

	<b>BHARAT HEAVY ELECTRICAL LIMITED</b>				<b>Enquiry No. :</b>	
	<b>UNIT'S ADDRESS:</b>				<b>Due Date :</b>	
	<b>UNIT'S PHONE NO.:</b>				<b>Supplier Qtn. No.:</b>	
	<b><u>CONTACT PERSON'S NAME/DESGN./PHONE NO./E-MAIL</u></b> <b><u>(FROM PURCHASE DEPT.)</u></b>				<b>Date :</b>	
<b><u>SPECIFICATION CUM COMPLIANCE CERTIFICATION FOR MAIN PUMPS (2 Nos.)</u></b>						
<b>NOTE:-</b>						
1. Vendor must submit complete information against all clauses .The offer meeting clause no 14.0 would only be processed.						
2. The "Offered" Column and where applicable, the "Deviations" & "Remarks" Column of this format shall be filled in by the Vendor and submitted along with the offer. Inadequate / incomplete, ambiguous, or unsustainable information against any of the clauses of the specifications/requirements shall be treated as non-compliance.						
3. The offer and all documents enclosed with offer should be in English language only.						
<b>ADDRESS OF THE SUPPLIER :</b>			<b>ADDRESS OF THE INDIAN AGENTS :</b>			
<b>TELEPHONE NOS.:</b>			<b>TELEPHONE NOS.:</b>			
<b>FAX NOS.:</b>			<b>FAX NOS.:</b>			
<b>E-MAIL ADDRESS :</b>			<b>E-MAIL ADDRESS :</b>			
<b>SCOPE: SUPPLY OF MAIN PUMP WITHOUT MOTOR (360KW) AS SPECIFIED BELOW</b>						
<b>SNO</b>	<b>DESCRIPTION FOR BHEL REQUIREMENT</b>	<b>SPECIFIED / TO BE CONFIRMED BY</b>	<b>OFFERED</b>	<b>DEVIATIONS</b>	<b>REMARKS</b>	
1.0	<b>Purpose</b>					
1.01	The two pumps described hereafter are intended for creating head and discharge which will be used in a hydro turbine model testing laboratory.	Vendor to Confirm				

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1.02	Two identical pumps (with interchangeability of parts) are required. These will be located as per sketch given in Annexure-I. These may be run either in series, parallel or solo operation through suitable piping & valve arrangements as required.	Vendor to Confirm			
1.03	Motors will be arranged by BHEL	Vendor to Confirm			
2.0	<b>completeness of supply</b>				
	The supply shall be complete in all respects and any device not particularly mentioned in the specifications, but essential for proper operation of the system is required to be included in the supply by supplier.	Vendor to Confirm			
3.0	<b>Standards</b>				
	Material, method or quality required is to confirm International Standards may be applied, shall be supplied, executed, or performed in accordance with highest grade as specified in such standards .	Vendor to Confirm			
4.0	<b>Metric units</b>				
	Dimensions on drawings and documents shall be in metric units. Should the dimensions shown fail to coincide with Standard nominal sizes available, reasonable substitutions shall be authorized	Vendor to Confirm			
5.0	<b>Brief description</b>				
5.1	Two identical pumps are required. These may be run either in series, parallel or solo operation through suitable piping & valve arrangements as required.	Vendor to Confirm			
5.2	The two pumps described hereafter are intended for operation in a hydro turbine model testing laboratory. The main operation characteristics are the following:				
5.2.1	Pumps shall be suitable for variable speed operation	Vendor to Confirm			
5.2.2	Pumps shall be suitable to work as turbine in reverse operation	Vendor to Confirm			
5.2.3	Pump cavitation should be prevented to the maximum extent (refer 7.1)	Vendor to Confirm			
6.0	<b>Hydraulic data/ requirements</b>				
6.1	<b>Liquid handled :</b> potable water at temperature 5 to 35 °C	Vendor to Confirm			
6.2	Operating range of Speed of rotation 200-1100 rpm	Vendor to Confirm			

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6.3	Reference Design speed of rotation	960 $\pm$ 10% rpm	Vendor to Confirm			
6.4	Max. speed of rotation	1100 rpm	Vendor to Confirm			
6.5	Design discharge rate at 960rpm	800 $\pm$ 5% ltr/s	Vendor to Confirm			
6.6	Design head at 960rpm	35 $\pm$ 5% mWC	Vendor to Confirm			
6.7	Shut-off head at Design Speed	50 $\pm$ 10% mWC	Vendor to Confirm			
6.8	Efficiency of the pump at design head ,design dischrage at 960 rpm	80% or more	Vendor to Confirm			
6.9	Casing pressure rating	11 bar minimum	Vendor to Confirm			
6.10	The pump characteristic shall be stable, i.e. the slope shall display continuous negative slope from shut-off to 1.2 x design discharge(Nominal). Typical characteristics curves are attched in ANNEXURE-II		Vendor to Specify			
6.11	Note: Maximum admissible speed in reverse operation(turbine mode) shall be stated by supplier		Vendor to Specify			
<b>7.0</b>	<b>Special Requirement</b>					
<b>7.1</b>	<b>Required NPSH (Net positive suction head) / Cavitation</b>					
	The usual required NPSH based on 3% efficiency/ head drop is of no use in the present case. Supplier is requested to submit NPSHR curve (at reference speed ) corresponding to 0% efficiency/ head drop (point where efficiency/ head begins to drop) and if possible NPSHR curve corresponding to incipient cavitation. This is necessary for checking correctness of pump vertical setting inside the laboratory.		Vendor to Submit			
<b>7.2</b>	<b>Turbining mode</b>					
	Pumps will be operated as turbines for energy dissipation purpose. A device( not in the scope of supplier) will be installed,in -series with the main pumps as a complementary energy dissipating device.		Vendor to Confirm			

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<b>8.0</b>	<b>Construction data</b>					
8.1	Number of pumps	2	Vendor to Confirm			
8.2	Installation	dry pit( non submersible)	Vendor to Confirm			
8.3	Construction arrangement	Horizontal,longitudinally split casing	Vendor to Confirm			
8.4	Shaft end location	seen from pump inlet towards outlet, shaft drive end to be on the left hand side.	Vendor to Confirm			
8.5	Pump type	Centrifugal , double suction	Vendor to Confirm			
8.6	Shaft seal	Packing, lantern ring, external water flushing line	Vendor to Confirm			
8.7	Flexible Coupling	flexible, vendor to supply ( one side unfinished for motor side other side to match pump)	Vendor to Confirm			
8.8	Baseplate	Motor size would be intimated later. Baseplate to be provided with longitudinal/Transverse alignment provision for installing pump and motor.	Vendor to Confirm			
8.9	Motor	Shall be arranged by BHEL	Vendor to Note			
<b>9.0</b>	<b>Pump motor rating</b>					
9.1	Supplier has to confirm adequacy of the pump to be driven by motor of 360KW at 960 rpm.		Vendor to Confirm			
<b>10.0</b>	<b>Materials</b>					
10.1	Casing	C.I. or cast steel	Vendor to Confirm			
10.2	Impeller	bronze or SS	Vendor to Confirm			
10.3	Case wear rings	bronze or SS	Vendor to Confirm			
10.4	Impeller wear rings	bronze or SS	Vendor to Confirm			
10.5	Shaft protection sleeve	SS steel	Vendor to Confirm			
10.6	Shaft	Suitable steel	Vendor to Confirm			

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<b>11.0</b>	<b>Accessories for both pumps</b>				
11.1	2 baseplate for pump & Motor with foundation bolts i.e. one for each pump. The baseplate should be a single fabricated baseplate suitable for mounting pump & motor and to maintain their alignment. The Sturdiness of the baseplate to be ascertained to provide vibration free operation of pump during complete operation range.	Vendor to Confirm			
11.2	2 flexible coupling (Motor side details will be intimated at later stage) i.e. one for each pump	Vendor to Confirm			
11.3	2 coupling safety guard suitable for above i.e. one for each pump	Vendor to Confirm			
11.4	4 suitable pressure gauges i.e. two for each pump	Vendor to Confirm			
11.5	4 sets service maintenance instructions in English i.e. two for each pump	Vendor to Confirm			
11.6	2 set of special tools if any i.e. one set for each pump	Vendor to specify			
11.7	4 no. of suitable expansion joints at inlet and outlet of pumps i.e. two for each pump	Vendor to Confirm			
<b>12.0</b>	<b>Dynamic balancing &amp; material testing of Impeller</b>				
12.1	Dynamic balancing of the impeller is required. In case balance weights are welded or eccentric machine cut is taken on the impeller's outer periphery, it shall be made in such a way that the impeller's surfaces remain smooth and concentric with the axis of rotation. NDT test for impeller as required by standards is to be performed and certificate to be attached with dispatch.	Vendor to Confirm			
<b>13.0</b>	<b>Factory acceptance tests ( Before dispatch)</b>				
13.1	Both pumps shall be tested on test facilities of the pump manufacturer by suitable coupling to check head ,discharge,rpm etc. The tests shall be witnessed by BHEL representative. All test arrangements are to be made by supplier.	Vendor to Confirm			

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<b>13.2</b>	<b>Efficiency tests :</b>				
13.2.1	The performance tests shall be carried out according to the requirements of the German standard DIN 1944/ Class II or BS 5316/ Class B or equivalent ASME standard. The accuracy class of the measuring instruments shall meet the requirements of same standard. Ten measuring points are specified, including shut-off and 1.2 x rated discharge. The tests may be conducted at variable speed. standard speed is 960rpm	Vendor to Confirm			
<b>13.3</b>	<b>Cavitation tests :</b>				
13.3.1	NPSHR0 curve submitted by Tenderer shall be checked by at least 3 NPSHR0 test points. Each individual value of NPSHR0 involves several measuring points, with stabilized discharge, to determine the point where efficiency/ head starts dropping.	Vendor to Confirm			
<b>13.4</b>	<b>Hydrostatic tests :</b>				
13.4.1	The assembled pumps shall be submitted to a minimum static pressure tests of 12.1 bar. Pressure shall be maintained for at least 30 minutes.	Vendor to Confirm			
<b>14.0</b>	<b>Qualifying Criteria</b>				
14.1	The supplier should have supplied earlier similar proven design pump of capacity more than 300kw OR head more than 30m & discharge more than 640 ltr/sec. Offered item should be running satisfactorily for at least one years from the date of tender opening and at present also. A list of customers using the item is to be given by supplier with offer furnishing details of atleast one customer as given below	Vendor to confirm and Submit			
14.2	Name of Customer/Company with name of contact person where the system is installed. Copy of Purchase order from atleast one customer to be submitted alongwith the offer	Vendor to Submit			
14.3	Complete postal address ,email address, and phone nos.				
14.4	month and Year of Commissioning				
14.5	Application for which the item is used				
14.6	Performance certificate / proof from the Customer regarding satisfactory performance of the system for atleast one year. The certificate should have been issued in year 2010.	Vendor to Submit			

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<b>15.0</b>	<b>Technical information to be Submitted with tender</b>				
15.1	Head–discharge and power characteristics at speed 500,800,1100 and reference speed 960 r.p.m.	Vendor to Submit			
15.2	Efficiency characteristic at reference speed 960 r.p.m.	Vendor to Submit			
15.3	NPSHR incipient cavitation curve for reference speed ( refer clause 7.1 also)	Vendor to Submit			
15.4	NPSHR0 curve for reference speed	Vendor to Submit			
15.5	NPSHR 3% efficiency drop curve for reference speed	Vendor to Submit			
15.6	Foundation, flanges and pump main dimensions including impeller main dimensions, construction detail of pump with drawings & operation manual.	Vendor to Submit			
15.7	Turbine operation characteristics	Vendor to Submit			
15.8	Recommended minimum discharge at reference speed (necessary for by-pass design)	Vendor to Submit			
<b>16.0</b>	<b>Spares</b>				
	The following spares are to be quoted separately :				
16.1	impeller 1	Vendor to Confirm			
16.2	roller/ ball bearings 1 set	Vendor to Confirm			
16.3	shaft protection sleeves 1 set	Vendor to Confirm			
16.4	packing rings 1 set	Vendor to Confirm			
16.5	stuffing-box glands 2 no	Vendor to Confirm			
16.6	lantern ring 2 no	Vendor to Confirm			
16.7	case wear ring 2 no	Vendor to Confirm			
16.8	impeller wear ring 2 no	Vendor to Confirm			
16.9	coupling buffers 2 sets	Vendor to Confirm			
	Any other spare which supplier suggests is to be included as optional.	Vendor to Specify			
	Nitin Khodre	S.S.Kujur	M.Mangla		
	Dy.Manager(HLE)	DGM(FHX)	AGM(Hydro Lab)		
	Technical Committee member	Technical Committee member	Chairman(Technical Committee)		

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			ANNEXURE-I	PAGE 1 OF 1	
	LOCATION OF PUMPS				



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			ANNEXURE-II	PAGE 1 OF 1	
	<p>The graph illustrates the typical characteristics of a pump. The vertical axis represents Total Head (<math>H_T</math>) and the horizontal axis represents Flow Rate (<math>Q</math>). The Pump Q-H curve shows a decreasing trend from the Shut-off Head point. The Input Power Curve and Efficiency Curve both show an increasing trend with flow rate. The Operating Point at 960 rpm is marked at the intersection of the Pump Q-H curve and the system resistance curve, corresponding to a Design Discharge of approximately 800 ltr/s and a Design Head of approximately 35m.</p>				
	TYPICAL PUMP CHARACTERISTICS CURVE				