

TD-106-2 Rev No. 5 Form No.		PRODUCT STANDARD PUMPS HYDERABAD		FP 50694							
				Rev. No. 04							
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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>PURCHASE SPECIFICATION FOR VERTICAL THRUST AND GUIDE BEARING</u> <u>FOR CONCRTE VOLUTE TYPE CW PUMP</u> 1.0 <u>Scope:</u> This standard specifies the requirements of vertical thrust and journal bearings for concrete volute type Cooling Water Pumps. 2.0 <u>Technical Requirements:</u> 2.1 Bearings shall be designated to meet the technical requirements detailed in the variant table. 2.2 Bearing shall be oil sump lubricated. 2.3 Top cover of the bearing shall of split design to facilitate easy assembly and disassembly of the bearing internals. 2.4 Bearing shall be designed in such a way that the measured temperatures are less than the following set points at design condition. <table border="0"> <tr> <td>Radial pads:</td> <td>Alarm = 85 deg. C & Trip = 90 deg. C</td> </tr> <tr> <td>Thrust pads:</td> <td>Alarm = 90 deg. C & Trip = 95 deg. C</td> </tr> <tr> <td>Oil temperature:</td> <td>Alarm = 60 deg. C & Trip = 65 deg. C</td> </tr> </table> 2.5 Bearing shall be provided with the following accessories: a) 1 no. thermometer for bearing oil temperature with suitable connection. b) 1 no. platinum duplex 3 wire RTD (100 ohms at 0 deg C) for bearing oil temperature with suitable connection. c) 2 no.s platinum duplex 3 wire RTDs (100 ohms at 0 deg C) for thrust pads with suitable connection. d) 1 no. platinum duplex 3 wire RTD (100 ohms at 0 deg C) for journal pad, with suitable connection. e) Suitable leak proof fittings shall be provided to prevent leakage of oil through the RTD connections. f) Spring fitted duplex RTDs for bearing pad metal temperature.				Radial pads:	Alarm = 85 deg. C & Trip = 90 deg. C	Thrust pads:	Alarm = 90 deg. C & Trip = 95 deg. C	Oil temperature:	Alarm = 60 deg. C & Trip = 65 deg. C
		Radial pads:	Alarm = 85 deg. C & Trip = 90 deg. C								
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Revisions: Refer record of revisions sheet.	Prepared: MVSS	Approved: MSRAM	Date: 14.01.20								

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Ref. Doc				

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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.			h) Punch mark shall be carried out near the pipe connecting part to prevent the connection mistake of cooling water piping. Inlet of cooling water : IN Outlet of cooling water : OUT i) Thrust bearings shall be oil lubricated, and capable of absorbing axial thrust in both directions of rotation. Refer to the Technical requirements at 9.0 for type of pads. j) Adequate bearing lubrication shall be provided for all operating conditions. The bearing housings shall be designed to exclude the ingress of dust and water and shall have suitable provision for breathing and be adequately sealed to prevent leakage of oil. Thrust bearings shall be suitable for reverse rotation and shall be suitable for continuous operation at all duties. k) The bearing housing shall be designed to exclude the ingress of dust and water and shall have suitable provision for breathing and be adequately sealed to prevent leakage of oil. l) The design of the bearing shall be such that the bearing performance is insensitive to small change in oil levels. m) The bearing must be designed to permit easy filling and drainage of lubricating oil. n) The cooling water piping of thrust bearing shall be designed based on water analysis data given at clause no. 9. Bearing manufacturer shall inform the mesh size of strainers, if necessary. 2.8 <u>Materials of Construction:</u> All materials shall be free of asbestos. The materials of construction of the bearings shall not be inferior to the following: Base plate : SG iron/ cast steel Casing : Cast iron/ cast steel Top cover : Cast iron/ cast steel Thrust collar : ASTM A29 Grade 1022 Journal pads : ASTM A29 Grade 1022 with white metal Thrust pads : ASTM A36 with white metal White metal on pads : IS: 25 Gr. 84 3.0 <u>Drawings & Documents:</u> 3.1 Following information shall be submitted along with technical offer: • Allowable time without cooling water.		
			Ref. Doc		

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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.		• Spring constant and damping co-efficient of bearing. • Allowable white metal temperature for thrust pad and journal pad • Power loss (kW) • Weight of bearing assembly • ID of thermowell, insertion length and size of threading of RTDs for journal and thrust pads. • Position of journal & Thrust pad RTDs 3.2 Following drawings / documents shall be furnished for BHEL approval / information, within 3 weeks after placement of purchase order. 5 copies of detailed dimensional / sectional assembly drawing of the bearing with all parts & accessories identified shall be submitted for BHEL approval. The following information shall be indicated on the drawing. • Shaft diameter & collar bore, mm • Pump speed, rpm • Thrust load, normal & maximum, kN • Thrust surface, sq.mm • Thrust pressure, kN/sq.mm • Journal load, kN • Journal surface, sq.mm • Journal pressure, kN/sq.mm • Journal diameter, mm • Journal length, mm • Journal diametrical clearance, mm • Power loss, kW • CW quantity required, LPH • CW inlet temperature, deg. C • Oil viscosity at 60 deg.C, Poise • Oil designation, ISO VG • Lube oil quantity • Weight of bearing, kg • Bearing rating (kgf) 3.3 Quality Assurance plan of the bearing 3.4 Instruction manuals covering installation, operation and maintenance procedures of the bearing. 4.0 <u>NDT Requirements:</u>		
Ref. Doc		Following Non destructive tests shall be conducted:		

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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 . 1) Ultrasonic test shall be done on thrust pads to ensure bonding between white metal lining and backing as per ISO 4386-2B2 (PART-1). 2) Liquid penetrant examination shall be done on thrust pads white metal face as per ISO 4386-CLASS B (PART-3). 3) The cooling water tubes inside the bearing shall be capable of withstanding a pressure of 10 kg/sq.cm 5.0 CERTIFICATES: The following certificates shall be furnished in 5 copies along with consignment. 1) Compliance certificates for accessories. 2) Chemical analysis for white metal. 3) Ultrasonic test certificate for white metal bonding 4) Liquid penetrant Examination 5) Dimensional inspection report 6.0 MARKING: 1) Name plate containing supplier's name, model no., year of mfg and BHEL material code shall be provided on the bearing housing. 2) A tag bearing relevant 12 digit material code of BHEL shall be attached for each consignment. 7.0 PACKING: The material shall be properly packed to ensure capability of withstanding transit risks without damages. The packing shall be sea-worthy for export orders and for specific mention in the purchase enquiry/order. The following details shall be marked on the packing case: 1) Manufacturer's name 2) BHEL Order No. & date 3) BHEL Standard No. FP 50694/VAR No. xx 4) Net weight in Kgs			
Ref. Doc			

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In addition, this data may be confirmed again after BHEL 's analysis. </td> </tr> <tr> <td>Max</td> <td colspan="2">9.2</td> </tr> <tr> <td>Total (Static +Dynamic)</td> <td>Max</td> <td colspan="2">70</td> </tr> <tr> <td rowspan="2">Spring Constant (Radial direction)(Under the static load condition) (N/m)</td> <td>Rated</td> <td colspan="2">To be informed</td> <td colspan="2" rowspan="2">To be informed the spring constants under rated and max static load condition.</td> </tr> <tr> <td>Max</td> <td colspan="2">To be informed</td> </tr> <tr> <td rowspan="2">Damping coefficient (Radial direction) (Under the static load condition) (N s/m)</td> <td>Rated</td> <td colspan="2">To be informed</td> <td colspan="2" rowspan="2">To be informed the damping coefficients under rated and max static load condition.</td> </tr> <tr> <td>Max</td> <td colspan="2">To be informed</td> </tr> <tr> <td colspan="2">Rotation Direction</td> <td colspan="2">Clockwise (view from top)</td> <td colspan="2">Thrust bearings shall be suitable for reverse rotation</td> </tr> <tr> <td colspan="2">Rotation Speed (min⁻¹)</td> <td colspan="2">297</td> <td colspan="2"></td> </tr> <tr> <td colspan="2">(min⁻¹)</td> <td colspan="2">420</td> <td colspan="2"></td> </tr> <tr> <td colspan="2">Reverse Rotation Speed</td> <td colspan="2">Approx.420</td> <td colspan="2"></td> </tr> <tr> <td colspan="2">Driver output (kW)</td> <td colspan="2">4,700</td> <td colspan="2"></td> </tr> <tr> <td rowspan="9">Cooling water (C.W.) 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In addition, this data may be confirmed again after BHEL 's analysis.	Max	9.2		Total (Static +Dynamic)	Max	70		Spring Constant (Radial direction)(Under the static load condition) (N/m)	Rated	To be informed		To be informed the spring constants under rated and max static load condition.		Max	To be informed		Damping coefficient (Radial direction) (Under the static load condition) (N s/m)	Rated	To be informed		To be informed the damping coefficients under rated and max static load condition.		Max	To be informed		Rotation Direction		Clockwise (view from top)		Thrust bearings shall be suitable for reverse rotation		Rotation Speed (min ⁻¹)		297				(min ⁻¹)		420				Reverse Rotation Speed		Approx.420				Driver output (kW)		4,700				Cooling water (C.W.) Spec.	Cooling method		water cooling			kind		sea water		Refer to water chemistry	Capacity (m ³ /hr)		2			(°C)	C.W. Inlet	35			C.W. 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		Journal pads metal temperature	To be informed	·ANN : 85°C ·TRIP : 90°C Bearing pad metal temperature shall be designed in considering the following value at the rated condition. ·ANN : 85°C ·TRIP : 90°C		
		Allowable limit temp. of white metal (Thrust pads)	To be informed			
		Thrust pads metal temp.	To be informed	·ANN : 85°C ·TRIP : 90°C Thrust pad metal temperature shall be designed in considering the following vale at the rated condition. ·ANN : 85°C ·TRIP : 90°C		
		Allowable limit temp. of white metal (Thrust pads)	To be informed			
		Mesh size for strainers (If required)	To be informed			
		Installation direction	vertical			
		design / max/ min(°C) Atmosphere temp.	35.0/32.0/24.0			
		Mechanical Loss of Bearing	Max.24	At the rated condition the mechanical loss shall be reduced as much as possible, if this requirement can't be satisfied.		
		Allowable operation time without cooling water	To be informed			
		Lube	Lube.Method	Oil bath		
			Lube Q'ty	To be informed		
			Lube Kind	To be informed		
			Lube max. temp.	To be informed		
		Temp. Gauge	Type	Dial type		
		Thermowell for RTDs	Necessity	Required	To be installed at the positions to measure the bearing pad metal temperature.	
		Ref. Doc	Fitting Dimensions		Refer to page Fig.I	
			Shaft Material		ASTM S31803	

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		Pump Type		MKSV-220C				
		Q'ty		2 sets & 1 spare				
		Shaft diameter at collar(mm)		Ø404				
		Pad Type		To be informed		Thrust Pad: Off-set pivoted tilting pad type; Radial Pad: Centrally pivoted tilting pad type		
		Axial Thrust (for calculation of Spring Constant & Damping Coefficient) (Load is not including safety margin) Down/Up (kN)	Rated	350 / 0		Including the dead weight during pump idle condition		
			Max	600 / 0		Including the dead weight during pump idle condition		
			Dead weight	100				
		Design Load of Axial Thrust(Load is including safety margin down/up(kN))		Max	720 / 0		To design the bearing to be with stand this load	
		Radial load(kN)	Static	Rated	10			
				Max	35			
			Total (Static +Dynamic)	Max	120		The bearing shall not be damaged under max. load (static+dynamic) condition. In addition, this data may be confirmed again after BHEL 's analysis.	
		Spring Constant (Radial direction)(Under the static load condition) (N/m)		Rated	To be informed		To be informed the spring constants under rated and max static load condition.	
				Max	To be informed			
		Damping coefficient (Radial direction) (Under the static load condition) (N s/m)		Rated	To be informed		To be informed the damping coefficients under rated and max static load condition.	
				Max	To be informed			
		Rotation Direction		Clockwise (view from top)		Thrust bearings shall be suitable for reverse rotation		
		Rotation Speed (min ⁻¹)		269				
		Reverse Rotation Speed (min ⁻¹)		Approx. 382				
		Driver output (kW)		3200				
		Cooling water (C.W.) Spec.	Cooling method		water cooling			
			Type		Clarified river water		Refer to water chemistry	
			Capacity (m ³ /hr)		2			
			(°C) Desgn temp.	C.W. Inlet	35			
				C.W. Outlet	max.45		If C.W. outlet temp. can't be satisfied, manufacturer shall inform	
Design Pressure			0.6					
Hydrostatic test pressure			0.9		Design pressure X1.5 Times			
Pressure drop			Max.0.05		If pressure drop can't be satisfied, manufacturer shall inform it.			
Pipe Material		SUS 316L or Cu-Ni						
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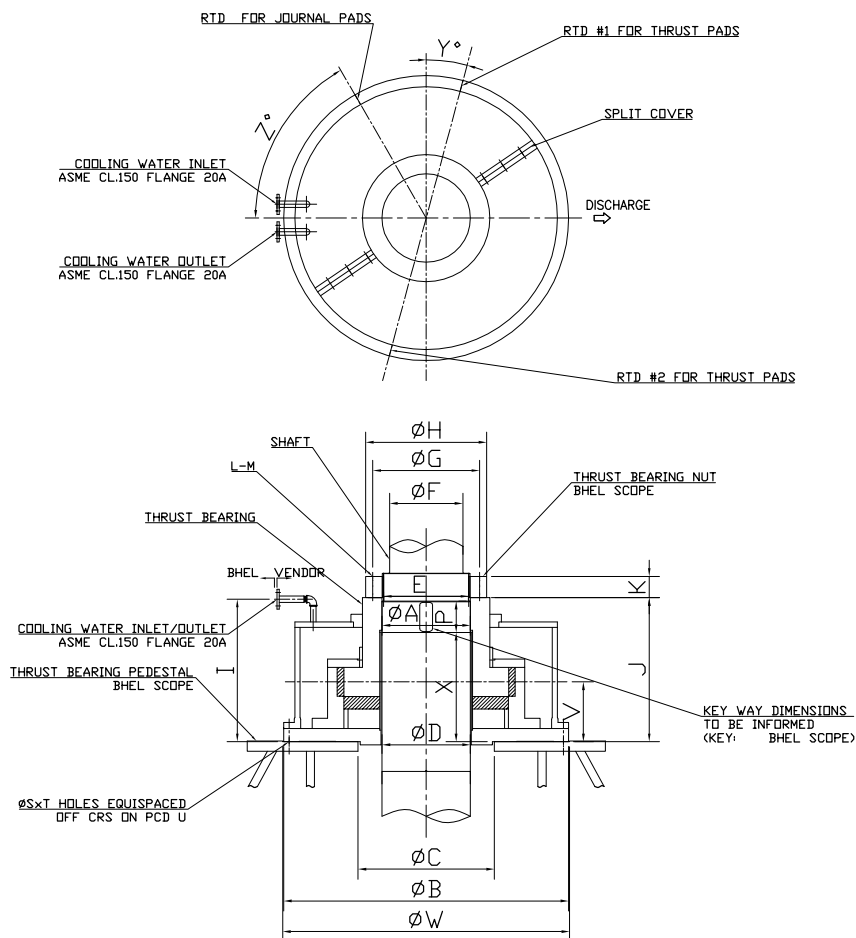
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OUTLINE DIMENSIONSFIGURE-INOTE:

- 1) THRUST COLLAR NUT SHALL BE MANUFACTURED BY BHEL
- 2) ALL DIMENSIONS ARE IN MM

DIMENSION	VAR-01 (MKS V-210C)	DIMENSION	VAR-01 (MKS V-210C)	DIMENSION	VAR-02 (MKS V-220C)	DIMENSION	VAR-02 (MKS V-220C)
A	Ø348 H7 ^{+0.057} / ₀ g6 ^{-0.018} / _{-0.054}	L	8	A	Ø404 H7 ^{+0.063} / ₀ g6 ^{-0.094} / _{-0.098}	L	8
B	Ø1400	M	M30	B	Ø1400	M	M30
C	Ø670	S	Ø28	C	Ø670	S	Ø28
D	Ø348 ^{-0.1} / _{-0.5}	T	24	D	Ø404 ^{-0.1} / _{-0.5}	T	24
E	M345X8	U	Ø1348	E	M400X8	U	Ø1348
F	Ø320	V	293.5	F	Ø330	V	To be informed
G	Ø475	W	1410	G	Ø495	W	1410
H	Ø545	X	522	H	Ø565	X	536.6
I	700	P	160	I	700	P	153
J	707±0.5	Y	to be informed	J	707±0.5	Y	to be informed
K	105	Z	to be informed	K	105	Z	to be informed
KEY WAY DIMENSIONS to be informed		KEY WAY DIMENSIONS to be informed		KEY WAY DIMENSIONS to be informed		KEY WAY DIMENSIONS to be informed	
MDC - SHAFT: ASTM A276 S31803		MDC - SHAFT: SUS410Q		MDC - SHAFT: SUS410Q		MDC - SHAFT: SUS410Q	
MDC - THRUST BRG. NUT: S45CH		MDC - THRUST BRG. NUT: S45CH		MDC - THRUST BRG. NUT: S45CH		MDC - THRUST BRG. NUT: S45CH	
MDC - COOLING WATER INLET&OULET: SS316L		MDC - COOLING WATER INLET&OULET: SS316L		MDC - COOLING WATER INLET&OULET: SS316L		MDC - COOLING WATER INLET&OULET: SS316L	

Revisions:

Refer to record of revisions

Prepared:

Approved:

Date:

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		Rev. No.	Date	Revision Details	Revised By	Approved By	
		01	02-03-2020	Variant No. 50 changed to 51	MVSS	MSRAM	
		02	11-04-2020	Var. no.s 02 & 52 added	MVSS	MSRAM	
		03	01-07-2020	Baseplate MOC revised.	MVSS	MSRAM	
		04	08-07-2020	Material codes numbers corrected.	MVSS	MSRAM	
		Ref. Doc.					