             |                     |  |              |   |   |                  |
|--|--|-----------|-------------|---------------------|--|--------------|---|---|------------------|
|  | <b>DATA SHEET FOR CONTROL VALVES<br/>(WITH PNEUMATIC ACTUATOR)</b>   |           |             |                     |  |              | SPECIFICATION NO.: <b>PE-TS-367-145-I104</b>  |   |                  |
|  |  |           |             |                     |  |              | VOLUME II-B   |   |                  |
|  |  |           |             |                     |  |              | SECTION D   |   |                  |
|  |  |           |             |                     |  |              | REV. NO. 03   | DATE : 05.06.2013                             |                  |
|  |  |           |             |                     |  |              | SHEET 35 OF 52  |   |                  |
| Tag No. ....DRV-37... Qty.: ...1 per Unit ... <span style="float: right;">Data Sheet No. PES-145-06-DS1-0</span>   |  |           |             |                     |  |              |   |   |                  |
| <b>DATA SHEET – A &amp; B</b>  |  |           |             |                     |  |              |   |   |                  |
| DATA SHEET – A FOR CONTROL VALVE (WITH PNEUMATIC ACTUATOR)<br>(TO BE FILLED BY PURCHASER)  |  |           |             |                     |  |              |   | DATA SHEET – B<br>(TO BE FILLED UP BY BIDDER) |                  |
| PERFORMANCE OF VALVE   | LINEARITY<br>HYSTERESIS<br>SENSITIVITY<br>ACCURACY (OVERALL)   |           |             |                     | $\pm 1\%$<br>$\pm 1\%$<br>$\pm 0.5\%$<br>$\pm 2\%$ |              | .....<br>.....<br>.....<br>.....  |   |                  |
| SERVICE CONDITION  | SL. No. +  | LOAD      | FLOW (T/HR) | INLET PR. KG/CM2(A) | OUTLET PR. KG/CM2(A)                               | TEMP DEG (C) | CALC ULATED CV  | % VLV LIFT                                    | VLV O/L VELOCITY |
|  | 1.   | 40% MCR   | 70.4        | 1.08                | 0.3  | 78           |   |   |                  |
|  | 2.   | 60% MCR   | 113.5       | 1.26                | 0.3  | 86.8         |   |   |                  |
|  | 3.   | 100% MCR  | 217.5       | 1.61                | 0.3  | 98.7         |   |   |                  |
|  | 4.   | VWO       | 236.8       | 1.67                | 0.3  | 100.4        |   |   |                  |
|  | 5.   | LPH-1 OUT | 270         | 1.37                | 0.5  | 90.9         |   |   |                  |
|  | VALVE TYPE   |           |             |                     |  |              | <input checked="" type="checkbox"/> CAVITATION <input checked="" type="checkbox"/> FLASHING<br><input type="checkbox"/> HIGH DP |   |                  |
|  | MAX SHUT OFF PRESS (KG/CM2g) 7<br>BODY DESIGN : PRESS (KG/CM2g)   TEMP (DEG C) 7/VACUUM   105<br>IBR FORM III-C <input type="checkbox"/> REQUIRED <input checked="" type="checkbox"/> NOT REQUIRED |           |             |                     |  |              | .....<br>.....<br>.....   |   |                  |
| TOTAL WEIGHT (VALVE + ACTUATOR + ACCESSORIES) Kg   |  |           |             |                     |  |              | .....   |   |                  |
| NOTES:<br><br>1.            +            DESIGN CV SHALL BE BASED ON SERVICE CONDITIONS INDICATED AT SL. NO. ____4____ AND SHALL BE CHECKED FOR ALL OTHER CONDITIONS AS PER SPECIFICATION CLAUSE NUMBER 3.1.7. |  |           |             |                     |  |              |   |   |                  |

|  |      |                   |
|--|------|-------------------|
| SPECIFICATION NO.: <b>PE-TS-367-145-I104</b> |      |                   |
| VOLUME                                       | II-B |                   |
| SECTION                                      | D    |                   |
| REV. NO.                                     | 03   | DATE : 05.06.2013 |
| SHEET  | 36   | OF 52             |


Data Sheet No. PES-145-06-DS1-0

## DATA SHEET – A & B

DATA SHEET – B  
(TO BE FILLED UP  
BY BIDDER)

[illegible]



|   |  |                    |             |                     |   |              |  |   |                  |
|---|--|--------------------|-------------|---------------------|---|--------------|--|---|------------------|
|    | <b>DATA SHEET FOR CONTROL VALVES<br/>(WITH PNEUMATIC ACTUATOR)</b>   |                    |             |                     |   |              | SPECIFICATION NO.: <b>PE-TS-367-145-I104</b>   |   |                  |
|   |  |                    |             |                     |   |              | VOLUME II-B  |   |                  |
|   |  |                    |             |                     |   |              | SECTION D  |   |                  |
|   |  |                    |             |                     |   |              | REV. NO. 03  | DATE : 05.06.2013                             |                  |
|   |  |                    |             |                     |   |              | SHEET 37 OF 52   |   |                  |
| Tag No. ....DRV-48... Qty.: ...1 per Unit ... <span style="float: right;">Data Sheet No. PES-145-06-DS1-0</span>  |  |                    |             |                     |   |              |  |   |                  |
| <b>DATA SHEET – A &amp; B</b>   |  |                    |             |                     |   |              |  |   |                  |
| DATA SHEET – A FOR CONTROL VALVE (WITH PNEUMATIC ACTUATOR)<br>(TO BE FILLED BY PURCHASER)   |  |                    |             |                     |   |              |  | DATA SHEET – B<br>(TO BE FILLED UP BY BIDDER) |                  |
| PERFORMANCE OF VALVE  | LINEARITY<br>HYSTERESIS<br>SENSITIVITY<br>ACCURACY (OVERALL)   |                    |             |                     | $\pm 5\% \#$<br>$\pm 5\%$<br>$\pm 0.5\%$<br>$\pm 2\%$ |              | .....<br>.....<br>.....<br>.....   |   |                  |
| SERVICE CONDITION   | SL. No. +  | LOAD               | FLOW (T/HR) | INLET PR. KG/CM2(A) | OUTLET PR. KG/CM2(A)                                  | TEMP DEG (C) | CALC ULATED CV   | % VLV LIFT                                    | VLV O/L VELOCITY |
|   | 1.   | MAX.-1<br>10% BMCR | 231         | 14.7                | 0.3   | 189.5        |  |   |                  |
|   | 2.   | MAX.-2<br>10% BMCR | 231         | 5.7                 | 0.5   | 138.2        |  |   |                  |
|   |  |                    |             |                     |   |              |  |   |                  |
|   |  |                    |             |                     |   |              |  |   |                  |
|   |  |                    |             |                     |   |              |  |   |                  |
|   | VALVE TYPE   |                    |             |                     |   |              | <input type="checkbox"/> CAVITATION <input checked="" type="checkbox"/> FLASHING<br><input type="checkbox"/> HIGH DP |   |                  |
|   | MAX SHUT OFF PRESS (KG/CM2g) 20<br>BODY DESIGN : PRESS (KG/CM2g)   TEMP (DEG C) 20/VACUUM   200<br>IBR FORM III-C <input type="checkbox"/> REQUIRED <input checked="" type="checkbox"/> NOT REQUIRED |                    |             |                     |   |              | .....<br>.....<br>.....  |   |                  |
| TOTAL WEIGHT (VALVE + ACTUATOR + ACCESSORIES) Kg  |  |                    |             |                     |   |              | .....  |   |                  |
| NOTES:<br>1.        +        DESIGN CV SHALL BE BASED ON SERVICE CONDITIONS INDICATED AT SL. NO. ____1____ AND SHALL BE CHECKED FOR ALL OTHER CONDITIONS AS PER SPECIFICATION CLAUSE NUMBER 3.1.7.<br>2.        #        WITHOUT POSITIONER, LINEARITY SHALL BE $\pm 5\%$ ONLY. |  |                    |             |                     |   |              |  |   |                  |

|  |      |                   |
|--|------|-------------------|
| SPECIFICATION NO.: <b>PE-TS-367-145-I104</b> |      |                   |
| VOLUME                                       | II-B |                   |
| SECTION                                      | D    |                   |
| REV. NO.                                     | 03   | DATE : 05.06.2013 |
| SHEET  | 38   | OF 52             |


## DATA SHEET – A & B

DATA SHEET – B  
(TO BE FILLED UP  
BY BIDDER)


|                    |  |  |  |
|--------------------|--|--|--|
| GENERAL            | PROJECT<br>SERVICE<br>LOCATION<br>DUTY<br>PIPE SIZE (inlet / outlet)<br>PIPE MATERIAL (inlet / outlet)   | KPCL-BELLARY#3, (1X700MM)<br>HPH-8A/8B NORMAL DRAIN TO HPH-7A/7B<br><input checked="" type="checkbox"/> INDOOR <input type="checkbox"/> OUTDOOR<br><input type="checkbox"/> ON/OFF <input checked="" type="checkbox"/> MODULATING<br>168.3 x 14.27   219.1 x 12.7<br>SA 106 GR C   SA 106 GR C   |  |
| BODY               | MODEL NO.<br>TYPE OF BODY: GUIDING : NO. OF PORTS<br>BODY SIZE: PORT SIZE: DESIGN CV<br>END CONNECTION & RATING (ANSI)<br>BODY MATERIAL<br><br>PACKING: MATERIAL SINGLE / DOUBLE<br>BONNET TYPE<br>TRIM FORM<br><br>TRIM MATERIAL: SEAT   PLUG<br>: CAGE   GUIDE BUSH<br><br>FLOW<br>OUTLET VELOCITY<br>REQUIRED LEAKAGE CLASS<br>NOISE LEVEL (dBA) (spec. 3.1.14)<br>VACUUM SERVICE<br>ANTI CAVITATION TRIM | <b>Bidder To Specify</b><br><input checked="" type="checkbox"/> GLOBE <input type="checkbox"/> ANGLE   <input type="checkbox"/> TOP <input checked="" type="checkbox"/> CAGE   ONE<br><b>Bidder To Specify</b><br><input checked="" type="checkbox"/> BWE <input type="checkbox"/> SWE <input type="checkbox"/> FLANGED<br><input type="checkbox"/> A216 WCB <input checked="" type="checkbox"/> A217 WC9 <input type="checkbox"/> SS <input type="checkbox"/> A217 CS<br><input type="checkbox"/> A351 CF8M<br><input type="checkbox"/> PTFE <input checked="" type="checkbox"/> GRAFOIL <input type="checkbox"/> DOUBLE <input checked="" type="checkbox"/> SINGLE<br><input type="checkbox"/> STD <input type="checkbox"/> EXTENDED <input type="checkbox"/> FINNED<br><input checked="" type="checkbox"/> LINEAR <input type="checkbox"/> EQ. PERCENTAGE<br><input type="checkbox"/> QUICK OPEN (ON/OFF)<br>17-4 PH SS   17-4 PH SS<br>17-4 PH SS   17-4 PH SS<br><br><input type="checkbox"/> BELOW SEAT <input type="checkbox"/> ABOVE SEAT<br><input checked="" type="checkbox"/> < 7 M/SEC (WATER)   <input type="checkbox"/> MAC NO. < 1/3(STM)<br><input type="checkbox"/> II <input type="checkbox"/> III <input checked="" type="checkbox"/> IV <input type="checkbox"/> V <input type="checkbox"/> VI<br>LESS THAN 85 dBA<br><input type="checkbox"/> YES <input checked="" type="checkbox"/> NO<br><input type="checkbox"/> YES <input checked="" type="checkbox"/> NO |  |
| PNEUMATIC ACTUATOR | MODEL NO. & SIZE<br>CLOSE AT : OPEN AT (KG/CM2g)<br>TRAVEL TIME FOR<br>OPEN TO CLOSE, CLOSE TO OPEN<br>VALVE POSN. ON SIGNAL AIR FAILURE<br>VALVE POSN. ON SUPPLY AIR FAILURE  | <b>Bidder To Specify</b><br>0.2   1.0<br>< 10 Seconds<br> <br><input type="checkbox"/> TO OPEN <input type="checkbox"/> STAYPUT <input checked="" type="checkbox"/> TO CLOSE<br><input checked="" type="checkbox"/> STAYPUT  |  |
| ACCESSORIES        | POSITIONER ( <b>SMART</b> )<br>AIR FILTER REGULATOR<br>AIR LOCK RELAY<br>POSITION LIMIT SWITCH<br>POSITION TRANSMITTER<br>SOLENOID VALVE<br>E/P CONVERTER<br>JUNCTION BOX<br>HAND WHEEL (SIDE MOUNTED)<br>LOCAL POSITION INDICATOR   | <input checked="" type="checkbox"/> REQUIRED <input type="checkbox"/> NOT REQUIRED<br><input checked="" type="checkbox"/> REQUIRED <input type="checkbox"/> NOT REQUIRED<br><input checked="" type="checkbox"/> REQUIRED <input type="checkbox"/> NOT REQUIRED<br><input checked="" type="checkbox"/> REQUIRED <input type="checkbox"/> NOT REQUIRED<br>PART OF POSITIONER<br><input checked="" type="checkbox"/> REQUIRED <input type="checkbox"/> NOT REQUIRED<br>PART OF POSITIONER<br><input checked="" type="checkbox"/> REQUIRED <input type="checkbox"/> NOT REQUIRED<br><input checked="" type="checkbox"/> REQUIRED<br><input checked="" type="checkbox"/> REQUIRED   |  |

|   |   |          |             |                     |  |              |  |   |                  |
|---|---|----------|-------------|---------------------|--|--------------|--|---|------------------|
|   | <b>DATA SHEET FOR CONTROL VALVES<br/>(WITH PNEUMATIC ACTUATOR)</b>  |          |             |                     |  |              | SPECIFICATION NO.: <b>PE-TS-367-145-I104</b>   |   |                  |
|   |   |          |             |                     |  |              | VOLUME II-B  |   |                  |
|   |   |          |             |                     |  |              | SECTION D  |   |                  |
|   |   |          |             |                     |  |              | REV. NO. 03  | DATE : 05.06.2013                             |                  |
|   |   |          |             |                     |  |              | SHEET 39 OF 52   |   |                  |
| Tag No. : DRV-53 & DRV-59 Qty.: 2 per Unit (One against each Tag No.) Data Sheet No. PES-145-06-DS1-0   |   |          |             |                     |  |              |  |   |                  |
| <b>DATA SHEET – A &amp; B</b>   |   |          |             |                     |  |              |  |   |                  |
| DATA SHEET – A FOR CONTROL VALVE (WITH PNEUMATIC ACTUATOR)<br>(TO BE FILLED BY PURCHASER)   |   |          |             |                     |  |              |  | DATA SHEET – B<br>(TO BE FILLED UP BY BIDDER) |                  |
| PERFORMANCE OF VALVE  | LINEARITY<br>HYSTERESIS<br>SENSITIVITY<br>ACCURACY (OVERALL)  |          |             |                     | $\pm 1\%$<br>$\pm 1\%$<br>$\pm 0.5\%$<br>$\pm 2\%$ |              | .....<br>.....<br>.....<br>.....   |   |                  |
| SERVICE CONDITION   | SL. No. +   | LOAD     | FLOW (T/HR) | INLET PR. KG/CM2(A) | OUTLET PR. KG/CM2(A)                               | TEMP DEG (C) | CALC ULATED CV   | % VLV LIFT                                    | VLV O/L VELOCITY |
|   | 1.  | 40% MCR  | 9.663       | 32                  | 24   | 226.2        |  |   |                  |
|   | 2.  | 60% MCR  | 18.267      | 47.1                | 36   | 247.9        |  |   |                  |
|   | 3.  | 100% MCR | 44.9        | 77.41               | 58.5   | 278.2        |  |   |                  |
|   | 4.  | VWO      | 50.3        | 83.2                | 53.5   | 283          |  |   |                  |
|   | 5.  | BMCR     | 51.97       | 82.32               | 62.8   | 282.2        |  |   |                  |
|   | VALVE TYPE  |          |             |                     |  |              | <input type="checkbox"/> CAVITATION <input checked="" type="checkbox"/> FLASHING<br><input type="checkbox"/> HIGH DP |   |                  |
|   | MAX SHUT OFF PRESS (KG/CM2g) 88<br>BODY DESIGN : PRESS (KG/CM2g)   TEMP (DEG C) 88   290<br>IBR FORM III-C <input type="checkbox"/> REQUIRED <input checked="" type="checkbox"/> NOT REQUIRED |          |             |                     |  |              | .....<br>.....<br>.....  |   |                  |
| TOTAL WEIGHT (VALVE + ACTUATOR + ACCESSORIES) Kg  |   |          |             |                     |  |              | .....  |   |                  |
| NOTES:<br>1. + DESIGN CV SHALL BE BASED ON SERVICE CONDITIONS INDICATED AT SL. NO. <u>4</u> AND SHALL BE CHECKED FOR ALL OTHER CONDITIONS AS PER SPECIFICATION CLAUSE NUMBER 3.1.7. |   |          |             |                     |  |              |  |   |                  |



|   |   |          |             |                     |  |              |   |   |                  |
|---|---|----------|-------------|---------------------|--|--------------|---|---|------------------|
|    | <b>DATA SHEET FOR CONTROL VALVES<br/>(WITH PNEUMATIC ACTUATOR)</b>  |          |             |                     |  |              | SPECIFICATION NO.: <b>PE-TS-367-145-I104</b>  |   |                  |
|   |   |          |             |                     |  |              | VOLUME II-B   |   |                  |
|   |   |          |             |                     |  |              | SECTION D   |   |                  |
|   |   |          |             |                     |  |              | REV. NO. 03   | DATE : 05.06.2013                             |                  |
|   |   |          |             |                     |  |              | SHEET 41 OF 52  |   |                  |
| Tag No. : DRV-56 & DRV-62 Qty.: 2 per Unit (One against each Tag No.) Data Sheet No. PES-145-06-DS1-0   |   |          |             |                     |  |              |   |   |                  |
| <b>DATA SHEET – A &amp; B</b>   |   |          |             |                     |  |              |   |   |                  |
| DATA SHEET – A FOR CONTROL VALVE (WITH PNEUMATIC ACTUATOR)<br>(TO BE FILLED BY PURCHASER)   |   |          |             |                     |  |              |   | DATA SHEET – B<br>(TO BE FILLED UP BY BIDDER) |                  |
| PERFORMANCE OF VALVE  | LINEARITY<br>HYSTERESIS<br>SENSITIVITY<br>ACCURACY (OVERALL)  |          |             |                     | $\pm 1\%$<br>$\pm 1\%$<br>$\pm 0.5\%$<br>$\pm 2\%$ |              | .....<br>.....<br>.....<br>.....  |   |                  |
| SERVICE CONDITION   | SL. No. +   | LOAD     | FLOW (T/HR) | INLET PR. KG/CM2(A) | OUTLET PR. KG/CM2(A)                               | TEMP DEG (C) | CALC ULATED CV  | % VLV LIFT                                    | VLV O/L VELOCITY |
|   | 1.  | 40% MCR  | 9.663       | 33.1                | 0.3  | 286.18       |   |   |                  |
|   | 2.  | 60% MCR  | 18.267      | 48.5                | 0.3  | 259.2        |   |   |                  |
|   | 3.  | 100% MCR | 44.9        | 78.7                | 0.3  | 291.52       |   |   |                  |
|   | 4.  | VWO      | 50.30       | 84.5                | 0.3  | 296.48       |   |   |                  |
|   | 5.  | BMCR     | 51.97       | 83.6                | 0.5  | 295.8        |   |   |                  |
|   | VALVE TYPE  |          |             |                     |  |              | <input type="checkbox"/> CAVITATION <input type="checkbox"/> FLASHING<br><input type="checkbox"/> HIGH DP |   |                  |
|   | MAX SHUT OFF PRESS (KG/CM2g) 88<br>BODY DESIGN : PRESS (KG/CM2g)   TEMP (DEG C) 88/VACUUM   305<br>IBR FORM III-C <input type="checkbox"/> REQUIRED <input type="checkbox"/> NOT REQUIRED |          |             |                     |  |              | .....<br>.....<br>.....   |   |                  |
| TOTAL WEIGHT (VALVE + ACTUATOR + ACCESSORIES) Kg  |   |          |             |                     |  |              | .....   |   |                  |
| NOTES:<br>1.        +        DESIGN CV SHALL BE BASED ON SERVICE CONDITIONS INDICATED AT SL. NO. <u>  4  </u> AND SHALL BE CHECKED FOR ALL OTHER CONDITIONS AS PER SPECIFICATION CLAUSE NUMBER 3.1.7. |   |          |             |                     |  |              |   |   |                  |



|   |  |           |             |                     |  |              |  |   |                  |
|---|--|-----------|-------------|---------------------|--|--------------|--|---|------------------|
|    | <b>DATA SHEET FOR CONTROL VALVES<br/>(WITH PNEUMATIC ACTUATOR)</b>   |           |             |                     |  |              | SPECIFICATION NO.: <b>PE-TS-367-145-I104</b>   |   |                  |
|   |  |           |             |                     |  |              | VOLUME II-B  |   |                  |
|   |  |           |             |                     |  |              | SECTION D  |   |                  |
|   |  |           |             |                     |  |              | REV. NO. 03  | DATE : 05.06.2013                             |                  |
|   |  |           |             |                     |  |              | SHEET 43 OF 52   |   |                  |
| Tag No. ....DRV-65... Qty.: ...1 per Unit ... <span style="float: right;">Data Sheet No. PES-145-06-DS1-0</span>  |  |           |             |                     |  |              |  |   |                  |
| <b>DATA SHEET – A &amp; B</b>   |  |           |             |                     |  |              |  |   |                  |
| DATA SHEET – A FOR CONTROL VALVE (WITH PNEUMATIC ACTUATOR)<br>(TO BE FILLED BY PURCHASER)   |  |           |             |                     |  |              |  | DATA SHEET – B<br>(TO BE FILLED UP BY BIDDER) |                  |
| PERFORMANCE OF VALVE  | LINEARITY<br>HYSTERESIS<br>SENSITIVITY<br>ACCURACY (OVERALL)   |           |             |                     | $\pm 1\%$<br>$\pm 1\%$<br>$\pm 0.5\%$<br>$\pm 2\%$ |              | .....<br>.....<br>.....<br>.....   |   |                  |
| SERVICE CONDITION*  | SL. No. +  | LOAD      | FLOW (T/HR) | INLET PR. KG/CM2(A) | OUTLET PR. KG/CM2(A)                               | TEMP DEG (C) | CALC ULATED CV   | % VLV LIFT                                    | VLV O/L VELOCITY |
|   | 1.   | 40% MCR   | 30.83       | 2.34                | 1.1  | 98.3         |  |   |                  |
|   | 2.   | 60% MCR   | 49.8        | 3.4                 | 1.6  | 108.5        |  |   |                  |
|   | 3.   | 100% MCR  | 95.95       | 5.4                 | 2.3  | 122.6        |  |   |                  |
|   | 4.   | VWO       | 104.6       | 5.8                 | 2.4  | 124.7        |  |   |                  |
|   | 5.   | LPH-2 OUT | 115         | 5.1                 | 2.0  | 112.4        |  |   |                  |
|   | VALVE TYPE   |           |             |                     |  |              | <input type="checkbox"/> CAVITATION <input checked="" type="checkbox"/> FLASHING<br><input type="checkbox"/> HIGH DP |   |                  |
|   | MAX SHUT OFF PRESS (KG/CM2g) 7<br>BODY DESIGN : PRESS (KG/CM2g)   TEMP (DEG C) 7/VACUUM   135<br>IBR FORM III-C <input type="checkbox"/> REQUIRED <input checked="" type="checkbox"/> NOT REQUIRED |           |             |                     |  |              | .....<br>.....<br>.....  |   |                  |
| TOTAL WEIGHT (VALVE + ACTUATOR + ACCESSORIES) Kg  |  |           |             |                     |  |              | .....  |   |                  |
| NOTES:<br>1.        +        DESIGN CV SHALL BE BASED ON SERVICE CONDITIONS INDICATED AT SL. NO. <u>  4  </u> AND SHALL BE CHECKED FOR ALL OTHER CONDITIONS AS PER SPECIFICATION CLAUSE NUMBER 3.1.7. |  |           |             |                     |  |              |  |   |                  |

|  |      |                   |
|--|------|-------------------|
| SPECIFICATION NO.: <b>PE-TS-367-145-I104</b> |      |                   |
| VOLUME                                       | II-B |                   |
| SECTION                                      | D    |                   |
| REV. NO.                                     | 03   | DATE : 05.06.2013 |
| SHEET  | 44   | OF 52             |


Data Sheet No. PES-145-06-DS1-0

## DATA SHEET – A & B

**DATA SHEET – B  
(TO BE FILLED UP  
BY BIDDER)**

|                    |  |  |  |
|--------------------|--|--|--|
| GENERAL            | PROJECT<br>SERVICE<br>LOCATION<br>DUTY<br>PIPE SIZE (inlet / outlet)<br>PIPE MATERIAL (inlet / outlet)   | KPCL-BELLARY#3, (1X700MM)<br>LPH-4 ALT. DRAIN TO LP DRAIN F/T<br><input checked="" type="checkbox"/> INDOOR <input type="checkbox"/> OUTDOOR<br><input type="checkbox"/> ON/OFF <input checked="" type="checkbox"/> MODULATING<br>168.3 x 7.11   219.1 x 8.18<br>SA 106 GR B   SA 106 GR C   |  |
| BODY               | MODEL NO.<br>TYPE OF BODY: GUIDING : NO. OF PORTS<br>BODY SIZE: PORT SIZE: DESIGN CV<br>END CONNECTION & RATING (ANSI)<br>BODY MATERIAL<br><br>PACKING: MATERIAL SINGLE / DOUBLE<br>BONNET TYPE<br>TRIM FORM<br><br>TRIM MATERIAL: SEAT   PLUG<br>: CAGE   GUIDE BUSH<br><br>FLOW<br>OUTLET VELOCITY<br>REQUIRED LEAKAGE CLASS<br>NOISE LEVEL (dBA) (spec. 3.1.14)<br>VACUUM SERVICE<br>ANTI CAVITATION TRIM | <b>Bidder To Specify</b><br><input checked="" type="checkbox"/> GLOBE <input type="checkbox"/> ANGLE   <input type="checkbox"/> TOP <input checked="" type="checkbox"/> CAGE   ONE<br><b>Bidder To Specify</b><br><input checked="" type="checkbox"/> BWE <input type="checkbox"/> SWE <input type="checkbox"/> FLANGED<br><input type="checkbox"/> A216 WCB <input checked="" type="checkbox"/> A217 WC9 <input type="checkbox"/> SS <input type="checkbox"/> A217 CS<br><input type="checkbox"/> A351 CF8M<br><input type="checkbox"/> PTFE <input checked="" type="checkbox"/> GRAFOIL <input checked="" type="checkbox"/> DOUBLE <input type="checkbox"/> SINGLE<br><input type="checkbox"/> STD <input type="checkbox"/> EXTENDED <input type="checkbox"/> FINNED<br><input checked="" type="checkbox"/> LINEAR <input type="checkbox"/> EQ. PERCENTAGE<br><input type="checkbox"/> QUICK OPEN (ON/OFF)<br>440 C   440 C<br>440 C   440 C<br><br><input type="checkbox"/> BELOW SEAT <input type="checkbox"/> ABOVE SEAT<br><input checked="" type="checkbox"/> < 7 M/SEC (WATER)   <input type="checkbox"/> MAC NO. < 1/3(STM)<br><input type="checkbox"/> II <input type="checkbox"/> III <input type="checkbox"/> IV <input checked="" type="checkbox"/> V <input type="checkbox"/> VI<br>LESS THAN 85 dBA<br><input checked="" type="checkbox"/> YES <input type="checkbox"/> NO<br><input checked="" type="checkbox"/> YES <input type="checkbox"/> NO |  |
| PNEUMATIC ACTUATOR | MODEL NO. & SIZE<br>CLOSE AT : OPEN AT (KG/CM2g)<br>TRAVEL TIME FOR<br>OPEN TO CLOSE, CLOSE TO OPEN<br>VALVE POSN. ON SIGNAL AIR FAILURE<br>VALVE POSN. ON SUPPLY AIR FAILURE  | <b>Bidder To Specify</b><br>1.0   0.2<br>< 10 Seconds<br> <br><input checked="" type="checkbox"/> TO OPEN <input type="checkbox"/> STAYPUT <input type="checkbox"/> TO CLOSE<br><input checked="" type="checkbox"/> STAYPUT  |  |
| ACCESSORIES        | POSITIONER ( <b>SMART</b> )<br>AIR FILTER REGULATOR<br>AIR LOCK RELAY<br>POSITION LIMIT SWITCH<br>POSITION TRANSMITTER<br>SOLENOID VALVE<br>E/P CONVERTER<br>JUNCTION BOX<br>HAND WHEEL (SIDE MOUNTED)<br>LOCAL POSITION INDICATOR   | <input checked="" type="checkbox"/> REQUIRED <input type="checkbox"/> NOT REQUIRED<br><input checked="" type="checkbox"/> REQUIRED <input type="checkbox"/> NOT REQUIRED<br><input checked="" type="checkbox"/> REQUIRED <input type="checkbox"/> NOT REQUIRED<br><input checked="" type="checkbox"/> REQUIRED <input type="checkbox"/> NOT REQUIRED<br>PART OF POSITIONER<br><input checked="" type="checkbox"/> REQUIRED <input type="checkbox"/> NOT REQUIRED<br>PART OF POSITIONER<br><input checked="" type="checkbox"/> REQUIRED <input type="checkbox"/> NOT REQUIRED<br><input checked="" type="checkbox"/> REQUIRED<br><input checked="" type="checkbox"/> REQUIRED   |  |



|   |  |           |             |                     |  |              |   |   |                  |
|---|--|-----------|-------------|---------------------|--|--------------|---|---|------------------|
|    | <b>DATA SHEET FOR CONTROL VALVES<br/>(WITH PNEUMATIC ACTUATOR)</b>   |           |             |                     |  |              | SPECIFICATION NO.: <b>PE-TS-367-145-I104</b>  |   |                  |
|   |  |           |             |                     |  |              | VOLUME II-B   |   |                  |
|   |  |           |             |                     |  |              | SECTION D   |   |                  |
|   |  |           |             |                     |  |              | REV. NO. 03   | DATE : 05.06.2013                             |                  |
|   |  |           |             |                     |  |              | SHEET 45 OF 52  |   |                  |
| Tag No. ....DRV-68... Qty.: ...1 per Unit ... <span style="float: right;">Data Sheet No. PES-145-06-DS1-0</span>  |  |           |             |                     |  |              |   |   |                  |
| <b>DATA SHEET – A &amp; B</b>   |  |           |             |                     |  |              |   |   |                  |
| DATA SHEET – A FOR CONTROL VALVE (WITH PNEUMATIC ACTUATOR)<br>(TO BE FILLED BY PURCHASER)   |  |           |             |                     |  |              |   | DATA SHEET – B<br>(TO BE FILLED UP BY BIDDER) |                  |
| PERFORMANCE OF VALVE  | LINEARITY<br>HYSTERESIS<br>SENSITIVITY<br>ACCURACY (OVERALL)   |           |             |                     | $\pm 1\%$<br>$\pm 1\%$<br>$\pm 0.5\%$<br>$\pm 2\%$ |              | .....<br>.....<br>.....<br>.....  |   |                  |
| SERVICE CONDITION   | SL. No. +  | LOAD      | FLOW (T/HR) | INLET PR. KG/CM2(A) | OUTLET PR. KG/CM2(A)                               | TEMP DEG (C) | CALC ULATED CV  | % VLV LIFT                                    | VLV O/L VELOCITY |
|   | 1.   | 40% MCR   | 30.83       | 3.2                 | 0.3  | 127.8        |   |   |                  |
|   | 2.   | 60% MCR   | 49.8        | 4.2                 | 0.3  | 139.5        |   |   |                  |
|   | 3.   | 100% MCR  | 95.95       | 6.2                 | 0.3  | 156          |   |   |                  |
|   | 4.   | VWO       | 104.6       | 6.6                 | 0.3  | 158.3        |   |   |                  |
|   | 5.   | LPH-3 OUT | 133.2       | 5.6                 | 0.5  | 151.17       |   |   |                  |
|   | VALVE TYPE   |           |             |                     |  |              | <input checked="" type="checkbox"/> CAVITATION <input checked="" type="checkbox"/> FLASHING<br><input type="checkbox"/> HIGH DP |   |                  |
|   | MAX SHUT OFF PRESS (KG/CM2g) 7<br>BODY DESIGN : PRESS (KG/CM2g)   TEMP (DEG C) 7/VACUUM   165<br>IBR FORM III-C <input type="checkbox"/> REQUIRED <input checked="" type="checkbox"/> NOT REQUIRED |           |             |                     |  |              | .....<br>.....<br>.....   |   |                  |
| TOTAL WEIGHT (VALVE + ACTUATOR + ACCESSORIES) Kg  |  |           |             |                     |  |              | .....   |   |                  |
| NOTES:<br>1.        +        DESIGN CV SHALL BE BASED ON SERVICE CONDITIONS INDICATED AT SL. NO. <u>  4  </u> AND SHALL BE CHECKED FOR ALL OTHER CONDITIONS AS PER SPECIFICATION CLAUSE NUMBER 3.1.7. |  |           |             |                     |  |              |   |   |                  |


|  |      |                   |
|--|------|-------------------|
| SPECIFICATION NO.: <b>PE-TS-367-145-I104</b> |      |                   |
| VOLUME                                       | II-B |                   |
| SECTION                                      | D    |                   |
| REV. NO.                                     | 03   | DATE : 05.06.2013 |
| SHEET  | 46   | OF 52             |

Data Sheet No. PES-145-06-DS1-0

## DATA SHEET – A & B

DATA SHEET – B  
(TO BE FILLED UP  
BY BIDDER)

[illegible]

|   |   |                     |             |                     |  |              |  |   |                  |
|---|---|---------------------|-------------|---------------------|--|--------------|--|---|------------------|
|    | <b>DATA SHEET FOR CONTROL VALVES<br/>(WITH PNEUMATIC ACTUATOR)</b>  |                     |             |                     |  |              | SPECIFICATION NO.: <b>PE-TS-367-145-I104</b>   |   |                  |
|   |   |                     |             |                     |  |              | VOLUME II-B  |   |                  |
|   |   |                     |             |                     |  |              | SECTION D  |   |                  |
|   |   |                     |             |                     |  |              | REV. NO. 03  | DATE : 05.06.2013                             |                  |
|   |   |                     |             |                     |  |              | SHEET 47 OF 52   |   |                  |
| Tag No. ....DMV-2.... Qty.: ...1 per Unit ... <span style="float: right;">Data Sheet No. PES-145-06-DS1-0</span>  |   |                     |             |                     |  |              |  |   |                  |
| <b>DATA SHEET – A &amp; B</b>   |   |                     |             |                     |  |              |  |   |                  |
| DATA SHEET – A FOR CONTROL VALVE (WITH PNEUMATIC ACTUATOR)<br>(TO BE FILLED BY PURCHASER)   |   |                     |             |                     |  |              |  | DATA SHEET – B<br>(TO BE FILLED UP BY BIDDER) |                  |
| PERFORMANCE OF VALVE  | LINEARITY<br>HYSTERESIS<br>SENSITIVITY<br>ACCURACY (OVERALL)  |                     |             |                     | $\pm 1\%$<br>$\pm 1\%$<br>$\pm 0.5\%$<br>$\pm 2\%$ |              | .....<br>.....<br>.....<br>.....   |   |                  |
| SERVICE CONDITION   | SL. No. +   | LOAD                | FLOW (T/HR) | INLET PR. KG/CM2(A) | OUTLET PR. KG/CM2(A)                               | TEMP DEG (C) | CALC ULATED CV   | % VLV LIFT                                    | VLV O/L VELOCITY |
|   | 1.  | MIN. (1% MU)        | 10          | 6.7                 | 0.5  | 33           |  |   |                  |
|   | 2.  | NORMAL (1% MU)      | 23          | 4.9                 | 0.55   | 33           |  |   |                  |
|   | 3.  | DM PUMP DESIGN FLOW | 75          | 4.9                 | 1.6  | 33           |  |   |                  |
|   |   |                     |             |                     |  |              |  |   |                  |
|   |   |                     |             |                     |  |              |  |   |                  |
|   | VALVE TYPE  |                     |             |                     |  |              | <input checked="" type="checkbox"/> CAVITATION <input type="checkbox"/> FLASHING<br><input type="checkbox"/> HIGH DP |   |                  |
|   | MAX SHUT OFF PRESS (KG/CM2g) 10<br>BODY DESIGN : PRESS (KG/CM2g)   TEMP (DEG C) 10/VACUUM   50<br>IBR FORM III-C <input type="checkbox"/> REQUIRED <input checked="" type="checkbox"/> NOT REQUIRED |                     |             |                     |  |              | .....<br>..... .....<br>.....  |   |                  |
| TOTAL WEIGHT (VALVE + ACTUATOR + ACCESSORIES) Kg  |   |                     |             |                     |  |              | .....  |   |                  |
| NOTES:<br>1.        +        DESIGN CV SHALL BE BASED ON SERVICE CONDITIONS INDICATED AT SL. NO. <u>  2  </u> AND SHALL BE CHECKED FOR ALL OTHER CONDITIONS AS PER SPECIFICATION CLAUSE NUMBER 3.1.7. |   |                     |             |                     |  |              |  |   |                  |


|  |      |                   |
|--|------|-------------------|
| SPECIFICATION NO.: <b>PE-TS-367-145-I104</b> |      |                   |
| VOLUME                                       | II-B |                   |
| SECTION                                      | D    |                   |
| REV. NO.                                     | 03   | DATE : 05.06.2013 |
| SHEET  | 48   | OF 52             |

Data Sheet No. PES-145-06-DS1-0

## DATA SHEET – A & B

DATA SHEET – B  
(TO BE FILLED UP  
BY BIDDER)

|                    |  |  |  |
|--------------------|--|--|--|
| GENERAL            | PROJECT<br>SERVICE<br>LOCATION<br>DUTY<br>PIPE SIZE (inlet / outlet)<br>PIPE MATERIAL (inlet / outlet)   | KPCL-BELLARY#3, (1X700MM)<br>DM EMERGENCY MU TO HOTWELL<br><input checked="" type="checkbox"/> INDOOR <input type="checkbox"/> OUTDOOR<br><input type="checkbox"/> ON/OFF <input checked="" type="checkbox"/> MODULATING<br>168.3 x 3.4                                     168.3 x 3.4<br>SA 312 TP 304 (ERW )     SA 312 TP 304 (ERW )   |  |
| BODY               | MODEL NO.<br>TYPE OF BODY: GUIDING : NO. OF PORTS<br>BODY SIZE: PORT SIZE: DESIGN CV<br>END CONNECTION & RATING (ANSI)<br>BODY MATERIAL<br><br>PACKING: MATERIAL SINGLE / DOUBLE<br>BONNET TYPE<br>TRIM FORM<br><br>TRIM MATERIAL: SEAT   PLUG<br>: CAGE   GUIDE BUSH<br><br>FLOW<br>OUTLET VELOCITY<br>REQUIRED LEAKAGE CLASS<br>NOISE LEVEL (dBA) (spec. 3.1.14)<br>VACUUM SERVICE<br>ANTI CAVITATION TRIM | <b>Bidder To Specify</b><br><input checked="" type="checkbox"/> GLOBE <input type="checkbox"/> ANGLE   <input type="checkbox"/> TOP <input checked="" type="checkbox"/> CAGE   ONE<br><b>Bidder To Specify</b><br><input checked="" type="checkbox"/> BWE <input type="checkbox"/> SWE <input type="checkbox"/> FLANGED<br><input type="checkbox"/> A216 WCB <input type="checkbox"/> A217 WC6 <input type="checkbox"/> SS <input type="checkbox"/> A217 CS<br><input checked="" type="checkbox"/> A351 CF8M<br><input type="checkbox"/> PTFE <input checked="" type="checkbox"/> GRAFOIL <input checked="" type="checkbox"/> DOUBLE <input type="checkbox"/> SINGLE<br><input type="checkbox"/> STD <input type="checkbox"/> EXTENDED <input type="checkbox"/> FINNED<br><input type="checkbox"/> LINEAR <input checked="" type="checkbox"/> EQ. PERCENTAGE<br><input type="checkbox"/> QUICK OPEN (ON/OFF)<br>SS 316 STELLITED   SS 316 STELLITED<br>SS 316 STELLITED   SS 316 STELLITED<br><br><input type="checkbox"/> BELOW SEAT <input type="checkbox"/> ABOVE SEAT<br><input checked="" type="checkbox"/> < 7 M/SEC (WATER)   <input type="checkbox"/> MAC NO. < 1/3(STM)<br><input type="checkbox"/> II <input type="checkbox"/> III <input type="checkbox"/> IV <input checked="" type="checkbox"/> V <input type="checkbox"/> VI<br>LESS THAN 85 dBA<br><input checked="" type="checkbox"/> YES <input type="checkbox"/> NO<br><input checked="" type="checkbox"/> YES <input type="checkbox"/> NO |  |
| PNEUMATIC ACTUATOR | MODEL NO. & SIZE<br>CLOSE AT : OPEN AT (KG/CM2g)<br>TRAVEL TIME FOR<br>OPEN TO CLOSE, CLOSE TO OPEN<br>VALVE POSN. ON SIGNAL AIR FAILURE<br>VALVE POSN. ON SUPPLY AIR FAILURE  | <b>Bidder To Specify</b><br>0.2                                    1.0<br>< 10 Seconds<br> <br><input type="checkbox"/> TO OPEN <input type="checkbox"/> STAYPUT <input checked="" type="checkbox"/> TO CLOSE<br><input checked="" type="checkbox"/> STAYPUT   |  |
| ACCESSORIES        | POSITIONER ( <b>SMART</b> )<br>AIR FILTER REGULATOR<br>AIR LOCK RELAY<br>POSITION LIMIT SWITCH<br>POSITION TRANSMITTER<br>SOLENOID VALVE<br>E/P CONVERTER<br>JUNCTION BOX<br>HAND WHEEL (SIDE MOUNTED)<br>LOCAL POSITION INDICATOR   | <input checked="" type="checkbox"/> REQUIRED <input type="checkbox"/> NOT REQUIRED<br><input checked="" type="checkbox"/> REQUIRED <input type="checkbox"/> NOT REQUIRED<br><input checked="" type="checkbox"/> REQUIRED <input type="checkbox"/> NOT REQUIRED<br><input checked="" type="checkbox"/> REQUIRED <input type="checkbox"/> NOT REQUIRED<br>PART OF POSITIONER<br><input checked="" type="checkbox"/> REQUIRED <input type="checkbox"/> NOT REQUIRED<br>PART OF POSITIONER<br><input checked="" type="checkbox"/> REQUIRED <input type="checkbox"/> NOT REQUIRED<br><input checked="" type="checkbox"/> REQUIRED<br><input checked="" type="checkbox"/> REQUIRED   |  |

|   |   |                     |             |                     |  |              |  |   |                  |
|---|---|---------------------|-------------|---------------------|--|--------------|--|---|------------------|
|    | <b>DATA SHEET FOR CONTROL VALVES<br/>(WITH PNEUMATIC ACTUATOR)</b>  |                     |             |                     |  |              | SPECIFICATION NO.: <b>PE-TS-367-145-I104</b>   |   |                  |
|   |   |                     |             |                     |  |              | VOLUME II-B  |   |                  |
|   |   |                     |             |                     |  |              | SECTION D  |   |                  |
|   |   |                     |             |                     |  |              | REV. NO. 03  | DATE : 05.06.2013                             |                  |
|   |   |                     |             |                     |  |              | SHEET 49 OF 52   |   |                  |
| Tag No. ....DMV-9... Qty.: ...1 per Unit ... <span style="float: right;">Data Sheet No. PES-145-06-DS1-0</span>   |   |                     |             |                     |  |              |  |   |                  |
| <b>DATA SHEET – A &amp; B</b>   |   |                     |             |                     |  |              |  |   |                  |
| DATA SHEET – A FOR CONTROL VALVE (WITH PNEUMATIC ACTUATOR)<br>(TO BE FILLED BY PURCHASER)   |   |                     |             |                     |  |              |  | DATA SHEET – B<br>(TO BE FILLED UP BY BIDDER) |                  |
| PERFORMANCE OF VALVE  | LINEARITY<br>HYSTERESIS<br>SENSITIVITY<br>ACCURACY (OVERALL)  |                     |             |                     | $\pm 1\%$<br>$\pm 1\%$<br>$\pm 0.5\%$<br>$\pm 2\%$ |              | .....<br>.....<br>.....<br>.....   |   |                  |
| SERVICE CONDITION   | SL. No. +   | LOAD                | FLOW (T/HR) | INLET PR. KG/CM2(A) | OUTLET PR. KG/CM2(A)                               | TEMP DEG (C) | CALC ULATED CV   | % VLV LIFT                                    | VLV O/L VELOCITY |
|   | 1.  | MIN. (1% MU)        | 23          | 5.5                 | 0.45   | 33           |  |   |                  |
|   | 2.  | NORMAL (3% MU)      | 69          | 4.8                 | 0.5  | 33           |  |   |                  |
|   | 3.  | CT PUMP DESIGN FLOW | 150         | 3.9                 | 0.8  | 33           |  |   |                  |
|   |   |                     |             |                     |  |              |  |   |                  |
|   |   |                     |             |                     |  |              |  |   |                  |
|   | VALVE TYPE  |                     |             |                     |  |              | <input checked="" type="checkbox"/> CAVITATION <input type="checkbox"/> FLASHING<br><input type="checkbox"/> HIGH DP |   |                  |
|   | MAX SHUT OFF PRESS (KG/CM2g) 10<br>BODY DESIGN : PRESS (KG/CM2g)   TEMP (DEG C) 10/VACUUM   50<br>IBR FORM III-C <input type="checkbox"/> REQUIRED <input checked="" type="checkbox"/> NOT REQUIRED |                     |             |                     |  |              | .....<br>.....<br>.....  |   |                  |
| TOTAL WEIGHT (VALVE + ACTUATOR + ACCESSORIES) Kg  |   |                     |             |                     |  |              | .....  |   |                  |
| NOTES:<br>1.        +        DESIGN CV SHALL BE BASED ON SERVICE CONDITIONS INDICATED AT SL. NO. <u>  2  </u> AND SHALL BE CHECKED FOR ALL OTHER CONDITIONS AS PER SPECIFICATION CLAUSE NUMBER 3.1.7. |   |                     |             |                     |  |              |  |   |                  |


|  |      |                   |
|--|------|-------------------|
| SPECIFICATION NO.: <b>PE-TS-367-145-I104</b> |      |                   |
| VOLUME                                       | II-B |                   |
| SECTION                                      | D    |                   |
| REV. NO.                                     | 03   | DATE : 05.06.2013 |
| SHEET  | 50   | OF 52             |

Data Sheet No. PES-145-06-DS1-0

## DATA SHEET – A & B

DATA SHEET – B  
(TO BE FILLED UP  
BY BIDDER)

[illegible]

|  |   |                       |             |                     |  |              |   |   |                  |
|--|---|-----------------------|-------------|---------------------|--|--------------|---|---|------------------|
|   | <b>DATA SHEET FOR CONTROL VALVES<br/>(WITH PNEUMATIC ACTUATOR)</b>  |                       |             |                     |  |              | SPECIFICATION NO.: <b>PE-TS-367-145-1104</b>  |   |                  |
|  |   |                       |             |                     |  |              | VOLUME II-B   |   |                  |
|  |   |                       |             |                     |  |              | SECTION D   |   |                  |
|  |   |                       |             |                     |  |              | REV. NO. 03   | DATE : 05.06.2013                             |                  |
|  |   |                       |             |                     |  |              | SHEET 51 OF 52  |   |                  |
| Tag No. ....FDV-14... Qty.: ...1 per Unit ... <span style="float: right;">Data Sheet No. PES-145-06-DS1-0</span>   |   |                       |             |                     |  |              |   |   |                  |
| <b>DATA SHEET – A &amp; B</b>  |   |                       |             |                     |  |              |   |   |                  |
| DATA SHEET – A FOR CONTROL VALVE (WITH PNEUMATIC ACTUATOR)<br>(TO BE FILLED BY PURCHASER)  |   |                       |             |                     |  |              |   | DATA SHEET – B<br>(TO BE FILLED UP BY BIDDER) |                  |
| PERFORMANCE OF VALVE   | LINEARITY<br>HYSTERESIS<br>SENSITIVITY<br>ACCURACY (OVERALL)  |                       |             |                     | $\pm 1\%$<br>$\pm 1\%$<br>$\pm 0.5\%$<br>$\pm 2\%$ |              | .....<br>.....<br>.....<br>.....  |   |                  |
| SERVICE CONDITION  | SL. No. +   | LOAD                  | FLOW (T/HR) | INLET PR. KG/CM2(A) | OUTLET PR. KG/CM2(A)                               | TEMP DEG (C) | CALC ULATED CV  | % VLV LIFT                                    | VLV O/L VELOCITY |
|  | 1.  | 5% MCR (MIN.SPEED)    | 115.5       | 82                  | 18   | 111          |   |   |                  |
|  | 2.  | 15% MCR               | 346.5       | 122                 | 75.2   | 111          |   |   |                  |
|  | 3.  | 25% MCR               | 577.5       | 126                 | 115.4  | 111 TO 138   |   |   |                  |
|  | 4.  | 35% Boiler Min R/c-I  | 808.5       | 124                 | 119.5  | 155.4        |   |   |                  |
|  | 5.  | 35% Boiler Min R/c-II | 808.5       | 124                 | 20   | 111          |   |   |                  |
|  | VALVE TYPE  |                       |             |                     |  |              | <input type="checkbox"/> CAVITATION <input type="checkbox"/> FLASHING<br><input type="checkbox"/> HIGH DP |   |                  |
|  | MAX SHUT OFF PRESS ( KG/CM2g) 470<br>BODY DESIGN : PRESS (KG/CM2g)   TEMP (DEG C) 470   200<br>IBR FORM III-C <input type="checkbox"/> REQUIRED <input type="checkbox"/> NOT REQUIRED |                       |             |                     |  |              | .....<br>..... .....<br>.....   |   |                  |
| TOTAL WEIGHT (VALVE + ACTUATOR + ACCESSORIES) Kg   |   |                       |             |                     |  |              | .....   |   |                  |
| NOTES:<br>1. * PARAMETERS LIKELY TO CHANGE ON RECEIPT OF PUMP INPUTS FROM BHEL-HYD.<br>2. + DESIGN CV SHALL BE BASED ON SERVICE CONDITIONS INDICATED AT SL. NO. <u>  2  </u> AND SHALL BE CHECKED FOR ALL OTHER CONDITIONS AS PER SPECIFICATION CLAUSE NUMBER 3.1.7. |   |                       |             |                     |  |              |   |   |                  |

|   |  |   |                  |
|---|--|---|------------------|
|  | <b>Technical specification for<br/>Control Valves with Accessories</b><br>(Pneumatically Operated) | SPECIFICATION NO. <b>PE-TS-367-145-I104</b> |                  |
|   |  | VOLUME <b>II-B</b>                          |                  |
|   |  | SECTION <b>D</b>                            |                  |
|   |  | REV. NO. 03                                 | DATE: 05.06.2013 |
|   |  | SHEET <b>52</b> OF 52                       |                  |


|   |  |  |   |   |  |
|---|--|--|---|---|--|
| Tag No.....   |  | Quantity.....  |   | Data Sheet No. PES-145-06-DS1-1                                     |  |
| 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)<br>(TO BE FILLED BY PURCHASER)       |  |  |   | DATA SHEET – B<br>(TO BE FILLED-UP BY BIDDER)                       |  |
| <b>POSITIONER (SMART)</b><br>WITH HART PROTOCOL   | MFR. & MODEL NUMBER  |  | Bidder To Specify   |   |  |
|   | BYPASS   | GAUGES   | ENCL. CLASS   | <input type="checkbox"/> YES <input checked="" type="checkbox"/> NO | <input type="checkbox"/> THREE <input checked="" type="checkbox"/> TWO <input checked="" type="checkbox"/> IP-65 |
|   | INPUT SIGNAL (Kg / Cm <sup>2</sup> )   |  | <input checked="" type="checkbox"/> 0.2 – 1.0 <input type="checkbox"/> 0.2 – 0.6 <input type="checkbox"/> 0.6 – 1.0                                     |   |  |
|   | OUTPUT SIGNAL (Kg / Cm <sup>2</sup> )  |  | TO SUIT ACTUATOR  |   |  |
| <b>AIR FILTER REGULATOR</b><br>TWO (2) Nos.<br>PER CV   | MFR. & MODEL NUMBER  |  | Bidder To Specify   |   |  |
|   | AIR SUPPLY PRESS (Kg / Cm <sup>2</sup> g)                                    |  | <input checked="" type="checkbox"/> 7.0   |   |  |
|   | OUTPUT PRESS (Kg / Cm <sup>2</sup> g)  |  | TO SUIT ACTUATOR  |   |  |
|   | <b>FILTER SIZE</b>   |  | <b>5 MICRON</b>   |   |  |
| OUTPUT GAUGE  |  | <input checked="" type="checkbox"/> REQUIRED <input type="checkbox"/> NOT REQUIRED |   |   |  |
| <b>AIR LOCK</b>   | MFR. & MODEL NUMBER  |  | Bidder To Specify   |   |  |
|   | SET PRESS (Kg / Cm <sup>2</sup> )  |  | Bidder To Specify   |   |  |
|   | SUPPLY PRESS (Kg / Cm <sup>2</sup> )   |  | <input checked="" type="checkbox"/> 7.0   |   |  |
|   | RESET TYPE   |  | AUTO  |   |  |
|   | VENT PLUG  |  | REQUIRED  |   |  |
|   | ENCLOSURE CLASS  |  | <input checked="" type="checkbox"/> IP 65   |   |  |
| <b>LIMIT SWITCH</b>   | MFR. & MODEL NUMBER  |  | Bidder To Specify   |   |  |
|   | OPEN posn  | INT posn   | CLOSE posn  | <b>1 NO.</b>  | <b>1 NO.</b>   |
|   | CONTACT TYPE   |  | SPDT 2 NO + 2 NC  |   |  |
|   | RATING (AC / DC)   |  | 5A 240V AC AND 0.2A 220V DC   |   |  |
|   | ENCLOSURE CLASS  |  | <input checked="" type="checkbox"/> IP 55 <input type="checkbox"/>  |   |  |
| <b>POSITION TRANSMITTER</b><br><br>(PART OF POSITIONER)   | MFR. & MODEL NUMBER  |  | <b>PART OF POSITIONER</b>   |   |  |
|   | TYPE   |  | <input checked="" type="checkbox"/> Electronic (2-Wire) Contactless <input type="checkbox"/> OTHER  |   |  |
|   | SUPPLY   |  | <input checked="" type="checkbox"/> 24V DC  |   |  |
|   | OUTPUT RATING  |  | <input checked="" type="checkbox"/> 4-20mA  |   |  |
|   | ACCURACY   |  | ± 1% FS   |   |  |
| ENCLOSURE CLASS   |  | <input checked="" type="checkbox"/> IP 65  |   |   |  |
| <b>SOLENOID VALVE</b>   | MFR. & MODEL NUMBER  |  | Bidder To Specify   |   |  |
|   | RATING   |  | <input checked="" type="checkbox"/> 24V DC <input type="checkbox"/> 220V DC <input type="checkbox"/> 240V AC <input type="checkbox"/>                   |   |  |
|   | <b>TYPE</b>  |  | <b>3-WAY (UNIVERSAL OPERATION TYPE)</b>   |   |  |
|   | OPERATION  | QUANTITY   | <input type="checkbox"/> Stayput <input checked="" type="checkbox"/> Interlock  | <input checked="" type="checkbox"/> 1 <input type="checkbox"/> 2    |  |
|   | COIL INSULATION CLASS  |  | CLASS - H   |   |  |
| ENCLOSURE CLASS   |  | <input checked="" type="checkbox"/> IP 65  |   |   |  |
| <b>HANDWHEEL</b>  | ORIENTATION  |  | <input type="checkbox"/> TOP MOUNTED <input checked="" type="checkbox"/> SIDE MOUNTED   |   |  |
| <b>JUNCTION BOX</b>   | NO. OF WAYS  |  | <input type="checkbox"/> 24-WAYS <input type="checkbox"/> AS REQUIRED <input checked="" type="checkbox"/> 36-Ways                                       |   |  |
|   | SIZE   |  | AS REQUIRED   |   |  |
|   | CABLE GLANDS (Size / Quantity)   |  | AS REQUIRED (Double Compression Type).  |   |  |
|   | ENCLOSURE CLASS  |  | <input checked="" type="checkbox"/> IP 65   |   |  |
| <b>I/P CONVERTER</b><br><br>(PART OF POSITIONER)  | INPUT SIGNAL   | POWER SUPPLY   | <b>PART OF POSITIONER</b>   |   |  |
|   | SPLIT RANGE  |  | -----   |   |  |
|   | ENCLOSURE CLASS  |  | -----   |   |  |
|   | <b>LINEARITY</b>   |  | -----   |   |  |
|   | <b>HYSTERESIS</b>  |  | -----   |   |  |
| <b>Cu. Tubing &amp; Fittings / per CV</b>   | This is in addition to cu. Tubing and fittings which are integral part of CV |  | 15 Meters of ¼ " PVC coated 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. |   |  |
|   |  |  |   |   | COMPANY SEAL   |
|   |  |  |   |   | NAME   |
|   |  |  |   |   | SIGNATURE  |



|   |   |  |                                      |                   |
|---|---|--|--------------------------------------|-------------------|
|  | Technical specification for<br><b>Control Valves with Accessories</b><br>(Pneumatically Operated) |  | SPEC NO.: <b>PE-TS-367-145-I 004</b> |                   |
|   |   |  | VOLUME II B                          |                   |
|   | Bellary TPS Unit#3, 1x700MW - KPCL  |  | SECTION D                            |                   |
|   |   |  | REV. NO. 00                          | DATE : 05.06.2013 |
|   |   |  | SHEET OF                             |                   |

# SECTION – D

## DATA SHEET – C


|   |  |  |                                       |                  |
|---|--|--|---------------------------------------|------------------|
|  | <b>Technical specification for<br/>Control Valves with Accessories</b><br>(Pneumatically Operated) |  | SPECIFICATION NO. PE-TS-367-145-I 004 |                  |
|   |  |  | VOLUME <b>II-B</b>                    |                  |
|   | <b>Bellary TPS Unit#3, 1x700MW - KPCL</b>  |  | SECTION <b>D</b>                      |                  |
|   |  |  | REV. NO. 00                           | DATE: 05.06.2013 |
|   |  |  | SHEET OF                              |                  |


Tag No..... Quantity.....


Data Sheet No. PES-145-06-DS2-1

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

|  |  |              |             |              |
|--|--|--------------|-------------|--------------|
| <b>POSITIONER (SMART)</b><br>WITH HART<br>PROTOCOL             | MFR. & MODEL NUMBER  |              |             |              |
|  | BYPASS   | GAUGES       | ENCL. CLASS |              |
|  | INPUT SIGNAL (Kg / Cm <sup>2</sup> )   |              |             |              |
|  | OUTPUT SIGNAL (Kg / Cm <sup>2</sup> )  |              |             |              |
|  |  |              |             |              |
| <b>AIR FILTER<br/>REGULATOR</b><br>TWO (2) Nos.<br>PER CV      | MFR. & MODEL NUMBER  |              |             |              |
|  | AIR SUPPLY PRESS (Kg / Cm <sup>2</sup> g)  |              |             |              |
|  | OUTPUT PRESS (Kg / Cm <sup>2</sup> g)  |              |             |              |
|  | OUTPUT GAUGE   |              |             |              |
|  | FILTER SIZE  |              |             |              |
| <b>AIR LOCK</b>  | MFR. & MODEL NUMBER  |              |             |              |
|  | SET PRESS (Kg / Cm <sup>2</sup> )  |              |             |              |
|  | SUPPLY PRESS (Kg / Cm <sup>2</sup> )   |              |             |              |
|  | RESET TYPE   |              |             |              |
|  | VENT PLUG  |              |             |              |
| <b>LIMIT SWITCH</b>  | MFR. & MODEL NUMBER  |              |             |              |
|  | OPEN posn  | INT posn     | CLOSE posn  |              |
|  | CONTACT TYPE   |              |             |              |
|  | RATING (AC / DC)   |              |             |              |
|  | ENCLOSURE CLASS  |              |             |              |
| <b>POSITION<br/>TRANSMITTER</b><br><br>(PART OF<br>POSITIONER) | MFR. & MODEL NUMBER  |              |             |              |
|  | TYPE   |              |             |              |
|  | SUPPLY   |              |             |              |
|  | OUTPUT RATING  |              |             |              |
|  | ACCURACY   |              |             |              |
| <b>SOLENOID<br/>VALVE</b>                                      | MFR. & MODEL NUMBER  |              |             |              |
|  | RATING   |              |             |              |
|  | OPERATION  | QUANTITY     |             |              |
|  | COIL INSULATION CLASS  |              |             |              |
|  | ENCLOSURE CLASS  |              |             |              |
| <b>HANDWHEEL</b>   | ORIENTATION  |              |             |              |
| <b>JUNCTION BOX</b>  | NO. OF WAYS  |              |             |              |
|  | SIZE   |              |             |              |
|  | CABLE GLANDS (Size / Quantity)   |              |             |              |
|  | ENCLOSURE CLASS  |              |             |              |
| <b>I/P CONVERTER<br/>(PART OF<br/>POSITIONER)</b>              | INPUT SIGNAL   | POWER SUPPLY |             |              |
|  | SPLIT RANGE  |              |             |              |
|  | ENCLOSURE CLASS  |              |             |              |
|  | LINEARITY  |              |             |              |
|  | HYSTERESIS   |              |             |              |
| <b>Cu. Tubing &amp;<br/>Fittings / per CV</b>                  | 15 Meters of 1/4 " PVC coated Cu. Tubing, with<br>1 set of Fittings for connection to IA Header on<br>one end and accessories on another end of CV |              |             |              |
|  |  |              |             | COMPANY SEAL |
|  |  |              |             | NAME         |
|  |  |              |             | SIGNATURE    |
|  |  |              |             | DATE         |


|  |   |             |                        |  |   |                        |                           |                             |                               |
|--|---|-------------|------------------------|--|---|------------------------|---------------------------|-----------------------------|-------------------------------|
|   | <b>Technical specification for<br/>Control Valves with Accessories</b><br>(Pneumatically Operated)<br><br><b>Bellary TPS Unit#3, 1x700MW - KPCL</b> |             |                        |  | SPEC NO.: <b>PE-TS-367-145-I 004</b>          |                        |                           |                             |                               |
|  |   |             |                        |  | VOLUME II B                                   |                        |                           |                             |                               |
|  |   |             |                        |  | SECTION <b>D</b>                              |                        |                           |                             |                               |
|  |   |             |                        |  | REV. NO. 00                                   |                        | DATE : 05.06.2013         |                             |                               |
|  |   |             |                        |  | SHEET   |                        |                           |                             |                               |
| <b>Tag No..... Quantity.....</b> <span style="float: right;">Data Sheet No. PES-145-06-DS2-0</span>                            |   |             |                        |  |   |                        |                           |                             |                               |
| <b>DATA SHEET C</b>  |   |             |                        |  |   |                        |                           |                             |                               |
| <b>DATA SHEET – C FOR CONTROL VALVE (WITH PNEUMATIC ACTUATOR)<br/>(TO BE FILLED BY THE BIDDER AFTER THE AWARD OF CONTRACT)</b> |   |             |                        |  |   |                        |                           |                             |                               |
| <b>PERFORMANCE<br/>OF VALVE</b>  | LINEARITY   |             |                        |  |   |                        |                           |                             |                               |
|  | HYSTERESIS  |             |                        |  |   |                        |                           |                             |                               |
|  | SENSITIVITY   |             |                        |  |   |                        |                           |                             |                               |
|  | ACCURACY (OVERALL)  |             |                        |  |   |                        |                           |                             |                               |
| <b>SERVICE<br/>CONDITION*</b>  | <b>SL.<br/>NO.</b>  | <b>LOAD</b> | <b>FLOW<br/>(T/HR)</b> | <b>INLET PR.<br/>(KG/CM<sup>2</sup> (A))</b> | <b>OUTLET PR.<br/>(KG/CM<sup>2</sup> (A))</b> | <b>TEMP<br/>DEG. C</b> | <b>CALCULA<br/>TED CV</b> | <b>%<br/>VALVE<br/>LIFT</b> | <b>VALVE O/L<br/>VELOCITY</b> |
|  |   |             |                        |  |   |                        |                           |                             |                               |
|  |   |             |                        |  |   |                        |                           |                             |                               |
|  |   |             |                        |  |   |                        |                           |                             |                               |
|  |   |             |                        |  |   |                        |                           |                             |                               |
|  |   |             |                        |  |   |                        |                           |                             |                               |
| VALVE TYPE   |   |             |                        |  |   |                        |                           |                             |                               |
| * MAX SHUT OFF PRESS ((KG/CM <sup>2</sup> g)   |   |             |                        |  |   |                        |                           |                             |                               |
| * BODY DESIGN : PRESS ((KG/CM <sup>2</sup> g)   TEMP (DEG. C)  |   |             |                        |  |   |                        |                           |                             |                               |
| * IBR FORM III-C   |   |             |                        |  |   |                        |                           |                             |                               |
| TOTAL WEIGHT (VALVE + ACTUATOR + ACCESSORIES) KG.  |   |             |                        |  |   |                        |                           |                             |                               |

|  |   |  |                                      |                   |
|--|---|--|--------------------------------------|-------------------|
|   | <b>Technical specification for<br/>Control Valves with Accessories</b><br>(Pneumatically Operated)<br><br><b>Bellary TPS Unit#3, 1x700MW - KPCL</b> |  | SPEC NO.: <b>PE-TS-367-145-I 004</b> |                   |
|  |   |  | VOLUME II B                          |                   |
|  |   |  | SECTION <b>D</b>                     |                   |
|  |   |  | REV. NO. 00                          | DATE : 05.06.2013 |
|  |   |  | SHEET                                |                   |
|  |   |  | NAME                                 |                   |
|  |   |  | SIGNATURE                            |                   |
|  |   |  | DATE                                 |                   |
| Tag No..... Quantity.....  |   |  | Data Sheet No. PES-145-06-DS2-0      |                   |
| <b>DATA SHEET C</b>  |   |  |                                      |                   |
| <b>DATA SHEET – C FOR CONTROL VALVE (WITH PNEUMATIC ACTUATOR)<br/>(TO BE FILLED BY THE BIDDER AFTER THE AWARD OF CONTRACT)</b> |   |  |                                      |                   |
| <b>GENERAL*</b>  | PROJECT   |  |                                      |                   |
|  | SERVICE   |  |                                      |                   |
|  | LOCATION  |  |                                      |                   |
|  | DUTY  |  |                                      |                   |
|  | PIPE SIZE (inlet / outlet)  |  |                                      |                   |
|  | PIPE MATERIAL (inlet / outlet)  |  |                                      |                   |
| <b>BODY</b>  | 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  |  |                                      |                   |
| <b>PNEUMATIC ACTUATOR</b>  | MODEL NO. & SIZE  |  |                                      |                   |
|  | CLOSE AT : OPEN AT (Kg / Cm <sup>2</sup> g)   |  |                                      |                   |
|  | *TRAVEL TIME FOR OPEN TO CLOSE, CLOSE TO OPEN   |  |                                      |                   |
|  | *VALVE POSN. ON SIGNAL AIR FAILURE  |  |                                      |                   |
|  | *VALVE POSN. ON SUPPLY AIR FAILURE  |  |                                      |                   |
| <b>ACCESSORIES</b>   | POSITIONER (SMART)  |  |                                      |                   |
|  | 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  |  |                                      |                   |

|   |   |                                      |              |
|---|---|--------------------------------------|--------------|
|  | <p>Technical specification for<br/><b>Control Valves with Accessories</b><br/>(Pneumatically Operated)</p> <p><b>Bellary TPS Unit#3, 1x700MW - KPCL</b></p> | SPEC NO.: <b>PE-TS-367-145-I 004</b> |              |
|   |   | VOLUME                               | II B         |
|   |   | SECTION                              | D            |
|   |   | REV. NO.                             | 00           |
|   |   | DATE                                 | : 05.06.2013 |
| SHEET   |   | OF                                   |              |


# SECTION – D

## BILL OF QUANTITY

|   |  |       |                                      |              |
|---|--|-------|--------------------------------------|--------------|
|  | <b>Technical specification for<br/>Control Valves with Accessories</b><br>(Pneumatically Operated) |       | SPEC NO.: <b>PE-TS-367-145-I 004</b> |              |
|   |  |       | VOLUME                               | II B         |
|   | <b>Bellary TPS Unit#3, 1x700MW - KPCL</b>  |       | SECTION                              | D            |
|   |  |       | REV. NO.                             | 00           |
|   |  |       | DATE                                 | : 05.06.2013 |
|   |  | SHEET |                                      |              |

## BILL OF QUANTITY



| S.NO   | ITEM DESCRIPTION   |   | Qty/Unit   |
|--------|--|---|------------|
| [A]    | CONTROL VALVES COMPLETE WITH PNEUMATIC ACTUATOR<br>AND ALL ACCESSORIES MOUNTED , PIPED AND TERMINATED ON JB  |   |            |
| S. No. | TAG NO.  | SERVICE   |            |
| 1      | ASV-8  | D/A Pegging from Aux. Steam Header  | 01         |
| 2      | CRHV-6   | D/A Pegging from CRH Line   | 01         |
| 3      | CDV-22 & CDV-25  | Main Condensate Control   | 02         |
| 4      | CDV-10, CDV-12 & CDV-14  | CEP A/B/C Minimum Recirculation   | 03         |
| 5      | CDV-39   | GSC min. flow recirculation   | 01         |
| 6      | CDV-43   | Excess Return to CST  | 01         |
| 7      | CDV-67   | Condensate Spray to SD F/T  | 01         |
| 8      | CDV-72   | Condensate for Valve Gland Sealing  | 01         |
| 9      | DRV-2 & DRV-8  | HPH-7A/7B Normal Drain to HPH-6A/6B   | 02         |
| 10     | DRV-5 & DRV-11   | HPH-7A/7B Alt.Drain to HP Drain F/T   | 02         |
| 11     | DRV-15 & DRV-22  | HPH-6A/6B Normal Drain to Deaerator   | 02         |
| 12     | DRV-18 & DRV-25  | HPH-6A/6B Alt. Drain to HP Drain F/T  | 02         |
| 13     | DRV-28   | LPH-3 Normal Drain to LPH-2   | 01         |
| 14     | DRV-31   | LPH-3 Alt. Drain to LP Drain F/T  | 01         |
| 15     | DRV-34   | LPH-2 Normal Drain to LPH-1   | 01         |
| 16     | DRV-37   | LPH-2 Alt. Drain to LP Drain F/T  | 01         |
| 17     | DRV-48   | Deaerator Overflow to LP Drain F/T  | 01         |
| 18     | DRV-53 & DRV-59  | HPH-8A/8B Normal Drain to HPH-7A/7B   | 02         |
| 19     | DRV-56 & DRV-62  | HPH-8A/8B Alt. Drain to SD F/T  | 02         |
| 20     | DRV-65   | LPH-4 Normal Drain to LPH-3   | 01         |
| 21     | DRV-68   | LPH-4 Alt. Drain to LP Drain F/T  | 01         |
| 22     | DMV-2  | DM Normal MU to Hotwell   | 01         |
| 23     | DMV-9  | Emergency MU to Hotwell   | 01         |
| 24     | FDV-14   | Low Load Feed Control   | 01         |
|        |  |   |            |
| [B]    | 15 Meters of 10mm OD x 1.5mm thick PVC Coated annealed Cu. Tubing (for each CV) (To be supplied Loose)   |   | 495 METERS |
| [C]    | FITTINGS:<br>for each CV<br>(To be Supplied Loose)   | (i) BRASS FITTING-Double Compression Type for Connection to Air Filter Regulator        | 1 LOT      |
|        |  | (ii) BRASS FITTING- Double Compression Type for Connection to Solenoid Valve            | 1 LOT      |
|        |  | (iii) BRASS FITTING- Double Compression Type for Connection to IA Header isolation vlv. | 1 LOT      |
|        |  | (iv) BRASS TEE  | 1 LOT      |
| [D]    | START-UP/COMMISSIONING SPARES : ( TOTAL PRICE FOR 1 SETS OF BODY AND BONNET GASKET & 1 SETS OF GLAND PACKINGS PER CV )   |   | 1 LOT      |
| [E]    | MANDATORY SPARES   |   | 1 LOT      |
| [F]    | DIAGNOSTIC SOFTWARE: Software for diagnostic & configuration with facility of configuring all valve tags in a unit through polling & without any change in wiring. |   | 1 LOT      |
| [G]    | HAND HELD HART CALIBRATOR  |   | 2 No.s     |

|   |   |  |                                      |                   |
|---|---|--|--------------------------------------|-------------------|
|  | Technical specification for<br><b>Control Valves with Accessories</b><br>(Pneumatically Operated) |  | SPEC NO.: <b>PE-TS-367-145-I 004</b> |                   |
|   |   |  | VOLUME II B                          |                   |
|   | Bellary TPS Unit#3, 1x700MW - KPCL  |  | SECTION D                            |                   |
|   |   |  | REV. NO. 00                          | DATE : 05.06.2013 |
|   |   |  | SHEET OF                             |                   |

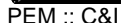
# SECTION – D

## QUALITY PLAN

# STANDARD QUALITY PLAN FOR CONTROL VALVES

|   |            |   |      |  |                                |       |   |                    |          |
|---|------------|---|------|--|--------------------------------|-------|---|--------------------|----------|
| JOB NO. 367                               |            |  |      | KARNATAKA POWER CORPORATION LIMITED      |                                |       |   |                    |          |
| STATUS CONTRACT                           |            |   |      | BELLARY THERMAL POWER STATION            |                                |       |   |                    |          |
| DISTRIBUTION                              |            |   |      | STAGE-III (1x700MW)                      |                                |       |   |                    |          |
| TO  |            |   |      | BHARAT HEAVY ELECTRICALS LTD             |                                | DEPT  | NAME  | SIGN               | DATE     |
| No. of                                    |            |   |      | POWER SECTOR                             |                                | CODE  | AKD   | -sd-               | 12.03.04 |
| REV.                                      | DATE       | ALT.  | CHD. | APPR.                                    | PROJECT ENGINEERING MANAGEMENT |       | CHD   | DJ                 | -sd-     |
| 01  | 02.04.2012 | MS  | HK   | SHB                                      | NOIDA                          |       | APPR  | JRC                | -sd-     |
| 1. REVISED IN LINE WITH CUSTOMER COMMENTS |            |   |      | TITLE                                    |                                |       |   |                    |          |
| VIDE TRANSMITTAL. NO.TB8T3/EPC/PDM/046    |            |   |      | STANDARD QUALITY PLAN FOR CONTROL VALVES |                                |       |   |                    |          |
| DATED 31.12.2011.                         |            |   |      |  |                                | DEPT. | SCALE   | DRAWING NO.        |          |
|   |            |   |      |  |                                | SIGN  |  | PE-QP-367-145-1006 |          |
|   |            |   |      |  |                                | DATE  |   | SHEET 00 OF 06     | REV. 01  |





|                   |                     |
|-------------------|---------------------|
| QUALITY PLAN NO.: | PE-QP-367-145-I 006 |
|-------------------|---------------------|

IIB


D



DATE: 02.04.2012


OF 6

| 1.0 | MATERIAL                                      |    |                               |    |                                  |                     |  |  |                    |                  |     |     |   |  |
|-----|---|----|-------------------------------|----|----------------------------------|---------------------|--|--|--------------------|------------------|-----|-----|---|--|
| 1.1 | Body & Bonnet casting / forgings, plug, stem. | 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   | Only for rating ANSI 900 and above.<br><br>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 |
|     |   | 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 - BHEL  
2 - Vendor  
3 - Sub-vendor  
4 - KPCL

|   |                       | <p align="center"><b>STANDARD QUALITY PLAN<br/>FOR<br/>CONTROL VALVE (PNEUMATIC)</b></p> |  |                              |                     |                                   |                                   | QUALITY PLAN NO.: <b>PE-QP-367-145-I 006</b> |                      |                  |        |         |
|--|-----------------------|--|--|------------------------------|---------------------|-----------------------------------|-----------------------------------|--|----------------------|------------------|--------|---------|
|  |                       |  |  |                              |                     |                                   |                                   | VOLUME IIB                                   |                      |                  |        |         |
|  |                       |  |  |                              |                     |                                   |                                   | SECTION D                                    |                      |                  |        |         |
|  |                       |  |  |                              |                     |                                   |                                   | REV. NO. 01 DATE: 02.04.2012                 |                      |                  |        |         |
|  |                       |  |  |                              |                     |                                   |                                   | SHEET 2 OF 6                                 |                      |                  |        |         |
| Sl. No.  | Component / operation | Characteristics Checked  | * Category   | Type/Method of Check         | Extent of Check     | Reference documents               | Acceptance Norms                  | Format of Records                            | Agency <sup>\$</sup> |                  |        | Remarks |
|  |                       |  |  |                              |                     |                                   |                                   |  | P                    | W                | V      |         |
| 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<br>10,000 cycles | One /<br>Type       | 10,000 cycles/<br>Mfr. standard.  | No damage                         | Test Certificate                             | 3/2                  |                  | 2,1    |         |
| 1.3  | Spring                | 1. Composition   | MA   | Chemical-Analysis            | One sample/<br>Heat | Material spec. /<br>Mfr. standard | Material spec. /<br>Mfr. standard | Test Certificate                             | 3                    | ---              | 2,1    |         |
|  |                       | 2. Mech. Properties  | MA   | Mech. Test                   | One sample/<br>Heat | Material spec. /<br>Mfr. standard | Material spec. /<br>Mfr. standard | Test Certificate                             | 3                    | ---              | 2,1    |         |
|  |                       | 3. Performance   | MA   | 1. Stiffness ratio           | 100%                | Material spec. /<br>Mfr. standard | Material spec. /<br>Mfr. standard | Test Certificate                             | 3                    | ---              | 2,1    |         |
|  |                       |  |  | 2. Scragging                 | 100%                | Material spec. /<br>Mfr. standard | Material spec. /<br>Mfr. standard | Test Certificate                             | 3                    | ---              | 2,1    |         |
|  |                       |  |  | 3. Cyclic test (Endurance)   | One / type          | 10,000 cycles                     | Material spec. /<br>Mfr. standard | Test Certificate                             | 3                    | ---              | 2,1    |         |
|  |                       |  |  | 4. Dimension (Measurement)   | One sample/<br>Lot  | Mfr. standard                     | Appd Drg                          | Record                                       | 3                    | ---              | 2,1    |         |
|  |                       | 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. Degree of protection  | MA                    |  |  | IP/NEMA Tests                | One sample / type   | Approved Data sheet               | Approved Data sheet               | Test Certificate                             | 3                    | ---              | 2,1, 4 |         |
| <p> <b>LEGEND:</b> * CR - Critical characteristics    RT- Radiographic Test    PT – Dye penetrant Test    <sup>\$</sup> P - Agency Performing the Test.    1 - BHEL<br/>         MA - Major characteristics    UT – Ultrasonic Test    MT- Magnetic Test    W - Agency Witnessing the Test.    2 - Vendor<br/>         MI - Minor characteristics    V - Agency Verifying the Test.    3 - Sub-vendor    4 - KPCL       </p> |                       |  |  |                              |                     |                                   |                                   |  |                      |                  |        |         |

|    |  | <h2 style="text-align: center;">STANDARD QUALITY PLAN<br/>FOR<br/>CONTROL VALVE (PNEUMATIC)</h2> |            |                                    |                               |  |  | QUALITY PLAN NO.: <b>PE-QP-367-145-I 006</b> |                      |                         |     |   |
|---|--|--|------------|------------------------------------|-------------------------------|--|--|--|----------------------|-------------------------|-----|---|
|   |  |  |            |                                    |                               |  |  | VOLUME IIB                                   |                      |                         |     |   |
|   |  |  |            |                                    |                               |  |  | SECTION D                                    |                      |                         |     |   |
|   |  |  |            |                                    |                               |  |  | REV. NO. 01                                  |                      | DATE: <b>02.04.2012</b> |     |   |
|   |  |  |            |                                    |                               |  |  | SHEET 3                                      |                      | OF 6                    |     |   |
| Sl. No.   | Component / operation                                  | Characteristics Checked  | * Category | Type/Method of Check               | Extent of Check               | Reference documents                      | Acceptance Norms                         | Format of Records                            | Agency <sup>\$</sup> |                         |     | Remarks   |
|   |  |  |            |                                    |                               |  |  |  | P                    | W                       | V   |   |
| 1.5   | Pressure Gauges  | 1. Performance   | MA         | Review of calibration certificates | 100%                          | Mfr. Standard                            | Mfr. Standard                            | Test Certificate                             | 3                    | ---                     | 2,1 |   |
|   |  | 2. Marking   | MA         | Visual                             | 100%                          | Mfr. standard                            | Mfr. standard                            | Records                                      | 3                    | ---                     | 2,1 |   |
| <b>2.0 IN PROCESS INSPECTION</b>  |  |  |            |                                    |                               |  |  |  |                      |                         |     |   |
| 2.1   | Body & Bonnet after machining, Plug with actuator stem | 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   |   |
|   |  | 4. Hard facing   | MA         | DP Test                            | 100%                          | ASME B 16.34                             | ASME B 16.34                             | Test Records                                 | 2                    | ---                     | 1   |  |
| 2.2   | Guide Bush(wherever applicable)                        | Physical/Chemical properties   | MI         | Physical/Chemical Test             | 100%                          | Material Specification/<br>Mfr. standard | Material Specification/<br>Mfr. standard | Test Certificate                             | 2                    |                         | 2   |   |
| 2.3   | Lapping  | Machining surface contact  | MA         | Blue Matching                      | One sample/lot                | -----                                    | Proper Physical Contact                  | Test Records                                 | 2                    |                         |     |   |
| <b>3.0 TESTS ON COMPLETED VALVE</b>   |  |  |            |                                    |                               |  |  |  |                      |                         |     |   |
| 3.1   | Actuator Chamber                                       | Leakage & Strength   | MA         | Pneumatic test                     | 100%                          | Mfr. Standard                            | No Leakage                               | Test Certificate                             | 2                    | 1,4                     | 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                     | 1,4 |   |
| 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                     | 1,4 |   |
| <b>LEGEND:</b> <div style="display: flex; justify-content: space-between;"> <div> <p>* CR - Critical characteristics</p> <p>MA - Major characteristics</p> <p>MI - Minor characteristics</p> </div> <div> <p>RT- Radiographic Test</p> <p>UT – Ultrasonic Test</p> </div> <div> <p>PT – Dye penetrant Test</p> <p>MT- Magnetic Test</p> </div> <div> <p><sup>\$</sup> P - Agency Performing the Test.</p> <p>W - Agency Witnessing the Test.</p> <p>V - Agency Verifying the Test.</p> </div> <div> <p>1 - BH&amp;I</p> <p>2 - Vendor</p> <p>3 - Sub-vendor</p> <p>4 - KPCL</p> </div> </div> |  |  |            |                                    |                               |  |  |  |                      |                         |     |   |




|  |  |  |            |   |                 |  |  |                                       |                      |                  |     |   |
|--|--|--|------------|---|-----------------|--|--|---------------------------------------|----------------------|------------------|-----|---|
| <div></div> <div>PEM :: C&amp;I</div> |  | STANDARD QUALITY PLAN<br>FOR<br>CONTROL VALVE (PNEUMATIC)      |            |   |                 |  |  | QUALITY PLAN NO.: PE-QP-367-145-I 006 |                      |                  |     |   |
|  |  |  |            |   |                 |  |  | VOLUME IIB                            |                      |                  |     |   |
|  |  |  |            |   |                 |  |  | SECTION D                             |                      |                  |     |   |
|  |  |  |            |   |                 |  |  | REV. NO. 01                           |                      | DATE: 02.04.2012 |     |   |
|  |  |  |            |   |                 |  |  | SHEET 4                               |                      | OF 6             |     |   |
| Sl. No.  | Component / operation                                | Characteristics Checked  | * Category | Type/Method of Check  | Extent of Check | Reference documents                      | Acceptance Norms                         | Format of Records                     | Agency <sup>\$</sup> |                  |     | Remarks   |
|  |  |  |            |   |                 |  |  |                                       | P                    | W                | V   |   |
| 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 | ♦ Size = Body & port size Or Body size & CV for non std port. Refer Note 1. |
|  |  | 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  |


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

RT- Radiographic Test  
UT – Ultrasonic Test  
PT – Dye penetrant Test  
MT- Magnetic Test

<sup>\$</sup> P - Agency Performing the Test.  
W - Agency Witnessing the Test.  
V - Agency Verifying the Test.

1 - BHEL  
2 - Vendor  
3 - Sub-vendor  
4 - KPCL

| <div><div>बि.पि.पि.पि.</div><div></div><div>PEM :: C&amp;I</div></div>   |  | STANDARD QUALITY PLAN<br>FOR<br>CONTROL VALVE (PNEUMATIC)            |             |  |                 |  |  | QUALITY PLAN NO.: PE-QP-367-145-I 006 |                      |                  |       |  |
|---|--|--|-------------|--|-----------------|--|--|---------------------------------------|----------------------|------------------|-------|--|
|   |  |  |             |  |                 |  |  | VOLUME IIB                            |                      |                  |       |  |
|   |  |  |             |  |                 |  |  | SECTION D                             |                      |                  |       |  |
|   |  |  |             |  |                 |  |  | REV. NO. 01                           |                      | DATE: 02.04.2012 |       |  |
|   |  |  |             |  |                 |  |  | SHEET 5                               |                      | OF 6             |       |  |
| Sl. No.   | Component / operation  | Characteristics Checked  | * Cate gory | Type/Method of Check                         | Extent of Check | Reference documents                      | Acceptance Norms                         | Format of Records                     | Agency <sup>\$</sup> |                  |       | Remarks  |
|   |  |  |             |  |                 |  |  |                                       | P                    | W                | V     |  |
|   |  | 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   |  |
| 5.0   | AUXILIARY ITEMS  |  |             |  |                 |  |  |                                       |                      |                  |       |  |
| 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     | 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   |  |
| 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                    | 1,4              | 1,4   | On completed valve   |
| 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   |  |
| LEGEND: * CR - Critical characteristics RT- Radiographic Test PT – Dye penetrant Test <sup>\$</sup> P - Agency Performing the Test. 1 - BHEL<br>MA - Major characteristics UT – Ultrasonic Test MT- Magnetic Test W - Agency Witnessing the Test. 2 - Vendor<br>MI - Minor characteristics V - Agency Verifying the Test. 3 - Sub-vendor 4 - KPCL |  |  |             |  |                 |  |  |                                       |                      |                  |       |  |


| <div><div>8/45 PM</div><div></div><div>PEM :: C&amp;I</div></div> |                                  | STANDARD QUALITY PLAN<br>FOR<br>CONTROL VALVE (PNEUMATIC) |            |                        |                 |  |  | QUALITY PLAN NO.: PE-QP-367-145-I 006 |                      |                  |       |                                    |
|--|----------------------------------|---|------------|------------------------|-----------------|--|--|---------------------------------------|----------------------|------------------|-------|------------------------------------|
|  |                                  |   |            |                        |                 |  |  | VOLUME IIB                            |                      |                  |       |                                    |
|  |                                  |   |            |                        |                 |  |  | SECTION D                             |                      |                  |       |                                    |
|  |                                  |   |            |                        |                 |  |  | REV. NO. 01                           |                      | DATE: 02.04.2012 |       |                                    |
|  |                                  |   |            |                        |                 |  |  | SHEET 6                               |                      | OF 6             |       |                                    |
| Sl. No.  | Component / operation            | Characteristics Checked                                   | * Category | Type/Method of Check   | Extent of Check | Reference documents                      | Acceptance Norms                         | Format of Records                     | Agency <sup>\$</sup> |                  |       | Remarks                            |
|  |                                  |   |            |                        |                 |  |  |                                       | P                    | W                | V     |                                    |
|  |                                  | 4. Hysterisis   | CR         | Measurement            | 100%            | Approved drg. / data sheet / BHEL specn. | Approved drg. / data sheet / BHEL specn. | Inspection Report                     | 2                    | ---              | 1,4   | <div><div></div><div>1</div></div> |
| 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                    | 1,4              | 1,4   |                                    |
| 6.0  | PAINTING                         | Soundness of Painting                                     | MA         | Visual and Measurement | 100%            | BHEL specn. / Mfr. Standard              | BHEL specn. / Mfr. Standard              | Inspection Report                     | 2                    | ---              | 1     | 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 :**

- Cv test will be conducted if Test Certificate for a similar Model / Size / Cv is not available. Validity of the certificate considered as last 3 years. Cv test conducted at IIT/FCRI/any govt. approved laboratory shall not be witnessed by BHEL.
- In the absence of BHEL spec. for painting, vendor to obtain BHEL's approval on their painting specification / procedure.
- Sea worthy packing, if applicable.
- The quantum of check shall be 100% for manufacturer and 10% for BHEL/BHEL nominated inspection agency.
- IBR certificates in Form III-C shall be submitted if called for in the specification/datasheet.
- 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.
- Inspection call shall be raised to Customer / Customer representative for the scheduled inspection/ testing. In absence of Customer / Customer representative BHEL representative will do inspection and necessary approval.




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

|   |   |  |                                      |                   |
|---|---|--|--------------------------------------|-------------------|
|  | Technical specification for<br><b>Control Valves with Accessories</b><br>(Pneumatically Operated) |  | SPEC NO.: <b>PE-TS-367-145-I 004</b> |                   |
|   |   |  | VOLUME II B                          |                   |
|   | Bellary TPS Unit#3, 1x700MW - KPCL  |  | SECTION D                            |                   |
|   |   |  | REV. NO. 00                          | DATE : 05.06.2013 |
|   |   |  | SHEET OF                             |                   |

# SECTION – D

## SPARES

|   |  |  |                                      |              |
|---|--|--|--------------------------------------|--------------|
|  | <b>Technical specification for<br/>Control Valves with Accessories</b><br>(Pneumatically Operated) |  | SPEC NO.: <b>PE-TS-367-145-I 004</b> |              |
|   |  |  | VOLUME                               | II B         |
|   | <b>Bellary TPS Unit#3, 1x700MW - KPCL</b>  |  | SECTION                              | D            |
|   |  |  | REV. NO.                             | 00           |
|   |  |  | DATE                                 | : 05.06.2013 |
|   |  |  | SHEET                                | OF           |

### [A] LIST OF COMMISSIONING SPARES


| S.No. | ITEM DESCRIPTION | QUANTITY REQUIRED                       |
|-------|------------------|---|
| 1     | Gaskets          | One (1) set with each control valve Tag |
| 2     | Gland Packing    | One (1) set with each control valve Tag |

### [B] LIST OF MANDATORY SPARES

| S. NO | ITEM DESCRIPTION     | QUANTITIES FOR ONE UNIT |
|-------|----------------------|-------------------------|
| 1.    | Plug & Stem Assembly | 1 No. of each type      |
| 2.    | Seat Ring            | 1 No. of each type      |
| 3.    | Packing & Gaskets    | 1 No. of each type      |
| 4.    | Pilot Relay          | 1 No. of each type      |
| 5.    | Actuator Diaphragm   | 1 No. of each type      |
| 6.    | O-Rings              | 2 No. of each type      |
| 7.    | Feedback Linkages    | 1 No. of each type      |
| 8.    | Positioner           | 2 No. of each type      |
| 9     | Airlock Relays       | 1 No. of each type      |


**NOTE** :- The Actual Quantity shall be worked out during detailed Engineering.



|   |   |  |                                      |                   |
|---|---|--|--------------------------------------|-------------------|
|  | Technical specification for<br><b>Control Valves with Accessories</b><br>(Pneumatically Operated) |  | SPEC NO.: <b>PE-TS-367-145-I 004</b> |                   |
|   |   |  | VOLUME II B                          |                   |
|   | Bellary TPS Unit#3, 1x700MW - KPCL  |  | SECTION D                            |                   |
|   |   |  | REV. NO. 00                          | DATE : 05.06.2013 |
|   |   |  | SHEET                                |                   |

## SECTION – D

# SCHEDULE OF SUBMISSION OF DRAWINGS/DOCUMENTS

|   |  |  |                                      |              |
|---|--|--|--------------------------------------|--------------|
|  | <b>Technical specification for<br/>Control Valves with Accessories</b><br>(Pneumatically Operated) |  | SPEC NO.: <b>PE-TS-367-145-I 004</b> |              |
|   |  |  | VOLUME                               | II B         |
|   | <b>Bellary TPS Unit#3, 1x700MW - KPCL</b>  |  | SECTION                              | D            |
|   |  |  | REV. NO.                             | 00           |
|   |  |  | DATE                                 | : 05.06.2013 |
|   |  |  | SHEET                                | OF           |

### SCHEDULE OF SUBMISSION OF DRAWINGS / DOCUMENTS, EQUIPMENT MANUFACTURE INSPECTION AND DESPATCH

| 1. | <b><u>ZERO DATE</u></b>   | <b><u>DATE of LOI / FOI / TOI</u></b> |
|----|---|---------------------------------------|
| 2. | Submission of Data Sheets / documents / catalogues / Valve sizing calculations / Noise calculations for approval.   | 2 Weeks from the Zero date.           |
| 3. | Technical finalisation, freezing of inputs of manufacture by way of vetting of documents and technical discussions and resubmissions of documents (if required) | 8 Weeks from the Zero date.           |
| 4. | Inspection of Equipment as per Approved (Category-I) drawings / documents.  | 18 Weeks from the Zero date.          |
| 5. | Release of MDCC by BHEL   | 20 Weeks from the Zero date.          |
| 6. | Dispatch (Packaging & Dispatch)   | 21 Weeks from the Zero date.          |
| 7. | Final documents submission as per Contract  | 22 Weeks from the Zero date.          |

**NOTE:** Delays due to non-fulfillment of the requirements of approved Quality Plan and approved Data sheets; Drawings, Catalogues and Sizing Calculations observed during inspection shall be to the Vendor's account.

Delays due to INCOMPLETE (Partly) submission of Data sheets, Drawings, Catalogues and Sizing Calculations also be considered as **"DOCUMENTS NOT SUBMITTED"**

**(Signature and Stamp of the Bidder)**

**KARNATAKA POWER CORPORATION LIMITED**  
**BELLARY TPS Unit#3, 1x700MW**

TECHNICAL SPECIFICATION  
FOR  
**CONTROL VALVES WITH ACCESSORIES**  
(Pneumatically Operated)

**VOLUME III**

SPECIFICATION No: **PE-TS-367-145-I 004**



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

|   |   |                                      |     |
|---|---|--------------------------------------|-----|
|  | <p>Technical specification for<br/><b>Control Valves with Accessories</b><br/>(Pneumatically Operated)</p> <p><b>Bellary TPS Unit#3, 1x700MW - KPCL</b></p> | SPEC NO.: <b>PE-TS-367-145-I 004</b> |     |
|   |   | VOLUME                               | III |
|   |   | SECTION                              |     |
|   |   | REV. NO.                             | 00  |
|   |   | DATE : 05.06.2013                    |     |
|   |   | SHEET                                | OF  |

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### VOL-III

| S. No. | DESCRIPTION             | No. of sheets |
|--------|-------------------------|---------------|
| 1      | COMPLIANCE CERTIFICATE  | 1             |
| 2      | SCHEDULE OF PRICES      | 1             |
| 3      | SCHEDULE OF UNIT PRICES | 1             |
| 4      | CV TEST CHARGES         | 1             |
| 5      | INSPECTION SCHEDULE     | 1             |


**COMPLIANCE CERTIFICATE**  
**For**  
**Control Valve with accessories**  
**(To be Signed & Stamped by the Bidder)**

**Project: Bellary TPS Unit#3, 1x700MW - KPCL**  
**Specification no.: PE-TS-367-145-1004**

**We shall comply with the following:-**

1. All the requirements as stated in Technical Specification / Specific Technical requirement / Data sheets / Drawings, BHEL quality plan etc as enclosed in the tender, shall be fully complied **without any deviation**.
2. BHEL Quality Plan (enclosed with the specification) duly signed and stamped is submitted herewith **without any deviation**.
3. Calculation of Cv, Noise level, Valve outlet velocity, Trim exit velocity, Actuator sizing, Data sheet-C in line with Data sheet-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 LOI.
4. Selection of valves and Actuators are our (bidder's) responsibility. Any change in selection of type of valve and Actuators / 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 without any commercial implication and time delay.
5. Body material and Trim material combinations offered will be equivalent or better than the material specified in data sheet-A. Wherever Trim material combinations offered differ from the specification, its superiority shall be authenticated with documentary evidence and justification produced for BHEL / Customer's concurrence. BHEL / Customer reserves the right to accept/rejects any variation to the specification.

|                     |  |
|---------------------|--|
| Signature with date |  |
| Name                |  |
| Company seal        |  |

|   |   |  |                               |                   |
|---|---|--|-------------------------------|-------------------|
|  | <b>Technical specification for<br/>Control Valves with Accessories</b><br>(Pneumatically Operated)<br><br><b>Bellary TPS Unit#3, 1x700MW - KPCL</b> |  | SPEC NO.: PE-TS-367-145-I 004 |                   |
|   |   |  | VOLUME III                    |                   |
|   |   |  | SECTION                       |                   |
|   |   |  | REV. NO. 00                   | DATE : 05.06.2013 |
|   |   |  | SHEET OF                      |                   |

## SCHEDULE OF PRICES

| S.NO  | ITEM DESCRIPTION       |                                      |          | UNIT PRICE<br>(Ex-works) | TOTAL PRICE for<br>ONE Units<br>(Ex-works) |
|---|------------------------|--------------------------------------|----------|--------------------------|--|
| [A] CONTROL VALVES COMPLETE WITH PNEUMATIC ACTUATOR AND ALL THE ACCESSORIES |                        |                                      |          |                          |  |
| S. No.  | TAG NO.                | SERVICE                              | QTY/UNIT |                          |  |
| 1.  | ASV-8                  | D/A Pegging from Aux. Steam Header   | 01       |                          |  |
| 2.  | CRHV-6                 | D/A Pegging from CRH Line            | 01       |                          |  |
| 3.  | CDV-22 & CDV-25        | Main Condensate Control              | 02       |                          |  |
| 4.  | CDV-10,CDV-12 & CDV-14 | CEP A/B/C Minimum Recirculation      | 03       |                          |  |
| 5.  | CDV-39                 | GSC min. flow recirculation          | 01       |                          |  |
| 6.  | CDV-43                 | Excess Return to CST                 | 01       |                          |  |
| 7.  | CDV-67                 | Condensate Spray to SD F/T           | 01       |                          |  |
| 8.  | CDV-72                 | Condensate for Valve Gland Sealing   | 01       |                          |  |
| 9.  | DRV-2 & DRV-8          | HPH-7A/7B Normal Drain to HPH-6A/6B  | 02       |                          |  |
| 10.   | DRV-5 & DRV-11         | HPH-7A/7B Alt.Drain to HP Drain F/T  | 02       |                          |  |
| 11.   | DRV-15 & DRV-22        | HPH-6A/6B Normal Drain to Deaerator  | 02       |                          |  |
| 12.   | DRV-18 & DRV-25        | HPH-6A/6B Alt. Drain to HP Drain F/T | 02       |                          |  |
| 13.   | DRV-28                 | LPH-3 Normal Drain to LPH-2          | 01       |                          |  |
| 14.   | DRV-31                 | LPH-3 Alt. Drain to LP Drain F/T     | 01       |                          |  |
| 15.   | DRV-34                 | LPH-2 Normal Drain to LPH-1          | 01       |                          |  |
| 16.   | DRV-37                 | LPH-2 Alt. Drain to LP Drain F/T     | 01       |                          |  |
| 17.   | DRV-48                 | Deaerator Overflow to LP Drain F/T   | 01       |                          |  |
| 18.   | DRV-53 & DRV-59        | HPH-8A/8B Normal Drain to HPH-7A/7B  | 02       |                          |  |
| 19.   | DRV-56 & DRV-62        | HPH-8A/8B Alt. Drain to SD F/T       | 02       |                          |  |
| 20.   | DRV-65                 | LPH-4 Normal Drain to LPH-3          | 01       |                          |  |
| 21.   | DRV-68                 | LPH-4 Alt. Drain to LP Drain F/T     | 01       |                          |  |
| 22.   | DMV-2                  | DM Normal MU to Hotwell              | 01       |                          |  |
| 23.   | DMV-9                  | Emergency MU to Hotwell              | 01       |                          |  |
| 24.   | FDV-14                 | Low Load Feed Control                | 01       |                          |  |

|     |   |   |            |  |  |
|-----|---|---|------------|--|--|
| [B] | 15 Meters of 10mm OD x 1.5mm thick PVC Coated annealed Cu. Tubing (for each CV)<br>(To be supplied Loose)   |   | 495 METERS |  |  |
| [C] | <b>FITTINGS:</b><br>for each CV<br>(To be Supplied Loose)   | (i) BRASS FITTING-Double Compression Type for Connection to Air Filter Regulator        | 1 LOT      |  |  |
|     |   | (ii) BRASS FITTING- Double Compression Type for Connection to Solenoid Valve            | 1 LOT      |  |  |
|     |   | (iii) BRASS FITTING- Double Compression Type for Connection to IA Header isolation vlv. | 1 LOT      |  |  |
|     |   | (iv) BRASS TEE  | 1 LOT      |  |  |
| [D] | <b>START-UP/COMMISSIONING SPARES :</b> ( TOTAL PRICE FOR 1 SETS OF BODY AND BONNET GASKET & 1 SETS OF GLAND PACKINGS PER CV )   |   | 1 LOT      |  |  |
| [E] | <b>MANDATORY SPARES</b>   |   | 1 LOT      |  |  |
| [F] | <b>DIAGNOSTIC SOFTWARE:</b> Software for diagnostic & configuration with facility of configuring all valve tags in a unit through polling & without any change in wiring. |   | 1 LOT      |  |  |
| [G] | <b>HAND HELD HART CALIBRATOR</b>  |   | 2 No.s     |  |  |
| [H] | <b>DOCUMENTATION CHARGES FOR THE FINAL DOCUMENTS &amp; SOFT COPIES.</b>   |   | 1 LOT      |  |  |

### PARTICULARS OF THE BIDDER / AUTHORISED REPRESENTATIVE

| NAME | DESIGNATION | SIGNATURE | DATE | COMPANY SEAL |
|------|-------------|-----------|------|--------------|
|------|-------------|-----------|------|--------------|

|   |   |  |                                      |    |                   |
|---|---|--|--------------------------------------|----|-------------------|
|  | <p>Technical specification for<br/><b>Control Valves with Accessories</b><br/>(Pneumatically Operated)</p> <p><b>Bellary TPS Unit#3, 1x700MW - KPCL</b></p> |  | SPEC NO.: <b>PE-TS-367-145-I 004</b> |    |                   |
|   |   |  | VOLUME III                           |    |                   |
|   |   |  | SECTION                              |    |                   |
|   |   |  | REV. NO.                             | 00 | DATE : 05.06.2013 |
|   |   |  | SHEET                                | OF |                   |

## UNIT PRICES

### CONTROL VALVE ACCESSORIES

| S. No. | ITEMS  | UNIT PRICE<br>(Ex-Works) |
|--------|--|--------------------------|
| 1.     | SMART POSITIONER (EACH TYPE)   |                          |
| 2.     | VALVE TRIM OF EACH TYPE (Separate list to be attached if required)                                       |                          |
| 3.     | DIAPHRAGMS,O-RINGS,SEALS ETC OF ALL TYPE,MAKE ETC  |                          |
| 4.     | AIR FILTER REGULATORS  |                          |
| 5.     | AIR LOCK RELAY   |                          |
| 6.     | POSITION LIMIT SWITCH  |                          |
| 7.     | VOLUME BOOSTER   |                          |
| 8.     | SOLENOID VALVE   |                          |
| 9.     | E/P CONVERTER  |                          |
| 10.    | PRESSURE GAUGES OF EACH TYPE   |                          |
| 11.    | JUNCTION BOX (24 WAYS)   |                          |
| 12.    | HANDWHEEL  |                          |
| 13.    | HART CALIBRATOR  |                          |
| 14.    | PERSONAL COMPUTER ( INDUSTRIAL GRADE )   |                          |
| 15.    | SOFTWARE FOR POSITIONER(DIAGONOSTIC)   |                          |
| 16.    | HARDWARE FOR CONNECTION B/W PC & CV POSITIONER<br>(RS-232/485 CONVERTER, MULTIPLEXER & HART MODEM, ETC.) |                          |
| 17.    | ACTUATOR OF EACH TYPE (Separate list to be attached if required)   |                          |
| 18.    | BRASS FITTING FOR CONNECTION TO AIR FILTER REGULATOR   |                          |
| 19.    | BRASS FITTING FOR CONNECTION TO SOLENOID VALVE   |                          |
| 20.    | BRASS FITTINGS FOR CONNECTING TO AIR HEADER  |                          |
| 21.    | EQUAL COPPER TEE   |                          |
| 22.    | COPPER TUBING PER METRE  |                          |

### PARTICULARS OF THE BIDDER / AUTHORISED REPRESENTATIVE

|      |             |           |      |              |
|------|-------------|-----------|------|--------------|
|      |             |           |      |              |
| NAME | DESIGNATION | SIGNATURE | DATE | COMPANY SEAL |

|   |   |  |                                      |    |                   |
|---|---|--|--------------------------------------|----|-------------------|
|  | <p>Technical specification for<br/><b>Control Valves with Accessories</b><br/>(Pneumatically Operated)</p> <p><b>Bellary TPS Unit#3, 1x700MW - KPCL</b></p> |  | SPEC NO.: <b>PE-TS-367-145-I 004</b> |    |                   |
|   |   |  | VOLUME III                           |    |                   |
|   |   |  | SECTION                              |    |                   |
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## CV TEST CHARGES

| S.NO | ITEM DESCRIPTION        |                                      | QTY | CV TEST CHARGES (Ex-works) |
|------|-------------------------|--------------------------------------|-----|----------------------------|
|      | TAG NO.                 | SERVICE                              |     |                            |
| 1    | ASV-8                   | D/A Pegging from Aux. Steam Header   | 1   |                            |
| 2    | CRHV-6                  | D/A Pegging from CRH Line            | 1   |                            |
| 3    | CDV-22 & CDV-25         | Main Condensate Control              | 1   |                            |
| 4    | CDV-10, CDV-12 & CDV-14 | CEP A/B/C Minimum Recirculation      | 1   |                            |
| 5    | CDV-39                  | GSC min. flow recirculation          | 1   |                            |
| 6    | CDV-43                  | Excess Return to CST                 | 1   |                            |
| 7    | CDV-67                  | Condensate Spray to SD F/T           | 1   |                            |
| 8    | CDV-72                  | Condensate for Valve Gland Sealing   | 1   |                            |
| 9    | DRV-2 & DRV-8           | HPH-7A/7B Normal Drain to HPH-6A/6B  | 1   |                            |
| 10   | DRV-5 & DRV-11          | HPH-7A/7B Alt.Drain to HP Drain F/T  | 1   |                            |
| 11   | DRV-15 & DRV-22         | HPH-6A/6B Normal Drain to Deaerator  | 1   |                            |
| 12   | DRV-18 & DRV-25         | HPH-6A/6B Alt. Drain to HP Drain F/T | 1   |                            |
| 13   | DRV-28                  | LPH-3 Normal Drain to LPH-2          | 1   |                            |
| 14   | DRV-31                  | LPH-3 Alt. Drain to LP Drain F/T     | 1   |                            |
| 15   | DRV-34                  | LPH-2 Normal Drain to LPH-1          | 1   |                            |
| 16   | DRV-37                  | LPH-2 Alt. Drain to LP Drain F/T     | 1   |                            |
| 17   | DRV-48                  | Deaerator Overflow to LP Drain F/T   | 1   |                            |
| 18   | DRV-53 & DRV-59         | HPH-8A/8B Normal Drain to HPH-7A/7B  | 1   |                            |
| 19   | DRV-56 & DRV-62         | HPH-8A/8B Alt. Drain to SD F/T       | 1   |                            |
| 20   | DRV-65                  | LPH-4 Normal Drain to LPH-3          | 1   |                            |
| 21   | DRV-68                  | LPH-4 Alt. Drain to LP Drain F/T     | 1   |                            |
| 22   | DMV-2                   | DM Normal MU to Hotwell              | 1   |                            |
| 23   | DMV-9                   | Emergency MU to Hotwell              | 1   |                            |
| 24   | FDV-14                  | Low Load Feed Control                | 1   |                            |

**NOTE:**

- a) CV TEST TO BE CONDUCTED FOR ONE PER TYPE PER SIZE, CV VALUE. TAG NOS. TO BE GROUPED ACCORDINGLY AND INDICATED.
- b) IF THE BIDDER HAS CV TEST CERTIFICATE FOR A SIMILAR MODEL/SIZE/CV AND THE CERTIFICATE IS NOT MORE THAN THREE YEARS OLD FROM THE DATE OF TEST CONDUCTED, THE CERTIFICATE SHALL BE ACCEPTABLE.
- c) IN CASE THE SUBMITTED CV TEST CERTIFICATES ARE FOUND NON-ACCEPTABLE TO BHEL/CUSTOMER, BIDDER SHALL CONDUCT THE CV TYPE TEST WITHOUT ANY PRICE IMPLICATION TO BHEL.



|   |   |                                      |                   |
|---|---|--------------------------------------|-------------------|
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|   |   | VOLUME III                           |                   |
|   |   | SECTION                              |                   |
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## INSPECTION SCHEDULE

(PLACE & ADDRESS OF TESTING/ INSPECTION AND ITS SCHEDULE DATE & DURATION IN NUMBER OF DAYS ITEM/COMPONENTWISE TO BE LISTED)

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