

	Product Standard Heat Transfer & Fluid Flow	No: HTF 0014 Rev 04	Page 1 of 9
---	--	------------------------	-------------

Technical Specification for Magnetic Coupling



Bharat Heavy Electricals Limited
Corporate Research & Development Division
Vikasnagar, Hyderabad- 500093, India

Prepared by: Mullapudi Naveen Kumar	Approved by: G R Rao	Date: 30-08-2021
COPY RIGHT AND CONFIDENTIAL The information on this document is the property of BHEL. It must not be used directly or indirectly in any way detrimental to the company		



Table of Contents

1. Introduction	3
2. Scope of supply	5
3. Scope of work	5
4. Magnetic coupling specification.....	5
5. General Requirement	6
6. Quality Assurance Plan and Inspection	6
7. Certificate of compliance/release note.....	6
8. Qualification Requirements	7
9. Definitions	8
10. Magnetic Coupling External Rotor (Driving rotor) drawing	8
11. Magnetic Coupling Internal Rotor (Driven rotor) drawing	8

1. Introduction

This document defines the technical specification for magnetic coupling which is used between rotary vane pump and induction motor.

Figure-1 below shows general arrangement of pump with magnetic coupling. For present application, a vane pump is being employed. Magnetic coupling's internal rotor will be assembled on pump shaft through interference fit and coupling's external rotor will be connected to motor shaft through interference fit. A wall of pump casing of one mm thickness will separate the internal and external rotor of magnetic coupling. A small amount of fluid flowing through the discharge will be used for cooling of coupling's internal rotor and drive end side journal bearing.

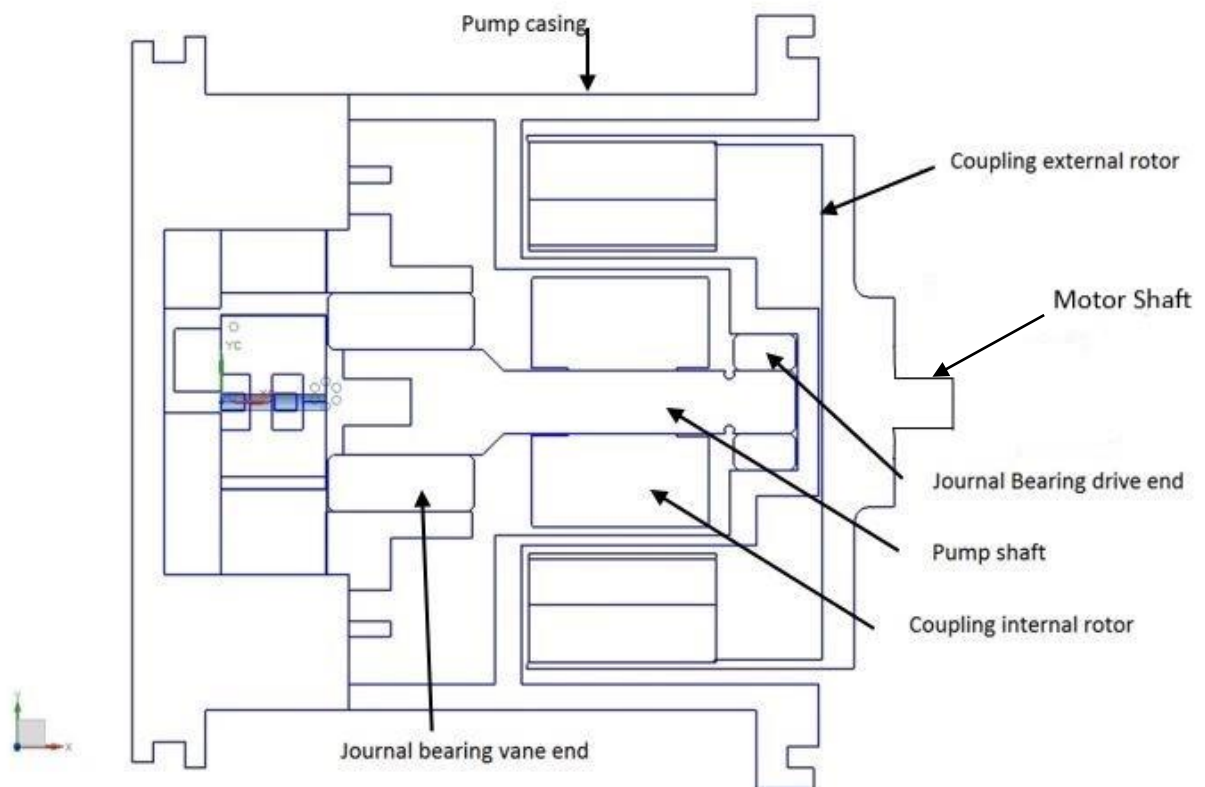


Figure-1: Pump with magnetic coupling – sectional arrangement

The details of pump, motor and fluid medium are given in the following tables.

1.1. Pump details

Description	Specification
Pump type	Rotary displacement pump
Shaft position	System is for airborne application
Coupling internal rotor mounting on pump shaft	Interference fit
Shaft construction material	EN25
Pump housing construction material	Titanium alloy Grade 5
Discharge pressure (max)	7 bar

1.2. Fluid medium details

Description	Specification
Fluid	Mixture of Ethylene Glycol (65%) and water (35%)
Solid particles present	No
Corrosive	Yes
Density of fluid medium @ 20 °C	1110 kg/m ³
Specific heat capacity	2.562 kJ/kg-K
Dynamic viscosity (min, max)	0.001599, 0.265976 Pa-s

1.3. Motor details

Description	Specification
Motor type	Induction
Power	750 Watts
Poles	4
Speed (synchronous)	12000 RPM
Starting of electric motor	Direct
Motor coupling fit	Interference Fit

2. Scope of supply

- i. Magnetic coupling external rotor
- ii. Magnetic coupling internal rotor

3. Scope of work

The scope of the work shall be design, engineering, manufacture, inspection, test, supply, transportation & delivery, as the case may be, of the magnetic coupling in accordance with the technical specifications and drawings of this documents.

4. Magnetic Coupling Specification

S. No	Description	Quantity
1.	Design torque for the coupling at room temperature (20 °C)	1 N-m
2.	Operating temperature	-40 °C to +85 °C
3.	Maximum operating temperature	+150 °C
4.	Nominal testing pressure	7 bar
5.	Operating speed	12000 RPM
6.	Balancing grade	G 2.5 grade as per ISO-1940:2003
7.	Total weight of coupling (max)	400 g
8.	Dimensions	As per drawing number: '3-LCS-45-00001'
9.	Total radial air gap between internal rotor and external rotor of magnetic coupling	2.5 mm (including 1 mm thick casing shroud of Titanium alloy Grade5)
10.	External and internal rotor body material	Titanium Alloy Grade 5 (Ti-6Al-4V)
11.	Magnet	Samarium Cobalt (Sm ₂ Co ₁₇)
12.	Corrosion protection	Corrosion protection coating to be applied
13.	Marking	Following information on parts: a. Manufacturer identification b. Manufacturer P/N

5. General requirements

- The equipment shall be highly reliable which shall be the prime consideration. It shall be capable of safe, proper and continuous operation at all conditions as indicated. The equipment shall be designed for a service life of 3000 hours.
- All material used shall be new and of tested quality and shall conform to the respective material specifications. The bought out items shall be from reputed manufacturers and shall be subjected to Purchaser's approval.
- Coupling parts subjected to temperature changes shall be designed and supported to permit free thermal expansion and contraction without resulting in harmful distortion or misalignment.
- Design dimension should not go beyond the limits specified. Changes if any, can be made only with prior approval of purchaser in writing.
- The contractor shall perform the detailed design review, dynamic balancing, stress analysis and prepare the reports for the same. These reports shall be submitted to BHEL for acceptance and shall be considered the property of BHEL.
- Torsional stiffness, moment of inertia and weight of each part should be furnished.
- Containment shroud / Can material power loss should be evaluated and specified in the report submitted to purchaser.
- Warranty against defects in design, workmanship and materials for a period of 12 months from the date of supply.

6. Quality Assurance Plan (QAP) and Inspection

- Contractor shall submit QAP and drawings. All the tests shall be carried out as per the applicable standards as well as the QAP.
- All GOODS shall be supplied with relevant Test Certificates & other shop test certificates, as applicable.
- Inspection of GOODS shall be carried out at PURCHASER'S Site Stores upon receipt of materials. CONTRACTOR shall, however, repair/replace the damaged/rejected GOODS to the satisfaction of the PURCHASER at no extra cost.

7. Certificate of compliance/release note:

A release note shall be furnished with the supplies on the following lines:

“CERTIFIED THAT GOODS SUPPLIED AGAINST THE REFERENCED PURCHASE ORDER ARE FREE FROM DEFECTS AND HAVE BEEN INSPECTED, TESTED AND CONFORM TO GIVEN SPECIFICATIONS. THESE GOODS CAN BE USED FOR AEROSPACE APPLICATIONS” or on similar lines.

8. Qualification Requirements:

The pump motor assembly will undergo following qualification tests. Vendor should confirm that the coupling shall meet the tests mentioned below:

Sl. No.	TEST & PROCEDURE	SEVERITY	DURATION	REMARKS
1	Burn-In		8 Hours @ Ambient Temperature	To be operated at design point of ACM
2	Random Vibration Test (Test Procedure:MIL-810F Method-514.5 Procedure-I)	Random vibration spectrum as given by customer	1 hour/axis in all three axes	The test will be carried out in static condition. The functional checks will be carried out before & after the test.
3	High Temperature Storage cum Operation Test (Test Procedure:MIL-810F Method-501.4)	+85 ⁰ C ambient for 1.5 hrs. Performance check at an ambient of +65 ⁰ C. Test Cycle as given by customer	7 cycles	The test will be carried out in static condition. The functional checks will be carried out before & after the test
4	Low Temperature Storage cum Operation Test (Test Procedure:MIL-810F Method-502.2)	-54 ⁰ C for 2 hrs. Performance check at -40 ⁰ C. Test Cycle as given by customer	1 Cycle	The test will be carried out in static condition. The functional checks will be carried out before & after the test. Cold start should be checked at -40°
5	Altitude (Low pressure) Test	Pressure corresponding to 60000 ft (18 km)	One-hour soak (non-operating)	Carryout one operational check after the soak period

	Product Standard Heat Transfer & Fluid Flow	No: HTF 0014 Rev 04	Page 8 of 9
---	--	------------------------	-------------

	Procedure: MIL-810F Method-500.4 Procedure-II	altitude (i.e. 7.172 kPa/54mm of Hg) Test Cycle as given by customer	Rate of change of altitude=150m/sec	
6	Mechanical Shock (Test Procedure: MIL-810F Method-516.5).	20 g Saw tooth pulse	3 Shocks per axis	Carryout one operational check before and after completion of the test
7	Acceleration Test (Test Procedure MIL-STD-810F, method 513.5)	13.5 g	All three axis Duration 1 Minute	Carryout one operational check before and after completion of the test

9. Definitions

- "Purchaser" shall mean the Bharat Heavy Electricals Limited, a Government of India undertaking.
- "Contractor" shall mean firm / company / joint venture / consortium with whom or with which the purchase order for supply of goods has been placed.

10. Magnetic Coupling External rotor (Driving rotor) drawing

Refer drawing number '3-LCS-45-00001' Revision 02

11. Magnetic Coupling Internal Rotor (Driven rotor) drawing

Refer drawing number '3-LCS-45-00001' Revision 02



RECORD OF REVISIONS

REV.NO.	DATE	REVISION DETAILS	REVISED	APPROVED
00	26-06-2020	New Specification	SHAIENDRA	G.R.RAO
01	03-07-2020	General corrections	SHAIENDRA	G.R.RAO
02	16-07-2020	General corrections	SHAIENDRA	G.R.RAO
03	18-07-2020	General corrections	SHAIENDRA	G.R.RAO
04	30-08-2021	General corrections	NAVEEN	G.R.RAO