

SPECIAL CONDITIONS OF CONTRACT



1. Inspection:-

i. For Indigenous vendors:

Third party inspection by BHEL empaneled TPI and inspection charges to BHEL account. Inspections calls shall be raised by supplier in cqir.bhel.in or mail us at rajesh274@bhel.in or nagesht@bhel.in

BHEL empaneled inspection agencies as below

- M/s.TUV SUD
- M/s.Bureau veritas India pvt Ltd

ii. For Imported Vendors:

TPI for Import vendors are as follows:

HRRL DCU & VGO - Please note that Inspection shall be done by one of the BHEL approved TPIA (Lloyds/ BV/DNV/TUV)

In addition, Vendor is required to offer inspection to End Customer (TPL) appointed TPIA (M/s CEIL). - Charges for this will be borne by End Customer.

Charges for BHEL TPIA inspection will be in vendor's scope. Vendors shall quote charges for BHEL TPI separately. (Do not combine the TPI charges with Material Prices)

2. Please follow the link >> <https://dipp.gov.in/public-procurements> for all circulars. Evaluation will be done accordingly.
3. Evaluation is on Item wise L1 Basis.
4. Guarantee/Warranty Clauses are as follows:
All equipment/goods supplied shall be warranted for 12 months from the date of commissioning or upto 31st December 2023 whichever is earlier. Replaced/repaid equipment /material will be warranted for 12 months from the date of repair/replacement or 31st December 2024 whichever is earlier."
5. Supplier is required to submit Quality Plan for Customer approval (TPL/EIL) after placement of PO.
6. All the technically qualified bidders will be proposed to customer for approval (if not available in CAV list). Offers of customer-approved vendors will only be considered for further evaluation.

BOM (Bill of Materials)						
Sl.No.	PR NO.	Material Code	Description	Drawing	specification	Qty
1	8000094176, 7000088973	TC9751030315	TILTNG PAD JOURNAL BRG DIA100 SPL-A	23021400049-00	TC51030-22 (Variant-31)	2
2	8000094178, 7000088974	TC9751030323	TILTNG PAD JOURNAL BRG DIA100 SPL-A	23021500025-00	TC51030-22 (Variant-32)	2

Supplier Declaration:

I _____(Supplier Name) declare that the above points are noted and Confirmed while submitting the quotation.

Authorized Signature & Stamp

(_____) Vendor Name

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**TECHNICAL SPECIFICATIONS OF TILTING PAD JOURNAL BEARINGS
WITH OFFSET PIVOTED PADS**

1.0 PURPOSE : This standard specifies the requirements of tilting pad journal bearings for high-speed industrial steam turbines.

2.0 TECHNICAL REQUIREMENTS

2.1 The bearings shall be tilting pad type, with 5 pads, load-between-pads, and conforming to the dimensions and other details given in the drawings mentioned in the variant table.

2.2 The bearings shall be **offset-pivoted**.

2.3 The oil to be used in operation is ISO-VG46 grade or ISO-VG32 grade.

2.4 The loads and speeds for which these bearings may be used are given in the variant table.

2.5 Along with the offer, the supplier should give the complete dimensional drawing, and the complete data of non-dimensional stiffness and damping coefficients (including horizontal, vertical and cross-coupled coefficients) of the bearings for various Sommerfeld numbers covering the entire operational range given in the variant table. The definition of the Sommerfeld number and the non-dimensional stiffness and damping coefficients is as follows:

$$S_o = (P_{stat} \times \psi^2) \times 1000 / (\eta \times \omega)$$

$$\gamma_{ij} = C_{ij} \cdot \Delta R \cdot S_o / F$$

$$\beta_{ij} = B_{ij} \cdot \Delta R \cdot \omega \cdot S_o / F$$

where S_o = Sommerfeld number;

P_{stat} = specific pressure on bearings (N/mm^2) = $F / (L \times D)$

F = static load on bearings (N)

L = Bearing length (mm)

D = Bearing nominal diameter (mm)

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<p>ψ = Bearing clearance in per-thou, i.e., (diametrical bearing clearance / Bearing nominal diameter) x 1000.</p> <p>η = Coefficient of dynamic viscosity (mN-sec/m²) at oil inlet temp.</p> <p>ω = angular velocity of the shaft (rad / sec)</p> <p>$\gamma_{i,j}$ = Non-dimensional stiffness coefficients in horizontal (i,i), vertical (j,j) and cross-coupled (i,j) directions.</p> <p>$\beta_{i,j}$ = Non-dimensional damping coefficients in horizontal (i,i), vertical (j,j) and cross-coupled (i,j) directions.</p> <p>$C_{i,j}$ = Stiffness (N/mm) in horizontal (i,i), vertical (j,j) and cross-coupled (i,j) directions.</p> <p>$B_{i,j}$ = Damping (N-sec/mm) in horizontal (i,i), vertical (j,j) and cross-coupled (i,j) directions.</p> <p>ΔR = Radial clearance (mm)</p> <p>The above properties are to be submitted separately for maximum clearance condition and minimum clearance condition.</p> <p>2.6 The supplier shall note that the shaft dimension and tolerance is as fixed in the drawing mentioned in the variant table. Supplier shall specify in his offer the maximum and minimum recommended clearances of the bearings, and limit his bearing diameters to achieve these clearances.</p> <p>2.7 The supplier shall give the following information about the bearing along with the offer:</p> <p>a) Oil flow requirement vs.speed curves for different loads.</p> <p>b) Power losses for different speeds and loads.</p> <p>c) Minimum film-formation speed vs Sommerfeld number curve.</p> <p>d) The allowable specific pressure of the bearing vs. speed curve.</p> <p>The above information is to be given for maximum and minimum clearance conditions, and also for both the oil grades mentioned above.</p> <p>2.8 Provision shall be made in both the bottom pads for mounting a thermo-element as shown in the enclosed drawing. The provision shall be made at places where the maximum temperature occurs in operation for each direction of rotation.</p>		
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<p>2.9 The supplier shall indicate in his offer the alarm and trip settings of temperature of babbitt metal used, and also the softening temperature of the babbitt metal.</p> <p>3. TEST AND GUARANTEE CERTIFICATES :</p> <p>3.1 Five copies of the following test certificates shall be supplied for each item of the consignment quoting BHEL standard number and Purchase Order number. Test certificates shall indicate the detailed test results of the tests carried out to ensure proper adhesion of the babbitting material.</p> <p>a) Dye-penetrant test</p> <p>b) Ultrasonic test</p> <p>3.2 Test certificates shall also indicate the chemical composition and mechanical properties of the babbitting material.</p> <p>3.3 A guarantee certificate for 24 months of trouble-free performance from the date of shipment or 12 months from the date of commissioning, whichever is earlier, shall be furnished.</p> <p>4.0 PACKING :</p> <p>The material shall be properly packed to international standards, suitable for sea-worthy transportation, and withstanding transit risks without damage. The bearings may be stored for prolonged periods, and the preservation and packing should prevent any deterioration of the bearing.</p> <p>5.0 REFERENCE LIST :</p> <p>The supplier shall furnish along with the offer a reference list indicating similar type of bearings being supplied and in operation for similar services.</p> <p>6.0 MARKING:</p> <p>6.1 The manufacturer’s identification serial number of the bearing shall be marked at suitable location, and the same shall be mentioned in the test certificates pertaining to it.</p> <p>6.2 A tag bearing the relevant 12-digit material code of BHEL shall be attached to each bearing.</p> <p>6.3 The following details shall be marked on the packing case.</p> <p>a) Manufacturer’s name</p> <p>b) BHEL order number</p> <p>c) BHEL standard number: TC51030</p> <p>NOTE:</p> <p>1). After placement of purchase order vendor has to be submit detailed bearing drawings & data sheets including lube oil flow,pressure,temperature etc for our approval/ reference.</p> <p>2). Punching of direction of rotation on both the faces of the bearing.</p> <p>3). Punching of BHEL material code clearly visible on the bearing face.</p>		
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7.0 RANGES OF OPERATION AND BHEL CODIFICATION:

I) VARIANT TABLE FOR BEARINGS WITHOUT JACKING OIL

Var No	Bearing Size	BHEL Drawing No.	Speed range (rpm)	Load range (N)	Material Code
00	Dia 100-Spl-A	2-302-14-00042-00	4000-18000	6,000	TC9751030137
01	Dia 125-Spl-B	1-302-15-00043-01	7000 – 14000	10,000	TC9751030013
02	Dia 160-Spl-A	1-302-14-00064-01	6000 – 12000	14,000	TC9751030021
03	Dia 200-Spl-B	1-302-15-00051-00	5500 – 10000	35,000	TC9751030030
04	Dia 200-Spl-A	1-302-14-00073-00	5500 – 7700	44,800	TC9751030048
05	Dia 125-Spl-A	1-302-14-00066-01	7000-12000	10,000	TC9751030056
06	Dia 160-Spl-B	1-302-15-00045-01	5500-10000	14,000	TC9751030064
07	Dia 100-Spl-B	2-302-15-00021-00	4000-18000	8,000	TC9751030072
08	Dia 100-Spl-A	2-302-14-00044-00	4000-18000	6,000	TC9751030080
09	Dia 125-Spl-A	1-302-14-00078-00	7000-12000	10,000	TC9751030099
50	Dia 125-Spl-A	1-302-15-00056-00	7000-12000	10,000	TC9751030501
20	Dia 160-Spl-A	1-302-14-00085-00	6000 – 12000	14,000	TC9751030200
21	Dia 160-Spl-B	1-302-15-00062-00	5500-10000	14,000	TC9751030218
24	Dia 100-Spl-A	2-302-14-00045-00	4000-18000	6,000	TC9751030242
25	Dia 99.5*-Spl-A	2-302-14-00046-00	4000-18000	6,000	TC9751030250
26	Dia 125-Spl-A	1-302-14-00102-00	7000-12000	10,000	TC9751030269

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27	Dia 125-Spl-B	1-30215-00072-00	7000 – 14000	10,000	TC9751030277
28	Dia 125-Spl-A	1-30215-00076-00	5000 – 12000	7,000	TC9751030285
29	Dia 80-Spl-A	2-30214-00047-00	5000 – 12000	2,500	TC9751030293
30	Dia 80-Spl-A	2-30214-00048-00	5000 – 12000	2,500	TC9751030307
31	Dia 100-Spl-A	23021400049-00	4000- 18000	6,000	TC9751030315
32	Dia 100-Spl-A	23021500025-00	4000- 18000	6,000	TC9751030323
35	Dia 160-Spl-A	13021400110-00	6000- 12000	14,000	TC9751030358

*- tentative. Final Bearing Bore Dia. will be informed before PO.

II) VARIANT TABLE FOR BEARINGS WITH JACKING OIL

Var.No	Bearing Size	BHEL Drawing No.	Speed range (rpm)	Load range (N)	Material Code
10	Dia 160-Spl-A	1-302-14-00065-01	6000- 12000	20,000	TC9751030102
11	Dia 200-Spl-B	1-302-15-00044-01	5500 – 10000	35,000	TC9751030110
12	Dia 160-Spl-B	1-302-15-00054-01	6000- 12000	20,000	TC9751030129
13	Not to be used Var.13 code was used for var.00				
14	Dia 200-Spl-A	1-302-14-00074-00	5500 – 10000	44,800	TC9751030145
15	Dia 200-Spl-B	1-302-14-00075-00	5500 – 10000	35,000	TC9751030153
16	Dia 250-Spl-B	1-302-15-00055-00	Up to – 10000	70,000	TC9751030161
17	Dia 250-Spl-B	1-302-14-00077-00	Up to – 10000	70,000	TC9751030170
18	Dia 125-Spl-A	1-30214-00082-00	7000- 12000	10,000	TC9751030188

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19	Dia 160-Spl-B	1-30215-00060-00	6000-12000	20,000	TC9751030196
22	Dia 160-Spl-A	1-302-14-00090-00	6000-12000	20,000	TC9751030226
23	Dia 200-Spl-B	1-302-15-00066-00	5500 – 10000	35,000	TC9751030234
33	Dia 200-Spl-A	1-302-15-00077-00	5000 – 10000	30,000	TC9751030331
34	Dia 200-Spl-A	1-302-14-00109-00	5000 – 10000	30,000	TC9751030340

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RECORD OF REVISIONS

REV NO.	DATE	REVISION DETAILS	REVISED	APPROVED
00	24/06/2004	NEW	CNVR	CNVR
01	23/02/2005	VAR 02, 03 ADDED. Generally revised.	SMK	MRB
02	17/10/2005	VAR 04 ADDED	NSN	MRB
03	03/12/2005	Drg.no.1-30214-00073 was 1-30215-00073 for Var.04	NSN	MRB
04	24/06/2006	VAR 12 ADDED.	NSN	MRB
05	13/12/2006	VAR 00 MODIFIED. MATL CODE & DRG NO ADDED.	ASHOK	MRB
06	30/08/2008	VAR 13 to 16 ADDED.	NSN	MRB
07	24/12/08	VAR 07 ADDED.	ASHOK	MRB
08	27/05/09	VAR 17 ADDED.	NSN	MRB
09	19.03.10	VAR 08,09,50 ADDED FOR WITHOUT JACKING OIL	G.S.RANI	MRB
10	25.01.12	VAR 18 to 19 ADDED FOR WITH JACKING OIL	N.S.N	MRB
11.	11.04.12	NOTE: 2 & 3 ADDED.	PATIL	ASHOK
12	15.05.13	VAR 20,21 ADDED FOR WITHOUT JACKING OIL	PS	NSN
13	04.10.14	MAT CODE ADDED IN VAR 12	ASHISH	ASHISH
14	14.10.14	VAR. 22 & 23 ADDED FOR WITH JACKING OIL	VIJAY	NSN
15	19.03.15	VAR 24 ADDED FOR WITHOUT JACKING OIL	G.S.RANI	S.M.K

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16	28.10.16	VAR 25 ADDED FOR WITHOUT JACKING OIL	ASHISH	GSPR
17	18.03.17	VAR 26 & 27 ADDED FOR WITHOUT JACKING OIL	RP	NSN
18	10.06.17	VAR 28 ADDED FOR WITHOUT JACKING OIL	TMK	GMM
19	16.06.17	VAR29 & 30 ADDED FOR WITHOUT JACKING OIL	MAMTA	ASHOK
20	19.07.17	VAR31&32 ADDED FOR WITHOUT JACKING OIL	RP	NSN
21	05.03.18	VAR 33 & 34 ADDED FOR WITH JACKING OIL	MAMTA	ASHOK
22	29.08.18	VAR 35 ADDED FOR WITHOUT JACKING OIL	MAMTA	ASHOK

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