

	TITLE: PREAMBLE	SPECIFICATION NO. PE-SS-999-100-Q001	
		VOLUME	
		SECTION	
		REV. NO.	DATE: 26/08/2011
		SHEET	1 OF 1

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.

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

2 X 660MW MOUDA STPP


VOLUME – IIB

TECHNICAL SPECIFICATION FOR BUTTERFLY VALVES (STEAM SERVICE)

SPECIFICATION NO. PE-TS-387-100-M016




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

	TECHNICAL SPECIFICATION BUTTERFLY VALVES (STEAM SERVICE) 2 X 660MW MOUDA STPP	SPECIFICATION NO. PE-TS-387-100-M016	
		VOLUME : IIB	
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SECTION-A

SCOPE OF ENQUIRY

	TECHNICAL SPECIFICATION BUTTERFLY VALVES (STEAM SERVICE) 2 X 660MW MOUDA STPP	SPECIFICATION NO. PE-TS-387-100-M016	
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SCOPE OF ENQUIRY

1. SCOPE

This enquiry covers the Design, Manufacture, Inspection & Testing at vendor's and/or his sub-vendor's works, proper packing and delivery to site of Butterfly Valves(steam service) complete with all accessories as per the requirements mentioned in different sections of the specification for 2 X 660MW MOUDA STPP.


2. GENERAL TECHNICAL INSTRUCTIONS

- a) It is not the intent to specify herein all the details of design and manufacture. However the equipment shall conform in all respects to high standards of design, engineering and workmanship, and shall be capable of performing the required duties in a manner acceptable to Engineer/ Owner, who will interpret the meaning of drawing and specifications, and shall be entitled to reject any component or material, which in his judgement is not in full accordance herewith.
- b) The omission of specific reference to any component/ accessories necessary for the proper performance of Butterfly Valves (steam service) shall not relieve the bidder of the responsibility of providing such facilities to complete the supply of Butterfly Valves (steam service) at quoted prices.
- c) Design/ drawings/ data sheets etc. shall be subject to approval of BHEL as per specification, in the event of order.
- d) BHEL's / customer's representative shall be given access to the shop in which the equipment are being manufactured or tested and all test records shall be made available to him.
- e) The equipment covered under this specification shall not be despatched unless the same have been finally inspected, accepted and shipping release issued by BHEL.

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SECTION-B


PROJECT INFORMATION

	TECHNICAL SPECIFICATION BUTTERFLY VALVES (STEAM SERVICE) 2 X 660MW MOUDA STPP	SPECIFICATION NO. PE-TS-387-100-M016	
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PROJECT INFORMATION


The bidder shall acquaint himself by a visit to the site, if felt necessary, with the conditions prevailing at site before submission of the bid. The information provided in this section will be for general guidance and shall not be contractually bidding on BHEL/OWNER. All relevant site data/information as may be necessary shall have to be obtained/ collected by the bidder.

The plant site is located in Mouda Tehsil, district Nagpur of Maharashtra State, having latitude and longitude of 20°10'50" N and 79°23'52" E respectively. The site is bounded by villages Kumbhari on North, Lapka & Mouda on South, Koradi on East & Rahli on West and is at a distance of about 4 Kms from Mouda town and approachable from NH-6. Nearest railway station is Chacker, 8 Kms away from the site on Nagpur – Kolkata Broad Gauge (BG) section of South Eastern Railway (main line). The nearest commercial airport is at Nagpur located at a distance of approximately 42 Kms from the project site.

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SECTION-C

SPECIFIC TECHNICAL REQUIREMENTS

	SPECIFIC TECHNICAL REQUIREMENTS BUTTERFLY VALVES (STEAM SERVICE) 2 X 660MW MOUDA STPP		SPECIFICATION NO. PE-TS-387-100-M016
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1. GENERAL

- 1.1 The valves shall meet the technical requirements and conform to the standard technical specifications, Data sheet A-1 & Data sheet-A2 of Section D. In addition, the requirements of this Section-C shall also be complied with. However, wherever the details given in standard technical specification of Section-D and Data sheets A-1 & A2 are different, the requirements of Data sheet A-1 & A2 shall prevail. Similarly in the event of contradictions between Section –C & Section –D/ Data sheet A-1 & A2, Section –C will prevail.
- 1.2 The technical requirements for valves shall, in general, be as per the attached standard Technical specification for Valves, and Data sheets A-1 and A-2 of Vol. II B Section D.

2. SCOPE OF SUPPLY


- 2.1 The valves complete with all accessories shall be supplied as per Data sheets A-1 & Data sheet-A2 of Section D. For detail refer the same. Each valve (quantity and other details specified in Data Sheet-A-1) shall be complete with the following accessories.
 - i) Lifting arrangement provision for handling i.e., lifting lugs, eye bolts etc.
 - ii) Actuators and limit switches as required to make valve complete in all respects.
- 2.2 Commissioning spares, if any.
- 2.3 Set of special tools and tackles if required for the maintenance, erection etc. of the equipment supplied.
- 2.4 Mandatory spares as applicable depending upon the project requirement.
- 2.5 Finish paints for touch-up painting of equipment after erection at site in sealed containers.
- 2.6 Various drawings, datasheets, operation and maintenance manuals etc., as specified in Data Sheet-C.

3. EXCLUSIONS:

Erection & Commissioning of equipment at site.

4. QUALITY ASSURANCE

The Quality Plans enclosed with this specification specify minimum quality control requirement. During contract stage vendor shall furnish these Quality Plans duly signed & stamped for their compliance. Quality plans shall be approved by BHEL and customer (If necessary). All inspection and testing shall be carried out by BHEL and CUSTOMER (if necessary). In case inspection is by both BHEL and CUSTOMER, then the inspection can be carried out jointly or separately, which will be informed later.

	SPECIFIC TECHNICAL REQUIREMENTS BUTTERFLY VALVES (STEAM SERVICE) 2 X 660MW MOUDA STPP	SPECIFICATION NO. PE-TS-387-100-M016	
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5 PAINTING REQUIREMENT:

Surface preparation shall be as per SSPC-SP-3/ Power Tool Cleaning followed by 2 coat of Heat Resistance Aluminium paint to IS 13183 Gr. I or equivalent, paint shade Aluminium and total DFT of paint will be equal to 80 microns minimum.

6 PACKING INSTRUCTIONS:

- a) Each valve shall be drained, cleaned, prepared and suitably protected in such a way so as to minimize the possibility of damage and deterioration during transit and storage.
- b) The valve has to be dispatched in total assembled form.
- c) Discs of all valves shall be properly secured while dispatching so that there is no risk of damage to the disc & seat.
- d) Body ends shall be suitably sealed to protect them against damage during transit and storage.
- e) Valves with butt-welding ends shall be protected by means of polythene caps/rubber and protectors to prevent damage to ends & also to avoid foreign material entering the valve while shipment & storage.
- f) Valve Tag Nos. shall be incorporated in all the dispatch documents.
- g) Proper care shall be taken to avoid damage to the painted surface during transit.
- h) All the valves shall be packed suitably in wooden cases in order to avoid damage during transit and also during storage at site in tropical climate conditions for a period of 15-18 months.

7 SPARES


- a) **Mandatory Spares:** These shall be as per Data Sheet-A1.
- b) **Recommended Spares:** List of recommended spares for 3 year reliable operation along with the unit price shall be indicated in the schedule of prices for recommended spares enclosed in Volume-III. Cost of Recommended spares shall not be included in the base price.
- c) Order for the spares may be placed simultaneously or otherwise at the option of purchaser.

8 DOCUMENTS TO BE SUBMITTED ALONG WITH OFFER

Bidder shall submit the following documents (enclosed in Vol III) duly filled, signed and stamped along with the bid:

- a) Compliance sheet
- b) Schedule of Deviations if any.
- c) Schedules of Price & Unit Price for each project.
- d) Schedule of declaration.

The above are the only documents which will be used for technical evaluation unless other documents are asked for during technical clarifications. Any other technical document enclosed with the bid shall be ignored for the purpose of technical evaluation. All other documents attached with the specification are for information of the vendor and no comments shall be marked on these.


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SECTION-D

STANDARD TECHNICAL SPECIFICATIONS

D1: FOR VALVES

D2: FOR ACTUATORS

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SECTION-D1

VALVES

STANDARD TECHNICAL SPECIFICATION QUALITY PLAN DATA SHEET – A1 DATA SHEET – C

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		SECTION D	
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1.0 GENERAL

This specification covers the design, materials, construction features, manufacture and testing comprising of Butterfly valves (steam service) at Vendor's or/ and sub-Vendor's works inclusive of painting and packing requirements.

2.0 CODES AND STANDARDS:

The design, manufacture, inspection and testing of the butterfly valves shall suit the design parameters specified in datasheet-A1 & comply with the requirements of latest revisions of the following standards. However, the testing shall be as per AWWA C504 including disc strength test (all sizes of valves), gear box POD Test & Valve POD test.

a) American Water Works Association standard AWWA C504.

b) BS EN 593 (replaces BS 5155).

2.1 In case of any conflict between the above Codes/Standards and this specification, the latter shall prevail and in case any further conflict in this matter, the interpretation of the specification by the Engineer shall be final & binding.

3.0 DESIGN REQUIREMENTS:

3.1 All valves shall be suitable for the service conditions i.e. flow, temperature and pressure under which they are required to operate and those performing similar duties shall be interchangeable with each other unless otherwise specified.

3.2 The butterfly valves shall be suitable for Indoor/outdoor installation with shaft either in horizontal or vertical position.

3.3 The valves shall have double off-set type disc (design with shaft eccentric to disc) and long design as specified in Data sheet-A1.

3.4 The butterfly valves shall be with butt welded ends as specified in Data sheet-A1 and designed to ensure bubble tight shut off at the rated pressure of valve.

3.5 MATERIALS

3.5.1 The materials of construction of main parts of the butterfly valves (steam service) shall be specified in Data sheet-A1.

3.5.2 The materials of construction of the remaining parts shall be as per relevant standard governing the valves and to suit the service conditions. These materials shall be subject to approval of the purchaser.

3.5.3 Materials used in manufacture of valves shall be of tested quality.

4.0 CONSTRUCTION FEATURES:

4.1 Valve Body

4.1.1 The valve body shall have integral hubs for shaft bearing housing. The minimum body shell thickness and minimum diameter of seat bore shall be as per requirement of the applicable table of AWWA-C504. Material of construction of body and valve parts shall be as per materials indicated in Data sheet-A1.

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- 4.1.2 An arrow shall be embossed/ engraved and painted on the outside of body to clearly indicate the direction of flow.

4.2 Valve Shaft

- 4.2.1 The shaft of each butterfly valve shall be securely attached to the disc through Bolting, Riveting, threading, upsetting or cross pinning, adequately locked.

- 4.2.2 Valve shaft design shall consist of one piece unit extending completely through the valve disc. or may be the "Stub Shaft" type which consists of two separate shafts inserted into the disc. Each stub shaft shall be inserted into the valve disc hubs for a minimum distance of at least 1.5 times shaft diameter. The connection between the shaft and the disc shall be designed to transmit shaft torque equivalent to at least 75% of the torsional strength of the minimum required shaft diameter. The minimum shaft diameter shall be as per the relevant standard and shall be such that it will safely sustain the maximum differential pressure across the closed valve and transmit the maximum torque required to operate the valve.

- 4.2.3 Surface finish for shaft shall be minimum 16 RMS in the area of gland packing.

4.3 Valve Disc:

The valve disc shall have no external ribs transverse to the flow and shall sustain full differential pressure across closed valve disc without exceeding working stress of one fifth of the tensile strength of the material used. The thickness of the valve disc shall not be more than 2 ¼ times the shaft diameter listed in AWWA C504. The valve disc shall be designed to rotate 90° from full open to tight shut off position. Material of Disc shall be as per the Data sheet-A1.

4.4 Body Seat & Disc Seal (Valve seat)

The soft seat shall be of replaceable type of suitable grade resilient material, adequately reinforced, securely attached to the disc or to the body, and shall be designed to provide bubble tight shut off under all operating conditions. The soft seat/ seal shall be attached by clamping ring, bolting or other suitable methods as per the standard design of the manufacturer. All clamping rings, bolts/studs, nuts used shall be of stainless steel. The sealing ring on the disc shall be continuous type and easily replaceable.

The mating seat surface accordingly shall be on valve body or disc and shall be of stainless steel and securely attached to the body/disc by directly clamping, bolting or suitable methods. All clamps, retaining rings, nuts, screws / all hardware shall be of stainless steel.

4.5 Valve Bearing:

Each butterfly valve shall be fitted with sleeve type bearings contained in the hub of the valve body. The bearing shall be of self-lubricating type and the coefficient of friction of bearing material shall not exceed 0.25 when rubbing at the maximum bearing pressure. The housing for this bearing shall be rigidly attached to the valve body. Thrust bearings shall also be provided for vertical shaft installation. For valves of 350 NB and larger, the bearing should be capable of taking axial thrust also. The material of the bearing shall be self-lubricated type & low coefficient of friction in accordance with the relevant standard.

4.6 Shaft Seal:

Wherever the shaft project through the valve body for actuator connection, a shaft seal shall be provided. Shaft seal shall be designed for use of Standard 'O' rings

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seals and they shall be contained in a removable corrosion resistant recess. Shaft seals shall be designed to allow its replacement without removal of the valve shaft.

4.7 The hand wheel shall be of malleable iron or equivalent.

4.8 Body Ends:

These shall be as butt welded as per ASME B 16.25 as specified in Data sheet-A1.

4.9 Nameplate:

Each valve shall be fitted with a circular Stainless steel 2mm thick nameplate indicating the valve Tag No. and service description given in Data sheet-A1. All details shall be engraved 1 mm deep and filled with black enamel paint.

4.10 The stops which limit the travel of any valve in the 'Open' or 'Shut' position shall be arranged exterior to the valve body.

4.11 All valves shall be closed by rotating the handwheel in a clockwise direction when looking at the face of the handwheel. The pulling force required on handwheel rim shall not exceed 25 Kgf when operating the valve under full flow and operating pressure. The face of each hand wheel shall be clearly marked with the words 'Open' and 'Shut' with adjacent arrows to indicate the direction of rotation to which each refers.

4.12 Special attention shall be given to the operating mechanism for large size valves in order that quick and easy operation is obtained and maintenance is kept to a minimum.

4.13 Eyebolts shall be provided where necessary to facilitate handling heavy valves or part of valves.

4.14 Wherever practical, valves (including actuator, drive motor, integral bypass etc.) of total weight equal to or greater than 500 Kg shall be provided with suitable lugs to permit direct suspension by hanger rods or direct resting on bottom support, as applicable.

4.15 The valves as well as accessories shall be designed for easy dismantling and maintenance.

4.16 The disc shall rotate through 90° from full open to the tight shut position. The disc shall be contoured to ensure the least possible resistance to flow and be suitable for throttling operation. While the disc is in throttled position, the valve shall not create any noise or vibration.

5.0 SPECIAL FEATURES:

5.1 Gland Sealing Arrangement:

Butterfly valves, provided with gland sealing arrangement, shall be vacuum tested. All valves required with this arrangement shall be provided with G3/8" connection (duly plugged) for water sealing. Sealing water shall be supplied at 4 ata and 50°C unless otherwise specifically indicated for the particular project.

5.2 Motorised Valves:

5.2.1 The motorised valves shall be offered with the electric actuators of reputed make. A particular make and type of actuator shall be designed for the maximum differential working pressure. However, the stall torque of the selected actuators shall be

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minimum 1.5 times the valve unseating torque requirement at the maximum differential working pressure (design pressure) and required operating time as mentioned in in Datasheet A-1/Datasheet A-2.

5.2.2 Electric actuators shall be mounted directly on the valves.

5.2.3 The motors, gearing and disengaging hand wheel shall be adequate to open and close the valve under maximum differential pressure and shall be completely assembled on the respective valve and shop tested before shipment.

5.2.4 Gear box and Electric Actuator shall also meet the inspection & testing requirements of latest revision of AWWA C504/AWWA C540.

6.0 INSPECTION AND TESTING:-

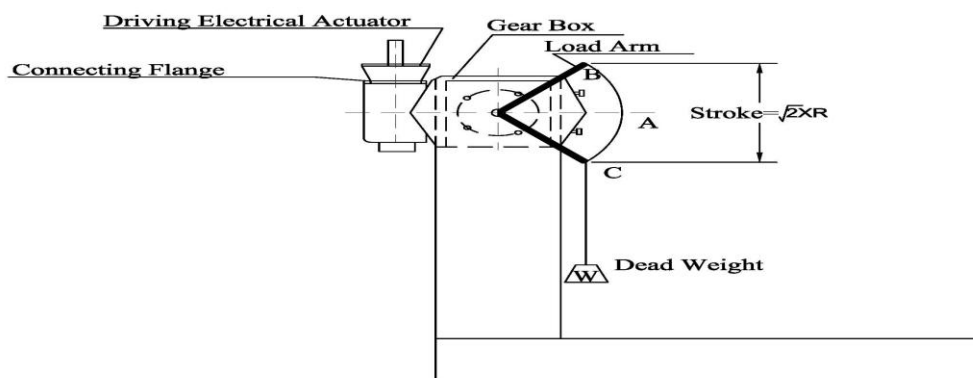
All inspection & Testing for valve, Gear box and actuators shall be as per the requirements of the relevant standard.

The minimum NDT/testing and inspection requirements for valve, Gear Box, electric actuator etc. shall be as per the attached Quality Plan. However, in case of order, final inspection and testing shall be carried out as per the final approved quality plan without any price implications.

6.1 P.O.D. Tests:

- a) POD (Proof-of-design) Test as per AWWA C504 is required to be carried out for valves. In case the valve POD Test has been done earlier, only Test Report of POD test for same model/ type/size/ rating is required to be submitted for verification.
- b) Gear Box and Electric Actuator shall be designed & tested in accordance with latest editions of AWWA C 504(valve) and AWWA C 540 (actuator) respectively. Gear Box shall be designed to hold the valve disc in intermediate position between full open and full closed position without creeping or fluttering.
- c) For valves designed and manufactured as per both AWWA and BS valve POD shall follow the guidelines of AWWA-C-504 Actuators shall meet the requirements of POD test of AWWA-C-540.
- d) Gear box POD test: - Valve POD and gear box POD tests should be done separately on each one of the valve & the gear box. Gear box POD test shall be done as per the procedure described below or as per the procedure agreed between purchaser & vendor.
- e) Gear box POD Test shall be carried out only at full rated torque of gear box, throughout the full cycle of testing i.e. at no point during each full cycle of testing; the applied torque should be less than the full rated torque of Gear Box. Refer Sketch below for Gear Box POD test set up. Dead weight and length of arm shall be so selected that the torque generated at point "C" and "B" shall in no case be less than the full rated torque of the gear box.

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TEST SET UP

FIG. 1

6.2 These valves are for vacuum service and shall be provided with gland sealing arrangement which shall be vacuum tested with vacuum and helium gas.

7.0 PERFORMANCE GUARANTEE:

7.1 The vendor shall guarantee the material & workmanship of all components as well as operation of the equipment as per the requirements of the specification.

7.2 The vendor shall also guarantee the following for each butterfly valve:

- a) Pressure drop as per the approved drop vs. opening curve.
- b) The valve opening and closing time.

8.0 SURFACE PREPARATION & PAINTING

The surface preparation of all exterior and interior surfaces of valves shall include the following:

- a) Removal of oil, grease and dirt.
- b) Removal of rust and scale etc.,
- c) Sand blasting/ shot blasting.

All exterior surfaces of valves shall be painted with primer and finish coated with coating of min. 80 microns thickness. Color shade etc. shall be subject to BHEL/ Customer approval.

9.0 CLEANING AND PROTECTION FOR DESPATCH:

9.1 Each valve shall be drained, cleaned, prepared and suitably protected in such a way so as to minimize the possibility of damage and deterioration during transit and storage.

9.2 Discs of all valves shall be unseated when they are despatched but care shall be taken to ensure that there is no risk of damage to the disc.


9.3 Body ends shall be suitably sealed to protect them against damage during transit and storage.

9.4 Valve Tag Nos. shall be incorporated in all the despatch documents.

MEGR's LOGO		MANUFACTURER'S NAME AND ADDRESS		MANUFACTURING QUALITY PLAN					PROJECT : 2X660 MW MOUDA STPP	
				ITEM : CS BUTTERFLY VALVES DESIGN STD: AWWA C 504 SIZE : 2000 NB SUB-SYSTEM : STEAM SERVICE					QP NO. : PE-QP-387-100- M024 REV.NO.: 00 DATE : 21.01.2013 PAGE:1 OF 9	
SL. NO	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY	REMARKS
1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.

1. MATERIALS										
1.1	BODY, DISC	1. CHEM. COMPOSITION & MECH. PROPERTIES	MA	1) CHEM. TESTS	ONE PER HEAT	ONE PER HEAT	APPD DRG/ TECH SPEC	APPD DRG/ TECH SPEC	TEST CERT.	
				2) MECH TESTS	ONE PER HEAT & HEAT TREATMENT BATCH	ONE PER HEAT & HEAT TREATMENT BATCH	APPD DRG/ TECH SPEC	APPD DRG/ TECH SPEC	TEST CERT.	
		2. INTERNAL DEFECTS OF CASTINGS	MA	1. MPI	100%	100%	ASTM E 709 ASME B16.34	ASME B16.34 ASME B16.34	NDT REPORT	P/ W P/ V V
		3. SUB-SURFACE DEFECTS OF SHAFT DIA > 50 MM	CR	UT	100%	100%	ASTM A388	REFER REMARKS**	INSP REPORT	P/ W P/ V V
		4. CASTING DEFECTS	MA	VISUAL	100%	100%	MSS SP55	MSS SP55	INSP REPORT	P/ W P/ V V

MANUFACTURER/ SUB-SUPPLIER		MAIN-SUPPLIER		SIGNATURE		LEGEND: * RECORDS, IDENTIFIED WITH "TICK" (✓) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION. ** MA: MANUFACTURER/SUB-SUPPLIER IN QA DOCUMENTATION. P: PERFORM W: WITNESS AND V: VERIFICATION, AS APPROPRIATE, CHP: NTPC SHALL IDENTIFY IN COLUMN "N" AS "W"		FOR NTPC USE DOC. NO.: REV..... CAT.....		REVIEWED BY APPROVED BY APPROVAL SEAL	
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 22/01/13



MANUFACTURER'S NAME AND ADDRESS		MANUFACTURING QUALITY PLAN							PROJECT				
ITEM : CS BUTTERFLY VALVES		OP NO. : PE-QP-387-100-M024		ACCEPTANCE NORMS			FORMAT OF RECORD			AGENCY			REMARKS
DESIGN STD: AWWA C 504 SIZE : 2000 NB SUB-SYSTEM : STEAM SERVICE		REV.NO.: 00 DATE : 21.01.2013 PAGE:2 OF 9											
1.	2.	3.	4.	5.	6.		7.	8.	9.	D *	**	10.	11.
SL. NO	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK M C/N		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	M	C	N	REMARKS
1.2	CLAMP RING	CHEM., MECH PROPS	MA	1) CHEM. TESTS 2) MECH TESTS	ONE PER HEAT ONE PER HEAT & TREATMENT BATCH	ONE PER HEAT & TREATMENT BATCH	APPD DRG/ TECH SPEC APPD DRG/ TECH SPEC	APPD DRG/ TECH SPEC APPD DRG/ TECH SPEC	TEST CERT. TEST CERT.	P/ W P/ W	V	V	SHALL BE SCANNED AND ANY DEFECT ECHO MORE THAN 20% FSH IS NOT ACCEPTABLE ALSO ANYWHERE COMPLETE LOSS OF BACK WALL ECHO IS NOT ACCEPTABLE
1.3	DISC SEAL (FROM VENDORS REGULAR & APPROVED SOURCE)	1. VISUAL INSPN 2. DIMENSIONS 3. TENSILE AND HARDNESS FOR VULCANISING 4. OZONE CRACK RESISTANCE	MA MA MA MA	VISUAL MEASURE- MENT MEASURE MENT	100% 100% 100% 100%	100% 100% 100% 100%	APPD DRG APPD DRG TECH. SPEC/ APPD DRG TECH. SPEC + ASTM	APPD DRG APPD DRG TECH. SPEC/ APPD DRG TECH. SPEC + ASTM	INSPN. REPORT LOG BOOK TEST CERT. TEST CERT.	P/ W P/ W P/ W P/ W	V V V V	V V V V	SPECIMEN TYPE A, 40 DEG CENTIGRADE FOR 70 HRS

LEGEND: * RECORDS, IDENTIFIED WITH "TICK" (✓) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION.

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P: PERFORM W: WITNESS AND V: VERIFICATION AS APPROPRIATE,
CHP: NTPC SHALL IDENTIFY IN COLUMN "N" AS "W"

MANUFACTURER/ SUB-SUPPLIER	SIGNATURE	FOR NTPC USE	DOC. NO.:	REV..... CAT.....
		REVIEWED BY	APPROVED BY	APPROVAL SEAL

Sanjay
22/01/12



MEGR.'s LOGO		MANUFACTURER'S NAME AND ADDRESS		MANUFACTURING QUALITY PLAN						PROJECT : 2X660 MW MOUDA STPP				
				ITEM : CS BUTTERFLY VALVES DESIGN STD: AWWA C 504 SIZE : 2000 NB SUB-SYSTEM : STEAM SERVICE QP NO. : PE-QP-387-100- M024 REV.NO.: 00 DATE : 21.01.2013 PAGE:3 OF 9						PACKAGE : MAIN PLANT PACKAGE CONTRACT NO. : 387 MAIN-SUPPLIER : BHEL PEM NOIDA				
SL. NO	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY			REMARKS	
1.	2.	3.	4.	5.	M	C/N	7.	8.	9.	D	**	10.	11.	
		5. AGEING TEST	MA	TESTING	1/BATCH	1/BATCH	TECH SPEC+IS 3400 PART IV	TECH SPEC+IS 3400 PART IV *	TEST CERT	✓	P/	W	V	*TEST TEMP. 125 DEG C, TEST DURATION 72 HRS, MAX CHANGE IN TENSILE STRENGTH, 20% ELOGATION; 20% HARDNESS.3%
		6. HYDRAULIC STABILITY TEST (AFTER AGEING)	MA	TESTING	1/BATCH	1/BATCH	TECH SPEC./ REL STD.	TECH SPEC./ REL STD.	TEST CERT	✓	P/	W	V	
		7. WEAR RESISTANCE	MA	TESTING	TYPE TEST	1/ BATCH	AWWA C-504	NO DAMAGE	TEST REPORT	✓	P/	W	V	TYPE TEST REPORT WILL BE FURNISHED FOR REVIEW, PART OF VALVE POD
1.4	FASTENERS ASTM A193 GR B7 ASTM A194 GR2H, GRB8M	1. VERIFICATION OF MAKE, GRADE, REVIEW OF TEST CERTIFICATE 2. DIMENSIONS	MI	VISUAL	100%	100%	TECH. SPEC/ DATA SHEET	TECH. SPEC/ DATA SHEET	INSPN REPORT	✓	P/	W	V	
			MA	MEASURE- MENT	SAMPLING PLAN	SAMPLING PLAN	APPD DRG	APPRD DRG	INSP REPORT	✓	P	V	V	
1.5 OPERATORS														

MANUFACTURER/ SUB-SUPPLIER		SIGNATURE		LEGEND: * RECORDS, IDENTIFIED WITH "TICK" (✓) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION. ** MA: MANUFACTURER/SUB-SUPPLIER C: MAIN SUPPLIER, N NTPC P: PERFORM W: WITNESS AND V: VERIFICATION AS APPROPRIATE, CHP: NTPC SHALL IDENTIFY IN COLUMN "N" AS "W"				FOR NTPC USE		DOC. NO.:		REV..... CAT.....			
										REVIEWED BY		APPROVED BY		APPROVAL SEAL	

Forced
22/01/13



MANUFACTURER'S NAME AND ADDRESS		MANUFACTURING QUALITY PLAN						PROJECT : 2X660 MW MOUDA STPP						
MEGR's LOGO		ITEM : CS BUTTERFLY VALVES DESIGN STD: AWWA C 504 SIZE : 2000 NB SUB-SYSTEM : STEAM SERVICE				QP NO. : PE-QP-387-100-M024 REV.NO.: 00 DATE : 21.01.2013 PAGE: 4 OF 9		PACKAGE : MAIN PLANT PACKAGE CONTRACT NO. : 387 MAIN-SUPPLIER : BHEL PEM NOIDA						
SL. NO	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK M C / N		REFERENCE DOCUMENT	ACCEPTANCE CRITERIA	FORMAT OF RECORD	AGENCY M C N			REMARKS	
1.	2.	3.	4.	5.	6.		7.	8.	9.	D*	**	10.	11.	
1.5.1 GEAR OPERATOR														GEAR BOX MANUFACTURER M/S AUMA
A) GEAR, WORM & SHAFT (BS970Gr En8)		1. CHEM. COMP. & PHYS PROPERTIES	MA	CHEM & PHYS TEST	1/ BATCH	1/ BATCH	RELV STD/ DATA SHT/ MFG DRG	RELV STD/ DATA SHT/ MFG DRG	TEST CERT	P/ W	V	V		
		2. DIMENSIONS	MA	MEASURE-MENT	100%	100%	RELV STD/ DATA SHT/ MFG DRG	RELV STD/ DATA SHT/ MFG DRG	INSP REPORT	P/ W	V	V		
		3. HARDNESS	MA	MEASURE-MENT	100%	100%	RELV STD/ DATA SHT/ MFG DRG	RELV STD/ DATA SHT/ MFG DRG	TEST CERT	P/ W	V	V		
B) TORQUE TEST		1. TORQUE TRANSMITTING	MA	TORQUE TEST AT TWICE THE RATED TORQUE	ONE/ TYPE/ MODEL RATING	ONE/ TYPE/ MODEL RATING	AWWA-C-504/ DATA SHT/ MFG DRG.	AWWA-C-504/ DATA SHT/ MFG DRG.	INSP REPORT*	P/ W	V*	V*	* VERIFICATION OF TEST REPORT ON GEAR BOX EARLIER CARRIED OUT FOR NTPC PROJECT (SAME SIZE, MODEL & RATING)	
		2. DESIGN VERIFICATION	MA	CYCLE TEST AT FULL RATED TORQUE OF GEAR	ONE/ TYPE/ MODEL	ONE/ TYPE/ MODEL RATING	AWWA-C-504 (AT FULL RATED TORQUE OF GB) /	CL. 4.3.8.5.9 OF AWWA-C-504-2000/ APPD PROCEDURE	INSP REPORT*	P/ W	V*	V*	* VERIFICATION OF TEST RECORDS ON GEAR BOX EARLIER CARRIED OUT FOR 500 MW NTPC PROJECTS (SAME MODEL, SIZE &	
MANUFACTURER/ SUB-SUPPLIER		MAIN-SUPPLIER		LEGEND: * RECORDS, IDENTIFIED WITH "TICK" (✓) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION. ** MA: MANUFACTURER/SUB-SUPPLIER C: MAIN SUPPLIER, N: NTPC P: PERFORM W: WITNESS AND V: VERIFICATION AS APPROPRIATE, CHP: NTPC SHALL IDENTIFY IN COLUMN "N" AS "W"				FOR NTPC USE		DOCS. NO.:		REV..... CAT.....		
SIGNATURE										REVIEWED BY		APPROVED BY		APPROVAL SEAL

Sanjay
22/01/13



MANUFACTURER'S NAME AND ADDRESS		MANUFACTURING QUALITY PLAN										PROJECT : 2X660 MW MOUDA STPP PACKAGE : MAIN PLANT PACKAGE	
MFGR.'s LOGO		ITEM : CS BUTTERFLY VALVES DESIGN STD: AWWA C 504 SIZE : 2000 NB SUB-SYSTEM : STEAM SERVICE				QP NO. : PE-QP-387-100-M024 REV.NO.: 00 DATE : 21.01.2013 PAGE:5 OF 9		CONTRACT NO. : 387 MAIN-SUPPLIER : BHEL PEM NOIDA					
SL. NO	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY		REMARKS	
1.	2.	3.	4.	5.	M	C/N	7.	8.	9.	D*	**	10.	11.
				BOX			APPD PROCEDURE						(RATING)
1.6	ELECTRICAL ACTUATOR	INSPECTION/ TESTING SHALL BE CARRIED OUT AS PER NTPC REFERENCE QUALITY PLAN NO.....											
2.0	INPROCESS CONTROL												
2.1	BODY & DISC	1 DIMENSIONS	MA	MEASURE-MENT	100%		MFG DRG	MFG DRG	INSPN. REPORT	P/W	-	V	
		2. SURFACE DEFECTS	CR	P.T.	100%		ASTM E165	ANSI B 16.34 APPENDIX III	INSPN. REPORT	P/W	V	V	ON MACHINED AREA ONLY.
2.2	WELDING OVERLAY DEPOSIT	WELDING PROCEDURE AND WELDER PERFORMANCE QUALIFICATION	-	-	-		ASME IX	ASME IX	INSPN. REPORT	P/W			
		CLADDING	MA	DEPTH MEASURE-MENT	100%		MFG. DWG	MFG. DWG	TEST REPORT	P/W	V	V	
			MA	SURFACE DEFECT LPI ON WELD OVERLAY AND	100%		ASTM E165	FREE FROM POROSITY/ CRACK	NDT REPORT	P/W	V	V	

LEGEND: * RECORDS, IDENTIFIED WITH "TICK" (✓) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION.

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MANUFACTURER/ SUB-SUPPLIER		MAIN-SUPPLIER		SIGNATURE	

FOR NTPC USE

REVIEWED BY

APPROVED BY

APPROVAL SEAL

DOC. NO.:

REV..... CAT.....

Signature
22/01/13



MANUFACTURER'S NAME AND ADDRESS		MANUFACTURING QUALITY PLAN										PROJECT : 2X660 MW MOUDA STPP	
ITEM : CS BUTTERFLY VALVES		DESIGN STD: AWWA C 504		QP NO. : PE-QP-387-100-M024		REV. NO.: 00		DATE : 21.01.2013		PAGE: 6 OF 9		PACKAGE : MAIN PLANT PACKAGE	
SIZE : 2000 NB		SUB-SYSTEM : STEAM SERVICE										CONTRACT NO. : 387	
												MAIN-SUPPLIER : BHEL PEM NOIDA	
SL. NO	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY			REMARKS
1.	2.	3.	4.	5.	M	C / N	7.	8.	9.	D *	**	10.	11.
2.3	BODY (BUTT WELD ENDS)	SUB-SURFACE DEFECT	CR	ADJACENT AREA MPI	100% ON BW AREA	100% ON BW AREA	ASTM E709	ANSI B 16.34 APPENDIX II	INSP REPORT		P/ W	V	V
2.4	SHAFT	1. DIMENSIONS	MA	MEASURE-MENT	100%	100% ON BW AREA	MFG DRG	MFG DRG	LOG BOOK		P/ W	-	-
		2.SURFACE DEFECTS	MA	P.T.	100%	100%	ASTM E165	ANSI B 16.34 APPENDIX III	INSP REPORT		P/ W	W	V
3.1	VERIFICATION OF ALL PREVIOUS TESTS AND DOCUMENTS	VERIFICATION OF RECORDS	MA	---	100%	100%	TECH SPEC	TECH SPEC			P	V	V
3.2	TESTS (HYDRAULIC)	1. BODY TEST	CR	HYDRO TEST	100%	100%	AWWA C504/ APPRD DRG	NO LEAKAGE	QAC	V	P/ W	W	W
													CHP

MANUFACTURER/ SUB-SUPPLIER		MAIN-SUPPLIER		SIGNATURE		LEGEND: * RECORDS, IDENTIFIED WITH "TICK" (✓) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION. ** MA: MANUFACTURER/SUB-SUPPLIER C: MAIN SUPPLIER, N: NTPC P: PERFORM W: WITNESS AND V: VERIFICATION AS APPROPRIATE, CHP: NTPC SHALL IDENTIFY IN COLUMN "N" AS "W"		DOC. NO.: REV..... CAT.....	
						FOR NTPC USE		REVIEWED BY	
								APPROVED BY	
								APPROVAL SEAL	

Sawadeh
 21/01/13



MANUFACTURER'S NAME AND ADDRESS			MANUFACTURING QUALITY PLAN							PROJECT : 2X660 MW MOUDA STPP			
MFGR.'s LOGO			ITEM : CS BUTTERFLY VALVES DESIGN STD: AWWA C 504 SIZE : 2000 NB SUB-SYSTEM : STEAM SERVICE			OP NO. : PE-QP-387-100-M024 REV.NO.: 00 DATE : 21.01.2013 PAGE: 7 OF 9			PACKAGE : MAIN PLANT PACKAGE CONTRACT NO. : 387 MAIN-SUPPLIER : BHEL PEM NOIDA				
SL. NO	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY		REMARKS	
1.	2.	3.	4.	5.	M	C/N	7.	8.	9.	D	**	10.	11.
		2. DISC STRENGTH	CR	HYDRO TEST	100%	100%	AWWA C504/ APPRD DRG	NO LEAKAGE	QAC	✓	P/ W	W W	CHP ONE VALVE/SIZE SHALL BE TESTED FOR TWICE THE DESIGN PRESSURE FROM BOTH SIDE OF THE VALVE IN ADDITION TO 100% TESTING IN THE NORMAL FLOW DIRECTION. NO PART OF DISC/ VALVE SHALL BE PERMANENTLY DEFORMED/DAMAGED. DISC DEFORMATION IS MEASURED USING DIAL GAUGE AND BODY DEFORMATION BY MEASURING TAPE
		3. SEAT LEAKAGE WITH ACTUATOR (BOTH DIRECTION)	CR	HYDRO/AIR TEST	100%	100%	AWWA C504/ APPRD DRG	NO LEAKAGE	QAC	✓	P/ W	W W	CHP
		4. PERFORMANCE TEST	CR	PERFORMANCE	OPERATING THREE TIMES UNDER NO LOAD/ FLOW CONDITION	100%	AWWA C504	SMOOTH OPERATION	QAC	✓	P/ W	W W	CHP - COMPLETE VALVE ASSEMBLY ALONG WITH ACTUATOR SHALL BE SHOP OPERATED IN HORIZONTAL & VERTICAL POSITION 1) UNDER AT NO LOAD (25 CYCLES) 2) UNDER PRESURE (3 CYCLES) IN HORIZONTAL POSITION ONLY

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MANUFACTURER/ SUB-SUPPLIER	SIGNATURE	DOC. NO.:		REV. CAT.	
		FOR NTPC USE	REVIEWED BY	APPROVED BY	APPROVAL SEAL

Forwarded
22/01/13



MANUFACTURER'S NAME AND ADDRESS		MANUFACTURING QUALITY PLAN							PROJECT : 2X660 MW MOUDA STPP				
MEGR's LOGO		ITEM : CS BUTTERFLY VALVES		DESIGN STD: AWWA C 504		QP NO. : PE-QP-387-100-M024		REV. NO.: 00		DATE : 21.01.2013			
		SUB-SYSTEM : STEAM SERVICE		PAGE: 8 OF 9		PACKAGE : MAIN PLANT PACKAGE		CONTRACT NO. : 387		MAIN-SUPPLIER : BHEL PEM NOIDA			
SL. NO	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY		REMARKS	
					M	C / N				M	C		N
1.	2.	3.	4.	5.	6.		7.	8.	9.	D *	**	10.	11.
					ON BOTH MANUAL & THROUGH OPERATORS								AND FOLLOWING SHALL BE CHECKED - OPERATING & CLOSING TIME - OPERATION OF TORQUE & LIMIT SWITCHES CURRENT DRAWN BY ACTUATORS
		5. GLAND LEAK TEST (TOP GLAND AND BOTTOM FLANGES)	CR	HELIUM LEAK TESTS (OPTIONAL)	100%		TECH SPEC	TECH SPEC	QAC	✓	P/ W	W	CHP
		6. VACUUM TEST & HELIUM LEAK TEST	CR	VACUUM TEST	100%		TECH SPEC	TECH SPEC	QAC	✓	P/ W	W	CHP
		7. PROOF OF DESIGN TEST (LIFE CYCLE TEST)	CR	CYCLE TEST	AS PER AWWA C504 ON ONE SIZE/ TYPE/ SIZE GROUP/ RATING	100%	APPROVED TEST PROCEDURE / AWWA C404	APPROVED TEST PROCEDURE / AWWA C404	QAC	✓	P/ W	W	VERIFICATION OF TEST REPORT OF POD TEST ON SAME. MODEL/TYPE/SIZE/RATING CARRIED OUT EARLIER NTPC PROJECT/ REPUTED CUSTOMER

LEGEND: * RECORDS, IDENTIFIED WITH "TICK" (✓) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION.

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MANUFACTURER/ SUB-SUPPLIER	SIGNATURE	FOR NTPC USE	DOC. NO.:	REV..... CAT.....
		REVIEWED BY	APPROVED BY	APPROVAL SEAL

Sansrathy
22/01/13



MFGR.'s LOGO		MANUFACTURER'S NAME AND ADDRESS		MANUFACTURING QUALITY PLAN						PROJECT : 2X660 MW MOUDA STPP				
				ITEM : CS BUTTERFLY VALVES DESIGN STD: AWWA C 504 SIZE : 2000 NB SUB-SYSTEM : STEAM SERVICE OP NO. : PE-OP-387-100- REV.NO.: 00 DATE : 21.01.2013 PAGE:9 OF 9						PACKAGE : MAIN PLANT PACKAGE CONTRACT NO. : 387 MAIN-SUPPLIER : BHEL PEM NOIDA				
SL. NO	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK M C / N		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY M C N			REMARKS	
1.	2.	3.	4.	5.	6.		7.	8.	9.	D	*	**	10.	11.
4 SHIPPING RELEASE														
4.1	FINAL INSPECTION	1. OVERALL DIMENSION	MA	MEAS.	100%		100%	APPD DRG	APPD DRG		P/	W	V	
		2. DOCUMENTATION REVIEW	MA	REVIEW	100%		100%	APPD DRG/ TECH SPEC	APPD DRG/ TECH SPEC		P		V	
		3. CLEANLINESS	MA	VISUAL	100%		100%	APPD DRG/ TECH SPEC	APPD DRG/ TECH SPEC		P/	W	V	
		4. NAMEPLATE	MA	VIAUAL	100%		100%	APPD DRG/ TECH SPEC	APPD DRG/ TECH SPEC		P		V	
5.0	PAINTING	1. SURFACE PREPARATION 2. UNIFORMITY & THICKNESS	MI	VISUAL & MEASURE- MENT	100%		100%	APPROVED DATA SHEET FROM BHEL/ CUSTOMER	APPROVED DATA SHEET FROM BHEL/ CUSTOMER	INSPE N REPORT	P		V	STEAM WASHABLE PAINT ON INNER SURFACE AS PER BHEL SPEC AA55151 REV 01
6.0	PACKING	SOUNDNESS	MA	VISUAL	100%		100%	AS PER TECH SPECIFICATION	AS PER TECH SPECIFICATION	INSPE N REPORT	P		V	

MANUFACTURER/ SUB-SUPPLIER		MAIN-SUPPLIER		SIGNATURE	
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FOR NTPC USE		REVIEWED BY		APPROVED BY	
				APPROVAL SEAL	

Souvik
22/01/13





DATA SHEET - A1
BUTTERFLY VALVE
(STEAM SERVICE)
2 X 660MW MOUDA STPP


SPECIFICATION NO. PE-TS-387-100-M016
VOLUME - IIB
SECTION: D
REV. NO.: 00
DATE: 21.01.2013
SHEET 1 OF 2

1	2	3	4	5	6		7	8	9	11	12	13		14	15			16	17	18	
SL NO.	TAG NOS.	TYPE OF VALVE	SIZE mm (NB)	OPERATION	DESIGN	PRESSURE KG/CM2(G)	SERVICE	RATING, DESIGN & TESTING CODE	BODY & DISC MATERIAL	END CONN	SPECIAL FEATURES	MATCHING PIPE OD X THKN		MAIN VALVES QTY WITHOUT COMMISSIO NING SPARES NOS.	COMMISSIONING SPARES						
												(DEG ° C)	TEMP		MM	MM	GLAND PACKING (VALVES) (SETS)				BOTTOM GASKET (VALVES) (SETS)
1	EXV-25, EXV-26 (EACH 2 Nos)	BUTTERFLY VALVE (STEAM SERVICE)	2000	MO	2	100	BFP DRIVE CL 758 OF TURBINE AWWA-C-504 OR EQUIVALENT	CCS (ASTM A216 GR WCB)	BW AS PER ASME B16.25	SG MO OT = 50 - 90 SEC. IBR, SHAFT AXIS ORIENTATION HORIZONTAL/ VERTICAL SUITABLE FOR BOTH DIRECTIONS; ELECTRIC ACTUATOR WITH INTEGRAL STARTER.	2032	16.00	4	4	4	4				2	
TOTAL																					

ABBREVIATIONS:-
BW- BUTT WELDED, CCS - CAST CARBON STEEL, SG - SEALED GLAND, MO - MOTORIZED ELECTRIC ACTUATOR OT - OPENING/CLOSING TIME OF VALVE
WITH ELECTRIC ACTUATOR OPERATION IBR - INDIAN BOILER REGULATION
1. Valve POD test charges/ Gear box POD test charges or any other test charges, required as per this technical specification, shall not be included in the unit quoted prices of main valves as these tests are the mandatory requirements of valve governing standard AWWA C504 and this enquiry specification. If the bidder has not carried these test earlier, then the bidder is required to do these tests without any charges to BHEL, in case of order on the bidder i.e. NO EXTRA CHARGES ON THIS ACCOUNT IS ADMISSIBLE TO BIDDERS.
2. Main valve prices shall BE EXCLUSIVE of cost of Commissioning Spares prices.
3. Bidder is required to quote unit price of each item under commissioning spares separately & individually i.e. prices of all commissioning spares shall not be clubbed/ included in the unit price of Main valves.
4. Commissioning spares --> One set each of Bottom/ Cover Gasket with 'O' Rings & Seals, Gland Packing with 'O' ring & seals in Gland packing area and actuator 'O' rings and seal as applicable.


Signature of the bidder with name, designation, date and company's seal

Signature
22/01/13

	DATA SHEET-A1 BUTTERFLY VALVES (STEAM SERVICE) 2 X 660MW MOUDA STPP	SPECIFICATION NO. PE-TS-387-100-M016	
		VOLUME-IIB	
		SECTION : D	
		REV. NO.: 00	DATE: 21.01.2013
		Sheet 2 of 2	

Material of Construction

SL NO.	PART NAME	MATERIALS
VALVE		
a.	Valve Body Butt welded: (Long body butt weld ends)	ASTM A-216 Gr. WCB
b.	Valve Disc.	ASTM A-216 Gr.WCB
c.	Shaft	ASTM A182 Gr..F304
d.	Disc Seal/Seat	EPDM (70 ~ 75 SHORE 'A')
e.	Valve body seat edge	AISI 316 (WELD OVERLAY/ DEPOSIT)
f.	Seat retaining ring and internal Bolts etc.	SS 304/316
g.	Bearing	SLEEVE TYPE, SELF LUBRICATED
h.	Shaft seal :	'O' RINGS TYPE (65~70 SHORE 'A')
i.	Fasteners (bolts & nuts)	ASTM A193 Gr. B7 (BOLTS) / ASTM A194 Gr. 2H(NUTS)
j.	Hand wheel (actuator)	MALLEABLE IRON (NO OTHER ALTERNATE MATERIAL ACCEPTABLE)
GEAR BOX. (Bevel type)		
k.	Main Housing /Cover (Totally enclosed construction)	Cast Iron IS:210 Gr. FG 220/260
l.	Input shaft	13/% Cr SS/ EN8 (~200 BN)
m.	Worm	EN8 (~200 BN)
n.	Worm Wheel	Ductile iron / S.G iron
o.	Hand wheel	Malleable Iron

	TECHNICAL SPECIFICATION BUTTERFLY VALVES (STEAM SERVICE) 2 X 660MW MOUDA STPP	SPECIFICATION NO. PE-TS-387-100-M016	
		VOLUME : IIB	
		SECTION: D	
		REV. NO.: 00	DATE: 21.01.2013
		SHEET 1 OF 1	

DATA SHEET - C

Drawings/documents distribution schedule to be followed by the successful bidder:

1.0 The successful bidder shall submit the following drawings/documents within two weeks after award of contract.

- 1.1 Relevant drawings/leaflets for the valves showing following information.
 - i) Complete cross sectional arrangement of the valve.
 - ii) Binding dimensions, dismantling clearances & weights.
 - iii) Bill of material incorporating all the materials of construction of various parts along with BS/ASTM/IS standards to which the materials conform to.
 - iv) Special features, if any, as called for in the specific requirement
 - v) Type of oil/Grease wherever required and its annual consumption.
- 1.2 Relevant catalogue/leaflet of the actuators
- 1.3 Torque calculations of actuator selected.
- 1.4 Actuator data sheet with Wiring Diagram.
- 1.5 Quality Plan duly signed & stamped with bidder's seal.
- 2.0 The following shall be submitted within the stipulated time period as per vendor's drawings/ documents schedule, but not later than one month before first dispatch.
 - a) Drawings of components & details as deemed necessary.
 - b) Instruction manual for erection, operation and maintenance.
 - c) Storage instructions.
- 3.0 Before dispatch of the equipment the vendor shall furnish the following.
 - a) Material Test certificates.
 - b) Shop test reports and certificates.
- 4.0 Distribution of drawings / documents for all projects:
After award of the contract the successful bidder shall furnish drawings/ documents as per following distribution schedule.

Sl. No.	Type of Document	No of Hard copies	No. of Soft copies
1	Documents submitted for Approval	2 Nos.	1 Nos.
2	Final Distribution(Approved Documents)	12 Nos.	1 Nos.
3	O&M Manuals	12 Nos.	2 Nos.

BHEL PEM	DOCUMENT TITLE	DOCUMENT PE-DC-387-100-N306
	DATA SHEET FOR BFP TURBINE EXHAUST BUTTERFLY VALVES	REVISION 00 DATE 15/12/2012 NUMBER
	NTPC – 2 x 660 MW MOUDA STPP; TG PACKAGE	SHEET 1 OF 2

NOTES:

1. General technical requirement shall be as per Customer tender specification.
2. Testing and all other general requirements shall be as per NTPC tender specification.
3. **Mandatory spares** to be supplied as per Contract.

TECHNICAL REQUIREMENTS


1. Tag no. : EXV-25 & EXV-26
2. Main Quantity : One each (Total 2 nos.) per unit
3. Total Main Qty. : Four nos. for two units
4. Type : Resilient seal.
5. Service : Butterfly valves shall be located in the exhaust ducts of the auxiliary drive turbines of the boiler feed pumps to isolate the aux. drive turbine from the surface condenser.
6. Size (Nominal) mm : 2000
7. Flow medium : Wet Steam, 2-7% moisture
8. Flow Velocity (Design) : 100 m/sec..
9. Operating parameters :

	<u>At normal condition</u> (Ref. HBD no.: T1012 LR0)	<u>At maximum condition</u> (Ref. HBD no.: A1033 LR00)
9.1 Pressure (kg/cm ² (a)) :	0.1161	0.1192
9.2 Flow (T/hr) :	53.08	60.25
9.3 Dryness fraction :	0.965	0.965

BHEL PEM	DOCUMENT TITLE	DOCUMENT PE-DC-387-100-N306
	DATA SHEET FOR BFP TURBINE EXHAUST BUTTERFLY VALVES	NUMBER
	NTPC – 2 x 660 MW MOUDA STPP; TG PACKAGE	REVISION 00 DATE 15/12/2012 NUMBER SHEET 2 OF 2

TECHNICAL DATA


1. Design Pressure : Full vacuum and 2 kg/cm² (g)
2. Design temp. : 100 Deg. C
3. End Connections : Butt welded
4. Connecting pipe size and material : OD 2032 x 16 thk.
SA672 Gr. B60 Cl.12/22
5. Valve operation type : Motor operated
6. Shaft Axis orientation : Horizontal
7. Pipe line axis orientation : Horizontal
8. Operation : Full open & full close
9. Design pressure drop at max. flow.: 0.0002 kg/cm² (max.)
10. **MATERIAL OF CONSTRUCTION:**
 - a) Valve Body : ASTM A-216 Gr.WCB
 - b) Valve Disc. : AS PER Customer Spec.
 - c) Shaft : ----- do -----
 - d) Valve seating edge and fittings : ----- do -----
 - e) Valve seat material : ----- do -----
 - f) Valve Trim : ----- do -----
 - g) Bearing : ----- do -----
 - h) Shaft seal : ----- do -----
11. Valve rating : ANSI 75B / Customer Spec.


	TECHNICAL SPECIFICATION BUTTERFLY VALVES (STEAM SERVICE) 2 X 660MW MOUDA STPP	SPECIFICATION NO. PE-TS-387-100-M016	
		VOLUME : IIB	
		SECTION: D	
		REV. NO.: 00	DATE: 21.01.2013
		SHEET 1	OF 1

SECTION-D2

ACTUATORS

DATA SHEET – A2 WIRING DIAGRAM


	SPECIFICATION FOR MOTORISED VALVE ACTUATOR		SPECIFICATION NO.: PE-SS-387-145-I007			
			VOLUME			
			SECTION			
			REV. NO.	00	DATE:	17.07.2012
			SHEET	1	OF	3
Data Sheet A & B						
DATA SHEET-A (TO BE FILLED BY PURCHASER)			DATA SHEET-B (TO BE FILLED-UP BY BIDDER)			
GENERAL	* PROJECT	2x660 MW MAUDA STPP STAGE II				
	OFFER REFERENCE					
	* TAG NO. SERVICE					
	* DUTY	<input type="checkbox"/> ON / OFF <input type="checkbox"/> INCHING				
	* LINE SIZE (inlet/outlet): MATERIAL					
	* VALVE TYPE	<input type="checkbox"/> GLOBE <input type="checkbox"/> GATE <input type="checkbox"/> REG. GLOBE <input type="checkbox"/> BUTTERFLY				
	* OPENING / CLOSING TIME					
	* WORKING PRESSURE					
	AMBIENT CONDITION	SHALL BE SUITABLE FOR CONTINUOUS OPERATION UNDER AN AMBIENT TEMP. OF 0-55 DEG C AND RELATIVE HUMIDITY OF 0-95%				
	VALVE SEAT TEST PRESS	BIDDER TO SPECIFY				
	REQUIRED VALVE TORQUE	BIDDER TO SPECIFY				
	ACTUATOR RATED TORQUE	BIDDER TO SPECIFY				
CONSTRUCTION AND SIZING	CONSTRUCTION	TOTALLY ENCLOSED, WEATHER PROOF, IP:55				
	MECHANICAL POSITION INDICATOR	TO BE PROVIDED FOR 0-100% TRAVEL				
	BEARINGS	DOUBLE SHIELDED, GREASE LUBRICATED ANTI-FRICTION.				
	GEAR TRAIN FOR LIMIT SWITCH/TORQUE SWITCH OPERATION	METAL (NOT FIBRE GEARS). SELF-LOCKING TO PREVENT DRIFT UNDER TORQUE SWITCH SPRING PRESSURE WHEN MOTOR IS DE-ENERGIZED.				
	SIZING	OPEN/CLOSE AT RATED SPEED AGAINST DESIGNED DIFFERENTIAL PRESSURE AT 85% OF RATED VOLTAGE. FOR ISOLATING SERVICE THREE SUCCESSIVE OPEN-CLOSE OPERATIONS OR 15 MINS. WHICHEVER IS HIGHER. FOR INCHING(REGULATING) SERVICE 150 STARTS/HR MINIMUM				
HANDWHEEL	* REQUIRED	<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO				
	* ORIENTATION	<input type="checkbox"/> TOP MOUNTED <input type="checkbox"/> SIDE MOUNTED				
	TO DISENGAGE AUTOMATICALLY DURING MOTOR OPERATION.					
ELECTRIC ACTUATOR	ACTUATOR MAKE/MODEL	BIDDER TO SPECIFY				
	MOTOR MAKE / MODEL / TYPE / RATING (KW)	BIDDER TO SPECIFY				
	MOTOR TYPE	SQUIRREL CAGE INDUCTION MOTOR, STARTING CURRENT LIMITED TO SIX TIMES THE RATED CURRENT.				
	ACTUATOR APPLICABLE WIRING DIAGRAM	<input checked="" type="checkbox"/> ENCLOSED (BIDDER TO CONFIRM) A: <input type="checkbox"/> DRG. NO. 3-V-MISC-24227 R00 B: <input type="checkbox"/> DRG. NO. 3-V-MISC-24550 R00 C: <input checked="" type="checkbox"/> DRG. NO. 3-V-MISC-24283 R00 D: <input type="checkbox"/> DRG. NO. 4-V-MISC-90271 R11				
	COLOUR SHADE	<input checked="" type="checkbox"/> BLUE (RAL 5012) ENAMEL <input type="checkbox"/>				
	SHAFT RPM	BIDDER TO SPECIFY				
	OLR SET VALUE	BIDDER TO SPECIFY				
	STARTING / FULL LOAD CURRENT	BIDDER TO SPECIFY				
	NO. OF REV FOR FULL TRAVEL	BIDDER TO SPECIFY				
	@ PWR SUPP TO MTR / STARTER Type	415V, 3PH, AC				
	@ CONTROL VOLTAGE REQUIREMENT	TO BE DERIVED FROM THE POWER SUPPLY TO THE STARTER <input type="checkbox"/> 24 VDC <input type="checkbox"/> 110 V				
	@ ENCLOSURE CLASS OF MOTOR	<input type="checkbox"/> IP 65 <input type="checkbox"/> IP 67 <input type="checkbox"/> FLAME PROOF <input checked="" type="checkbox"/> IP 55, TOTALLY ENCL, SELF VENTILATED.				
	@ INSULATION CLASS	<input checked="" type="checkbox"/> CLASS-B <input type="checkbox"/> CLASS-F				
	@ WINDING TEMP PROTECTION	<input checked="" type="checkbox"/> THERMOSTAT (3 Nos., 1 IN EACH PHASE) <input type="checkbox"/>				

	SPECIFICATION FOR MOTORISED VALVE ACTUATOR	SPECIFICATION NO.: PE-SS-387-145-I007	
		VOLUME	
		SECTION	
		REV. NO. 00	DATE: 17.07.2012
		SHEET 2	OF 3

Data Sheet A & B

DATA SHEET-A (TO BE FILLED BY PURCHASER)	DATA SHEET-B (TO BE FILLED-UP BY BIDDER)
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	SINGLE PHASE / WRONG PHASE SEQUENCE PROTECTION	REQUIRED	
INTEGRAL STARTER	INTEGRAL STARTER	<input checked="" type="checkbox"/> REQUIRED <input type="checkbox"/> NOT REQUIRED	
	TYPE OF SWITCHING DEVICE	<input checked="" type="checkbox"/> CONTACTORS <input type="checkbox"/> THYRISTORS	
	TYPE	<input checked="" type="checkbox"/> CONVENTIONAL <input type="checkbox"/> SMART (NON-INTRUSIVE)	
	STEP DOWN CONT. TRANSFORMER	<input checked="" type="checkbox"/> REQUIRED	
	OPEN / CLOSE PB	<input checked="" type="checkbox"/> REQUIRED <input type="checkbox"/> NOT REQUIRED	
	STOP PB	<input checked="" type="checkbox"/> REQUIRED <input type="checkbox"/> NOT REQUIRED	
	INDICATING LAMPS	<input checked="" type="checkbox"/> REQUIRED <input type="checkbox"/> NOT REQUIRED	
	LOCAL REMOTE S/S	<input checked="" type="checkbox"/> REQUIRED <input type="checkbox"/> NOT REQUIRED	
	STATUS CONTACTS FOR MONITORING	<input checked="" type="checkbox"/> REQUIRED <input type="checkbox"/> NOT REQUIRED	
	INTEGRAL STARTER DISTURBED SIGNAL	REQUIRED (O/L RELAY OPERATED, CONT./POWER SUPPLY FAILED, S/S IN LOCAL, TORQUE SWITCH OPTD. MID WAY)	
INTERPOSING RELAY (Applicable for integral Starter)	INTERPOSING RELAYS	REQUIRED	
	INTERPOSING RELAY (QUANTITY)	<input checked="" type="checkbox"/> 2 NOs. <input type="checkbox"/> 3 NOs.	
	DRIVING VOLTAGE	<input checked="" type="checkbox"/> 20.5 – 24V DC <input type="checkbox"/> _____ V DC	
	DRIVING CURRENT	<input checked="" type="checkbox"/> 125mA MAX <input type="checkbox"/> _____ mA MAX	
	LOAD RESISTANCE	<input checked="" type="checkbox"/> > 192 ohms - <25 k ohms <input type="checkbox"/> > _____ ohms - < _____ ohms	
TORQUE SWITCH	MFR & MODEL NO.	BIDDER TO SPECIFY	
	OPEN / CLOSE	<input checked="" type="checkbox"/> 1 No. <input type="checkbox"/> 2Nos. / <input checked="" type="checkbox"/> 1 No. <input type="checkbox"/> 2Nos	
	CONTACT TYPE	2 NO + 2 NC	
	RATING	5A 240V AC AND 0.5A 220V DC	
	CALIBRATED KNOBS(OPEN&CLOSE TS)	REQUIRED FOR SETTING DESIRED TORQUE	
	ACCURACY	+3% OF SET VALUE	
LIMIT SWITCH	MFR & MODEL NO.	BIDDER TO SPECIFY	
	OPEN : INT : CLOSE	<input checked="" type="checkbox"/> 1 No. <input type="checkbox"/> 2 Nos. <input type="checkbox"/> 2 Nos. (ADJ.)	<input checked="" type="checkbox"/> 1 No. <input type="checkbox"/> 2Nos.
	CONTACT TYPE	2 NO + 2 NC	
	RATING (AC / DC)	5A 240V AC AND 0.5A 220V DC	

	SPECIFICATION FOR MOTORISED VALVE ACTUATOR	SPECIFICATION NO.: PE-SS-387-145-I007	
		VOLUME	
		SECTION	
		REV. NO. 00	DATE: 17.07.2012
		SHEET 3	OF 3
Data Sheet A & B			
DATA SHEET-A (TO BE FILLED BY PURCHASER)		DATA SHEET-B (TO BE FILLED-UP BY BIDDER)	

POSITION TRANSMITTER	POSITION TRANSMITTER (For inching duty)	<input checked="" type="checkbox"/> REQUIRED <input type="checkbox"/> NOT REQUIRED		
	MFR & MODEL NO.	BIDDER TO SPECIFY		
	TYPE	<input type="checkbox"/> ELECTRONIC (2 WIRE) R/I CONVERTER <input checked="" type="checkbox"/> ELECTRONIC (2 WIRE) CONTACTLESS		
	SUPPLY	<input checked="" type="checkbox"/> 24V DC <input type="checkbox"/>		
	OUTPUT	<input checked="" type="checkbox"/> 4-20mA		
	ACCURACY	$\pm 1\%$ FS		
SPACE HEATER	@SPACE HEATER	REQUIRED		
	@ POWER SUPPLY			
	@ RATING	415v, 3PH, AC FOR RATING > 0.2KW; SINGLE PHASE FOR RATING < 0.2KW		
TERMINAL BOX	MOTOR TERMINAL BOX	REQUIRED		
	ACTUATOR TERMINAL BOX	REQUIRED		
	ENCL CLASS MTR T.B. / ACTUATOR T.B.	@ <input type="checkbox"/> IP 65 @ <input type="checkbox"/>	<input checked="" type="checkbox"/> IP65 <input type="checkbox"/>	
	@ EARTHING TERMINAL	REQUIRED		
	PLUG & SOCKET(9 PIN) (FOR COMM, LS/TS FEED BACK, PoT)	<input checked="" type="checkbox"/> REQUIRED <input type="checkbox"/> NOT REQUIRED <input checked="" type="checkbox"/> 2 NOS. <input type="checkbox"/>		
CABLE GLANDS	@ POWER CABLE GLAND	SIZE:--DURING DETAIL ENGINEERING		
	@ SPACE HEATER CABLE GLAND	SIZE: 2C x 2.5 sq. mm		
	OTHER CONTROL CABLE GLANDS-1	<input checked="" type="checkbox"/> APPLICABLE		
	OTHER CONTROL CABLE GLANDS-2	<input checked="" type="checkbox"/> APPLICABLE		
WEIGHT	TOTAL WEIGHT (ACTUATOR + ACCESSORIES)	BIDDER TO SPECIFY		_____ Kg.

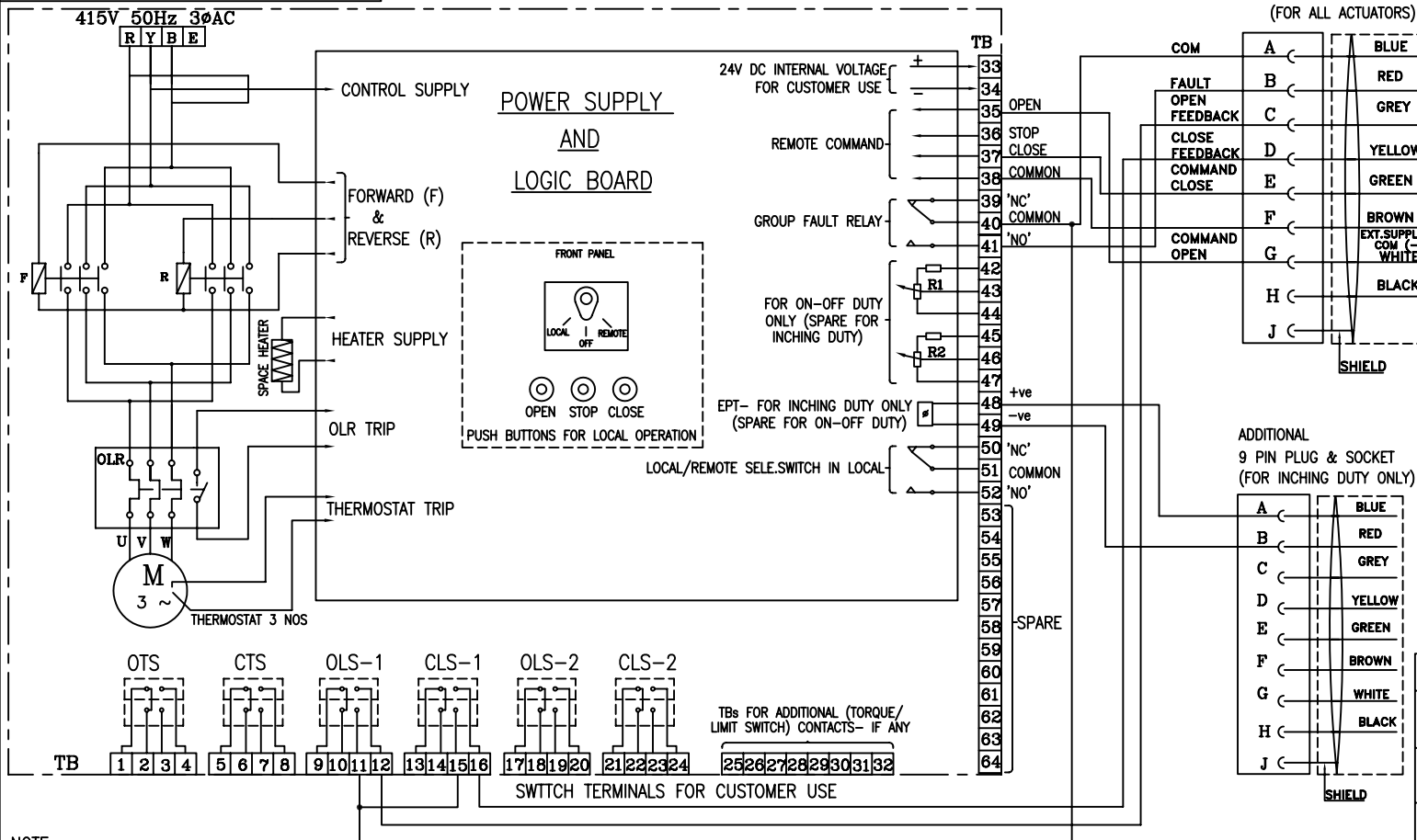
NOTES:

- SCOPE:** DESIGN, MANUFACTURE, INSPECTION, TESTING AND DELIVERY TO SITE OF ELECTRIC ACTUATOR FOR INCHING OR OPEN / CLOSE DUTY.
- CODES & STANDARDS:** DESIGN AND MATERIALS USED SHALL COMPLY WITH THE RELEVANT LATEST NATIONAL AND INTERNATIONAL STANDARD. AS A MINIMUM, THE FOLLOWING STANDARDS SHALL BE COMPLIED WITH:
IS-9334, IS-2147, IS-2148, IS-325, IS-2959, IS-4691 AND IS-4722
- TEMPERATURE RISE SHALL BE RESTRICTED TO 70 DEG. C FOR AMBIENT TEMPERATURE OF 50 DEG C.
- CABLE GLANDS OF DOUBLE COMPRESSION TYPE, BRASS MATERIAL SHALL BE PROVIDED.
- THE TORQUE SWITCHES SHALL BE PROVIDED WITH MECHANICAL LATCHING DEVICE TO PREVENT OPERATION WHEN UNSEATING FROM THE END 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 OPENS ON VALVE LEAVING END POSITION. THESE LIMIT SWITCHES ARE ADDITIONAL TO THE NUMBER OF LIMIT SWITCHES SPECIFIED ELSEWHERE.
- THE MOTOR SHALL OPERATE SATISFACTORILY UNDER THE +/- 10% SUPPLY VOLTAGE VARIATION AT RATED FREQUENCY, -5% TO +3% VARIATION IN FREQUENCY AT RATED SUPPLY VOLTAGE, SIMULTANEOUS VARIATION IN VOLTAGE & FREQUENCY THE SUM OF ABSOLUTE PERCENTAGE NOT EXCEEDING 10%.
- THE MOTOR SHALL BE SUITABLE FOR DIRECT ON LINE STARTING.

NOTES* = TO BE FILLED BY MPL (LEAD AGENCY). @ = TO BE FILLED BY ES

3-V-MISC-24283

DRAWING NO.



CONTACT DEVELOPMENT DIAGRAM

OTS	1-2	OPEN AT OVER TORQUE DURING OPENING TRAVEL				
	3-4	CLOSE AT OVER TORQUE DURING OPENING TRAVEL				
CTS	5-6	OPEN AT OVER TORQUE DURING CLOSING TRAVEL				
	7-8	CLOSE AT OVER TORQUE DURING CLOSING TRAVEL				
OLS-1	9-10					
	11-12					
CLS-1	13-14					
	15-16					
OLS-2	17-18					
	19-20					
CLS-2	21-22					
	23-24					
SWITCH	TERMINAL NO.	FULL OPEN	a	INTERMEDIATE	b	FULL CLOSE
		VALVE POSITION				
<div>————— INDICATES CONTACT CLOSED</div> <div>- - - - - INDICATES CONTACT OPEN</div>						
CONTACT RATING: 5A AT 250V AC & 0.5A AT 220V DC						

INDICATES CONTACT CLOSED

INDICATES CONTACT OPEN

CONTACT RATING: 5A AT 250V AC & 0.5A AT 220V DC

SETTING PROCEDURE OF POSITION LIMIT AND TORQUE SWITCH

VALVES	OPEN		CLOSE	
	MAIN	BACK UP	MAIN	BACK UP
GATE VALVE OF 100 mm AND ABOVE IN 1500 CL AND ABOVE RATINGS	OLS	OTS *	CLS	CTS
ALL OTHER GATE & GLOBE VALVES	OLS	OTS *	CTS	#
# - CLS NOT TO BE CONNECTED IN TRIP CIRCUIT				
* - BYPASS OTS FOR INITIAL 5% OF TRAVEL (FOR GATE VALVES ONLY)				

NOTE:-

- ALL TORQUE AND LIMIT SWITCHES (OTS, CTS, OLS1&2, CLS1&2) ARE WITH 2NO+2NC CONTACTS '1NO+1NC' IS TERMINATED IN TBS 1-24, REMAINING CONTACTS ARE FOR INTERNAL USE.
- ANY SPARE CONTACTS WHICH ARE NOT USED INTERNALLY ARE TO BE TERMINATED IN TBS 25-32
- CTS - TORQUE SWITCHES FOR CW ROTATION (CLOSE)
- OTS - TORQUE SWITCHES FOR CCW ROTATION (OPEN)
- OLS-1, OLS-2 - LIMITSWITCHES FOR POSITION OPEN
- CLS-1, CLS-2 - LIMITSWITCHES FOR POSITION CLOSE
- EPT - ELECTRONIC POSITION TRANSMITTER (CONTACTLESS TYPE, FOR INCHING DUTY)
- R1-R2-POTENTIOMETER 2 x 100 OHMS (FOR ON-OFF DUTY)
- FOR COMMANDS & EPT EITHER INTERNALLY GENERATED 24 VDC OR EXTERNAL SUPPLY OF 24VDC CAN BE USED
- M - MOTOR 3φ 415V 50 Hz AC SUPPLY
- TORQUE SWITCH BYPASS WITH LIMITSWITCH BOTH ON OPEN & CLOSE DIRECTION TO BE DONE INTERNALLY.

REV	DATE	ALTERED
		CHD & APPD

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TYPE OF PRODUCT
OR NAME OF
CUSTOMER/PROJECT

ELECTRICAL VALVE ACTUATORS (AC) WITH INTEGRAL STARTERS
FOR NTPC PROJECTS
(DRAWN FOR INTERMEDIATE POSITION OF VALVES)



BHARAT HEAVY ELECTRICALS LTD.,
UNIT: HIGH PRESSURE BOILER PLANT.
TIRUCHIRAPALLI-620014.

DEPT
VL
CODE



SCALE
NTS

WEIGHT (KG).
-

REFERENCE INFORMATION

NO. OF
ITEMS
-

TITLE
WIRING DIAGRAM (TERMINAL PLAN)
FOR ACTUATOR WITH INTEGRAL STARTER WITH PLUG & SOCKET
FOR NTPC PROJECTS

CARD
CODE
U 01

DRAWING NO.
3-V-MISC-24283

REV
0