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COPYRIGHT AND CONFIDENTIAL The information on this document is the property of BHARAT HEAVY ELECTRICALS LIMITED, It must not be used directly or indirectly in any way detrimental to the interest of the company. <u>MECHANICAL SEALS FOR BOILER FEED PUMP TYPE : MDG405</u> 1.0.0 INTENT OF SPECIFICATION : This specification is intended to cover the technical requirements of the shaft seals (Mechanical seals) for Boiler Feed Pumps type MDG405 Coupling side(DE) and End side(NDE). 2.0.0 SCOPE OF SUPPLY : 2.1.0 The scope of supply shall include Design, Engineering, Manufacturer, Inspection, Testing, Packing and forwarding the Mechanical seals. 3.0.0 TECHNICAL REQUIREMENTS: 3.1.0 <u>Technical Data :</u> <table border="0" style="width: 100%;"> <tr> <td style="width: 40%;">Seal type</td> <td style="width: 10%;">:</td> <td style="width: 50%;">Cartridge design, Flexible element shall be stationary</td> </tr> <tr> <td>Flushing</td> <td>:</td> <td>Self-flushing (API682 Plan 23)</td> </tr> <tr> <td>Quenching</td> <td>:</td> <td>N/A</td> </tr> <tr> <td>Auxiliary glands</td> <td>:</td> <td>Bush (Bronze cast)</td> </tr> <tr> <td>Dimensions</td> <td>:</td> <td>As per coordination diagram in another page</td> </tr> <tr><td colspan="3"> </td></tr> <tr> <td>Fluid</td> <td>:</td> <td>Boiler feed water</td> </tr> <tr> <td>Fluid temperature</td> <td>:</td> <td>4 / 187.8 / 215 deg.C (Min / Rated / Max)</td> </tr> <tr> <td>Specific gravity</td> <td>:</td> <td>0.878 (Rated)</td> </tr> <tr> <td>Pump Suct. pressure</td> <td>:</td> <td>2.84 / 6.54 MPaG (Rated / Design)</td> </tr> <tr> <td>Pump Gland pressure</td> <td>:</td> <td>1.51 MPaG</td> </tr> <tr> <td>Design condition</td> <td>:</td> <td>6.54 MPaG x 215 deg.C (as pressure casing)</td> </tr> <tr> <td>Rotational speed</td> <td>:</td> <td>0 to 6281 rpm</td> </tr> <tr> <td>Balance ratio</td> <td>:</td> <td>(*) to be indicated by manufacturer</td> </tr> <tr> <td>Contact pressure</td> <td>:</td> <td>(*) MPaG, to be indicated by manufacturer</td> </tr> <tr> <td>PV value</td> <td>:</td> <td>(*) MPaG.m/sec, to be indicated by manufacturer</td> </tr> <tr><td colspan="3"> </td></tr> <tr> <td>Face material</td> <td>:</td> <td>Manufacturer's proposal</td> </tr> <tr> <td>Couple driving ring</td> <td>:</td> <td>Manufacturer's proposal</td> </tr> <tr> <td>Seal cover</td> <td>:</td> <td>Manufacturer's proposal</td> </tr> <tr> <td>Shaft sleeve</td> <td>:</td> <td>ASTM A276 S42000</td> </tr> <tr><td colspan="3"> </td></tr> <tr> <td>CW temperature</td> <td>:</td> <td>38 deg.C</td> </tr> <tr> <td>Design temp rise</td> <td>:</td> <td>3 deg.C</td> </tr> <tr> <td>CW supply pressure</td> <td>:</td> <td>0.5 MPaG</td> </tr> <tr> <td>CW line design</td> <td>:</td> <td>1.0 MPaG x 50deg.C</td> </tr> <tr> <td>Design pre drop</td> <td>:</td> <td>0.1 MPa</td> </tr> <tr> <td>CW flow rate/cooler</td> <td>:</td> <td>(*) to be indicated by manufacturer</td> </tr> </table>						Seal type	:	Cartridge design, Flexible element shall be stationary	Flushing	:	Self-flushing (API682 Plan 23)	Quenching	:	N/A	Auxiliary glands	:	Bush (Bronze cast)	Dimensions	:	As per coordination diagram in another page				Fluid	:	Boiler feed water	Fluid temperature	:	4 / 187.8 / 215 deg.C (Min / Rated / Max)	Specific gravity	:	0.878 (Rated)	Pump Suct. pressure	:	2.84 / 6.54 MPaG (Rated / Design)	Pump Gland pressure	:	1.51 MPaG	Design condition	:	6.54 MPaG x 215 deg.C (as pressure casing)	Rotational speed	:	0 to 6281 rpm	Balance ratio	:	(*) to be indicated by manufacturer	Contact pressure	:	(*) MPaG, to be indicated by manufacturer	PV value	:	(*) MPaG.m/sec, to be indicated by manufacturer				Face material	:	Manufacturer's proposal	Couple driving ring	:	Manufacturer's proposal	Seal cover	:	Manufacturer's proposal	Shaft sleeve	:	ASTM A276 S42000				CW temperature	:	38 deg.C	Design temp rise	:	3 deg.C	CW supply pressure	:	0.5 MPaG	CW line design	:	1.0 MPaG x 50deg.C	Design pre drop	:	0.1 MPa	CW flow rate/cooler	:	(*) to be indicated by manufacturer
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3.1.1 **WATER CHEMISTRY:**
Dosing systems are provided to maintain the chemistry of the boiler feed water and also to comply with different modes of operation i.e. CWT, "Combined Water Treatment mode" during continuous plant operation and "Ammoniacal mode or All volatile treatment (Oxygenated) AVT (O) mode" during start-up & shutdown conditions.

The following philosophy of chemical feed system is considered:

Start-up sequence:

- Ammonia is dosed a pH of 9.2-9.5.
- Cation conductivity reaches below 0.15 $\mu\text{S}/\text{cm}$ (at 25°C) and the trend is downwards.
- Oxygen feed is manually started from DCS.

During normal operation:

- pH is maintained at 8.2-8.5 by dosing aqueous ammonia solution.

Oxygen dosing rate can be adjusted in the range of 30-150 ppb from DDCMIS.

- The oxygen dosing shall automatically turn off by closing the pneumatic control valve (PCV) if Cation conductivity in the cycle goes above 0.3 $\mu\text{S}/\text{cm}$.

Shut down sequence:

- Oxygen feed needs to be stopped one hour before shut down and deaerator and LP heater vents needs to be opened.
- Ammonia dosing rate needs to be increased to achieve pH in the range of 9.2-9.5.

3.2.0 The seals shall be capable of performing even in the event of complete loss of feed water due to incidents, such as inadvertent closure of suction valve. In such an event the pump needs to be safely brought down to rest and seals shall withstand the same.

3.3.0 The mechanical seals shall be of fully cartridge type. The seal shall be of proven design with reliable operating experience for at least a period of 3 years under similar conditions in at least 3 pumps.

3.4.0 The mechanical seals shall be designed for a minimum running life of 20,000 hours.

3.5.0 The seals offered shall be suitable to be accommodated in the stuffing box space available in the pumps.

3.6.0 The seals shall be designed to have minimum number of 'O' rings and shall be designed to withstand maximum temperature encountered by the system.

3.7.0 Mechanical seal offered shall have sealing faces not inferior to stationary carbon / Rotating silicon carbide combination.

3.8.0 The seals shall be balanced type and sufficient margin shall be provided between the maximum operating PV and the design PV. Bidder shall furnish the calculation for the PV value and shall indicate the margins provided.

3.9.0 The mechanical seals shall be designed for zero visible leakage.

3.10.0 During a complete AC Power supply failure, it would not be possible to supply any cooling water. All necessary protections shall be provided to prevent seal damage due to operation at high temperature.

3.11.0 The mounting arrangement of the seal, orientation of cooling water and flushing water connections shall be as per the coordination diagram shown in another page.

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3.12.0 Reference drawings of pump for seal mounting dimensions :

- a) Suction cover - drg.no. 01804314484
- b) Casing cover - drg.no. 01804414587
- c) Pumps Shaft - drg.no. 01804114442

3.13.0 Independent cooling circuits are provided for coupling side and end side mechanical seals. 2x100% coolers and 2x100% magnetic filters of each mechanical seal along with all the required accessories in cooling circuits & seal circuits are mounted on a single skid. **The complete skid assembly per pump is procured against specn no. FP60226.**

3.14.0 Although the mechanical properties of SUS403Q can be determined from a test piece taken from the same charge, the actual products shall be subjected to same heat treatment as the test piece and submit the heat treatment record and hardness record.

3.15.0 Design the capability of pumping ring without fail considering the pressure drop in the flushing water line. Bidder shall furnish the characteristic curve of the pumping ring along with the offer.

3.16.0 Apply the appropriate materials confirming to the water treatment as indicated in 3.1.1.

3.17.0 All materials shall be free of asbestos and all wetted surfaces other than sleeve, in contact with flushing water shall be SS316.

3.18.0 If supplier cannot satisfy this specification, the supplier shall offer deviation and clarification in writing and shall get approval in advance. Deviation/Clarification shall be submitted even if there is no deviation.

4.0.0 DRAWINGS & DATA TO BE FURNISHED:

4.1.0 Drawings to be furnished along with offer :

- Cross sectional drawing of seal indicating all the dimensions, bill of materials with positions nos., the schematic diagram showing all the connections sizes.
- Pumping ring characteristic curve.
- Part drawing of Shaft sleeve & Nut
- Description of Mechanical Seal structure.
- Mechanical seal data sheet as per attached format.
- Operating Manual
- List of recommended spares along with offer.
- Quality plan.

4.2.0 Data to be furnished along with offer :

- PV value of the face combination materials.
- Wear ratio.
- Balance ratio & contact pressure
- Roughness value.
- Leakage rate.
- Power consumption.
- PV calculation sheet.
- Estimated Heat generated in seal.
- Reference list.
- Quality assurance plan for the seal

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COPYRIGHT AND CONFIDENTIAL The information on this document is the property of BHARAT HEAVY ELECTRICALS LIMITED . It must not be used directly or indirectly in any way detrimental to the interest of the company.		Ref. Doc 5.0.0 <u>INFORMATION TO BE FURNISHED AFTER AWARD OF CONTRACT</u> 5.1.0 Detailed cross-sectional assembly of the seal with all parts identified on it along with their materials of construction (ASTM designation) and over all dimensions shall be submitted for BHEL approval. 5.2.0 Final quality assurance plan of the seal in five copies. 5.3.0 Soft copy of instruction manuals giving the details of installation, operation and maintenance instruction shall be furnished within four weeks of placement of purchase order. 6.0.0 <u>TESTS & GUARANTEE CERTIFICATES</u> 6.1.0 Complete seal unit shall be tested for its performance and leak tightness in the suitable test rig at vendors works. Details of test procedure and test rig facility available shall be furnished prior to the test. 6.2.0 Type test on one mechanical seal shall be done at supplier's works to prove their dry running capability as specified at Cl.No. 3.2.0 of specification. 6.3.0 The compliance certificates shall be furnished for mechanical seal, cooler and magnetic filter. 6.4.0 A guarantee certificate for trouble free performance of the seal for a period of 24 months from the date of supply or 12 months from the date of commissioning, whichever is earlier, shall be furnished. 7.0.0 <u>PACKING:</u> Mechanical seals shall be separately packed to ensure its capability to withstand transit risks without damage. 8.0.0 <u>MARKING :</u> 8.1.0 A tag bearing relevant 12 digit material code of BHEL shall be attached to each seal consignment. 8.2.0 Following details shall be marked on the packing case. a) Name of manufacturer b) BHEL Purchase order number. 8.3.0 Direction of rotation shall be clearly engraved (or) a suitable marked-up plate shall be riveted on the seal plate of mechanical seals. 8.4.0 A name plate containing following details shall be riveted or fixed by screws on top of seal plate and shall be clearly visible. Mechanical seals received without these details will be rejected during inspection at our stores. i) Name of manufacturer ii) Month & year of supply iii) Direction of rotation and application of seal		



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9.0.0 VARIANT TABLE:

VAR. NO.	DESCRIPTION & MAKE OF SEAL	MATERIAL CODE
01	Mechanical seal Coup. Side for BFP MDG405	FP9760225018
02	Mechanical seal End Side for BFP MDG405	FP9760225026

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MECHANICAL SEAL DATA SHEET						
				Date		
PUMP MODEL				OEM		
PURCHASE ORDER				END USER		
DRAWING NUMBER				SEAL ARRANGEMENT		
MEDIA				SEAL TYPE		
PARAMETER			UNIT		VALUE	
Specific gravity	P		kg/dm ³			
Specific heat	c		kcal/kg.deg.C			
Box / vessel temperature	D		deg.C			
Box / vessel pressure	P1		kg/cm ² G			
Flush flow rate	F		Lpm			
Shaft speed	N		rpm			
Balance diameter	D		mm			
Outside diameter	Do		mm			
Inside diameter	Di		mm			
Spring load	W		kg			
Reduction constant	K					
Co-efficient of friction	H					
Contact face area	A		cm ²			
Balance value			%			
Spring contact face pressure	Ps		kg/cm ²			
Face velocity	V		m/s			
PV value			kg/cm ² .m/s			
Torque	T		kg.m			
Power loss	H		KW			
Heat generation	Q		kcal/hr			
Temperature rise	DT		deg.C			
Calculated by				Approved by		

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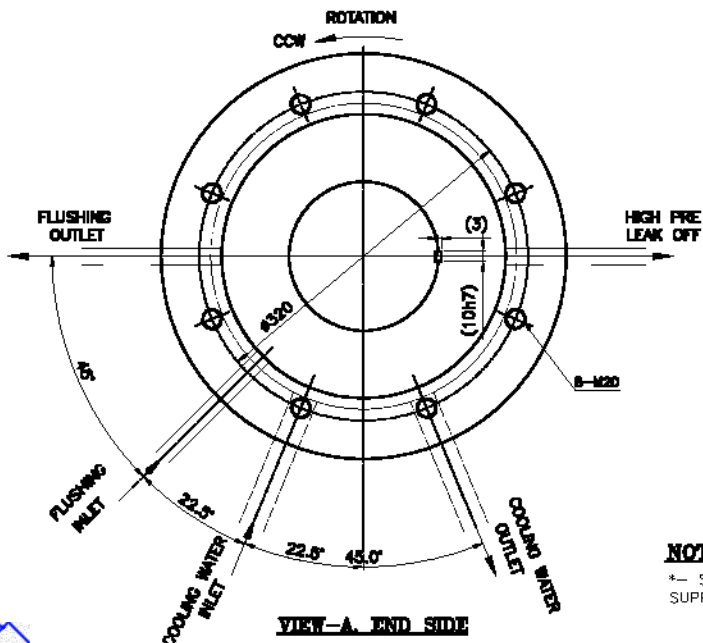
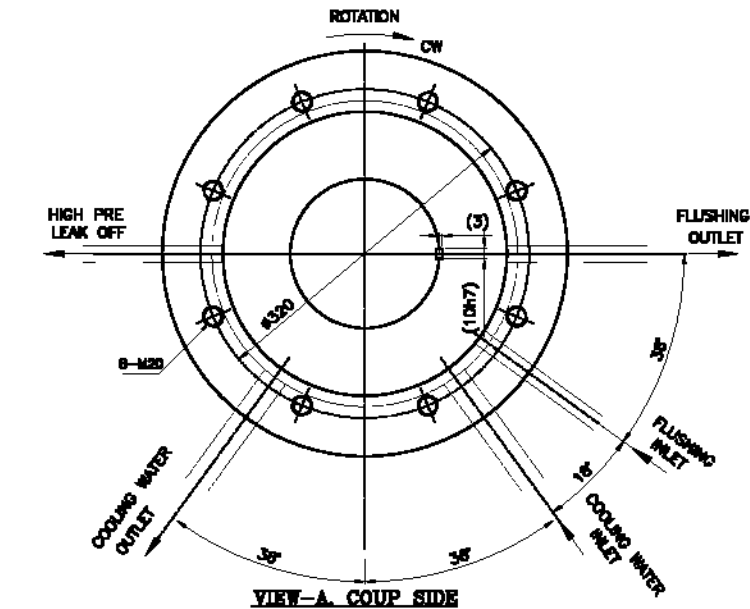
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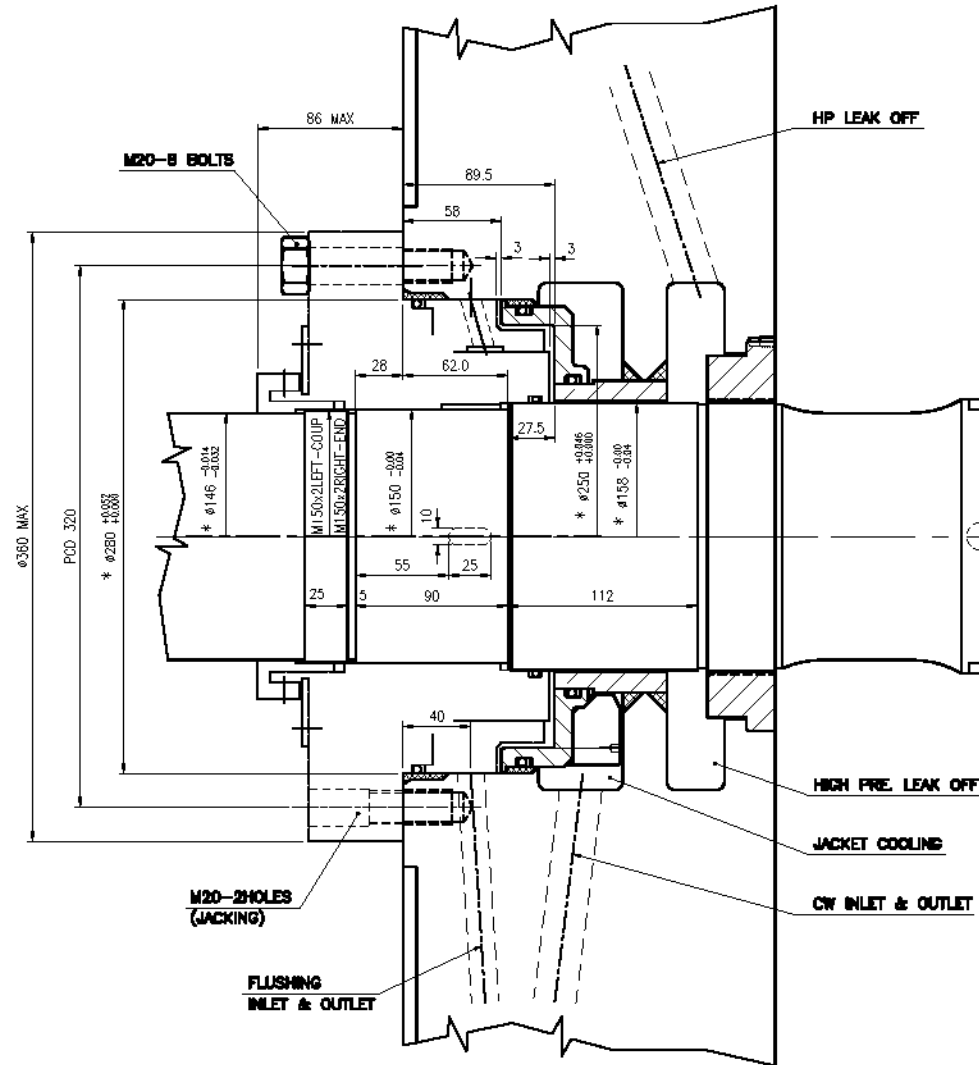
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NOTE :

*- SEAL DIMENSIONS TO BE INDICATED BY SEAL SUPPLIER AGAINST THE MOUNTING DIMENSIONS SHOWN.



**COORDINATION DIAGRAM
FOR SHAFT SEAL, MDG405 BFP**

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RECORD OF REVISIONS					
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	01	02.02.13	Specn generally revised in line with BHEL format.	MSR	PS
	02	21.01.15	Co-ord diagram in sh-5 revised in line with latest MHI drawings.	MSR	PS
	03	05.04.16	Revised to incorporate technical requirements in line with MHI purchase specification.	KKC	ASK