An ISO 9001 Company

Bharat Heavy Electricals Limited
(High Pressure Boiler Plant)
Tiruchirappalli – 620014, TAMIL NADU, INDIA

TITLE **Start-up system Control valves along with commissioning and Mandatory Spares for Udangudi, Yadadri and Patratu projects**	Phone: +**91 431 2574166/ 9486581324** Fax: **+91 431 252 0719** Email: sbrajesh@bhel.in mjjiby@bhel.in

Reference Enquiry Number: **1802100217**	**Enquiry Date:** **03.12.2021**	**Due date for submission of quotation: 20.01.2022**
You are requested to quote the Enquiry number date and due date in all your correspondences. This is only a request for quotation and not an order		

CORRIGENDUM

Details of Corrigendum

- Due date for submission of bid extended up to 20.01.2022, 14.00Hrs IST.
- Supply of Hydraulic torque wrench is excluded from the scope of supply by vendor and specification is revised accordingly (Revision 8). Clauses modified are indicated in the revision column.
- *The below mentioned Item description is mentioned against Sl. Nos. 230.10, 590.10 and 780.10 of BOQ:*

  "Lumpsum charges for Supervision of erection and commissioning of unloading skid as per clause 6 (d) of Annexure-A."

  shall be read as below:

  "Manday charges for Supervision of erection and commissioning of start-up control valves as per clause 20 of Annexure-A."

  Bidders shall quote per Manday charges against the Sl. Nos. 230.10, 590.10 and 780.10.
  The price calculated for 14 mandays of erection and commissioning per unit (Two HWL valves and One MEFCV) or 2 % of the total contract value of Main supply items of each unit(boiler) whichever is lower will be considered for price comparison per unit in line with Clause 20 of Annexure-A.

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Senior Engineer
MM / Purchase / BOI
BHEL, TRICHY - 620 014.

ENGINEERING SPECIFICATION

FOR

STARTUP CONTROL VALVES

SPECIFICATION NO: BM/SCV: 001

Prepared by:	Reviewed by:	Approved by:
A.JAIGANESH Sr.Engineer PE / FB (BM)	I.GOPALAN Manager PE / FB (BM)	K.PERIASAMY Dy.General Manager PE / FB (BM)

Revision Log — Template Form Revision No.: 00

Revision No.	Date	Reason	Prepared		Reviewed		Approved	
			Name	Sign	Name	Sign	Name	Sign.
01	19.01.13	C&I comments	A.Jai Ganesh		Gopalan.I		K.Perisamy	
02	07.03.14	Standardization	A.Jai Ganesh		K.Sridharan		K.Perisamy	
03	30.01.17	Site Feedbacks	A.Jai Ganesh		V.Gunasekaran		K.Sridharan	
04	30.03.17	Update	Saji. P.J		A.JaiGanesh		K.Sridharan	
05	11.07.19	Site Feedback	Pinisetty Raviraja		A.Jai Ganesh		V.Gunasekaran	
06	12.05.20	Site Feedback	Prateek Kumar Jain		A.Jai Ganesh		V.Gunasekaran	
07	21.09.20	Site Feedback	Prateek Kumar Jain		A.Jai Ganesh		V.Gunasekaran	
08	07.01.21	The following clause has been modified 4.4.1(d)-7.3-9.31.12-9.31.30 &9.32.1	Gireesh Babu		R Gopinath		K Sridharan	

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1.0 PURPOSE

1.1 This Specification defines the minimum, acceptable requirements for the design and performance of one pair of BOILER SEPARATOR LEVEL CONTROL VALVES (HWL-1, HWL-2 VALVES) and one BOILER MINIMUM ECONOMIZER FLOW CONTROL VALVE (MEFCV VALVE) for a coal fired, supercritical, steam generating unit.

2.0 SCOPE OF WORK

2.1 Supplier shall provide equipment and components in accordance with the approved suppliers listed in this specification, unless otherwise approved by BHEL. Equipment or components not listed shall be Supplier's standard.

2.2 For skid mounted assemblies, all instrumentation and control wiring connections by BHEL to Supplier's equipment shall be external to the equipment on numbered terminal strips in junction boxes or electrical panels.

2.3 All piping furnished by the Supplier shall be provided in ISO standard sizes in nominal Metric units (DN sizes). All weld end preparations, socket weld couplings, threaded connections, flange sizes and ratings, at BHEL/Supplier terminal points shall comply with ISO standards in Metric units and also as per the data sheet.

2.4 Nozzles shall be prepared for connection with BHEL piping as follows:

- Welded connections 50 NB and smaller shall be socket weld connections in accordance with the requirements of ASME B16.11.
- Welded connections 65NB and above shall be butt weld connections. Butt weld ends shall be beveled for welding in accordance with the requirements of BHEL.

2.5 All flanged connections shall be supplied in accordance with the requirements of ASME B16.5.

2.6 All materials shall be new and in accordance with applicable ASTM specifications or with other recognized standards such as SAE. No peening, caulking or filling shall be permitted in repairing cracks, pin-holes or blow-holes. Defects in fabricated steel shall be repaired by chipping out welds to bottom of vee and re-welding.

2.7 The use of asbestos or material containing asbestos shall not be permitted. The use of mercury or material containing mercury shall not be permitted. All nonmetallic materials shall be noted to BHEL for approval.

2.8 The equipment and materials specified are intended to be the minimum suitable for the intended service. They are not intended to limit the Supplier's responsibility for proper design and selection of equipment. It is the Supplier's responsibility to bid a complete system for the intended service and the specification is only for general guidelines. Any changes in proposed equipment or materials during design shall be approved by BHEL.

2.9 All quotations and attachments submitted to BHEL shall be in the English language.

2.10 All quotations and inquiries to BHEL shall be routed through Purchase department- Materials Management/BOI.

2.11 Parts subject to wear, corrosion, deterioration or requiring adjustment, inspection or repair shall be accessible and capable of reasonably convenient removal, replacement and repair.

2.12 The Supplier shall complete and submit the Supplier Data Sheets and guarantees located in Section 10.0 of this specification with the equipment offered in full conformance with the specification. The Supplier shall provide a complete written description of all omissions or exceptions to the requirements of this specification. This written description must be included in Section 11.0 EXCEPTIONS TO THE SPECIFICATION of this specification. Without the complete data sheets and the EXCEPTIONS TO THE SPECIFICATION sheets, the proposal will not be evaluated.

2.13 Optional equipment shall be priced separately.

2.14 The Supplier shall be governed by the following regulations, codes, and standards, including their latest respective addenda, amendments, and errata.

AFBMA	Antifriction Bearing Manufacturers' Association
AGMA	American Gear Manufacturers' Association
AHI	American Hydraulic Institute
AISI	American Iron and Steel Institute
ANSI	American National Standards Institute
API	American Petroleum Institute
ASME	American Society Mechanical Engineers

ASTM	American Society Testing and Materials
AWS	American Welding Society
EIA	Electronics Industries Association
FCI	Fluid Controls Institute, Inc.
IEC	International Electro technical Commission
IEEE	Institute of Electrical and Electronics Engineers
IPCEA	International Power Cable Engineers Association
ISA	Instrumentation Society of America
MSS	Manufacturers Standardization Society of the Valve & Fittings Industry
NEMA	National Electrical Manufacturers' Association
NEC	National Electrical Code
NFPA	National Fire Protection Association
OSHA	Occupational Safety Health Act
PFI	Pipe Fitting Institute
SAMA	Scientific Apparatus Makers Association
SSPC	Steel Structures Painting Council
UL	Underwriter's Laboratories

In addition to the codes and standards specifically mentioned above for the equipment / plant / system, all equipment parts, systems and works covered under this specification shall comply with all currently applicable statutory regulations and safety codes of the Republic of India as well as of the locality where they will be installed, including the following:

a) Bureau of Indian Standards (BIS)
b) Indian Electricity Act
c) Indian Electricity Rules
d) Indian Explosives Act
e) Indian Factories Act and State Factories Act
f) Indian Boiler Regulations (IBR)
g) Rules for Electrical installation by Tariff Advisory Committee (TAC).
h) Any other statutory codes / standards / regulations, as may be applicable.

Unless covered otherwise by Indian codes & standards and in case nothing to the contrary is specifically mentioned elsewhere in the specifications, the latest editions of the following codes and standards shall also apply:

a) American Petroleum Institute (API)
b) International Organization for Standardization (ISO)
c) Tubular Exchanger Manufacturer's Association (TEMA)
d) American Welding Society (AWS)
e) Expansion Joint Manufacturers Association (EJMA)
f) Heat Exchange Institute (HEI)
g) Standards of the Hydraulic Institute, U.S.A.

Other International/ National standards such as DIN, VDI, BS, GOST etc. shall also be accepted for only material codes and manufacturing standards, subject to the Employer's approval, for which the Supplier shall furnish, adequate information to justify that these standards are equivalent or superior to the standards mentioned above. In all such cases the Supplier shall furnish specifically the variations and deviations from the standards mentioned elsewhere in the specification together with the complete word for word translation of the standard that is normally not published in English.

3.0 APPLICABLE CODES & STANDARDS

3.1 The valves shall comply with the applicable requirements of the latest edition of ASME B31.1, Power Piping Code.

3.2 Valve design in accordance with ASME B16.34.

3.3 The valve sizing shall be in compliance with latest edition of ISA 75.01 Hand book on Control Valves considering measures to avoid choked flow.

3.4 All pressure retaining parts of the valve shall be made of materials, including specific limitations on various materials that are in full compliance with PG.-5 of ASME Code Section 1.

3.5 Materials- Only materials listed and rated in B16.34 are acceptable and materials offered shall be appropriate to the design conditions listed.

3.6 For valves manufactured other than standards listed above, the Supplier shall specify (at the time of quotation) the Codes and Standards which will be used through the manufacturing and design processes. The Codes and Standards as specified will be subject to approval by **BHEL.**

3.7 Reference to the above Codes and Standards shall mean the latest revision, edition and addenda effective at the date of order unless specifically stated otherwise in this specification.

3.8 All welders and all welding procedures welders utilized shall be qualified in accordance with ASME Section IX. When welders and welding procedures are qualified in accordance with codes other than those specified, the Supplier must take exception at the time of quotation.

3.9 All materials shall be readily identifiable. Mill test reports shall be obtained for all pressure boundary parts. These test reports shall be available for

review at the Vendor's shops. Copies of these are to be supplied to the Company, if requested, prior to ordering.

3.10 Valve Revisions at supplier end

Supplier shall fabricate the valves based on the drawings approved by BHEL. If the valve design requires modification due to Supplier error during the Supplier tests or QA inspection, the Supplier will correct the design and reflect these changes in the AS-BUILT revision of the drawings.

4.0 EQUIPMENT FURNISHED BY SUPPLIER

4.1 Two (2) BOILER SEPARATOR LEVEL CONTROL VALVES (HWL-1, HWL-2 VALVES) complete with hydraulic actuator and associated positioning controls as per this specification.

4.2 One (1) BOILER MINIMUM ECONOMIZER FLOW CONTROL VALVE (MEFCV) complete with hydraulic actuator and associated positioning controls as per this specification.

4.3 One (1) Common Hydraulic Unit and Electronic Control Unit for the positioning control of the two BOILER SEPARATOR LEVEL CONTROL VALVES (HWL-1, HWL-2 VALVES) and Minimum Economizer Flow Control Valve (MEFCV) as per this specification.

4.4 Optional Equipment

4.4.1 The following equipment shall be proposed as an option.

☒ One *(1)* stainless steel tubing, fittings and necessary supports to connect all necessary hydraulic lines between the SUPPLIER supplied Common Hydraulic Unit and the SUPPLIER supplied two BOILER SEPARATOR LEVEL CONTROL VALVES (HWL-1, HWL-2 VALVES) and one Minimum Economizer Flow Control Valve (MEFCV) hydraulic actuators. Each Valve location from the common hydraulic unit shall be referred from the project specific data sheet (Annexure I).

i. Hydraulic Unit to HWL1 - refer Annexure II
ii. Hydraulic Unit to HWL2 - refer Annexure II
iii. Hydraulic Unit to MEFCV - refer Annexure II

☒ *Two (2)* fills of hydraulic fluid, first for start up and second for hydraulic fluid change prior to operation.

☒ Following special tools are must.

a) Flushing kit for valves.

b) Flushing kit for Hydraulic system including the flushing device. Flushing filter, Flushing Filter elements, hose pipes & valves to be supplied as spares along with the flushing kit.

c) N2 filling kit – Used for charging of accumulators with N2 as well as pressure checking and adjustment

d) *One (1)* lot of all tools that are required for maintenance of the valves. In case of problems arising during hydro test /assembly / maintenance at later stage, it will be supplier responsibility to resolve at no extra cost to BHEL. (The list of tools not specified as required items varies from supplier to supplier). The supply shall furnish the following but not limited to the mentioned, all tools such as suitable sockets and extension bars, double wrenches, screwdrivers, tapes etc., required for erection, calibration, servicing including instructions for their use. Tools shall be new. Tools shall be shipped to the project site in a suitable, separate container, clearly marked with the name of the equipment for which they are intended.

☒ *One (1)* lot of commissioning spares for each valve per SUPPLIER'S specific recommendation.

5.0 TERMINAL POINTS

5.1 At all valve inlets and outlets.

5.2 At the terminal junction boxes on each supplied valve, the terminals in the hydraulic power unit, and the terminals in the control cabinet.

6.0 FACILITY SITE SPECIFIC DATA

Please refer to attached specifications Annexure-II for Facility Site Specific Data (if applicable) and Annexure-III for Surface Preparations and Coatings requirements (if applicable).

7.0 DRAWINGS AND DATA BY SUPPLIER

7.1 Detailed Calculations to demonstrate the suitability of the selected valve for the application.

7.1.1 Cavitation in case the valve is for liquid application.
7.1.2 Noise and Vibration.
7.1.3 Flashing in case the valve is for saturated liquid application.
7.1.4 Valve sizing calculations.(Cv, valve outlet velocity)
7.1.5 Actuator sizing calculations

7.2 All drawings, calculations, specifications, bills of materials and other data submitted shall be in Metric units. Dual Dimensions are acceptable with Metric (primary) and English (in parenthesis). Metric units shall comply with the International SI System.

7.2.1 The following units are to be used for main parameters:

- Temperature °C
- Pressure kg /ocm^2 (g)
- Dimensions mm
- Flow kg/sec

7.3 Documents to be submitted with Quotation

- Valve Performance Data and curves.
- The Supplier shall provide dimensional outline drawings of the assembled unit(s). The drawings shall show overall dimensions, terminal box dimensions, mounting connections, clearances required for proper installation and maintenance shall state lifting requirements, and the weights of all major components. In addition to the sectional drawing, supplier has to provide isometric drawing of HWL valve body for heat tracing requirement.
- GA drawing of actuator.
- Actuator sizing calculations.
- GA drawing and circuit diagram of Common Hydraulic Control Unit.
- Hydraulic Power Unit diagram (P&ID) with Set points.
- Hydraulic connection diagram from HPU to individual actuator with BOM.
- Flushing and commissioning procedure documents with drawings.
- Electrical Circuit diagram.
- Control panel arrangement.
- List of commissioning spares.

- List of special tools as required for maintenance of valve and all equipment supplied.
- Performance data and curves.
- Completed Supplier Data Sheets per Section 10.0
- Any special requirements or operational limits shall be explicitly stated in each quotation.
- Field testing requirements.
- Terminal box wiring diagram
- Integrated Manufacturing and Quality Plan for BHEL's review
- Certificates as per QR and PTR requirements (applicable to Non-PMD vendor).

7.4 Descriptions of Equipment

- A written description of the equipment being offered shall be provided with the Bid. This information shall explain details of the design, construction, control, operation and performance.
- Consumable list including, compressed air, instrument air and electrical requirements indicating frequency of usage; intermittent or continuous.
- Experience List for valves in similar service including size, service, flow rate, pressure, temperature, and date placed in operation.

7.5 Documents to be submitted during Contract

- Detailed arrangement drawings of the assembled units including support details, flange connections, etc. All materials shall be readily identifiable on Supplier's drawings.
- Electrical wiring diagrams and connection details
- Instrument list
- Instrument data sheet(s) (ISA format or equal)
- Valve flow characteristic curve
- List of shop tests that will be conducted on the furnished equipment
- Complete set(s) of instruction, operation, maintenance, and erection manuals, quantities will be identified in the purchase order
- List of shop applied paints and protective finishes identifying compatible site applied coatings
- List of all lubricants required for the equipment operation identifying preferred acceptable substitutes
- Detailed shipping list with quantity units in meters and numbers (not in Lot(s)).
- Link between BOM and shipping list shall be provided
- O&M manual for HPU and actuator.

- O&M manuals – 1 set of Hard copy to be sent to site along with equipment.
- Data sheets & drawings for approval.
- O&M manual in soft copy – One copy of O&M manuals in soft copy is to be submitted in CD-ROM (Compact disc). The O&M manuals should be furnished within three months from the date of placement of order.
- Certification sheet for each valve containing the following information:
  - ✓ Manufacturer's Name
  - ✓ Manufacturer's serial number on the valve body
  - ✓ Flow direction arrow on the valve body
  - ✓ ASME material specification used for pressure parts including valve body and other pressure retaining parts
  - ✓ Maximum allowable pressure (design pressure), kg/cm^2 (g) and design temperature, °C
  - ✓ Hydrostatic shell test pressure, kg/cm^2 (g). Additional certification for valves manufactured to B16.34 Special Class.
  - ✓ Welding Certification: All welding on the valve has been performed using procedures and welders qualified in accordance with ASME Code Section IX.
  - ✓ Radiographs: Radiographic examination has been performed as required by ASME B16.34. One set of the completed radiographs, properly identified with the respective parts, will be retained and available for inspection for a period of five (5) years.
  - ✓ IBR from III C.
  - ✓ Surface examination of all castings performed by magnetic particle or liquid penetrant methods to the technique and acceptance standards of ASME B16.34.
  - ✓ One (1) copy of each material manufacturer's certification.
  - ✓ Authorized and dated signature certifying the above information to be complete and correct.
  - ✓ Operation and Maintenance Manual describing the operation of the entire system shall be supplied (both hard copies and soft copies).

8.0 PERFORMANCE DATA & TECHNICAL REQUIREMENTS

8.1 Component Design Criteria-Function

8.1.1 Separator Level Control (HWL-1 & HWL-2) Valves:

The separator level control valves (HWL-1 & HWL-2) are used to control the water level in the water separator during "wet" mode operation of a supercritical boiler. As the level exceeds the set point first one, then the second valve will open. The valves will throttle saturated water from boiler at high pressure to a flash tank at atmospheric pressure. The water will be flashing to steam as it exits the valves.

8.1.2 Minimum Economizer Flow Control (MEFCV) Valve:

The Minimum Economizer Flow control valve (MEFCV) is used to control the economizer inlet flow during start-up and low load operation. Demand for this valve is established based on measured economizer inlet flow compared to a minimum boiler flow requirement.

Boiler start-up control valves ((HWL-1 & HWL-2) and (MEFCV) often experience debris, because the water separator is typically the debris collector of the boiler. On the other hand, the valve has to be absolutely tight for long operating periods. If the trim parts slightly damaged by debris, then continuous leakage of water will quickly erode the trim parts and further increase the leakage. This will lead to severe damage of the valve. Therefore, the trim design should prevent particle being trapped in the trim parts and subsequent damage to the trim parts and seals.

9.0 DESIGN AND CONSTRUCTION

9.1 In general, all valves and associated accessories shall meet the applicable requirements of accepted standards and attached customer specifications.

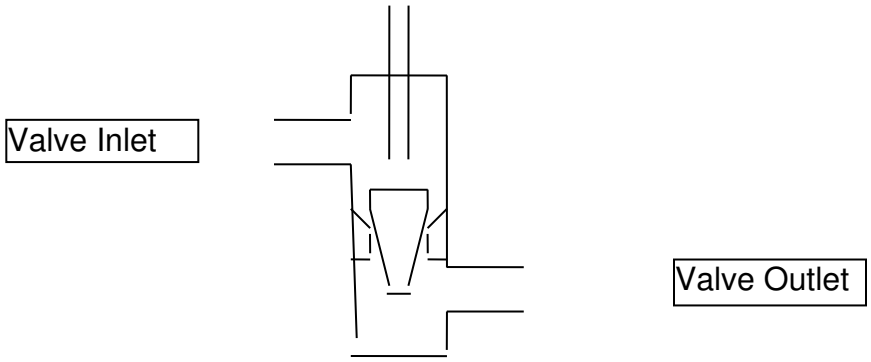
9.2 Design of the valves shall meet the latest edition of ASME B16.34.

9.3 The valve sizing shall be in compliance with latest edition of ISA S75.01 Hand book on Control Valves considering measures to avoid choked flow.

9.4 **The valve sizing shall be suitable for obtaining maximum flow conditions with valve opening at approximately 80% of total valve stem travel and minimum flow conditions with valve stem travel not less than 10% of total valve stem travel.** All the Control Valves shall be capable of handling at least 120% of the required maximum flow. Further the valve stem travel range from minimum flow condition to maximum flow condition shall not be less than 50% of the total valve stem travel.

9.5 The control valve size should not be smaller than connecting line size by more than 1 step.

9.6 Valves shall be straight through in "Z" valve configuration. "Z" configuration has parallel inlet and outlet nozzles in two different horizontal planes.



"Z" Valve

9.7 Valve shall be forged design.

9.8 Plug shall be one-piece construction either cast, forged, or machined from solid bar stock. Plugs shall be screwed and pinned to valve stems or shall be integral with the valve stems.

9.9 All control valves shall have stems, guide bushings, plugs, seat rings, stem lock pins, stuffing box parts and other trim parts made of stainless steel alloys and suitably hardened. Valve guide posts and bushings shall be stellite faced. Stellite faced guide posts and bushings shall be differential hardened for applications involving high pressure drop as well as for flashing and cavitation applications. **Trim material shall be 17-4 PH SS / 440C depending upon the service conditions to ensure required degree of hard facing so as to avoid erosion**. However , Bidder may offer valves with body and trim materials better than specified and in such cases , Bidder shall furnish the comparison of properties including cavitation resistance , hardness , tensile strength , strain energy , corrosion resistance and erosion resistance etc. of the offered material vis-a-vis the specified material for Owner's consideration and approval..

9.10 The valve model proposed should be designed to prevent cavitation, wire drawing and flashing on the downstream side of the valve and piping for operation throughout the full range under the specified conditions. For

cavitation service, the trim design shall be of multistage pressure drop type to prevent cavitation occurring downstream of trim / valve.

9.11 **Bidder shall furnish in his proposal detailed calculations to establish whether flashing or cavitation will occur or not under any operating condition for a particular application. These calculations shall be subject to Owner's review and approval and in case it is established at any stage of the contract that cavitation will occur, the Bidder shall provide specially designed anti-cavitation trim (such as cage guiding valves or multi stack/multi path disc valves) for the same at no extra price. Further the Bidder shall furnish in his proposal the detailed write up, technical literature, etc. clearly indicating as to how the occurrence of cavitation shall be prevented by the design of his offered anti-cavitation trim**.

9.12 Valve sizing shall be in accordance with the latest edition of ISA Handbook on Control Valves with due consideration for the measures to avoid chocked flow. Bidder shall ensure that valve outlet velocity does not exceed 8 m / sec. for liquid services, 150 m / sec. for steam services and 50% of sonic velocity for flashing services.

9.13 Valve outlet shall have a 5 degree downward slope to ensure proper drainage of valve outlet.

9.14 Valve inlet and outlet cages shall be provided if required by the indicated process conditions.

9.15 For valves with butt weld ends, the supplier is required to prepare weld profiles to BHEL supplied information.

9.16 Both the valves and their accessories shall be designed for the process and local installation environment.

9.17 All valves and accessories shall be suitable for outdoor service. Electrical components (actuators, limit switches, solenoid valves, positioners, controllers, etc.) shall meet the requirements of IP 65.

9.18 The Supplier shall provide all necessary converters, positioners, position transmitters, etc. mounted on the control valve.

9.19 The direction of flow shall be clearly marked on each valve.

9.20 Control valves, their actuators and associated ancillary equipment must be selected to suit the application, design and working conditions specified

and also the environmental conditions in which they are installed. The pressure and temperature rating of valve body shall be equal or exceed the process design conditions on control valve data sheet.

9.21 Valves and their actuators shall be adequately rated to suit the maximum differential pressure against which they will have to work, i.e. when the valve is fully closed.

9.22 Valve guiding and seating systems shall be so designed that smooth control is maintained over the full operational stroke. Design should be such that it eliminates vibration.

9.23 Valve's gland packing material shall be grafoil or graphite for all the valves.

9.24 The end for all the Control Valves shall be matched to the corresponding details for the piping on which the valve is installed.

9.25 The boiler water system will be acid cleaned at site using a 1 to 1.5% (by weight) inhibited hydrofluoric acid. The valve internals must be capable of withstanding hydrofluoric acid without getting damaged.

9.26 The Leakage Class of separator level control valves (HWL-1 & HWL-2) and for Minimum economizer flow control valve (MEFCV) is to be **Class-V** as per FCI 70.2.

9.27 Hydraulic Valve Actuators

9.27.1 The separator level control valves (HWL-1 & HWL-2) shall be supplied with a Hydraulic actuator capable of a quick full stroke closing time of 3 sec against closing loads. Normal full stroke opening/closing time shall be 12 sec. The Hydraulic actuator for the minimum economizer flow control valve (MEFCV) full stroke opening/closing time shall be 12 sec.

9.27.2 The Hydraulic actuator shall be sized to operate against the process maximum differential pressure.

9.27.3 A mechanical position indicator shall be provided on the actuator.

9.27.4 The actuator shall be equipped with a hydraulic positioning valve to convert a 4 –20 mA DC signal from the DCS to a hydraulic signal.

9.27.5 The actuator shall be furnished with a 4 –20 mA DC valve position feedback signal.

9.27.6 The actuators for the HWL valves only shall be equipped with a safety quick closing system. The safety control system shall be activated by a signal (dry contact) from the DCS supplied by others. The safety control system shall be independent of other control device. The safety control system shall be capable of closing the valve with normal control system devices unavailable.

9.28 Hydraulic Unit and Electronic Control Unit (HWL-1, HWL-2 & MEFCV)

9.28.1 All control valves (HWL-1, HWL-2 & MEFCV) shall be supplied with a Hydraulic Unit and Electronic Control Unit. The hydraulic power unit serves to supply the necessary pressurized hydraulic fluid to the Hydraulic actuators. A common hydraulic power unit may be used for multiple Hydraulic Valve Actuators. The hydraulic power unit shall be equipped with an accumulator to maintain adequate pressure during peak operating requirements. The hydraulic pumps shall be designed for the required pressure and mean oil consumption.

9.28.2 The hydraulic power unit shall be equipped with redundant motor-pump units with motor starters mounted in the Electronic Control Units. Each pump set shall be equipped with the necessary charging valve, check valves, filters, pressure reducing valves, pressure relief valves, and instrumentation required for operation of the hydraulic power unit.

9.28.3 The hydraulic power unit shall be equipped with an oil tank sized for the entire volume of oil. A tank air breather filter shall be furnished.

9.28.4 The hydraulic power unit shall be equipped with an accumulator sized to deliver the oil flow at required pressure for all conditions. The accumulator shall be equipped with a pressure gauge.

9.28.5 The Electronic Control Unit cabinet shall be a free standing IP 65 rated with front and rear access doors to be installed outdoors. The control cabinet shall contain processors or

controllers and I/O necessary for valve positioning, hydraulic unit control and interface between the Hydraulic Unit / Electronic Control Unit and customer supplied DCS.

9.28.6 In addition to the following signal exchanges, if additional signals are envisaged as per vendor's design, then the same have to be terminated in the respective terminal boxes/junction boxes.

HWL-1 Position Demand (from DCS)	4-20 mA DC
HWL-1 Valve Position feedback (to DCS)	4-20 mA DC
HWL-1 Position Failure (to DCS)	Dry Contact
HWL-1 Quick Closing (from DCS)	Dry Contact
HWL-1 Valve Opened (to DCS)	Dry Contact
HWL-1 Valve Closed (to DCS)	Dry Contact
HWL-2 Position Demand (from DCS)	4-20 mA DC
HWL-2 Valve Position feedback (to DCS)	4-20 mA DC
HWL-2 Position Failure (to DCS)	Dry Contact
HWL-2 Quick Closing (from DCS)	Dry Contact
HWL-2 Valve Opened (to DCS)	Dry Contact
HWL-2 Valve Closed (to DCS)	Dry Contact
MEFCV Position Demand (from DCS)	4-20 mA DC
MEFCV Valve Position feedback (to DCS)	4-20 mA DC
MEFCV Position Failure (to DCS)	Dry Contact
MEFCV Opened (to DCS)	Dry Contact
MEFCV Closed (to DCS)	Dry Contact
Hydraulic Power Unit On (from DCS)	Dry Contact
Hydraulic Power Unit Off (from DCS)	Dry Contact
Hydraulic Power Unit Pressure too low (to DCS)	Dry Contact
Hydraulic Power Unit Auto (to DCS)	Dry Contact
Hydraulic Power Unit Alarm (to DCS)	Dry Contact
Hydraulic Power Unit Fault (to DCS)	Dry Contact

9.28.7 415 V, 3 Ø, AC Power supply feeder will be provided for the hydraulic power pack. 240 V, AC Power supply feeder will be provided. It is vendor's responsibility to further distribute the same to different points and further derivation of various control supplies/power supplies.

9.28.8 Vendor to offer the latest version of control system/positioners with additional features.

9.28.9 The offered Hydraulic Power Unit and the Control system/panels shall be suitable for outdoor applications.

9.28.10 All Cables (Power cables/Control Cables/Instrumentation cables) run between various equipment supplied vendor, shall be in vendor's scope. These cables shall be laid in conduits/cable trays.

9.28.11 All Cables (Power cables/Control Cables/Instrumentation cables) interfaced with various equipment supplied by the vendor, have to be terminated by using suitable Double compression, flame proof/weather proof, Brass with Nickel plated cable glands.

9.28.12 Vendor to provide suitable cable glands for all interfacing cables from/to DCS. Cable sizes will be indicated during engineering stage.

9.28.13 Test Certificates and Calibration Certifications shall be provided for all Instruments and Motors as applicable.

9.29 Valve Selection Criteria

9.29.1 The control valves, actuators and actuator hydraulic systems shall be sized based on the valve data sheets. These data sheets shall be filled in and submitted with the bid and with the first submittal of valve drawings.

9.29.2 The Supplier shall meet all process conditions shown on the data sheet or shall notify BHEL of any deviations. All deviations must be approved by BHEL before manufacture of the valve.

9.29.3 The Supplier shall guarantee total sound levels on Supplier furnished equipment shall not exceed 85 dB(A). Sound pressure level at all conditions shall not be greater than 85 dBA when measured at 1.0 meter downstream of the valve and 1.0 meter away from the pipe. The noise abatement shall be obtained by valve body, trim design and piping arrangement and not by the use of silencers.

9.29.4 The bidder has to submit calculated noise levels (dBA) for the operating conditions specified in the datasheet.

9.30 Test and Examinations

All valves shall be tested in accordance with the quality assurance program agreed between the Owner and the Contractor, which shall meet the requirements of IBR and other applicable codes. The BHEL Approved Quality Plan is to be followed. The tests shall include but not limited to the following bidder shall submit a manufacturing quality plan along with the offer for BHEL / QA review and approval.

9.30.1 Material, mechanical and chemical test shall be performed in a manner as specified in the relevant codes.

9.30.2 Non-destructive examination shall be performed as per ASME-B-16.34 (Steel Valves).

9.30.3 100% radio graphic test on casings of all valves having rating of 600 lbs or above; magnetic particles / dye penetrant examination on all internal and external machined surfaces and 100% ultra-sonic testing of forgings and bars (of size 40 mm and above) of all valves with rating of 600 lbs or above shall be performed as per ASME B16.34.

9.30.4 The material test certificates (correlated to melt number) shall be furnished by the vendor for identification and correlation.

9.30.5 The butt-welding end of all valves, dye-penetrate test as per ASTM E165 shall be carried out on 100% of the valves and the result shall show no defects.

9.30.6 100% MPI shall be done on base/body casing with pressure rating 1500 class and above in line with ASME B16.34.

9.30.7 Hydrostatic Test

Valves shall be subjected to hydrostatic shell test in accordance with ASME-B16.34 prior to seat leakage test. If the valves are reworked on the pressure parts for any reason after hydrostatic test, they must be retested. Valves shall be hydrostatically tested in Manufacturer's Works in accordance with code requirements. All hydrostatic testing and inspection shall be completed before any paint is applied to valve body. Certificates of inspection shall be executed in accordance with the latest codes and required codes shall be forwarded to the Engineer. All gaskets used for test shall be of the same

material and design as specified for the finished product. Where mechanical gasket joints are broken following tests, new gaskets shall be furnished with the equipment, and the joints shall be retested.

9.30.8 Leakage Test

Valve closure test and seat leakage tests shall be performed in accordance with ASME -B16.34 and as per applicable Leakage Class. The leakage from packing shall be zero or bubble tight.

9.30.9 Functional Tests

The fully assembled or completed valves including the actuators control devices and accessories shall be functionally tested to demonstrate the operability and response time of the valve and the actuator. This may be done by cycling the valves 3 or 4 times form open to close position. The same controller can be used to test each valve. These tests shall also include the verification of control valve operation features such as stay put operation, fail to open, fail to close on signal failure etc. in line with the specification requirements. Performance tests such as Linearity, Hysteresis, Sensitivity and Accuracy are to be checked as per specification.

9.30.10 Cv Test (If applicable)

Cv test shall be carried out as type test on each size type and design of the valves as per ISA-75.02 standard and the test reports, shall be furnished for Owner's approval.

9.31 Additional requirements

9.31.1. Machined surfaces shall be suitably protected.

9.31.2. Valve ends shall be protected by means of metallic covers/polythene caps/rubber and protectors to prevent damage to ends & also to avoid foreign material entering the valve while shipment & storage.

9.31.3. All valves shall be packed suitably in wooden cases in order to avoid damage during transit and also during storage at site.

9.31.4. Valve tag nos. shall also be incorporated in all the dispatch documents.

9.31.5. All unpainted surfaces shall be protected with a rust preventive, which can be removed by solvent washing. The use of grease or oil other than light grade mineral oil for corrosion protection is prohibited.

9.31.6. Paint specifications are to be submitted for purchaser's review with bid.

9.31.7. All exposed machined surfaces shall be coated with suitable rust preventative coating prior to shipment.

9.31.8. The seller shall adequately crate, block, anchor and protect equipment as required to prevent damage during overseas shipment and outdoor storage for a period of one (1) year at the site.

9.31.9. All threaded connections shall be plugged or capped with standard pipe plugs or caps.

9.31.10. List of commissioning spares shall be quoted if applicable.

9.31.11. List of recommended spares for 5 years trouble free operation of valves shall be quoted.

9.31.12. Recommended list of special tools and equipment to be provided and also to be supplied along with valve.

9.31.13. One spare filter element each to be supplied for the SS filter provided in the Hydraulic Control Unit.

9.31.14. Drain valve for the oil tank, vent air breather, and isolation lines in the oil supply lines are to be necessarily provided.

9.31.15. Mechanical oil level indicator has to be extended through full height of the tank. (0 % to 100 %)

9.31.16. Man hole to be provided in the Oil tank in order to provide means to access the internals of the oil tank and for maintenance.

9.31.17. Stainless steel Oil tank to be supplied and internal surface should not be painted.

9.31.18. Vendor to provide isolation valves in the pressure and return lines (oil lines) to carry out maintenance activities in the oil line and also in the fail safe manifold & control manifold.

9.31.19. Vendor to supply welding type socket fittings in the entire hydraulic pipes joint.

9.31.20. Vendor to provide a provision to indicate the accumulator pressure in local as well as in remote.

9.31.21. Hydraulic fluid /oil cooler is to be provided

9.31.22. Flushing procedure for oil pipe lines with required drawings, BOM list to be submitted by vendor which shall meet the ISO 44061999/ NAS standard.

9.31.23. Vendor to mention the equivalent Servo grade or other Indian grades for HPU oil.

9.31.24. Recommended spares list shall be submitted by the vendor.

9.31.25. Hook up drawing to be submitted with all required details.

9.31.26. Pressure transmitter in the oil supply line of HPU to check leak in oil lines

9.31.27. P&ID for hydraulic circuit between HPU and individual actuators with BOM.

9.31.28. P&ID should include all the setting points for various control elements.

9.31.29. Detailed shipping list to be sent to site and that shall be easily correlated with P&ID and BOM.

9.31.30. Deleted.

9.31.31. Dos and Don'ts / Precautionary measures to be adopted at site during various stages of commissioning of boiler shall be prepared by the vendor and to be submitted for BHEL.

9.32 Support and Services

9.32.1 Optional price to be quoted by the seller in terms of price per man-day for erection and commissioning support.
If commissioning engineer is deputed from Indian office, then the payment will be released in INR only.
This service will be utilized by BHEL-site through power sector regions. Separate PO will be released by BHEL-Site through power sector regions to avail the vendor's supervision service.

During this period, vendor should also ensure that the blanking plate is installed during initial supply and subsequent hydro test and acid cleaning operation at site. Vendor to ensure proper purging of the lines to eliminate the presence of foreign particles before installing the trim parts and commissioning activity.

All the expenses like to & fro charges, incidentals, boarding & lodging at site are to be borne by the vendor.

The price calculated for 14 days of erection and commissioning per unit (Two HWL valves and One MEFCV) will be considered for price comparison per unit.

Depending upon the actual duration of erection and commissioning support availed, the payment will be paid by BHEL- power sector regions based on the vendor quoted amount (price per man-day).

In case of any issues/problems arise during the hydro test assembling, dismantling of valve or the maintenance of the valve, the supplier is responsible for resolving the issues and transporting the specialized tools and equipment (Hydraulic torque wrenches, special tools & equipment etc.,) to the site for carrying out the maintenance and repair works and vendor should bear the relevant expenses as well. They should make sure that they will take the materials back, only after all the issues have been resolved at the site. BHEL will not bear any expense on the repair work and on the transportation of equipment to the site.

The Vendors to submit an Optional price for providing training to our personnel at the works of Valve manufacturer for 2 man month period .

Our personnel will make their own Travel / Lodging / Boarding arrangements. Depending upon the actual duration of training man months availed, the payment will be proportionately reduced on the vendor quoted amount (if period is lesser than 2 man months).

9.33 Evaluations

9.33.1 Bids will be analyzed, not only to determine conformity to the requirements of this Specification, but also to evaluate any features of design, construction, and guaranteed performance of the equipment offered which would result in a higher or lower capital, operating, or maintenance cost to BHEL.

9.33.2 Nothing in this specification shall be construed to relieve the vendor from his responsibility. This specification covers briefly the requirements of the system. It is the responsibility of the vendor to take care of other basic and essential requirements. In case of any discrepancy in the contents expressed in the specification, vendor shall include all items required for completeness of the system even if it is not specified explicitly in this specification.

10.0 SUPPLIER'S DATA SHEETS (TO BE SUBMITTED WITH THE BID)

10.1 Valve Data Sheets

10.2 All data to be in Metric units. The Supplier shall fill in the valve data sheets for each valve. The operating conditions furnished for MEFCV is preliminary only. Final operating conditions can be informed only after the boiler recirculation pump operating conditions are finalized, which can happen even after the placement of this PO. This may/may not affect the selected Cv for MEFCV. The vendor to accommodate these changes in the operating conditions and offer the valve which meets all the specification requirements without any price implication to BHEL.

10.3 Guarantees

CUSTOMER NAME	
PROPOSAL NUMBER	
SUPPLIER NAME	

The Supplier shall clearly state at the time of quotation all performance guarantees specific to the equipment offered.

11.0 EXCEPTIONS TO THE SPECIFICATION

CUSTOMER NAME	
PROPOSAL NUMBER	
SUPPLIER NAME	

I have confirmed to Sections 1.0 through 10.0 and Appendix A except as specifically noted as follows:

12.0 APPENDIX A, CONTRACT SPECIFIC REQUIREMENTS

Please refer the attached, Annexure I - Valve Datasheets and project specific data sheets, Annexure II - for Facility Site Specific Data