SPECIFICATION

FOR

POLY-TETRA-FLOURO-ETHYLENE FACED THRUST BEARING PADS FOR 4 x 130 MW, 300 RPM HYDRO GENERATOR FOR TAPOVAN VISHNUGAD HYDRO ELECTRIC PROJECT.

PREPARED BY	CHECKED BY	APPROVED BY
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1. GENERAL CONDITIONS

1.1 GENERAL INSTRUCTIONS TO SUPPLIERS

1.1.1 BID SHALL BE IN TWO PARTS i.e. PART-1: TECHNICAL & PART-2: COMMERCIAL; DETAILS SHALL BE AS PER SPECIFICATION ENCLOSED.

1.1.2 SUPPLIER IS TO SUBMIT QUALITY ASSURANCE PLAN ALONG WITH OFFER.

1.1.3 SUPPLIER SHOULD SUBMIT WITH THE OFFER, A FLOW CHART OF ACTIVITIES SHOWING ACTIVITIES LIKE DESIGN, MATERIAL PROCUREMENT, MANUFACTURING, TESTING, DESPATCH ETC.

1.1.4 ANY DEVIATIONS SHALL BE CLEARLY BROUGHT OUT IN THE OFFER CLAUSE-WISE AND DOCUMENT-WISE IN THE FIRST INSTANCE ITSELF WITH CLARIFICATIONS/JUSTIFICATIONS. INCOMPLETE OFFER WILL BE REJECTED.

1.2 QUALIFICATION CRITERIA

THE SUPPLIERS SHOULD HAVE MANUFACTURED PTFE LINING BASED THRUST PADS FOR ATLEAST 10 POWER HOUSES WHERE THE THRUST BEARING DESIGN LOAD IS MORE THAN 500,000 Kg. (FOR THIS THE SUPPLIER SHOULD FURNISH RELEVANT DETAILS OF THOSE POWER HOUSES LIKE NAME OF POWER HOUSE, THRUST BEARING DESIGN LOAD IN Kg, PAD SIZE AND PTFE LINING THICKNESS). LATEST VERSION OF THE TECHNOLOGY FOR BONDING OF THE PTFE LINING WITH THE STEEL BASE SHOULD BE ADOPTED.

2. SCOPE OF SUPPLY

2.1 6 SETS OF PTFE FACED THRUST BEARING PADS.
EACH SET CONSISTING OF 20 NUMBERS OF PADS AS PER DRAWING 02550128601.

2.2 DESIGN OF PTFE LINING-
IT IS IN THE SCOPE OF SUPPLY OF SUPPLIER TO DECIDE THE FOLLOWING-

2.2.1 SUPPLIER IS TO DECIDE THE TECHNOLOGY TO BE ADOPTED FOR BONDING OF THE PTFE LINING WITH THE STEEL PAD.

2.2.2 TYPE & DETAILS OF PTFE MATERIAL SHALL BE INFORMED ALONG WITH OFFER.

2.2.3 SUPPLIER IS TO DECIDE THE DESIGN OF THE MESH TO BE USED i.e. THE SUPPLIER IS TO DECIDE THE MATERIAL OF THE WIRE, MESH DENSITY AND THICKNESS OF MESH TO BE ADOPTED & DETAILS SHALL BE FURNISHED ALONGWITH THE OFFER.

2.2.4 BASED ON THE BONDING TECHNOLOGY TO BE ADOPTED & THE MESH DESIGN, THE SUPPLIER IS TO PREPARE HIS THRUST PAD MANUFACTURING DRAWINGS & ALSO SUPPLIER IS TO SUBMIT PERFORMANCE CALCULATIONS.

2.3 MANUFACTURING DRAWINGS AND PERFORMANCE CALCULATIONS TO BE SUBMITTED, AS PER ANNEXURE-'A', TO BHEL FOR APPROVAL BEFORE GOING AHEAD WITH MANUFACTURING.

2.4 MANUFACTURING OF 6 SETS OF THRUST PADS AS PER THE BHEL APPROVED DESIGN/DRAWINGS.

2.5 TECHNOLOGY/PROCESS & METHODOLOGY FOR BONDING OF PTFE WITH STEEL PADS IS TO BE MADE AVAILABLE TO BHEL.

2.6 THE REPAIR PROCEDURE FOR DAMAGED PADS SHALL BE MADE AVAILABLE TO BHEL.

2.7 THE PADS FINISHED AS PER BHEL APPROVED DRAWING TO BE TRANSPORTED TO BHEL BHOPAL.

2.8 THRUST PADS SHALL BE TESTED AT VENDORS WORKS FOR PERFORMANCE TESTING ON TEST RIG.

3. TECHNICAL SPECIFICATION

3.1 INTRODUCTION

THIS SPECIFICATION COVERS THE SCOPE OF SUPPLY, BEARING DESIGN, PERFORMANCE & MANUFACTURING REQUIREMENTS FOR POLY TETRA FLUORO ETHYLENE (PTFE) FACED HYDRODYNAMIC THRUST BEARING PADS.

3.2 DESCRIPTION OF THE THRUST BEARING

THRUST BEARING IS OF TILTED PAD TYPE AND IT WILL BE SUPPORTED ON SPRING MATTRESS. THE THRUST BEARING SHALL BE MOUNTED IN A BRACKET THAT IS COMMON FOR THIS THRUST BEARING AND A GUIDE BEARING.OPERATION OF THE THRUST BEARING SHALL BE UNIDIRECTIONAL. PLUG – IN – TYPE OIL COOLERS, MOUNTED INSIDE THE BEARING HOUSING ARE PROVIDED FOR COOLING. THE CAPACITY OF EACH COOLER IS 48 KW WITH MAXIMUM COOLING WATER TEMPERATURE OF 28° C RELEVANT FACTS ABOUT THE THRUST BEARING ARE AS FOLLOWS-

S.NO	DESCRIPTION	REMARK
1	THRUST BEARING DESIGN LOAD	330,000 Kg (*Including hydraulic thrust*)
2	NORMAL SPEED	300 RPM
3	RUNAWAY SPEED	560 RPM
4	GRADE OF OIL	ISO VG-46
5	OIL QUANTITY IN HOUSING	5200 L
6	GUIDE BEARING LOSSES AT NORMAL SPEED AT RUN AWAY SPEED	 42.42 KW 104 KW
7	EXPECTED MEAN TEMPERATURE OF OIL BATH AT NORMAL SPEED AT RUN AWAY SPEED	 55 ^{O}C 65 ^{O}C
8	DIRECTION OF ROTATION	ANTI-CLOCKWISE LOOKING FROM TOP

4. GUARANTEE

THE SUPPLIER SHALL GURANTEE THE FOLLOWING FOR 24 MONTHS FROM THE DATE OF OPERATIONAL ACCEPTANCE BY THE CUSTOMER-

4.1 PERFORMANCE OF THE BEARING.

4.2 BONDING STRENGTH OF PTFE WITH STEEL PADS SHALL BE ADEQUATE ENOUGH TO AVOID RIPPING OFF OF THE LINING FROM PADS DURING OPERATION UPTO RUNAWAY SPEED CONDITION.

4.3 MAXIMUM PERMISSIBLE PAD OPERATING TEMPERATURE <= 70 ^{0} C.

4.4 BEARING SHALL BE CAPABLE OF SAFE OPERATION WITHOUT ANY DAMAGE UNDER FOLLOWING CONDITIONS-

- CONTINUOUS OPERATION AT ANY SPEED FROM 50% TO FULL RUNAWAY SPEED OF 560 RPM.
- OPERATION FOR A PERIOD OF ATLEAST 15 MINUTES UNDER MAXIMUM RUNAWAY SPEED CONDITIONS WITH COOLING WATER ON.

- OPERATION FOR A PERIOD OF ATLEAST 15 MINUTES AT MAXIMUM ALLOWABLE LOAD & RATED SPEED WITHOUT COOLING WATER FOLLOWED BY SAFE SHUTDOWN.
- OPERATION FOR A PERIOD OF ATLEAST 30 MINUTES AT LOW SPEED OF 0-10 RPM.
- BEARING SHOULD NOT INCUR ANY DAMAGE DURING START AND STOP OPERATIONS OF THE MACHINE. THIS NEEDS SPECIAL ATTENTION SINCE THERE IS NO PROVISION OF HYDRO STATIC LUBRICATION EQUIPMENT.
- PERFORMANCE BANK GUARANTEE FOR 10% AMOUNT OF P.O. VALUE VALID FOR 2 YEARS AND 6 MONTHS SHALL BE FURNISHED BY BIDDER.

5. GENERAL TERMS & CONDITIONS

5.1 THE PADS WILL BE INSPECTED AT VENDORS WORKS BY BHEL'S/THIRD PARTY'S ENGINEERS FOR WHICH MINIMUM 6 WEEKS NOTICE IS REQUIRED ALONGWITH AN INTERNAL TEST REPORT TO MOBILISE DEPUTATION OF ENGINEERS.

5.2 THE EXPECTED LIFE OF BEARING SHALL BE INFORMED ALONG WITH OFFER SUPPORTED BY TECHNICAL LITERATURE / WRITE UP.

5.3 10 COPIES OF TEST CERTIFICATES, MANUAL AND GURANTEE CERTIFICATES TO BE SUBMITTED ALONG WITH THE PACKING BOXES.

5.4 PADS SHALL BE SUPPLIED IN A SUITABLY PACKED IN WATER TIGHT CONDITION TO AVOID ANY DAMAGE DURING TRANSIT & FOR LONG TERM STORAGE OF 5 YEARS.

ANNEXURE-'A'

PERFORMANCE REQUIREMENTS OF THE THRUST BEARING

THIS THRUST BEARING, IN ADDITION TO THE REQUIREMENTS ALREADY STATED IN THE SPECIFICATION, SHOULD BE ABLE TO MEET THE FOLLOWING REQUIREMENTS-

	DESCRIPTION	REQUIREMENT	GURANTEED BY SUPPLIER
1	MINIMUM OIL FILM THICKNESS	$\geq$ 40 µm	VALUES TO BE FURNISHED BY SUPPLIER ALONG WITH CALCULATIONS.
2 2.1 2.2	MAXIMUM PAD TEMPERATURE: AT NORMAL SPEED AT RUNAWAY SPEED	 $\leq$ 70 ^{O}C $\leq$ 80 ^{O}C	
3 3.1 3.2	THRUST BEARING LOSSES: AT NORMAL SPEED AT RUNAWAY SPEED	 ---------- ----------	
4 4.1 4.2 4.3	DEFORMATION OF PADS THERMAL ELASTIC TOTAL (THERMAL+ELASTIC)	 ---------- ---------- ----------	
5	SPECIFIC PRESSURE	47Kgf/cm^2	
6	FEM ANALYSES OF THRUST PADS		*REPORT TO BE SUBMITTED BY VENDOR*
7 7.1 7.2	TEMPERATURE GRADIENT ACROSS RADIAL DIRECTION ACROSS THICKNESS		