

TD-106-1 Rev No. 5	Form No.	 HYDERABAD	PRODUCT STANDARD PUMPS HYDERABAD		FP60207 Rev No. 07 Page 1 of 20
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>HYDRAULIC COUPLING FOR 25% AND 30% DUTY MHI DESIGN BFPs OF 660MW & 800MW SUPER CRITICAL POWER PLANTS</u> 1.0.0 INTENT OF SPECIFICATION: This specification is intended to cover the technical requirements of the hydraulic coupling required between Boiler Feed Pump and its drive motor for achieving variable speed drive. 2.0.0 SCOPE OF SUPPLY: 2.1.0 Design Engineering, manufacture, inspection, testing, packing and forwarding the hydraulic coupling and accessories to site. 2.2.0 Each hydraulic coupling shall be supplied with following accessories. a. 2 x 100% working oil coolers and 2 x 100% lube oil coolers (duplex type) along with change-over device on oil side. b. 1 No. AC motor driven auxiliary lube oil pump to cater for external lubrication. c. An electrical actuator and linkages along with the necessary power amplifier unit shall be provided by the Bidder to operate the fluid coupling scoop tube. The time required by the actuator to operate the scoop from its minimum position to the maximum position shall be indicated in the Bid. The actuator and the power amplifier unit shall be compatible with microprocessor based Distributed Digital Control & Monitoring system (DDCMIS) procured by Owner. d. Instrumentation as specified at Cl.No. 6.0.0. e. Complete lube oil piping, working oil piping and vent piping to be connected between hydraulic couplings and coolers and drain piping with a valve to drain the oil from oil tank of hydraulic coupling. All necessary flanges, packings, reducers, elbows, bolts and nuts required in these lines shall be included in the scope. 40 meters of pipe and 30 Nos. of elbows per straight run per cooler shall be supplied. f. Duplex strainer in lube oil line. g. Holding down bolts to secure Hydraulic coupling to common foundation frame.(Applicable for Var-01 only) h. Foundation rails with suitable foundation bolts and holding down bolts etc as required for civil foundation.(Applicable for all Variants except Var-01)			
		Ref. Doc	Revisions : Refer to record of revisions :	Prepared : M.M.RAO	Approved : P. SRINIVAS



TD-106-1 Rev No.5 Form No.	 HYDERABAD	PRODUCT STANDARD		FP60207
		PUMPS		Rev No. 07
		HYDERABAD		Page 2 of 20
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		3.0.0 TECHNICAL PARAMETERS (AT 50 Hz) : (Powers & speeds as per cl.no. 15.0.0) Input speed (RPM) : 1495 Direction of rotation of BFP seen from drive end: CW GD sq. Value of BP (kg. Sq.m) : 8.4		
		4.0.0 SPECIFIC REQUIREMENTS:		
		4.1.0 Hydraulic Coupling: Hydraulic coupling shall be of full duty, generously designed, infinitely variable, remote controlled and totally enclosed type. It shall be adequately rated to meet the requirement of the boiler feed pump characteristics during start-up and load fluctuations. Operating range on lower side shall be upto 20% of the maximum output speed. The hydraulic coupling shall be complete with Stainless steel impellers & casing, and Kingsbury or Michell Tilting pad, type thrust bearings for input output shafts. An enclosing steel housing with removable covers, oil sump, duplex filters to remove all particle upto 5 microns, oil temperature and pressure gauges, control pump for oil regulation if provided, regulating valves, stainless steel scoop tube, oil coolers etc., shall be furnished to from a centralised lubrication system for the total pump set. Bidder shall also state in their offer the effect on fluid coupling if a reversal of pump rotation occurs through the failure of the non return valve. The starting time from minimum scoop position to 100% scoop position shall be less than 15 seconds after receipt of starting signal by motor, which operating single or in parallel with another Boiler Feed Pump. A quick start device shall be incorporated to meet the above requirement for auto stand by operation of Motor Driven Boiler Feed Pump.		
Ref. Doc				

TD-106-1 Rev No.5 Form No.	 HYDERABAD	PRODUCT STANDARD		FP60207
		PUMPS		Rev No. 07
		HYDERABAD		Page 3 of 20
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Ref. Doc				



TD-106-1 Rev No.5 Form No.	 HYDERABAD	PRODUCT STANDARD PUMPS HYDERABAD	FP60207
			Rev No. 07
			Page 4 of 20
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	Each hydraulic coupling shall be provided with built in lubrication system to also cater for external lubrication of 300 lpm. It shall comprise oil reservoir, main oil pump, auxiliary oil pump, duplex oil filter, and oil coolers with interconnecting piping and fittings. The main oil pump shall be driven by the motor shaft and shall be capable to supply lube oil for external requirement also. Aux. Oil pump shall be driven by an AC motor mounted on the hydraulic coupling itself AC motor shall be suitable for 415v, 3-phase, 50Hz supply. These motors shall comply with the Owner's specification for electrical motors annexed to this specification. Discharge system shall be common for main oil pump and aux. Oil pump with suitable NRVs in each line. The oil to be used shall be the same for lubrication and torque transmission. Oil piping shall be seamless sch. 80 and shall be supplied in pickled condition.		
Ref. Doc	4.5.0 <u>Oil Coolers:</u>		
	Each hydraulic coupling set shall be provided with 2 x 100% working oil coolers and 2 x 100% lube oil coolers. The coolers shall be adequately rated and shall have the necessary arrangements for change over the cooler without interrupting the oil flow. Both the coolers (Lubricating oil and working oil) shall be utilized in a closed loop system employing demineralized water of condensate quality as the cooling medium. The coolers shall be designed to accept the above system arrangement. The shell of the coolers shall be of mild steel construction. Suitable corrosion allowance shall be added to all the carbon steel and cast iron parts including shell, flanges etc. The tubes shall be of type 304 stainless steel. The tube bundle shall be of removable type. The tubes shall be roller expanded and flared at the ends. Provision for differential expansion shall be suitably incorporated. The coolers shall be so designed that the cooling medium will flow in the tube side. Suitable fouling allowance shall be taken into the design consideration based on the relevant standards. The design pressure of the coolers on the water side not be less than 10.0 kgs/sq.cm. Provision shall be made for complete venting and draining of all the parts of the heat exchangers. Connections along with temperature and pressure		



TD-106-1 Rev No.5 Form No.	 HYDERABAD	PRODUCT STANDARD PUMPS HYDERABAD	FP60207
			Rev No. 07
			Page 5 of 20
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	Ref. Doc		



TD-106-1 Rev No.5 Form No.	 HYDERABAD	PRODUCT STANDARD		FP60207
		PUMPS		Rev No. 07
		HYDERABAD		Page 6 of 20
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		6.1.0 <u>General:</u> The controls and instrumentation shall meet the following requirements. 6.1.1 All pressure and temperature instruments shall have metric scales, Graduation shall be in kg/sq cm for pressure instruments and in degree centigrade for temperature instruments. 6.1.2 All the instruments furnished shall be of the latest proven design for which performance and high availability have been demonstrated by a record of successful operation. 6.1.3 All instruments, devices must be capable of operating continuously under ambient temperature of 55 deg C and relative humidity of 95% without losing performance, accuracy etc. 6.1.4 Supplier shall furnish detailed information for each & every type of instrument included in his offer with their make, model, technical literature for BHEL/Owner's review and approval. Measuring instruments and sub-systems offered by the Supplier shall be reputed & experienced manufactures, whose guaranteed and trouble free performance has been proven for atleast two years. 6.1.5 All Electronic Pressure Transmitters shall be suitable for 24V, DC±10% power supply. 6.1.6 RTDs shall be cabled and terminated on junction boxes. 6.1.7 Out put signal and power supply wiring of Electronic Pressure Transmitters shall be terminated on separate junction box. 6.1.8 Stainless steel tags shall be fastened to each instrument. Instrument tag nos. as indicated by Customer/BHEL shall be punched on these tags before dispatch. 6.1.9 Pr Gauges, DP Gauges, Temp gauges, RTDs, Electronic transmitters and Level gauges as per attached specification and shall comply as per Annexure-I. 6.2.0 <u>Resistance Temperature Detectors:</u> All resistance temperature detectors shall be ungrounded, duplex, 4 wire type, Platinum one hundred ohm at 0 deg.C and shall conform to DIN 43760. 6.3.0 <u>Temperature Gauges:</u> The accuracy of the temperature gauges shall be ±1 %. All pipe thermometers shall be provided with thermowells. Contact rating of contact thermometers shall be 5A, 240V AC with 2xSPDT contacts.		



TD-106-1 Rev No.5 Form No.		PRODUCT STANDARD PUMPS HYDERABAD	FP60207 Rev No. 07 Page 7 of 20
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	Ref. Doc		

TD-106-1 Rev No.5 Form No.		बी एच ई एल  HYDERABAD		PRODUCT STANDARD PUMPS HYDERABAD		FP60207 Rev No. 07 Page 8 of 20	
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		6.6.0Tests on various instruments shall be as per the standards indicated below. Pressure Gauge : IS 3624 Temperature Gauge : BS 5235 Pressure Transmitters : IEC 770 RTD : DIN 43760 Electrical actuator : IS 9334					
		7.0.0QUALITY ASSURANCE AND INSPECTION:					
		7.1.0General: A quantity plan detailing out the specific quality control procedure adopted for controlling the quality characteristics relevant to each item of equipment / component shall be furnished in the format suggested by BHEL / Owner and abide by the same without any extra cost. If required, supplier shall depute his representative for discussions and finalization of quality plans with BHEL and Customer. Quality plan furnished for review / approval of Owner shall include all the reference documents such as material specifications, heat treatment procedure and acceptance norms, Balancing procedure, pressure test procedures and performance test procedure. Supplier shall abide by all decisions made during finalization of quality plans. Test certificates shall be furnished as per the finalized quality plans. BHEL / Owner shall be given reasonable notice of the tests which are identified as customer hold points during finalization of quality plans and shall have right to witness such tests and shall have access to the works of the Supplier and his Sub-contractor. The performance tests on hydraulic couplings can be witnessed by Customer and BHEL engineers.					
		Ref. Doc					



TD-106-1 Rev No.5 Form No.	 HYDERABAD	PRODUCT STANDARD PUMPS HYDERABAD	FP60207
			Rev No. 07
			Page 9 of 20
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	Ref. Doc		



TD-106-1 Rev No.5 Form No.		PRODUCT STANDARD PUMPS HYDERABAD	FP60207 Rev No. 07 Page 10 of 20
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Ref. Doc			



TD-106-1 Rev No.5 Form No.		PRODUCT STANDARD PUMPS HYDERABAD		FP60207 Rev No. 07 Page 11 of 20
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Ref. Doc				

TD-106-1 Rev No.5 Form No.		 HYDERABAD	PRODUCT STANDARD PUMPS HYDERABAD		FP60207 Rev No. 07 Page 12 of 20
There may be difference between the moving gauge and the fixed structure gauge and consignments infringing the moving gauge can be moved after investigation regarding possible infringement with the fixed structures. As the critical fixed structures in each route are different, consignments infringing moving dimensions have to be individually investigated to select a route and also determine the restrictions under which such movement is to be carried out. Such routes selected or other mode of transport envisaged is to be clearly bought out in the proposal wherever transport of over dimensioned equipment is involved. 12.3.0 Packing should be seaworthy 12.4.0 <u>Protection:</u> All coated surfaces shall be protected against abrasion, impact, discoloration and any other damages. All exposed threaded portions shall be suitably protected with either a metallic or a non-metallic protecting device. All ends of all valves and piping's and conduit equipment connections shall be properly sealed with parts which are likely to get rusted, due exposure to weather should also be properly treated and protected in a suitable manner. EMI / static charge proof packaging should be used for PLC / Electronic hardware. 13.0.0 <u>PRESERVATIVE SHOP COATING:</u> 13.1.0 All exposed metallic surface to corrosion shall be protected by shop application of suitable coatings. All surfaces which will not be easily accessible after the shop assembly, shell before hand be treated and protected for the life of the equipment. All surfaces shall be thoroughly cleaned of all mill scale oxide and other coatings and prepared in the shop, the surfaces that are to be finish painted after installation or require corrosion protection until installation, shall be shop painted with atleast two coats of primer. Transformers and other electrical equipment, if included shall be shop finished with one or more coats of primer and two coats of high grade resistance enamel. The finished colors shall be as per manufacturer's standards to be selected and specified by the Engineer at a later stage. 13.2.0 Shop primer for all steel surfaces which will be exposed to operating temperature below 95°C shall be selected by the Contractor. Special high temperature primer shall be used on surface exposed to temperature higher than 95°C. 13.3.0 All other steel surface which are not to be painted shall be coated with suitable dust preventive compound subject to the approval of the Engineer.					
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Ref. Doc					

TD-106-1 Rev No.5 Form No.		PRODUCT STANDARD PUMPS HYDERABAD	FP60207 Rev No. 07 Page 13 of 20
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Ref. Doc			

TD-106-1 Rev No.5 Form No.	 HYDERABAD	PRODUCT STANDARD PUMPS HYDERABAD		FP60207																																																																							
				Rev No. 07																																																																							
				Page 14 of 20																																																																							
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. 15.0.0 VARIANT TABLE: <table border="1"> <thead> <tr> <th>Var.No.</th> <th>Technical Parameters</th> <th>Material Code</th> </tr> </thead> <tbody> <tr> <td rowspan="8">01</td> <td align="center" colspan="2"><u>For 660MW (25% BFP) (BARA)</u></td> </tr> <tr> <td>Direction of rotation of Motor seen from BP end</td> <td>: CW</td> </tr> <tr> <td>GD sq. Value of BFP (kg. Sq.m)</td> <td>: 20</td> </tr> <tr> <td>GD sq. Value of coupl. between BFP and HC (kg.sq.m)</td> <td>: 4.04</td> </tr> <tr> <td>Oil quantity required for external lubrication</td> <td>: 300 lpm</td> </tr> <tr> <td>GD² Value of drive motor (Kg.Sq.m)</td> <td>: 2040</td> </tr> <tr> <td>Max. Output speed (RPM)</td> <td>: 6100</td> </tr> <tr> <td>Max. Input power to BFP (KW)</td> <td>: 6350</td> </tr> <tr> <td rowspan="8">02</td> <td align="center" colspan="2"><u>For 660MW (30% BFP) (MAUDA-II)</u></td> </tr> <tr> <td>Direction of rotation of Motor seen from BP end</td> <td>: CW</td> </tr> <tr> <td>GD sq. Value of BFP (kg.Sq.m)</td> <td>: 20</td> </tr> <tr> <td>GD sq. Value of coupl. between BFP and HC (kg.sq.m)</td> <td>: 4.04</td> </tr> <tr> <td>Oil quantity required for external lubrication (lpm)</td> <td>: 300</td> </tr> <tr> <td>GD² Value of drive motor (Kg.Sq.m)</td> <td>: 2150</td> </tr> <tr> <td>Max. Output speed (RPM)</td> <td>: 6370</td> </tr> <tr> <td>Max. Input power to BFP (KW)</td> <td>: 8250</td> </tr> <tr> <td rowspan="8">03</td> <td align="center" colspan="2"><u>For 800MW (30% BFP) (GADARWARA)</u></td> </tr> <tr> <td>Direction of rotation of Motor seen from BP end</td> <td>: CCW</td> </tr> <tr> <td>GD sq. Value of BFP (kg.Sq.m)</td> <td>: 21.5</td> </tr> <tr> <td>GD sq. Value of coupl. between BFP and HC (kg.sq.m)</td> <td>: 5.0</td> </tr> <tr> <td>Oil quantity required for external lubrication</td> <td>: 350lpm</td> </tr> <tr> <td>GD² Value of drive motor (Kg.Sq.m)</td> <td>: 3000</td> </tr> <tr> <td>Max. Output speed (RPM)</td> <td>: 5600</td> </tr> <tr> <td>Max. Input power to BFP (KW)</td> <td>: 10225</td> </tr> <tr> <td rowspan="8">04</td> <td align="center" colspan="2"><u>For 660MW (30% BFP) (BANHARPALLI)</u></td> </tr> <tr> <td>Direction of rotation of Motor seen from BP end</td> <td>: CW</td> </tr> <tr> <td>GD sq. Value of BFP (kg. Sq. m)</td> <td>: 19.5</td> </tr> <tr> <td>GD sq. Value of coupl. between BFP and HC (kg.sq.m)</td> <td>: 5.0</td> </tr> <tr> <td>Oil quantity required for external lubrication</td> <td>: 330 lpm</td> </tr> <tr> <td>GD² Value of drive motor (Kg.Sq.m)</td> <td>: 2500</td> </tr> <tr> <td>Max. Output speed (RPM)</td> <td>: 5400</td> </tr> <tr> <td>Max. Input power to BFP (KW)</td> <td>: 9172</td> </tr> </tbody> </table>					Var.No.	Technical Parameters	Material Code	01	<u>For 660MW (25% BFP) (BARA)</u>		Direction of rotation of Motor seen from BP end	: CW	GD sq. Value of BFP (kg. Sq.m)	: 20	GD sq. Value of coupl. between BFP and HC (kg.sq.m)	: 4.04	Oil quantity required for external lubrication	: 300 lpm	GD ² Value of drive motor (Kg.Sq.m)	: 2040	Max. Output speed (RPM)	: 6100	Max. Input power to BFP (KW)	: 6350	02	<u>For 660MW (30% BFP) (MAUDA-II)</u>		Direction of rotation of Motor seen from BP end	: CW	GD sq. Value of BFP (kg.Sq.m)	: 20	GD sq. Value of coupl. between BFP and HC (kg.sq.m)	: 4.04	Oil quantity required for external lubrication (lpm)	: 300	GD ² Value of drive motor (Kg.Sq.m)	: 2150	Max. Output speed (RPM)	: 6370	Max. Input power to BFP (KW)	: 8250	03	<u>For 800MW (30% BFP) (GADARWARA)</u>		Direction of rotation of Motor seen from BP end	: CCW	GD sq. Value of BFP (kg.Sq.m)	: 21.5	GD sq. Value of coupl. between BFP and HC (kg.sq.m)	: 5.0	Oil quantity required for external lubrication	: 350lpm	GD ² Value of drive motor (Kg.Sq.m)	: 3000	Max. Output speed (RPM)	: 5600	Max. Input power to BFP (KW)	: 10225	04	<u>For 660MW (30% BFP) (BANHARPALLI)</u>		Direction of rotation of Motor seen from BP end	: CW	GD sq. Value of BFP (kg. Sq. m)	: 19.5	GD sq. Value of coupl. between BFP and HC (kg.sq.m)	: 5.0	Oil quantity required for external lubrication	: 330 lpm	GD ² Value of drive motor (Kg.Sq.m)	: 2500	Max. Output speed (RPM)	: 5400	Max. Input power to BFP (KW)	: 9172
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TD-106-1 Rev No.5 Form No.	 HYDERABAD	PRODUCT STANDARD PUMPS HYDERABAD	FP60207
			Rev No. 07
			Page 15 of 20

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05	<u>For 660MW (30% BFP) (NORTH KARANPURA)</u> Direction of rotation of Motor seen from BP end : CW GD sq. Value of BFP (kgm²) : 20 GD sq. Value of coupl. between BFP and HC (kgm²) : 4.04 Oil quantity required for external lubrication (lpm) : 300 GD² Value of drive motor (kgm²) : 2300 Max. Output speed (RPM) : 6650 Max. Input power to BFP (KW) : 9286 FP9760207052
06	<u>For 660MW (25% BFP) (MAITREE BANGLADESH)</u> Direction of rotation of Motor seen from BP end : CW GD sq. Value of BFP (kgm²) : 20 GD sq. Value of coupl. between BFP and HC (kgm²) : 4.04 Oil quantity required for external lubrication (lpm) : 300 GD² Value of drive motor (kgm²) : 2300 Max. Output speed (RPM) : 6600 Max. Input power to BFP (KW) : 8672 FP9760207060
07	<u>For 800MW (35% BFP) (PATRATU)</u> Direction of rotation of Motor seen from BP end : CCW GD sq. Value of BFP (kgm²) : 20 GD sq. Value of coupling between BFP and HC (kgm²) : 5.0 Oil quantity required for external lubrication (lpm) : 350lpm GD² Value of drive motor (kgm²) : 3000 Max. Output speed (RPM) : 5880 Max. Input power to BFP (KW) : 10771 FP9760207079
08	<u>For 660MW (30% BFP) (BHUSAWAL MAHAGENCO)</u> Direction of rotation of Motor seen from BP end : CW GD sq. Value of BFP (kgm²) : 20 GD sq. Value of coupl. between BFP and HC (kgm²) : 4.04 Oil quantity required for external lubrication (lpm) : 300 GD² Value of drive motor (kgm²) : 2030 Max. Output speed (RPM) : 6250 Max. Input power to BFP (KW) : 7400 FP9760207087

Note for variant No. 06:

The gear boxes design shall be in accordance with AGMA 420 and 421 (or) other international standard, as applicable

Ref. Doc



TD-106-1 Rev No.5 Form No.	 HYDERABAD	PRODUCT STANDARD PUMPS HYDERABAD		FP60207																													
				Rev No. 07																													
				Page 16 of 20																													
SPARES FOR HYDRAULIC COUPLING FOR 25% AND 30% DUTY MHI DESIGN BFPs OF 660MW & 800MW SUPER CRITICAL POWER PLANTS <table border="1"> <thead> <tr> <th>VAR No.</th> <th>ITEM DESCRIPTION</th> <th>PROJECT</th> <th>MATERIAL</th> </tr> </thead> <tbody> <tr> <td>51</td> <td>AUXILIARY OIL PUMP MOTOR FOR HC-VAR 05</td> <td rowspan="8">2 X 800 MW Gadarwara</td> <td>FP9760207516</td> </tr> <tr> <td>52</td> <td>AUXILIARY OIL PUMP MOTOR FOR HC-VAR 03</td> <td>FP9760207524</td> </tr> <tr> <td>53</td> <td>RTD FOR BERAING TEMP POS 34.1 VAR-03</td> <td>FP9760207532</td> </tr> <tr> <td>54</td> <td>RTD&THERMOWEL OIL TEMP POS 34.21 VAR-03</td> <td>FP9760207540</td> </tr> <tr> <td>55</td> <td>DPT FOR OIL FILTERS POS-37.3 OF VAR-03</td> <td>FP9760207559</td> </tr> <tr> <td>56</td> <td>OIL LEVEL INDICATOR POS-40 OF VAR-03</td> <td>FP9760207567</td> </tr> <tr> <td>57</td> <td>OIL LEVEL TRANSMITTER POS-40.2 OF VAR03</td> <td>FP9760207575</td> </tr> <tr> <td>58</td> <td>PT 0-6 KG/WQCM FOR LO&WO PR HC-800MW</td> <td>FP9760207583</td> </tr> </tbody> </table>					VAR No.	ITEM DESCRIPTION	PROJECT	MATERIAL	51	AUXILIARY OIL PUMP MOTOR FOR HC-VAR 05	2 X 800 MW Gadarwara	FP9760207516	52	AUXILIARY OIL PUMP MOTOR FOR HC-VAR 03	FP9760207524	53	RTD FOR BERAING TEMP POS 34.1 VAR-03	FP9760207532	54	RTD&THERMOWEL OIL TEMP POS 34.21 VAR-03	FP9760207540	55	DPT FOR OIL FILTERS POS-37.3 OF VAR-03	FP9760207559	56	OIL LEVEL INDICATOR POS-40 OF VAR-03	FP9760207567	57	OIL LEVEL TRANSMITTER POS-40.2 OF VAR03	FP9760207575	58	PT 0-6 KG/WQCM FOR LO&WO PR HC-800MW	FP9760207583
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TD-106-1 Rev No.5 Form No.		PRODUCT STANDARD PUMPS HYDERABAD	FP60207 Rev No. 07 Page 17 of 20
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>Annexure-I</u> <u>Transmitters:</u> 1) All transmitters shall have an impressed output signal of 4-20 mA corresponding to zero to full range input. However, digital communication shall also be acceptable. 2) Generally, 2-wire transmitters shall be used. If for some special purposes (e.g. analyzers) 230 V AC power supply is required, the output circuit shall be isolated. 3) As far as possible, all transmitters shall be of the SMART – type. This applies also to field mounted temperature transmitters. 4) All transmitters shall be fitted with a local analog indicator displaying appropriate physical units which may be read clearly from an easily accessible position. 5) Transmitters with accuracy class “0” or better must be used. The repeatability shall be within a range of ± 0.1 % of full span. 6) The output signal of all transmitters must be independent of the burden of the transmitter output circuit including cable resistance over a wide range. 7) The removal of connected devices must not open the transmitter output circuit or cause malfunction of this circuit. In the case of failure and return of the supply voltage within a measuring circuit, no false signals endangering the system shall be issued. All transmitters shall be individually fused. If not specified otherwise, local parameterization at eh transmitter or protocol shall be possible. 8) For the continuous remote position indication of valves, dampers etc. also transmitters with impressed output signal of 4-20 mA shall be employed. 9) All transmitters shall be suitable for field installation and shall have strong, moisture and dustproof cases of IP 65 or better according to EN 60529. This applies also for temperature transmitters when installed in the field. 10) Diaphragm seals shall be provided to serve as a barrier for corrosive process fluids, slurries or highly viscous oils. The seal shall be of the flanged type, suitable for the same conditions as those for the transmitter. The material selection shall be according to the requirements of the fluids to be measured. The seal shall be provided with a flushing connection. 11) Transmitters to be used in hazardous areas shall be explosion proof. Suitable intrinsically safe circuits are to be provided in accordance with EN 60079-11. 12) All transmitters potentially subjected to vacuum shall be capable of withstanding 100% vacuum without damage. 13) No stress shall be imposed through the connections between Plant and the transmitter. As far as possible, the transmitters shall be grouped together into enclosed racks or panels for easy access. Sunshades shall be provided for all outdoor panels. 14) Individually installed Transmitters shall have their own weather proof enclosure of robust construction and be suitable for the proposed environment. All field equipment terminals shall be wired to a terminal box using screwed connections. 15) Transmitters shall be provided with all necessary isolating, vent and blow-down valves and facilities shall be provided for the connection of test instruments at the input and output of each transmitter, to enable calibration to be carried out. <u>TEMPERATURE MEASUREMENTS:</u> 1) Glass thermometers, bi-metallic and capillary remote thermometers are to be used for local temperature measurement. For both, class 1.0 shall be provided. 2) Glass thermometers are to be inserted into pockets provided for the purpose. The use of mercury is forbidden. 3) Capillary remote thermometers (Pt-100) in accordance with IEC 60751 shall be used for remote measurements. All resistance thermometers shall be wired according to the four-conductor principle.	
Ref. Doc			



TD-106-1 Rev No.5 Form No.		PRODUCT STANDARD PUMPS HYDERABAD	FP60207 Rev No. 07 Page 18 of 20
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) Otherwise, thermocouples with appropriate heat resistance in accordance with DIN IEC 60584-1 or equivalent may be used for remote measurements. 5) All thermocouples shall be of the quick response type, ungrounded and preferably of double element type. 6) Thermocouples shall be arranged in such a way that the ambient temperature of the head is lower than 100 °C, and that the measuring inserts can easily be exchanged. 7) All thermocouples and extension leads shall be terminated with a suitable gland and the conductor to sheath resistance shall be greater than 100 M-Ohms when tested after termination. 8) Thermometers and thermocouples shall generally be fitted in protective wells. They shall be provided with weatherproof terminal heads and shall be installed so as to totally prevent the ingress of foreign matter. 9) High speed response pockets shall be provided for all applications involving control of critical process temperatures. 10) Where more than one temperature measurement e.g. for redundant loops, recording, indication, automatic control is to be made at one location, individual protective wells with sensors shall be provided at the common place of measurement. Protective wells for unoccupied test measuring points shall be arranged with the opening inclined downwards wherever possible and shall be provided with a screw-on protection cover. For all remote temperature measurements (i.e. for RTDs and TCs) transmitters shall be installed locally in a transmitter protecting box on a DIN rail. <u>PRESSURE MEASUREMENTS:</u> 1) Pressure gauges of class 1.6 or better must be used. The standard measuring ranges must be selected with regard to the maximum operating pressure. 2) A pressure instrument installed for measurement of steady pressure at varying pressure shall operate in a band centered on 60% of its maximum range. 3) When the pressure impulse line is liquid filled the measuring unit shall be compensated for static head. The head correction shall be stated on the unit. 4) Pressure gauges shall have a dial size of 160 mm and shall be located in such a way that they can be easily observed or shall be combined in groups on local gauge boards or cubicles. 5) Pressure gauges shall be resistant against vibrations. Furthermore, pressure gauges shall be designed in such a way that the measured value may reach the end of the indicating range without affecting the calibration of the gauge. 6) Pressure measurement tapping points shall generally be in accordance with the specification for the pipeline in which they are installed and shall be equipped with one, and for high pressure installations (45 bar) two, isolating valves arranged directly at the tapping point. 7) Piping shall be of approved quality and sized for the particular service. In all cases the pipe size shall be chosen to ensure strength and freedom from blockage. Instrument impulse pipework shall be manufactured from a suitable grade of stainless steel to the approval of the Employer / Engineer. 8) Pressure transmitters for remote measurement shall not be mounted directly at the tapping point, but shall be arranged at a distance from the tapping point by means of enclosures. The impulse line between tapping point and transmitter shall be arranged in such a way as to form a siphon loop, when steam pressure measurements are involved.	
Ref. Doc			

TD-106-1 Rev No.5 Form No.		PRODUCT STANDARD PUMPS HYDERABAD	FP60207 Rev No. 07 Page 19 of 20
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.		9) A valve combination or multiway cock shall be provided directly on each pressure gauge or transducer connection. They shall be equipped with a connection for test gauges, and it shall be possible to shut off the test connection without isolating the service pressure gauge at the same time. 10) Open blowdown / drain connections shall not be arranged within panels and local equipment. Instead it shall be led to a drain external to the panel. All valves shall be installed so that they are accessible for in-situ maintenance from a floor or permanent structure landing. 11) Stainless steel shall normally be used for all corrosive duties.	
Ref. Doc			

TD-106-3 Rev.No. 5 Form No.	 HYDERABAD	PRODUCT STANDARD PUMPS HYDERABAD		FP60207		
				Rev No. 07		
				Page 20 of 20		
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.		RECORD OF REVISIONS				
		Rev. No.	Date	Revision Details	Revised By	Approved By
		01	21.03.13	Cl No: 2.2.0(e) Length & Qty of Pipes &. Bends corrected. At Cl No. 3.0.0 Technical Parameters i.e Speeds & Power deleted and added in Cl. No. 15.0.0. Var No. 02 added for 30% duty BFP.	MMR	P SRINIVAS
		02	03.07.14	At Cl No. 3.0.0 Technical Parameters i.e GD sq value of BFP, Direction of Motor etc deleted and added in Cl. No. 15.0.0. Var No. 03 added for 30% duty BFP for 800 MW.	CH RAJESH	P SRINIVAS
		03	12.11.14	Var No. 04 added for 35% duty BFP for 660 MW (BANHARPALLI) Cl no 2.2.0(g) and (h) are corrected. GD Sq value of BFP for Var-03 is corrected.	CH RAJESH	P SRINIVAS
		04	20.03.15	Var No. 05 added for 30% duty BFP.	ROHIT.P	P SRINIVAS
		05	27.10.17	Var No. from 51 to 58 added for Gadarwara spares Var No. 06 added for 25% duty BFP.	SATISH	KHRK
		06	31.01.18	Power value revised for Variant no. 06 and annexure-I added	SATISH	KHRK
		07	03.05.19	1. Var No. 07 & 08 are added. 2. Clause 6.5.0 (u) revised	KULDEEP	ASJK
		Ref. Doc.				