

TD-106 Rev No. 00	Form No.		<u>PRODUCT STANDARD</u> PUMPS HYDERABAD		FP50706 Rev No. 02 Page 1 of 11					
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 CONCRETE VOLUTE TYPE CW PUMPS</u> 1.0.0 INTENT OF SPECIFICATION: This specification is intended to cover the technical requirements of the shaft seals (Mechanical seals) for Concrete Volute type Cooling water Pumps. 2.0.0 SCOPE OF SUPPLY: 2.1.0 The scope of supply shall include Design, Engineering, and Manufacturing, Inspection, Testing, Packing and forwarding the Mechanical seal along with its shaft sleeve and maintenance seal. 3.0.0 TECHNICAL REQUIREMENTS: 3.1.0 <u>Technical Data:</u> <u>Standard inputs:</u> Number of gland : 1 set per 1 pump Seal type : The flexible element shall be stationary. Replacement of seal faces from inside of pump casing cover without pump dismantling. Flushing (self/external) : Self (Pumped medium) and external flushing. Quenching : No external quenching water shall be provided. Auxiliary glands : with maintenance seal Dimensions : Refer the outline drawing (Section 11.1.0) Minimum life : 25,000 hr Leakage : Max. 10 l/hr at 25000hr operation <u>Specific inputs:</u> <u>For VAR. 01</u> Pumped Fluid : Clarified water. Refer water quality sheet (Section 3.1.1) "Fluid temperature Rated/Max." : 25/35 degree C Specific gravity (Rated) : 1.00 "Pump suction pressure Rated/Design" : Sump Intake "Pumps discharge pressure Rated / Design" : 2.4/4.6 kg/cm²								
		<table border="1"> <tr> <td data-bbox="76 1960 207 2110">Ref. Doc</td> <td data-bbox="207 1960 646 2110"> Revisions: Refer to record of revisions: </td> <td data-bbox="646 1960 1029 2110"> Prepared: MVSS </td> <td data-bbox="1029 1960 1348 2110"> Approved: MSRAM </td> <td data-bbox="1348 1960 1503 2110"> Date: 01.06.20 </td> </tr> </table>				Ref. Doc	Revisions: Refer to record of revisions:	Prepared: MVSS	Approved: MSRAM	Date: 01.06.20
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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			Pressure at pump run-out : 1.85 kg/cm^2 Pump gland pressure : 2.4/4.6 kg/cm^2 Design condition as pressure casing : 7.0 kg/cm^2 x 35 degree C Rotational speed : 269 RPM Runaway speed due to Reverse flow : 383 RPM Axial direction : vertical Rotational direction : Clockwise (from top view) Max. ambient air temp. : 42 degree C Total axial displacement : 48.8 mm (+32.4/ -16.4 mm) Power loss : Max. 5kW (At rated operation) Face material : Hard face-Hard face combination Couple-driving ring MOC : Manufacturer's proposal Seal cover MOC : SS304 Shaft sleeve MOC : SUS410Q/ASTM A276-S41000 Bolts/Nuts (Fasteners) : SS316 "Flushing water temperature Design" : 35 degree C "External flushing water pressure Design" : 10 kg/cm^2 "Self flushing water pressure Rate/Design" : 2.4/4.6 kg/cm^2 Design / Hydrostatic test pressure (Design pressure x 1.5 times)" : 10/ 15 kg/cm^2 Flow rate of flushing water-in : 2 m^3/hr "External Flushing water Outflow temperature " : 35 degree C Mesh size of strainer for External flushing : 60 mesh (250 µm openings) Supply air pressure for maintenance seal : 4.9 ~ 7.8 kg/cm^2		

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3.1.1 WATER CHEMISTRY OF PUMPED MEDIUM:

FOR VAR. 01:

SR. NO.	PARAMETERS	UNITS	Raw Water Values	Clarified Water Properties	Circulating water properties COC 5- For Design
1.0	pH		8.0 – 8.5	6.5	8 - 8.5
2.0	Temperature	°C	22 - 30	22 - 30	32
3.0	Conductivity	µS/cm	1300	1300	6500
4.0	Colour	Hazen Units	Not Available	Not Available	Not Available
5.0	Odour		Not Available	Not Available	Not Available
6.0	Taste		Not Available	Not Available	Not Available
7.0	TDS	ppm	870	903	4515
8.0	P-Alkalinity as CaCO ₃	ppm	Nil	Nil	Nil
9.0	M-Alkalinity as CaCO ₃	ppm	400	400	250
10.0	T – Alkalinity as CaCO ₃	ppm	400	400	250
11.0	Organic Matter as KMnO ₄	ppm	50	Negligible	Negligible
12.0	Iron (as Fe)	ppm	1	1	5
13.0	Turbidity (NTU)	ppm	Clariflocculator shall be designed considering TSS : ≤ 2000 ppm. Centrifuge & thickener shall be designed considering TSS : ≤ 1000 ppm	Less than 2 NTU	Less than 10 NTU
14.0	CATIONS				
	(a) Ca as CaCO ₃	ppm	295	326.5	1632.5
	(b) Mg as CaCO ₃	ppm	77	77	385
	(c) Na as CaCO ₃	ppm	203	203	1015
	(d) K as CaCO ₃	ppm	10	10	50
	(e) Al as CaCO ₃	ppm	0	1.8	9
	Total Cation	ppm	585	618.3	3092.5

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15.0	ANIONS				
	(a) HCO ₃ as CaCO ₃	ppm	400	404.5	2022.5
	(b) Chlorides	ppm	149	176	880
	(c) SO ₄ as CaCO ₃	ppm	33	34.8	174
	(d) Fluoride as CaCO ₃	ppm	1	1	5
	(e) Nitrate as NO ₃	ppm	2	2	10
	Total Anion	ppm	585	618.3	3092.5
16.0	Ammonia	ppm	Absent - Traces	Absent - Traces	Absent - Traces
17.0	Silica Colloidal (as SiO ₂)	ppm	< 1 (can be present in summer)	< 1 (can be present in summer)	< 5 (can be present in summer)
18.0	Silica Non - Colloidal (as SiO ₂)	ppm	36	36	180
19.0	Free Chlorine	ppm	Nil	Nil	Nil
20.0	Total Suspended Solids	ppm	-	4	20
21.0	Carbonates as CaCO ₃	ppm	-	-	-
22.0	Boron	ppm	Less than One(1) ppm	Less than One(1) ppm	Less than Five(5) ppm
23.0	Oil & Grease	ppm	Nil	Nil	Nil

Note: Max. Size of suspended particle is 500 µm.

3.2.0

The design shall be such that both rotating and stationary seal faces can be replaced from casing cover without any major dismantling.

3.3.0

The quality of external flushing water is same as pumped medium with filtration by strainer of size mentioned at 3.1.0.

3.4.0

Design attention is to be paid regarding deposit of particulate matter (from pumped medium and ambient atmosphere) at seal faces and at maintenance seal during idle condition of the pump. Flushing provision will be provided to flush away the particulate deposits at seal faces before start of pump also.

3.5.0

The external flushing water return shall be drained below stuffing box.

3.6.0

The mechanical seals shall be designed for a minimum running life of 25,000 hours. A guarantee certificate as indicated at clause 6.7.0 shall be submitted along with the offer

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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	3.7.0 The seals offered shall be suitable accommodated in the stuffing box space available in the pumps as shown in outline drawing (Section 11.1.0). Orientation of cooling water and flushing water connections shall be as per the connection drawing (Section 11.2.0). The vent line of external flushing water should be provided with a valve. 3.8.0 The seals shall be designed to have minimum number of 'O' rings. 3.9.0 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. 3.10.0 The mechanical seals shall be designed for maximum leakage of 10 l/hr (including external flushing vent- if applicable) within design life period. 3.11.0 Since the installed level of pump is below water level, utmost importance shall be given to maintenance seal's design. It shall be designed to function for long continuous durations at the time of maintenance of main seal. The design of maintenance seal shall be such that it should not puncture because of sand particles that may come in between the shaft and maintenance seal. 3.12.0 Maintenance seal shall be designed such that it can be inspected from Pump casing cover. 3.13.0 All materials of construction of the mechanical seal shall be free of asbestos and refractory ceramic fiber (RCF). 3.14.0 As for mechanical seal cover and shaft sleeve, the material inspection record (including mechanical properties) shall be submitted respectively. Although the mechanical properties of Sleeve 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 Apply the appropriate materials confirming to the water chemistry as indicated in 3.1.1. 3.16.0 Flexible nylon tubes with SS316 NPT connections of length around 1m shall be provided for flushing water and maintenance seal inlets/outlets. 3.17.0 List of recommended spares shall be submitted/indicated in the supplier drawing. 3.18.0 All seal components shall be designed to prevent them from being dislodged. 3.19.0 This pump is vertical type and the rotor will be adjusted axially by 48.8mm (+32.4mm/-16.4mm) based on the pump casing. Therefore, the mechanical seal shall accept this adjustable movement of the pump rotor. After adjusting the rotor, mechanical seal will be fastened axially. 3.20.0 The punch marks such as flushing in/out, drain, rotation direction etc., shall be indicated in order to prevent any wrong assemblies of mechanical seal and the pipes. 3.21.0 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. 3.22.0 Two sets of spare O-rings/gaskets shall be supplied as initial spares along with each mechanical seal. O-ring groove details and O-ring sizes at interface locations of mechanical seal and pump shall be indicated in the drawing. 3.23.0 One set of special tools (if any) shall be supplied per each mechanical 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			3.24.0 Seal shall be capable of handling the instantaneous pump lift equaling the clearance available in the thrust bearing, 1 mm, which can occur during pump operation, during startup or pump trip.		
			4.0.0 <u>DRAWINGS & DATA TO BE FURNISHED:</u>		
			4.1.0 <u>Drawings to be furnished along with offer:</u>		
			- Cross sectional drawing of seal indicating all the dimensions, bill of materials with positions nos., weights & MOC & schematic diagram showing all the connections sizes. - Description of Mechanical Seal including maintenance seal structure. - Mechanical seal data sheet as per attached format (Section 10.0.0). - List of recommended spares.		
			4.2.0 <u>Data to be furnished along with offer:</u>		
			- PV value of the face combination materials including calculation sheet. - Wear ratio. - Balance ratio & contact pressure - Roughness value. - Leakage rate at installed condition and at end of design life (i.e. 25000hr operation). - Duration of flushing water operation before pump start-up. - Power loss. - O-ring & gasket details. - Maintenance seal air capacity. - Required time for cut-off by maintenance seal at min. air pressure specified. - Max. duration of continuous operation of maintenance seal. - Estimated Heat generated in seal. - Quality assurance plan for the seal. - Reference list		
			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 Shaft sleeve drawing		
			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, special tools details shall be furnished within four weeks of placement of purchase order.		
			6.0.0 <u>INSPECTION AND TESTING:</u>		
			6.1.0 Visual & Dimensional check: Major dimensions including terminal point, fitting and outline dimensions shall be checked.		
			6.2.0 Material test: Mechanical seal cover and shaft sleeve. Refer 3.14.0		
			6.3.0 Liquid Penetrant Test: LPI shall be carried out on all the surfaces of shaft sleeve by certified inspector. Test procedure: ASME Sec. V, Article 6 & 24. Acceptance criteria: ASME Sec. VIII Div.1, Appendix 8		

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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. 6.4.0 Hydrostatic Pressure test shall be carried out for 30 minutes with test pressure value as indicated at 3.1.0. 6.5.0 Any other manufacturer's standard test, if necessary shall be carried out. 6.6.0 The compliance certificates shall be furnished for mechanical seal. 6.7.0 A guarantee certificate shall be furnished for trouble free operation of the seal for a period of 24 months from the date of commissioning. 7.0.0 PACKING: Mechanical seals shall be separately packed to ensure its capability to withstand transit risks without damage. 8.0.0 MARKING: 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. - Name of manufacturer - 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. - Name of manufacturer - Month & year of supply - Direction of rotation and application of seal 9.0.0 VARIANT TABLE: <table border="1"> <thead> <tr> <th>VAR. NO.</th> <th>DESCRIPTION</th> <th>PROJECT</th> <th>MATERIAL CODE</th> </tr> </thead> <tbody> <tr> <td>01</td> <td>Mechanical seal for MKSV220C (including shaft sleeve & Maintenance seal)</td> <td>1x660MW Bhusawal TPS U#06</td> <td>FP9750706013</td> </tr> <tr> <td>51</td> <td>Shaft sleeve for Var.01</td> <td>1x660MW Bhusawal TPS U#06</td> <td>FP9750706510</td> </tr> <tr> <td>52</td> <td>Set of O-rings & gaskets for Var.01</td> <td>1x660MW Bhusawal TPS U#06</td> <td>FP9750706528</td> </tr> <tr> <td>53</td> <td>Maintenance seal for Var.01</td> <td>1x660MW Bhusawal TPS U#06</td> <td>FP9750706536</td> </tr> </tbody> </table>					VAR. NO.	DESCRIPTION	PROJECT	MATERIAL CODE	01	Mechanical seal for MKSV220C (including shaft sleeve & Maintenance seal)	1x660MW Bhusawal TPS U#06	FP9750706013	51	Shaft sleeve for Var.01	1x660MW Bhusawal TPS U#06	FP9750706510	52	Set of O-rings & gaskets for Var.01	1x660MW Bhusawal TPS U#06	FP9750706528	53	Maintenance seal for Var.01	1x660MW Bhusawal TPS U#06	FP9750706536
VAR. NO.	DESCRIPTION	PROJECT	MATERIAL CODE																					
01	Mechanical seal for MKSV220C (including shaft sleeve & Maintenance seal)	1x660MW Bhusawal TPS U#06	FP9750706013																					
51	Shaft sleeve for Var.01	1x660MW Bhusawal TPS U#06	FP9750706510																					
52	Set of O-rings & gaskets for Var.01	1x660MW Bhusawal TPS U#06	FP9750706528																					
53	Maintenance seal for Var.01	1x660MW Bhusawal TPS U#06	FP9750706536																					

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10.0.0 DATA SHEET FORMAT:

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				
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		m ³ /hr		
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	

NOTE: Supplier shall submit the datasheet duly filled along with the offer.

1) ALL DIMENSIONS ARE IN MM

Date:



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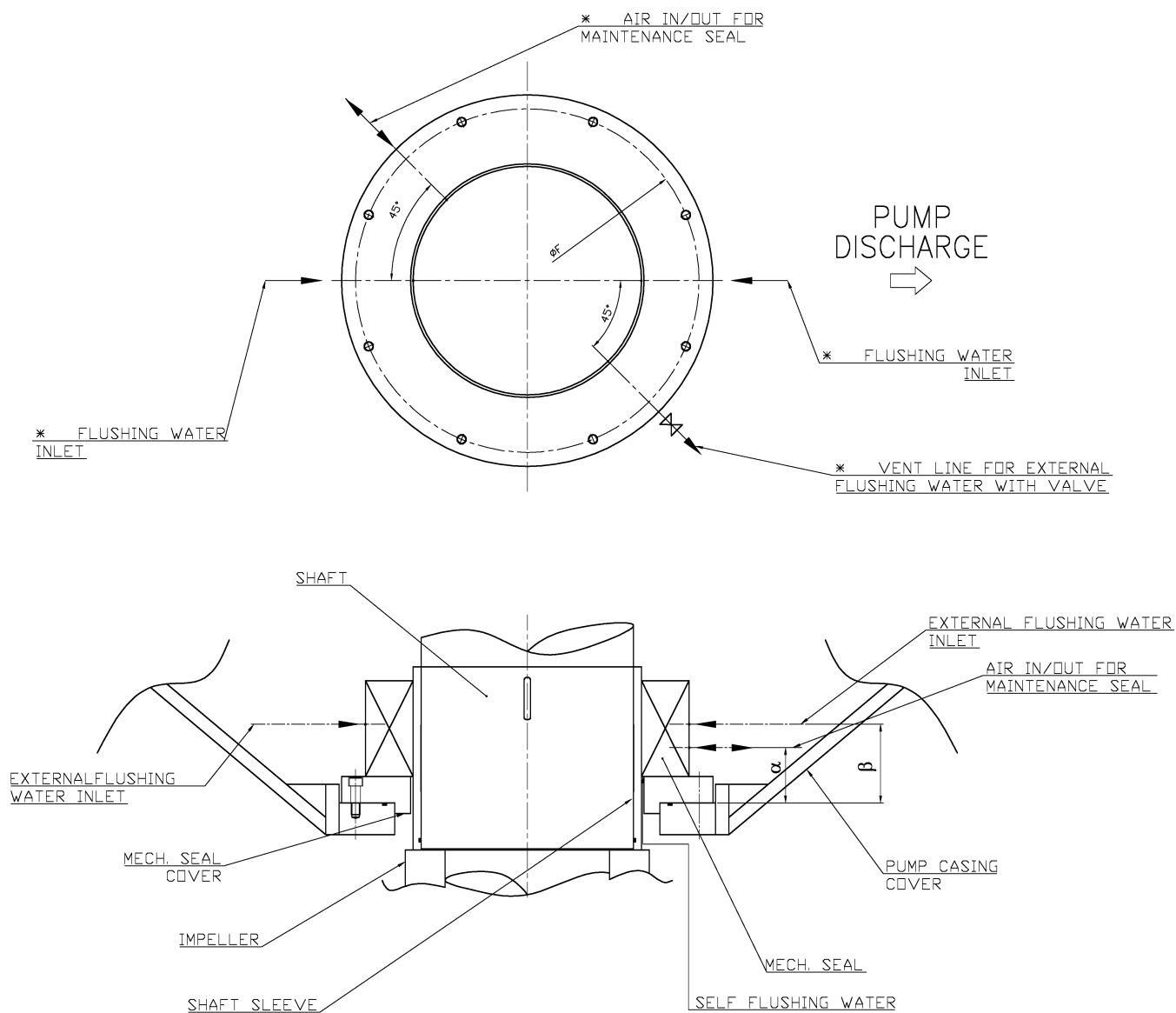
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11.2.0 CONNECTION DRAWING



NOTE:

- * THE POSITION AND SPECIFICATION OF TERMINAL POINTS SHALL BE INFORMED BY VENDOR.
- 1) ALL DIMENSIONS ARE IN MM.
- 2) THE DIMENSIONS α, β SHALL BE INFORMED BY VENDOR.

Revisions:

Refer to record of revisions

Prepared:

Approved:

Date:

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	01	10-07-2020	Revised Clauses 3.1.0, 3.3.0, 3.10.0, 3.16.0 & 6.4.0.	MVSS	MSRAM
	02	22-07-2020	Revised Clauses 3.1.0, 3.3.0, 3.4.0, 3.5.0, 3.7.0, 3.10.0, 4.2.0 & 3.11.0	MVSS	MSRAM

