PURCHASE SPECIFICATION FOR VERTICAL THRUST AND GUIDE BEARING FOR CONCRTE VOLUTE TYPE CW PUMP

1.0 Scope:

This standard specifies the requirements of vertical thrust and journal bearings for concrete volute type Cooling Water Pumps.

2.0 Technical Requirements:

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.

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

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.

g) IP54 or more protection level for all RTDs.

h) Machined surface 85mm x 100mm shall be provided on bearing cover to mount vibration pickups.

i) 1 no. oil level gauge with suitable connection. Maximum and Minimum levels shall be marked on the indicator scale.

j) 1 no. air vent with suitable connection on the bearing top cover.

k) 1 no. oil drain connection with valve in the base plate to drain the oil completely from the bearing.

l) 2 no.s SORF ASME class-150 flanged connections for cooling water inlet & outlet. The connections shall be fitted to avoid accidental loosening of the fittings and consequent failure of sealing between top cover and cooling coil.

m) Special tools, if any shall be supplied. One set per thrust bearing assembly.

2.7 Bearing shall confirm to the following:

a) If oil level gauge is broken, oil shall not be leaked outside.

b) High and Low level mark shall be indicated on oil level gauge.

c) The temperature detecting point of the duplex RTDs shall be designed in order to measure the maximum temperature of measuring object as much as possible.

d) The position of each boss and accessories shall be indicated in the drawing submitted for approval.

e) Painting procedure shall be based on manufacturer's standard.
And BHEL will inform the outside painting color of bearing box later.

f) The list of spare parts like O-Rings or packing's etc. and list of special tools shall be submitted.

g) Punch mark shall be carried out on each side surface of base plate to prevent the assembly mistake.
Pump discharge side : PUMPS DIS
Pump suction side : PUMP SUC

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, centrally pivoted tilting pad type capable of absorbing axial thrust in both directions of rotation.

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 Materials of Construction:

All materials shall be free of asbestos.
The materials of construction of the bearings shall not be inferior to the following:

Base plate	:	Cast 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 Drawings & Documents:

3.1 Following information shall be submitted along with technical offer:

- Allowable time without cooling water.
- 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>

Following Non destructive tests shall be conducted:

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

8.0 VARIANT TABLE:

Var. No.	Description	Material
01	Thrust Bearing Assembly- 1410 kN	FP9750694015
51	Thrust pads to suit material FP9750694015	FP9750694511

9.0 TECHNICAL DATA:

VAR No.1 **FP509750694015**

Pump Type			MKSV-210C	
Q'ty			6 sets & 2 spare	
Case for Quotation			Case 2	
Shaft diameter at collar(mm)			ø348	
Bearing Type			To be informed	To be determined by manufacturer
Axial Thrust (for calculation of Spring Constant & Damping Coefficient) (Load is not including safety margin) Down/Up (kN)		Rated	610 / 0	Including the dead weight during pump stopping
		Max	1180 / 0	Including the dead weight during pump stopping
		Dead weight	82.2	
Design Load of Axial Thrust(Load is including saftey margin down/up(kN)		Max	1410 / 0	To be design the bearing to be withstood this load
Radial load(kN)	Static	Rated	1.2	
		Max	9.2	
	Total (Static +Dynamic)	Max	70	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 conditon.
		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}) Reverse Rotation Speed			420 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) 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	

VAR No.1 **FP509750694015**

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.
Fitting Dimensions		Refer to page Fig.I	
Shaft Material		ASTM S31803	

10.0 WATER CHEMISTRY

VAR No.1 **FP509750694015**

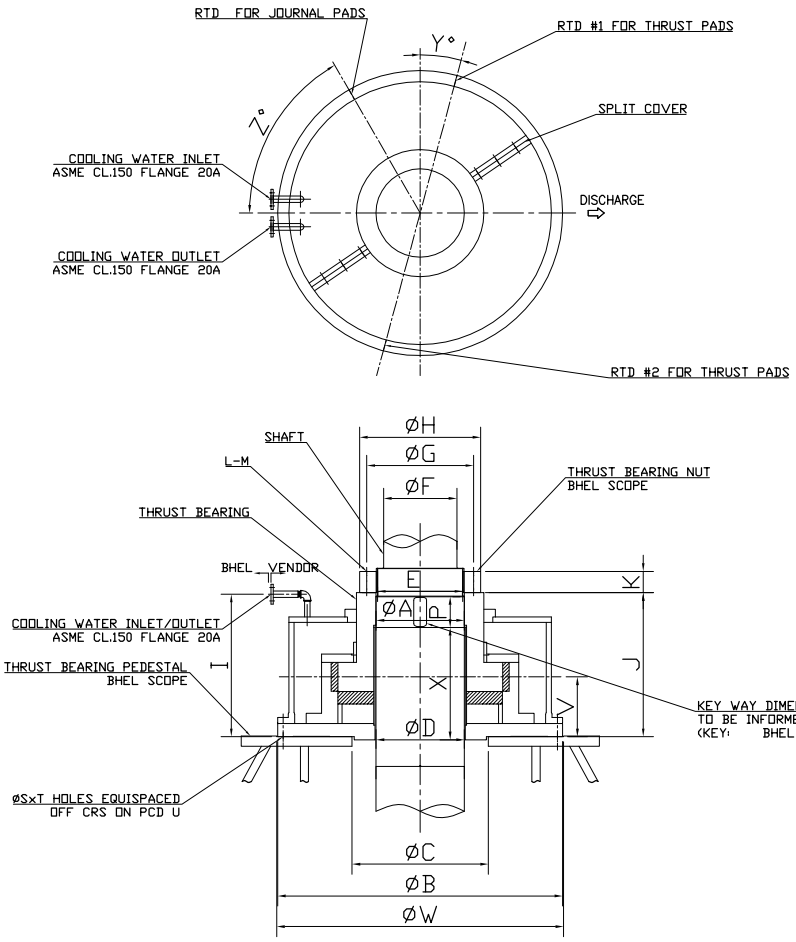
S.No	Description	Unit	Value
1.	**General**		
a)	pH	---	7.98 - 8.1
b)	Conductivity	µS / cm	53700
c)	Temperature range/ design	Deg C	(25 – 33) / 29
d)	Turbidity	NTU	12.5 – 14.8
e)	Total Suspended Solids (TSS)	mg/l	11
f)	Total Dissolved Solids (TDS)	mg/l	38000
g)	BOD @ 27 Deg C for 3 days	mg/l	11*
h)	COD	mg/l	62*
i)	Oil and Grease (free)	mg/l	< 1**
j)	Phenols	mg/l	Nil
k)	Free residual chlorine	mg/l	< 0.2
2.	**Cations**		
a)	Calcium	mg/l	409
b)	Magnesium	mg/l	1274
c)	Sodium	mg/l	12600
d)	Potassium	mg/l	380
e)	Ammonia	mg/l	Nil
f)	Strontium	mg/l	2.37
g)	Barium	mg/l	Nil
h)	Zinc	mg/l	0.1
i)	Nickel	mg/l	Nil
j)	Copper as Cu	mg/l	Nil
k)	Cadmium as Cd	mg/l	Nil
l)	Lead as Pb	mg/l	Nil
m)	Mercury as Hg	mg/l	Nil
n)	Aluminium Total	mg/l	Nil
o)	Aluminium Dissolved	mg/l	Nil
p)	Manganese Total	mg/l	Nil
q)	Manganese Dissolved	Micro g/l	Nil
r)	Iron Total	mg/l	0.49
s)	Iron Dissolved	mg/l	0.25
3.	**Anions**		
a)	Chloride	mg/l	21088
b)	Sulphate	mg/l	3396
c)	Nitrate	mg/l	1.62
d)	Nitrite	mg/l	0.04
e)	Bicarbonate as HCO_3	mg/l	140
f)	Carbonate	mg/l	Nil
g)	Fluoride	mg/l	1.4
h)	Boron	mg/l	1.38
i)	Phosphate	mg/l	0.16
j)	Sulphide as H_2S	mg/l	Nil
k)	Silica Dissolved	mg/l	0.25
4.	**Density of Sea water**	Kg /m^3	1030

Note:
1) Any other feed parameter not listed above is assumed as "Nil".
2) * - We have considered all BOD and COD in suspended form
3) **- We have considered 1 mg/l free oil & grease.

COC = 1.3

OUTLINE DIMENSIONS

FIGURE–I



NOTE:

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

DIMENSION	VAR-01 (MKSV-210C)	DIMENSION	VAR-01 (MKSV-210C)
A	ø348 $H7^{+0.057}_{0}/g6^{-0.018}_{-0.054}$	L	8
B	ø1400	M	M30
C	ø670	S	ø28
D	$ø348^{-0.1}_{-0.5}$	T	24
E	M345X8	U	ø1348
F	ø320	V	293.5
G	ø475	W	1410
H	ø545	X	522
I	700	P	160
J	707±0.5	Y	to be informed
K	105	Z	to be informed
KEY WAY DIMENSIONS	to be informed		
MOC - SHAFT: ASTM A276 S31803			
MOC - THRUST BRG. NUT: S45CH			
MOC - COOLING WATER INLET&OULET: SS316L			

PRODUCT STANDARD
PUMPS
HYDERABAD

FP 50694

Rev No. 01

RECORD OF REVISIONS

Rev. No.	Date	Revision Details	Revised By	Approved By
01	02-03-2020	Variant No. 50 changed to 51	MVSS	MSRAM

Ref. Doc.