BHARAT HEAVY ELECTRICAL LTD.
COPRORATE R&D
VIKASNAGAR
HYDERABAD 500093

SPECIFICATION FOR DEVELOPMENT OF EDM TECHNOLOGY FOR CLOSED 2D IMPELLERS OF CENTIGUGAL COMPRESSOR

Specification Number: Q-E-20-15-730-RD-39/SPEC01 REV00

A. Purpose:

To develop a manufacturing process for closed 2D impellers of centrifugal compressors using EDM technology as per BHEL drawing No. 1-332-08-04982 REV 02.

B. Scope:

Sr. No.	Description	Vendor's Acceptance	Remarks
1	Design and development of manufacturing process for 2D closed impellers of centrifugal compressors (as per BHEL drawing No. 1-332-08-04982 REV 02) using EDM die-sink technology in association with BHEL.		
2	Design and development of EDM electrode, holding fixtures and CNC tool path generation for manufacturing process for 2D closed impellers of centrifugal compressors using EDM technology in association with BHEL.		
3	Optimization of EDM process parameters such as discharge voltage, frequency of current, gap between tool electrode & work piece, ignition delay time, pulse on time, pulse off time, polarity, flushing type, properties of dielectric media, conductivity of electrodes, eroding area, CNC tool path etc.		

4	Inspection of impeller vanes w.r.t. visual, position and dimensional checks by non-destructive methods using touch trigger probes that can reach interior of vanes.		
5	Inspection of vanes of 2D closed impeller for surface roughness using surface roughness measuring probes that can reach interior of vanes.		
6	Development of manufacturing process should be established by using only one sample of machined blank that will be supplied by BHEL. All vanes of the impeller shall be machined.		
7	Deliverables by the vendor shall be:		
	a. Detailed technical report, in MS word format, with detailed drawings, procedures, tool path etc. with recommendation for manufacturing impeller through EDM technology		
	b. Manufactured 2D closed impeller with EDM technology as per BHEL drawing No. 1-332-08-04982 REV 02		
	c. Electrodes used for manufacturing process of 2D closed impeller using EDM technology		
	d. Holding fixtures developed and used during the manufacturing process of 2D closed impeller using EDM technology		
	e. Program code developed during the manufacturing process of 2D closed impeller using EDM technology		

C. Details to be submitted at the time of quotation

Sr. No.	Item	Vendor's Description	Remarks
1	Description of the proposed manufacturing process for 2D closed impeller through EDM technology (Use separate page, if required).		

2	Description of the proposed machine to be used for manufacturing 2D closed impeller through EDM technology (Use Separate page, if required).		

3	Estimated time required for the proposed manufacturing process for each impeller vane. This is for information only and will not be used as evaluation criteria.		

D. Notes and conditions

Sr. No.	Description	Vendor's Acceptance	Remarks
1	Low alloy steel material i.e. forged and machined blank to be used for development of manufacturing process of finished 2D closed impeller through EDM process will be provided by BHEL. Electrodes, holding fixtures etc. and all other material, including any consumables, shall be in scope of supplier.		
2	The material used for 2D closed impeller is low alloy steel X12Cr13. Please see Annexure-I for material properties.		
3	Required surface finish of the 2D closed impeller vanes (through EDM process only) is equal to or less than 0.6 micron Ra.		
4	All designs and drawings related to development of manufacturing process of finished 2D closed impeller through EDM process, tools, tool path, fixtures etc. shall be approved by BHEL personnel before manufacture of tools, fixtures etc. required for carrying out the manufacturing process.		
5	All designs and drawings related to development of manufacturing process of 2D closed impeller through EDM process will be property of BHEL.		
6	All Intellectual Property Rights i.e. patents, copyrights and design rights etc. arising during or after development of this order shall be property of BHEL and vendor shall not apply or		

	claim for any IPR arising during or after development of this order.		
7	Dimensions of raw material i.e. machined blank: O.D 300 mm, and Height 63.59 mm (height) as shown in drawing No. 1-332-08-04982 REV 02. The weight of raw material: 12 kg.		
8	Pre-qualification criteria: Indigenous vendors only.		

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ANNEXURE-1

Properties of Low Alloy Steel Material for 2D impeller As per BHEL specification HY19391

CHEMICAL COMPOSITION:

The steel shall conform to the following Chemical Composition:

Element		C	Si	Mn	Cr	Ni	S	P	S+P	H_2 ppm
Ladle analysis	Min	0.09	-	-	11.5	-	-	-	-	
	Max.	0.15	1.0	1.0	14.0	1.0	0.020	0.020	0.035	2.0
Variation in product analysis		±0.01	+0.05	+0.03	±0.15	+0.03	+0.003	+0.003	-	-

Note: Cr equivalent shall be less than 8.4
(Cr.-eq. = Cr +2Si +1.5Mo +5V +5.5Al -Ni -5Mn –30C –25N)