

Specifications for Arc welding Robot with Hot wire TIG welding Unit		
Specifications for Arc welding Robot		
S.No	Specification	Requirement
1	Arm type	Articulated
2	Number of Axes	6
3	Robot Wrist (4,5,6 axes)	Thermally coated with suitable material to withstand the welding preheat and inter-pass temperatures of 350 deg C.
4	Payload	15 Kgs or more
5	Supplementary Load on robot arm	Minimum 20 Kgs (at base unit/ Joint 1) and Minimum 10 Kgs (at arm/ Joint 3)
6	Repeatability	<= 0.1 mm
7	Linear Max.Speed	>= 1.8 Mtrs./Sec
8	Minimum Axes Range and Minimum Speed required	
	Joint 1	300 deg (150 deg/s)
	Joint 2	170 deg (140 deg/s)
	Joint 3	125 deg (150 deg/s)
	Joint 4	350 deg (330 deg/s)
	Joint 5	200 deg (330 deg/ s)
	Joint 6	700 deg (450 deg/s)
9	Max Reach	1500 mm or more
10	Mounting Position	Floor
11	Noise Level	Max 80 db
12	Motor	AC Servo Motor for all 6 axes
13	Position detection	Absolute position sensing with encoders / resolvers
14	Ambient Temperature	10 deg C to 45 deg c
15	Relative humidity	Max 95%
16	Brakes	Electrical/ Mechanical brakes in all axes
17	Main Applications	Multi pass, continuous arc welding (Hot wire TIG welding)
18	Safety regulations	Should fulfill one or more of the following standard industry applicable safety regulations like EN60204-1:2006 ,ISO 10218-1:2006, ANSI/ RIA R 15.06, UL 1740
19	Pedestal	Minimum 1 Meter height pedestal for mounting the robot on it.
CONTROLLER		
1	Drive System	AC Servo Drive
2	Number of controlled Axes	6 axes
3	Provision for additional axes	Minimum 2 numbers
4	Processor	Multi processor system preferably with PCI bus
5	Operating system	Well proven real time operating system
6	Programming Language	User friendly programming through Teach pendant and Robot programming language
7	Program Memory capacity	Flash disk for mass memory at least 1 MB, expansion and additional back-up facility will be preferred
8	External Storage	PCMCIA Card slot/ RW CD/ DVD drive
9	Other requirements	1. USB memory interface 2.Energy back-up power failure handling 3. Provision for connecting to external key board and external monitor display

S.No	Specification	Requirement
10	External Interfaces	Device net/ Profibus/Interbus/Ethernet
11	Number of I /O points	Minimum 256 digital inputs and 256 digital outputs (Should be expandable)
12	Communication Ports	RS 232 / RS 485 / Ethernet port
13	Protection	IP54
14	Input Voltage	415V +/- 10%, AC 3phase
	OPERATOR'S PANEL (Teach Pendent)	
1	Cable length (from teach pendent to controller)	5m and above
2	Basic Switches	Lockable mushroom type Emergency, Reset, Power On/Off, Mode selector, and other functional keys as required, Joystick/6D Mouse for robot axes moment
3	Visual Display	At least 6 " or larger colour LCD screen on Teach pendent
	SOFTWARE	
1	Simulation software	1. Robot OEM's simulation software license for work cell layout design and modeling 2. Motion simulation for robots 3. Should be able to do Collision detection, reach and cycle time studies.
2	Offline programming software	Robot OEM's off-line programming software license for generating the robot programs offline, which is then downloadable to the robot controller.
3	Welding technology software	Robot OEM's Arc welding technology package for multi pass, continuous welding (TIG) to generate arc welding programs by defining process parameters such as Torch Angle, work angle, Push/ Drag and spin angles, seam and weave data, wire feed, velocity, speed, current, voltage etc.,
	Make	
	Preferably	KUKA,ABB,FANUC,KAWASAKI,MOTOMAN
	Specifications for Hot wire TIG Welding Unit	
	<u>Important Note:</u> The vendor has to quote a suitable hot wire TIG welding unit with wire feeder for the specifications as mentioned below. The controller of TIG welding set up should be compatible to the robot controller. The weld parameters shall be controlled directly from the robot program itself. Hence, the vendor is requested to take necessary care in this regard. It is purely the vendor's responsibility incase of any communication compatibility problem arises between the welding setup and the robot controller. The vendor is also requested to pay the attention on supplementary load carrying capacity of the robot as the welding wire feeder and wire spool shall be mounted on the Robot.	
	Welding Power Source	
1	Process	TIG DC
2	Output	500A (Max)
3	Mains Voltage	3 phase , 415V +/- 15%
4	Mains line protection	35 A MCB/MCCB

S.No	Specification	Requirement
5	Primary Continuous power	15 KVA
6	Cos Phi	0.99
7	Welding current range	3-500 A
8	Welding current range electrode	10-500 A
9	Duty Cycle at 10 Min/40 deg C	40% DC at 500 A
10	Duty Cycle at 10 Min/40 deg C	100% DC at 350A
11	Open-circuit voltage	>= 60V
12	Protection	IP23
13	Working Voltage	10-30V
14	Type of cooling	AF
15	Insulation class	F
16	Conformity	CE
17	Safety	S
19	Automatic cooling unit shutdown	Yes
20	Automatic gas post-flow time	Yes
21	Anti stick function	Yes
22	Digital welding process control	Yes
23	Earth fault monitor	Yes
24	Energy-saving inverter technology	IGBT/MOSFET
25	Hose pack holder	Yes
26	Microprocessor controlled	Yes
27	Non-Contact ignition (HF)	Yes
28	Operating hours counter	Yes
29	Over temperature protection	Yes
30	Temperature controlled fan	Yes
31	Touch down ignition	Yes
32	Operating mode	2- step mode, 4-step mode
33	Pulsed TIG	<ul style="list-style-type: none"> • Conventional Pulsed TIG • High Speed Pulsed TIG
34	Displays	<ul style="list-style-type: none"> • Operating mode • Over temperature • Sequence status • Welding current (actual value) • Welding voltage
35	Adjustable Parameters	<ul style="list-style-type: none"> • Downslope • Electrode diameter • Final (i.e. "end") current • Gas post-flow time • Gas pre-flow time • Hot start • Start arc current • Stepless welding power • TAC (tacking according to program) • Upslope

S.No	Specification	Requirement
36	Adjustable Parameters	<ul style="list-style-type: none"> • Downslope • Electrode diameter • Final (i.e. "end") current • Gas post-flow time • Gas pre-flow time • Hot start • Start arc current • Stepless welding power • TAC (tacking according to program) • Upslope
37	AVC (Automatic Voltage Control)	Yes
38	Material	<ul style="list-style-type: none"> • CrNi • Special metals • Steel
WIRE FEEDERS		
1	Connection voltage	50-60 V
2	Connection capacity	100W-120W
3	Wire feeder Mechanism	Powered rollers
4	Protection	IP34
5	Weight	<=10 Kg
Filler wires		
1	Solid Fe, SS	0.6-2.4 mm dia
2	Flux cored wire	0.8-2.4 mm dia
Wire Spool		
1	Max dia/ Weight	300mm /20 Kg
2	Wire feed speed	0-18 m/min
Water Cooling Unit		
1	Connecting voltage	230 V, I Phase, 50-60 Hz
2	Rated Power	0.1-0.12KW
3	Tank Volume	3 - 5 Lit
4	Cooling capacity	1.0 - 1.25 KW
5	Max flow	4 lit/ min
6	Max Pressure	4 bar
Note: The robot should be capable enough to take care of Wire feeder and wire spool, as they are mounted on it.		
TIG torches		
1	Hot wire TIG torch	Should be able to reach the bottom part of the centre line of groove dimension with cold wire feeding push/pull option. The minimum and maximum dimensions of the groove are attached herewith. The Torch should be suitable to the robot being selected for this project. The weight of the TIG torch including the accessories for feeding the filler wire, should be within the payload capacity of the robot.

S.No	Specification	Requirement
2	Hot wire power source	The system should have integral heating power source for heating the filler wire. Should preferably with same make of welding equipment.
3	Features required	<ul style="list-style-type: none"> • Screwable gas nozzle • Adjusting device for electrode • Holding clamp • Wire feeding tube rotatable with locking mechanism • Exact digital speed regulation • Wire feed forward/Back button
4	Hose pack length	Minimum 6 meters
5	Welding current	450 - 500 A
6	Duty Cycle	100% at 350A
7	Cooling system	Water cooled
8	Wire feed tube/Nozzle	Should have necessary accessories to feed the filler wire into the weld pool and should be attachable to the Torch.
9	Make: Preferably	Miller, Fronius, Lincoln, Kemppi
	Training	2 Engineers from BHEL shall be trained by vendor for a period of one week at vendor's works, for operation, programming, and maintenance of the Robot. A separate training program should be conducted for simulation & off-line programming software. The medium of training/interaction shall be English.
	Qualification criteria for the vendor Credentials	<ol style="list-style-type: none"> 1. Supplier has to furnish references of similar work (TIG/MIG) carried out in India. 2. Major sub assemblies of the system shall have products from the list mentioned below. <ul style="list-style-type: none"> • Motors – SIEMENS/ABB/FANUC/MITSUBISHI/YASKAWA/ROCKWELL/GE • Drives- SIEMENS/ABB/FANUC/MITSUBISHI/YASKAWA/ROCKWELL/GE • PLCs – SIEMENS/ABB/FANUC/MITSUBISHI/YASKAWA/ROCKWELL/ GE/ OMRON
	Pre-dispatch inspection and acceptance of equipment	BHEL engineers deputed for training will be doing pre- acceptance inspection at vendor's works and give dispatch clearance after satisfaction from all angles. During this inspection, all features of the Robot as listed in the specifications shall be tested and the measurements/observations shall be documented.
	Guarantee	Guarantee for complete Robot, Robot Controller, welding equipment, software and all supplied accessories/equipments for 12 months from the date of final acceptance of the Robot after successful E&C of the Robot at BHEL Corporate R&D. Any spares required during commissioning period (before final acceptance of the Robot) shall have to be arranged by the vendor at free of cost and duty levied have to be borne by the vendor.

	AMC	The vendor shall quote separately for Annual Maintenance Contract (AMC) for the equipment, beyond the expiry of guarantee period. This should be on "yearly" basis for a minimum period of 3 years, which may be extended, if required.
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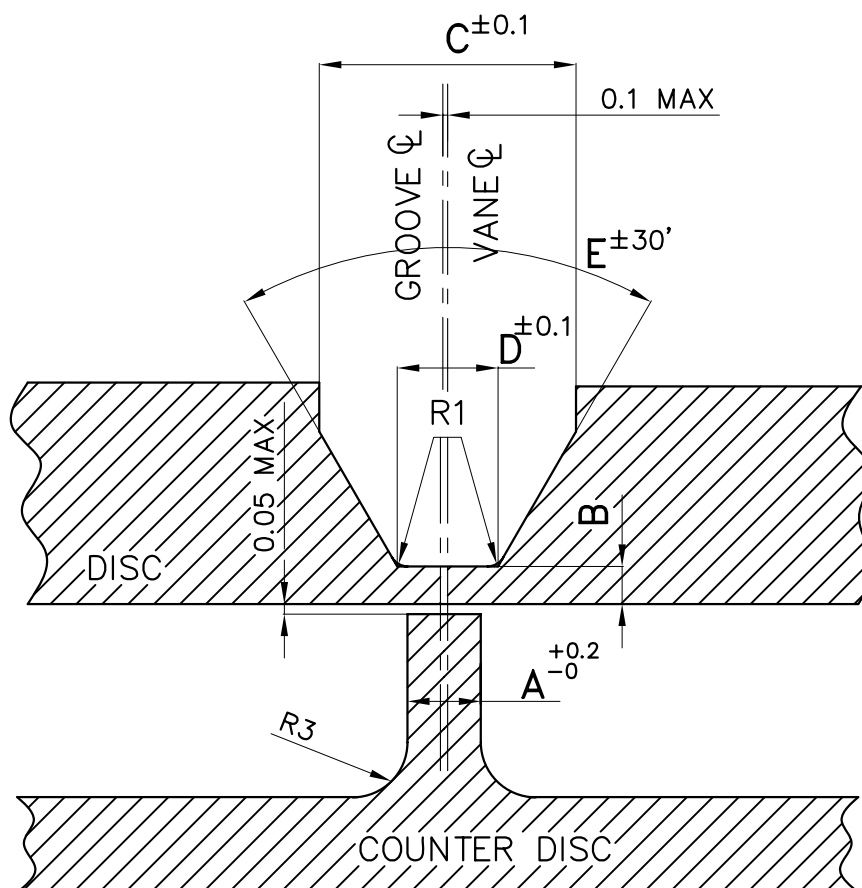
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WELD GROOVE DETAIL ON DISC OF EXTERNAL WELDED IMPELLERS
(FOR QUALIFICATION)



VAR NO	VANE THICKNES A	GROOVE BOTTOM THICKNESS—B			GROOVE TOP WIDTH—C	GROOVE BOTTOM WIDTH—D	GROOVE ANGLE—E°
		MATERIAL					
		HY19377 (KMNCOGNE)	HY19391 (X12Cr13)	HY19395 (FV520B)			
01	4	1.5 ^{±0.05}	1.5 ^{±0.05}	1.5 ^{±0.05}	14	5	60°
02	6	1.5 ^{±0.05}	1.5 ^{±0.05}	1.5 ^{±0.05}	14	7	46°
03	2.5	1.0 ^{+0.2 -0}	1 ^{+0.2 -0}	1 ^{+0.2 -0}	10	3.5	60°

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