

TD-106-2 Rev No. 5	Form No.		PRODUCT STANDARD PUMPS HYDERABAD		FP 50571 Rev No. 06 PAGE 1 of 10																											
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>TECHNICAL SPECIFICATION FOR MECHANICAL SEAL & AUXILIARY SKID OF</u> <u>BOILER FEED BOOSTER PUMP TYPE: FA1B75 FOR 500 MW</u> 1.0.0 INTENT OF SEPCIFICATION : This specification is intended to cover the technical requirements of the shaft seals (Mechanical seals) for Boiler Feed Booster Pumps type FA1B75 Drive end and Non drive end side along with Auxiliary Seal Skid. 2.0.0 SCOPE OF SUPPLY: 2.1.0 Design, Engineering, Manufacture, Inspection, Testing, Packing and forwarding the Mechanical seals and its accessories. 2.2.0 Set of mechanical seals shall be supplied with the following accessories, if specified in the specification variant table. 2.2.1 Duplex coolers with integral change over device on seal water side OR 2x100% coolers, with isolating valves at seal water & cooling water inlet and outlet. 2.2.2 Duplex filters with integral change over device OR 2x100% filters with isolating valves and flanges. 2.2.3 Isolation valves of suitable size (as per cooling water requirement) at CW inlet and outlet of coolers and SW inlet and outlet of the skid. 2.2.4 Seal water and cooling water inlet and outlet connections shall be terminated with SORF flanges along with counter flanges, Gaskets, Bolts & Nuts. 2.2.5 All seal water piping, pipe fittings, valves & flanges shall be made of SS316 material. 2.2.6 All cooling water piping, pipe fittings, flanges & valves shall be made of carbon steel. All cooling water pipes & pipe fittings shall be subjected to pickling to remove internal rust, grease and mill scales. 2.2.7 Drive end and non drive end seal auxiliaries shall be mounted on one skid with necessary valves, piping and pipe fittings. (Refer informative drawing enclosed at page 8 of this spec) 3.0.0 TECHNICAL REQUIREMENTS: 3.1.0 <u>Technical Data</u> <table border="0" style="width: 100%;"> <tr> <td>Stuffing box pressure (normal/maximum)</td> <td>:</td> <td>20/25 atg</td> </tr> <tr> <td>Medium</td> <td>:</td> <td>Boiler feed water</td> </tr> <tr> <td>Rated temperature</td> <td>:</td> <td>200 deg.c</td> </tr> <tr> <td>Minimum temperature</td> <td>:</td> <td>40 deg.c</td> </tr> <tr> <td>Rated speed Normal/Max</td> <td>:</td> <td>1495/1650 rpm</td> </tr> <tr> <td>Direction of rotation of pump</td> <td>:</td> <td>As per Table-1</td> </tr> <tr> <td>Seal water inlet temperature to cooler</td> <td>:</td> <td>80 deg C</td> </tr> <tr> <td>Seal water outlet temperature from cooler</td> <td>:</td> <td>50 deg C</td> </tr> <tr> <td>Seal Water flow</td> <td>:</td> <td>8 lpm</td> </tr> </table>						Stuffing box pressure (normal/maximum)	:	20/25 atg	Medium	:	Boiler feed water	Rated temperature	:	200 deg.c	Minimum temperature	:	40 deg.c	Rated speed Normal/Max	:	1495/1650 rpm	Direction of rotation of pump	:	As per Table-1	Seal water inlet temperature to cooler	:	80 deg C	Seal water outlet temperature from cooler	:	50 deg C	Seal Water flow	:	8 lpm
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Ref. Doc	Revisions : Refer record of revisions.		Prepared : M.M.RAO	Approved : B.RAJKUMAR	Date: 17-09-01																											

TD-106-2 Rev No. 5		Form No.	बी एच ई एल BHEL		PRODUCT STANDARD PUMPS HYDERABAD		FP 50571 Rev No. 06 PAGE 2 of 10	
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.			Reference drgs. a) For stuffing box space 11891114915 b) For mechanical seal auxiliaries skid 21803914397 (reference only) c) For Thermometer sink 4180391 7111					
			3.2.0 The seals shall be capable of performing even in the event of complete loss of feed water due to incidents, such as inadvertent closure of suction valve. In such an event the pump needs to be safely brought down to rest and seals shall withstand the same.					
			3.3.0 The mechanical seals shall be of fully cartridised type. The seal shall be of proven design with reliable operating experience for at least a period of 3 years under similar conditions in at least 3 pumps.					
			3.4.0 The mechanical seals shall be designed so as to have a minimum life not less than 20,000 running hours.					
			3.5.0 The seals offered shall be suitable to be accommodated in the stuffing box space available in the pumps.					
			3.6.0 The seals shall be designed to have minimum number of 'O' rings and shall be designed to withstand maximum temperature encountered by the system.					
			3.7.0 Mechanical seal offered shall have sealing faces not inferior to stationary carbon / rotating silicon carbide combination. The seals shall be balanced type and sufficient margin shall be provided between the maximum operating P.V and the design P.V. Bidder shall furnish the calculation for the P.V factor and shall indicate the margins provided.					
			3.8.0 The mechanical seals shall be designed for zero visible leakage.					
			3.9.0 Independent cooling circuits shall be provided for drive end and non drive end mechanical seals of BFP. And all the seal accessories in cooling circuits & seal circuits shall be mounted on a single skid. The cooling coil/tube shall be made of SS316, the cooler shell shall be made of SS304.					
			3.10.0 Bidder may note that during a complete A.C Power supply failure, it would not be possible to supply any cooling water. All necessary protections to prevent seal damage due to high temperature operation shall be provided by the bidder.					
Ref. Doc			3.11.0 All connections on cooler and magnetic filter for seal water and cooling water shall not be less than ½" NPT (F).					
			3.12.0 The maximum pressure of cooling water is 10 kg/cm², normal pressure of cooling water is 6 kg/cm² and cooling water inlet temperature is 40 deg C. The cooling water outlet temperature from cooler shall be limited to 44 deg C.					
			3.13.0 The quantity of cooling water required per cooler shall be indicated by the bidder in his drgs.					
			3.14.0 Heat transfer area of each cooler shall have a margin of not less than 20% over the worst condition of heat generated in the mechanical seal.					
			3.15.0 The coolers and filters of the skid shall be designed for satisfactory performance of the mechanical seals (DE & NDE) fitted in Booster Pump FA1B75.					
			3.16.0 For easy replacement of filter, each filter shall be terminated with SORF flanges at inlet & outlet; the flange can be either integral with the filter or suitably connected with nipples.					

TD-106-2 Rev No. 5	Form No.		PRODUCT STANDARD PUMPS HYDERABAD	FP 50571 Rev No. 06 PAGE 3 of 10
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.		4.0.0 <u>DRAWINGS & DATA TO BE FURNISHED:</u> 4.1.0 <u>Drawings to be furnished along with the offer:</u> - Seal drg. Indicating dimensions, positions nos. size of 'O' rings, scope and materials of construction. - Cross sectional drg. of mechanical seal. - The scheme drg. Showing all the items covered in the scope and connections sizes. - Cooler and Magnetic filter drg. - Mechanical seal auxiliaries skid drawings. - Pumping ring characteristic curve. - List of recommended spares along with offer. - Quality plan. 4.2.0 <u>Data to be furnished along with the offer:</u> - Maximum allowable temperature of seal cooler outlet in seal water circuit. - Maximum allowable temperature of seal cooler inlet in seal water circuit. - Quantity of cooling water. - Pressure drop across cooler. - PV value of the face combination materials. - Wear ratio. - Balance ratio. - Roughness value. - Gap height and gap factor. - Leakage. - Power consumption. - Heat Load/Thermal Calculations. - Reference list. - Quality assurance plan for the seal(as per the format, if enclosed) - Completely filled in Mechanical Seal datasheet. 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 and over all dimensions shall be submitted for BHEL approval. 5.2.0 Final quality assurance plan of the seal in five copies along with soft copy. 5.3.0 Soft copy of instruction manuals giving the details of installation, operation and maintenance instruction shall be furnished within four weeks of placement of purchase order. 6.0.0 <u>TESTS & GUARANTEE CERTIFICATES.</u> 6.1.0 All the seal units shall be tested for leak tightness and dynamic performance in a suitable test rig at vendor works. Dynamic performance test shall be conducted at rated parameters. <u>Details of test procedure and test rig facility available shall be furnished for approval prior to the test.</u> 6.2.0 Type test on one mechanical seal per Purchase Order shall be carried out at supplier's works to prove its dry running capability followed by dynamic performance test as per clause 3.2.0. Seal unit assembly shall be completely strip down after the performance test and any visible damage is not acceptable. The type test and the strip down examination shall be witnessed by BHEL representative, who shall be intimated about the test couple of weeks in advance		
		6.3.0 Coolers, filters and thermometer sinks shall be hydro tested independently.		
		Ref. Doc		

TD-106-2 Rev No. 5	Form No.		PRODUCT STANDARD PUMPS HYDERABAD	FP 50571 Rev No. 06 PAGE 4 of 10
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 Hydraulic test at 38 Kg/cm² shall be conducted on the cooler and test report shall be furnished. 6.5.0 <u>Mech. Seal Skid</u>: Hydraulic test at 38 Kg/cm² and 15 Kg/cm² shall be conducted on seal water piping and cooling water piping respectively, along with pipe fittings and test reports shall be furnished. 6.6.0 The compliance certificate shall be furnished for satisfactory performance of the mechanical seal along with its auxiliary skid comprising cooler and magnetic filter. 6.7.0 The seal shall be guaranteed for a minimum operating life of 20,000 hours as indicated at clause 3.4.0. 6.8.0 In case of any mechanical failure/ leakage observed in the seal during the pump running either at BHEL works or at Customer Site within the above specified operating life, the seal shall be refurbished in-situ by replacing consumables or replaced, in order to put the pump into operation with minimum delay. An undertaking to the effect shall be given. 7.0.0 <u>PACKING:</u> Mechanical seals and auxiliaries skid shall be separately packed to ensure its capability to withstand transit risks without damage. The Seals shall be properly packed in thermocol / bubble polythene inside wooden box to prevent any kind of transit damage. The Skids shall be packed with polythene cover and wooden box/crate; additional GI sheet covering (1.6 mm gauge) either from inside the package or outside the package shall be carried out. 8.0.0 <u>MARKING:</u> 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. a) Name of manufacturer b) BHEL Purchase order number. 8.3.0 Following data shall be clearly engraved (or) a suitable marked-up plate shall riveted on the seal plate. - Direction of rotation (CW/CCW/Both) - Application of seal, ef. MD&TD-DE&NDE , MD-DE, TD-NDE etc. as indicated in the description of the Variant table-1 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. i) Name of manufacturer ii) Month & year of supply iii) Direction of rotation and application of seal		
Ref. Doc				

TD-106-2 Rev No. 5 Form No.		PRODUCT STANDARD PUMPS HYDERABAD		FP 50571																																																								
				Rev No. 06																																																								
				PAGE 5 of 10																																																								
<u>TABLE - 1 (FOR MAIN SEALS)</u> <table border="1"> <thead> <tr> <th>VAR. 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Pipe material shall be ASTM A312, Gr.304 (valid for Sagardhighi 2 X 500 MW only)</td> <td>FP9750571134</td> </tr> </tbody> </table>					VAR. NO.	PUMP TYPE	DESCRIPTION & MAKE OF SEAL	MATERIAL CODE	01.	FA1B75	Mechanical seal CW , for Booster pump (MD-DE & TD-NDE)	FP9750571010	02.	FA1B75	Mechanical seal CCW , for Booster pump (MD-NDE & TD-DE)	FP9750571029	03.	FA1B75	SKID for BP drive end and non driven end Mechanical seal accessories (this includes Duplex filters and Duplex coolers for each side of BP mechanical seal)	FP9750571037	04.	FA1B75	Mechanical seal CW , for Booster pump (MD-DE & TD-NDE) / EAGLE BURGMANN make (Type BURGMANN)	FP9750571045	05.	FA1B75	Mechanical seal CCW , for Booster pump (MD-NDE & TD-DE) / EAGLE BURGMANN make (Type BURGMANN)	FP9750571053	06.	FA1B75	SKID for BP drive end and non driven end Mechanical seal accessories (this includes Duplex filters and Duplex coolers for each side of Booster Pump mechanical seal) / EAGLE BURGMANN make (Type BURGMANN)	FP9750571061	07.	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Ref. Doc	Duplex Cooler/Filter = 2 nos. Single Cooler/Filter																																																											



TD-106-2 Rev No. 5	Form No.		PRODUCT STANDARD PUMPS HYDERABAD	FP 50571
				Rev No. 06
				PAGE 6 of 10

TABLE - 2 (FOR SPARES)

VAR. NO.	DRG.NO. & MAKE	DESCRIPTION OF ITEM	MATERIAL CODE

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TD-106-2 Rev No. 5 Form No.		PRODUCT STANDARD PUMPS HYDERABAD	FP 50571
			Rev No. 06
			PAGE 7 of 10

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TABLE - 3 (For internal reference only)

a) The following Table indicates the Supplier-wise material codes for each Variant of the Mechanical Seal, which shall be used for LPO reference and for Ordering.

b) General material Codes are meant for purchase enquiry only, Purchase Orders shall not be issued on these material codes. Indents will be issued with general material codes where make of the seal is not specific, hence enquiries may be sent to all suppliers. For LPO reference and issue of Purchase Orders, supplier specific material codes indicated in the Table shall be used. This enables proper storage of the seals avoiding mix up of all makes of the seals, and also provides record of make of the seals supplied to various Customers.

c) For Supplier Specific requirements like Mandatory Spares, O&M spares, specific Customer requirements, indents will be issued on Supplier-wise material codes with 'OEM' certification. These codes directly provide LPO and Purchase Orders shall be issued on these supplier-wise codes.

VAR. No.	GENERAL MATERIAL CODE, for Enquiry	APPLICATION	SUPPLIER-WISE MATERIAL CODES, for LPO & Ordering
01	FP9750571010	FA1B75 – BOOSTER MD - DE TD - NDE	FP9750571045 - M/s. BURGMANN FP9750571070 - M/s. ESSIL FP9750571096 - M/s. CRANE, UK FP9750571118 – M/s. FLOW SERVE
02	FP9750571029	FA1B75 – BOOSTER MD - NDE TD - DE	FP9750571057 - M/s. BURGMANN DE & NDE SEALS ARE SAME FOR ESSIL, CRANE & FLOW SERVE MAKES.
03	FP9750571037	FA1B75 – BOOSTER COMMON FOR DE & NDE	FP9750571061 - M/s. BURGMANN FP9750571088 - M/s. ESSIL FP9750571100 - M/s. CRANE, UK FP9750571126 - M/s. FLOW SERVE

Ref. Doc	
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TD-106-2 Rev No. 5 Form No.		PRODUCT STANDARD PUMPS HYDERABAD		FP 50571		
				Rev No. 06		
				PAGE 8 of 10		
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				Date		
		PUMP MODEL		OEM		
		PURCHASE ORDER		END USER		
		DRAWING NUMBER		SEAL ARRANGEMENT		
		MEDIA		SEAL TYPE		
		PARAMETER		UNIT		VALUE
		Specific gravity	P	kg/dm ³		
		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	Lpm		
		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		

Ref. Doc



TD-106-3 Rev No. 5 Form No.		PRODUCT STANDARD PUMPS HYDERABAD		FP 50571		
				Rev No. 06		
				PAGE 10 of 10		
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		Rev. No.	Date	Revision Details	Revised By	Approved By
		01.	05/11/07	Table-2 added (for internal reference) Clause nos. re-numbered. Scope & tech requirements unaltered.	MSR	JRR
		02.	13.10.10	Spec Generally revised.	PB	BRK
		03	10.09.11	Clause 7.0.0 Packing procedure revised	PB	BRK
		04	25.02.12	Spec Generally revised; Details elaborated for cooler & Seal Skid	PB	BRK
		05	17.06. 13	Var. No 13 added for Sagardhighi Project	MMR	BRK
		06	17.03.18	Cl. 6.1.0, 6.2.0 & 6.7.0 modified. Cl. 6.8.0 and seal datasheet added.	ASK	MSR
		Ref. Doc.				