Bought Out specification

M/s BHEL
Trichy – 620014

For supplying

HFO & LFO PUMPS

MOU NO : MOU / TPBHEL /HFO & LFO PUMPS, REV.01

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SCOPE OF THIS SPECIFICATION

The specification is bifurcated in two broad sections, one is the “standard section” another is “project specific section”.

Project specific section is the variable part of the specification. It contains all the requirements of a specific project over and above the requirements of the standard section.

1.0 GENERAL:

1.1 Sections 1.0, 2.0 and 3.0 are standard and Section 4.0 alone will be furnished along with enquiry to the vendors for their acceptance.

1.2 In case of any difference between the details given in Section 5.0 and other sections, Section 5.0 shall be considered as final and binding and the vendors shall meet the requirements for this project.

1.3 Two years recommended Spares list (vide Section 4.0) with price break up, if required, shall be enclosed.

1.4 If any special or non-standard tools are required for installation, operation or maintenance, the same shall be supplied along with the equipment.

1.5 Materials shall be dispatched on "Door Delivery with or without Consignee Copy attached basis to avoid demurrage at transporter's godown".

1.6 Since the vendors works alone is approved by BHEL, it is agreed the vendor will manufacture this item in their own works only and will not off-load the jobs to any other suppliers without the written approval by BHEL. All components shall be packed in such a way that they should not get damaged during transport.

2.0 STANDARD TECHNICAL SPECIFICATIONS

2.1 SCOPE :

To design, manufacture, test & supply of screw pump as per the specification.

This specification covers design, manufacture, inspection, testing, marking, identification, packing and supply of FUEL OIL SCREW PUMPS as per the specification that follows. Technical parameters for equipment design are furnished in Section-1 to 4. For quantity, scope of supply and special requirements refer Section-5.

This is a general specification dealing with technical requirements as specified under scope. Contract requirements and special requirements (if any) for a particular project are specified in Section-5.

The extent of supply stated herein is not necessarily exhaustive and shall not relieve the vendor from his responsibility to provide goods and services necessary to satisfy the performance criteria and guarantees specified.

2.2 **APPLICABLE CODES & STANDARDS**: VDMA 24284 performance testing.

The equipment shall be designed to meet the governing standards as applicable and also meet with the local standards where the equipment is installed. In case of any information not specified in this technical delivery conditions these standards will be binding.

2.3 TECHNICAL REQUIREMENTS:

2.3.1 The fuel oil pump procured for HFO application shall be suitable for HFO/LSHS/HPS oil and other heavy fuel oils. The fuel oil pump procured for LFO application shall be suitable for LFO/LDO/HSD and other light fuel oils.

2.3.2 For performance data & others refer to project specific technical specification.

2.3.3 Triple screw, hydraulically balanced to eliminate end thrust; pulsation free discharge & low noise level.

2.3.4 Cartridge type elements for ease of maintenance & replacement.

2.3.5 All materials & construction shall be suitable for specified pumping temperature & to meet all the performance needs.

2.3.6 Horizontal execution - axial suction nozzle through the end cover & top vertical discharge nozzle - flanged to ANSI 150 lbs& 300 lbs respectively.

2.3.7 Provide steam heating cover/full jacketing for HFO pumps, if it called for in the data sheet.

2.3.8 HFO pump shall be with steam jacketing (if applicable) for maintaining the oil flow temperature. Steam operating pressure 16 kg/cm2(g). Steam operating temperature 290 ºC. Steam jacket shall cover the body so that the heat is dissipated to oil at maximum possible extent.

2.3.9 LFO pump shall be without steam jacketing.

2.3.10 Screws of nitride & hardened steel; inner casing & bushes of aluminum alloy for LFO; Aluminium alloy or cast iron for HFO pumps; welded steel / cast steel body.

2.3.11 Two horizontal 50mm long 1 inch SCH 40 pipe stubs with taper plugs, one on suction side and another on the discharge side of the body, for pressure gauges.

2.3.12 Single acting mechanical seal, with Viton O-ring. Double acting mechanical seal preferred.

2.3.13 Externally mounted adequately sized bearing with grease nipple for lubrication.

2.3.14 Built - in safety valve - spring adjustable over a range of ±50% of the specified discharge pressure - over pressure within 10% of set value for relieving pump's maximum capacity - mounted on left side of the pump body as seen from motor end.

2.3.15 Include adequately sized Pin Type Flexible coupling of three piece construction - Flender N - Eupex series A or equate; Double piece half of the coupling shall be supplied mounted onto the pump shaft; the other single piece half supplied loose in rough bore condition.

2.3.16 The pump body shall have enough clearance to allow free removal of selected coupling bolts.

2.4 DRIVE MOTOR AND BASE FRAME ARE BY BHEL.

3.0 Variants of Pumps

3.1 Table A

S. No	Variant No.	Pump Type	Capacity (LPM) *	Discharge Pressure (kg/sq.cm(g))	Speed (RPM)	Remarks
1	LP01	LDO Pump	275	25	2920	
2	LP02	LDO Pump	350	25	2920	
3	LP03	LDO Pump	450	25	2920	
4	LP04	LDO Pump	542	25	2920	
5	LP05	LDO Pump	600	25	2920	
6	LP06	LDO Pump	900	25	2920	
7	LP07	LDO Pump	1200	25	2920	
8	LP08	LDO Pump	1400	25	2920	

***LPM at minimum viscosity**

3.2 Table B

S. No	Variant No.	Pump Type	Capacity (LPM)*	Discharge Pressure (kg/sq.cm(g))	Speed (RPM)	Remarks
1	HP01	HFO Pump	850	30	1450	
2	HP02	HFO Pump	980	30	1450	
3	HP03	HFO Pump	1100	30	1450	
4	HP04	HFO Pump	1200	30	1450	
5	HP05	HFO Pump	1400	30	1450	

***LPM at minimum viscosity**

4.0 MARKING, PAINTING, PACKING, TESTING CERTIFICATES, AND INSPECTION,

4.1 MARKING:

4.1.1 Stainless steel name plates with following boldly engraved shall be firmly fixed to the body:

Maker's name & production serial number, BHEL material code, Full pump designation; Flow, viscosity, minimum allowable suction pressure, discharge pressure and speed corresponding to the maximum operating viscosity; body rating and safety valve set pressure range.

4.1.2 Each spare shall be individually tagged with part name, makers name & spare code and BHEL material code.

4.2 PAINTING

4.2.1 All interior surfaces applied with rust preventive oil, following hydraulic text, drying or performance test.

4.2.2 All exposed surfaces degreased, dressed and epoxy coated.

4.2.3 For contract specific painting shades, vendor to refer & follow the applicable painting schedule.

4.3 PACKING

4.3.1 All opening shall be firmly capped against ingress of water or dust.

4.3.2 Shall be seaworthy packed in wooden boxes with water proof under cover for export jobs and road worthy packing for inland jobs.

4.3.3 Liberal packing material & struts shall be used to arrest rolling & to protect from transit damages.

4.4 TEST CERTIFICATES:

Following Works TC's shall be submitted along with the supplies; Refer to column on special contract requirements for any Third Party witnessing requirements.

4.4.1 Body hydraulic test done at 1.5 times the relief Valve Set pressure.

4.4.2 Performance test on each of pump and spare cartridge assy. on standard oil over the entire operating range, with the curves extrapolated for the specified oil.

4.4.3 Material certificate for body, inner casing & Screws.

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4.4.4 As inspected data on hardness and clearances between screws and inner casing.

4.4.5 Dimensional certificate for overall dimensions and all terminal connections.

4.4.6 The following tests should be carried out.

i) Over all dimension & orientation
ii) Mechanical run/ performance test as per VDMA 24284
iii) Leak check
iv) Noise level
v) Vibration level
vi) Relief valve test (as per 4.4.7)

4.4.7 Pump relief valve test for set pressure and over pressure to be performed. Relief valve shall start opening at set pressure and completely relieve the pumps max. capacity by the time discharge pressure reaches over pressure. There shall not any pressure rise beyond over pressure for minimum test duration of 30 minutes

4.4.8 Also refer applicable quality plan

4.5 INWARD INSPECTION:.

4.5.1 Verify the works test certificates, marking particulars and the scope of supply.

4.5.2 Watch for damages.

4.5.3 Perform random check on all mounting dimensions and terminal connections and coupling details.

4.6 OPERATING & INSTRUCTIONAL MANUALS:

4.6.1 Minimum of 3 sets comprising of documents listed under 4.5.1 & 4.5.2 below, shall be furnished within 1 month from the date of purchase order.

4.6.2 Soft copy of operation manual shall be furnished.

4.7 DOCUMENTS TO BE SUBMITTED

4.7.1 Compliance to the MOU (MOU number, as applicable, shall be confirmed)

4.7.2 Point wise compliance or deviations to the project specific requirements of section-5 of the MOU specification for all the selected variants.

4.7.3 Overall dimensional assembly drawing for all the selected variants.

4.7.4 Cartridge assembly and cross sectional drawing Mechanical seal with BOM for all the selected variants.

4.7.5 Cross sectional drawing with parts and materials identified with pump assembly details.

4.7.6 Pressure. Vs Flow and Pressure Vs BHP curves at 150,370,500 and 750 cst for HFO oil pumps and 2, 15.7, 20 and 25 cst for LDO oil pumps for the all the selected variants.

4.7.7 Speed and Torque calculations for all the selected variants

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4.7.8 Starting torque Vs Speed curves at each of the above viscosities for all the selected variants.

4.7.9 Full pump designation with description of the designation codes for all the selected variants.

4.7.10 Pump efficiency calculations for all the selected variants.

4.7.11 Coupling sizing and selection calculations for all the selected variants.

4.7.12 Coupling dimensional drawings for all the selected variants

4.7.13 All documents referred under 'Reference Documents' part-of the project specific technical specification. (Over all dimensional drawing; performance curves; catalogues, drawings and O&M manuals of the pump cartridge and all mountings) for all the selected variants.

4.7.14 Lubricant grade , quantity per fill and frequency or filling for the bearings;

4.7.15 NPSH requirements of the pump at 150,370,500 and 750 cst, with curves for HFO Oil pumps and at 2, 15.7,20 & 25 cst for LDO oil pumps for all the selected variants.

4.7.16 Relief valve capacity curve as Plotted against set pressure and over pressure for all the selected variants. Relief valve spring selection criteria shall be furnished by vendor.

4.7.17 Spares quotation for 3 year operation with clear description, part number, identification drawings break up price with 6 months validity.

4.7.18 Work instructions for painting of pumps.

4.8 AFTER PLACEMENT OF ORDER / ALONG WITH THE SUPPLY.

Following documents shall be submitted along with the supplies.

4.8.1 O&M instruction in soft version

4.8.2 Dimensional drawing

4.8.3 Cross section drawing with material identification and pump assembly details and Data sheets

4.9 Guarantee:

Vendor shall guarantee for the indented performance and trouble free operation of the pump for a period of 24 months from the date of dispatch or 18 months from the date of commissioning, whichever is earlier.

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5.0 PROJECT SPECIFIC TECHNICAL SPECIFICATION:

5.1 HFO PUMP DATA SHEET

5.1.1 Project Name :
5.1.2 Customer No. :
5.1.3 HFO Pump Variant No :
5.1.4 HFO Pump Model :

A.PERFORMANCE DATA			**F. MECHANICAL SEAL**	
1. OIL GRADE	HFO as per IS-1593		1.ACTION	SINGLE OR DOUBLE
2. OIL POUR POINT	66 ^{0}C		2.MAKE	*
3. SP.GRAVITY AT 15^{0}C	0.93		3.MODEL No.& SIZE	*
4.PUMPING TEMP.	67 ^{0}C		4.O RING SPRING MATL.	*
5. OIL VISCOSITY min/max	180 CST	500 CST	5.ROTARY RING MATL.	*
6.CAPACITY AT min.CST	980 LPM @ 180 CST		6.STATIONARY RING MATL.	*
7.CAPACITY AT max. CST	* LPM @ CST		7.SUCTION PRESS. MAX.	+/- 0.5 Kg/Cm^2 (g)
8.SUCTION PRESSURE	- 0.5 Kg/Cm^2 (g)			
9.DELIVERY PRESSURE	30.0 Kg/Cm^2 (g)		**G.SAFETY RELIEF VALVE - INTEGRAL**	
10.NPSH REQUIRED	* <5 METERS WC AT MAX.CST		1.MAKE	*
11.RPM	1450		2.MODEL No.& SIZE	*
12.SENSE OF ROTATION	CW AS SEEN FROM MOTOR END		3.CAPACITY	100% or FULL
13.BHP AT min.CST	* KW		4.SET PRESSURE	3 Kg/Cm^2 (g) above delivery press
14.BHP AT max. CST	* KW		5.OVER PRESSURE	* 10% of RV set Pressure
15. PUMP EFFICIENCY	* % @ MIN. cst.		6.SPRING ADJUST RANGE	* Kg/Cm^2 (g) TO * Kg/Cm^2 (g)
			7.RELIEF OUTLET	INTERNAL
B.PERFORMANCE GRAPHS			8. RELIEF OUTLET CONN.	NOT APPLICABLE
1.PRESS.VS FLOW & BHP	*		9.HANDWHEEL	NOT APPLICABLE
2.CST VS NPSH REQD.	*			
3.SPEED VS TORQUE	*		**H.STEAM JACKET**	Required
			1.STYLE	End cover or full jacket
C.**PUMP CONSTRUCTION DETAILS**			2. PRESSURE DESIGN/TEST	16 Kg/Cm^2 (g) / 24 Kg/Cm^2 (g)
1.MOUNTING	Horizontal		3.CONNECTION IN / OUT	* Inch npt(f) / * Inch npt(f)
2.PITCH & ROTOR DIA	* mm	* mm		
3.PUMP GD^2	* Kg m^2		**I.DRIVE MOTOR SCOPE (by BHEL)**	
4.NOZZLES IN	* ANSI 150# WNRF		1.MAKE OR FRAME SIZE	*
5.NOZZLES OUT	* ANSI 300# WNRF		2.KW,V,PHASE& HZ	*Recommended power by pump vendor
6.INLET NOZZLE POSITION	Horizontal axial thru end cover		3.DIMENSIONAL DRG.	-
7.OUTLET NOZZLE POSIT.	Vertical Top		4.DATA SHEET REF.	-
8.BODY& COVER MATL.	*			
9.INSERT MATL.	*		**J.PERFORMANCE GUARANTEE**	
10.ROTOR SHAFT MATL	*		1.PER VDMA 24284 GROUP-II	
11.IDLERS MATL	*		2.EXCESSCAPACITY PERMITTED	
12.BEARING BUSH MATL.	*			
13.BASE FRAME MATL	**BHEL Scope**		**K.TEST CERTIFICATES & INSPECTION**	
14.BODY DESIGN /TEST PR.	Inlet * Kg/Cm^2 (g) / * Kg/Cm^2 (g)		1.BODY HYDRO TEST ; *	
	Outlet * Kg/Cm^2 (g) / * Kg/Cm^2 (g)		2.PERFORMANCE TEST ON EACH CATRIDGE: *	
D.BEARINGS			3.RELIEF VALVE OVER PRESSURE TEST: *	
1.TYPE AND NUMBER OFF	Ball bearing, 1 off			
2.POSITION	EXTERNAL		**L. O & M REFF. DOCUMENTS (fill compulsorily)**	
3.ISO No. & CLEARANCE	*		1.PUMP DESIGNATION SHEET : *	
4.LUBRICANT GRADE	*		2.PERFORMANCE GRAPHS : AS UNDER SECTION - B	
5.QTY. & FILLING FREQ.	*		3.DIMENSIONAL DRAWINGS : *	
			PUMP - MOTOR ASSY.	
E.COUPLING (3PIECE, PIN - PUSH)			PUMP : *	CARTRIDGE:*
1.MAKE	*		RLF. VALVE : *	COUPLING :*
2.MODEL No. & SIZE	*		4..SECTIONAL DRGS. WITH SPARES IDENTIFICATION :	
3.GD^2	* Kg m^2		PUMP BODY : *	CARTRIDGE :*
4.DOUBLE PIECE SIDE	Fitted onto pump shaft in flush		RLF. VALVE :*	SEAL :*
5.SINGLE PIECE	To fit motor shaft in rough bore condition.		5. O&M INSTRUCTIONS :	
			PUMP ; *	
NOISE LEVEL	Noise < 85 m at 1 meter distance		COUPLING : *	SEAL :*
VIBRATION LEVEL	<4.5mm/sec - VDI-2056			

*information shall be furnished by the vendor

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5.2 LDO PUMP DATA SHEET

5.2.1 Project Name :
5.2.2 Customer No. :
5.2.3 LDO Pump Variant No :
5.2.4 LDO Pump Model :

A.PERFORMANCE DATA			**F. MECHANICAL SEAL**	
1. OIL GRADE	LDO as per IS-1460		1.ACTION	SINGLE OR DOUBLE
2. OIL POUR POINT	12-21 ^{0}C		2.MAKE	*
3. SP.GRAVITY AT 15^{0}C	0.83		3.MODEL No.& SIZE	*
4.PUMPING TEMP.	40 ^{0}C		4.O RING SPRING MATL.	*
5. OIL VISCOSITY min/max	2 CST	15.7 CST	5.ROTARY RING MATL.	*
6.CAPACITY AT min.CST	350 LPM @ 2 CST		6.STATIONARY RING MATL.	*
7.CAPACITY AT max. CST	* LPM @ CST		7.SUCTION PRESS. MAX.	+/- 0.5 Kg/Cm^2 (g)
8.SUCTION PRESSURE	- 0.5 Kg/Cm^2 (g)			
9.DELIVERY PRESSURE	25.0 Kg/Cm^2 (g)		**G.SAFETY RELIEF VALVE - INTEGRAL**	
10.NPSH REQUIRED	* <5 METERS WC AT MAX.CST		1.MAKE	*
11.RPM	2920		2.MODEL No.& SIZE	*
12.SENSE OF ROTATION	CW AS SEEN FROM MOTOR END		3.CAPACITY	100% or FULL
13.BHP AT min.CST	* KW		4.SET PRESSURE	2.5 Kg/Cm^2 (g) above delivery press
14.BHP AT max. CST	* KW		5.OVER PRESSURE	* 10% of RV set Pressure
15. PUMP EFFICIENCY	* % @ MIN. cst.		6.SPRING ADJUST RANGE	* Kg/Cm^2 (g) TO * Kg/Cm^2 (g)
			7.RELIEF OUTLET	INTERNAL
B.PERFORMANCE GRAPHS			8. RELIEF OUTLET CONN.	NOT APPLICABLE
1.PRESS.VS FLOW & BHP	*		9.HANDWHEEL	NOT APPLICABLE
2.CST VS NPSH REQD.	*			
3.SPEED VS TORQUE	*		**H.STEAM JACKET**	Not Required
			1.STYLE	End cover or full jacket
C.**PUMP CONSTRUCTION DETAILS**			2. PRESSURE DESIGN/TEST	* Kg/Cm^2 (g) / * Kg/Cm^2 (g)
1.MOUNTING	Horizontal		3.CONNECTION IN / OUT	* Inch npt(f) / * Inch npt(f)
2.PITCH & ROTOR DIA	* mm	* mm		
3.PUMP GD^2	* Kg m^2		**I.DRIVE MOTOR SCOPE (by BHEL)**	
4.NOZZLES IN	* ANSI 150# WNRF		1.MAKE OR FRAME SIZE	*
5.NOZZLES OUT	* ANSI 300# WNRF		2.KW,V,PHASE& HZ	*Recommended power by pump vendor
6.INLET NOZZLE POSITION	Horizontal axial thru end cover		3.DIMENSIONAL DRG.	-
7.OUTLET NOZZLE POSIT.	Vertical Top		4.DATA SHEET REF.	-
8.BODY& COVER MATL.	*			
9.INSERT MATL.	*		**J.PERFORMANCE GUARANTEE**	
10.ROTOR SHAFT MATL	*		1.PER VDMA 24284 GROUP-II	
11.IDLERS MATL	*		2.EXCESSCAPACITY PERMITTED	
12.BEARING BUSH MATL.	*			
13.BASE FRAME MATL	**BHEL Scope**		**K.TEST CERTIFICATES & INSPECTION**	
14.BODY DESIGN /TEST PR.	Inlet * Kg/Cm^2 (g) / * Kg/Cm^2 (g)		1.BODY HYDRO TEST ; *	
	Outlet * Kg/Cm^2 (g) / * Kg/Cm^2 (g)		2.PERFORMANCE TEST ON EACH CATRIDGE: *	
D.BEARINGS			3.RELIEF VALVE OVER PRESSURE TEST: *	
1.TYPE AND NUMBER OFF	Ball bearing, 1 off			
2.POSITION	EXTERNAL		**L. O & M REFF. DOCUMENTS (fill compulsorily)**	
3.ISO No. & CLEARANCE	*		1.PUMP DESIGNATION SHEET : *	
4.LUBRICANT GRADE	*		2.PERFORMANCE GRAPHS : AS UNDER SECTION - B	
5.QTY. & FILLING FREQ.	*		3.DIMENSIONAL DRAWINGS : *	
			PUMP - MOTOR ASSY.	
E.COUPLING (3PIECE, PIN - PUSH)			PUMP : *	CARTRIDGE:*
1.MAKE	*		RLF. VALVE : *	COUPLING :*
2.MODEL No. & SIZE	*		4..SECTIONAL DRGS. WITH SPARES IDENTIFICATION :	
3.GD^2	* Kg m^2		PUMP BODY : *	CARTRIDGE :*
4.DOUBLE PIECE SIDE	Fitted onto pump shaft in flush		RLF. VALVE :*	SEAL :*
5.SINGLE PIECE	To fit motor shaft in rough bore condition.		5. O&M INSTRUCTIONS :	
			PUMP ; *	
NOISE LEVEL	Noise < 85 m at 1 meter distance		COUPLING : *	SEAL :*
VIBRATION LEVEL	<4.5mm/sec - VDI-2056			

*information shall be furnished by the vendor

Vendor Sign & seal