



भारता परमाणु अनुसंधान केंद्र
BHABHA ATOMIC RESEARCH CENTRE

80 kV, 12 kW Electron Beam Welding Machine

Electron beam welding is an autogenous joining technique where the heat required for fusion is obtained from the impingement of high energy electrons.

The unique advantages of Electron beam welding are

- Weldability on wide variety of materials (Steel, Cu, Al etc.)
- High weld depth to width ratio (typically 4:1)
- Low Heat affected zone (HAZ)
- Low distortion
- Welding of precision components
- Welding of dissimilar metals (e.g. Cu-SS, SS-Al, SS-Zircaloy etc.)
- Welding of reactive and refractory materials (e.g. Ti, Mo, Zr, W etc)



Key Features

- 12 kW Electron beam gun
- Electromagnetic beam focusing , deflection and oscillation lenses
- Mid frequency SMPS power source
- Work table with CNC motion control
- Vacuum system with programmable pressure controller



Contact

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Electron Beam & Pulsed
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TECHNICAL SPECIFICATIONS

Electron Beam

- **Beam Power** : 12 kW
- **Acceleration Voltage** : 80 kV
- **Max weld thickness** : 24 mm (SS304)
12 mm (Copper)

Vacuum system

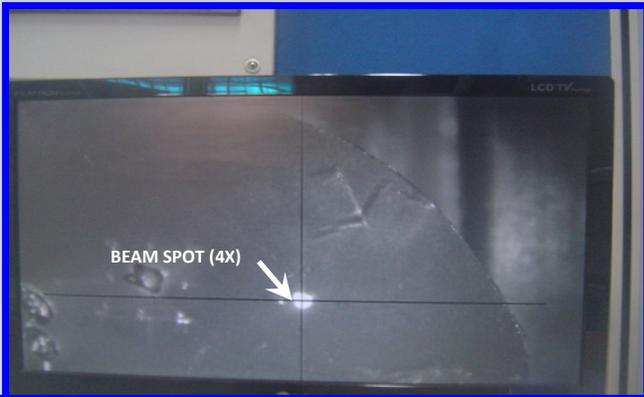
- **Gun Chamber** : 5×10^{-4} Pa
- **Process chamber** : 1×10^{-3} Pa

Job Handling Table

- **X-Y Table (400 x 400 mm)** : 200 mm traverse,
Speed range — 100 to 2000 mm/min
- **Rotary table with tilt facility** : 0 to 360 degrees
Speed range — 0.1 to 20 rpm

Standard Features

- **Interactive PC based SCADA control with touch screen HMI**
- **Offline seam tracking system and beam view through CCD camera**



On-line Beam view system

Large monitor for comfortable job view

Movable cross wire for beam referencing

4X Magnification for precise joint location

Diffuse light for job illumination

Machine learning mode for complex weld contours

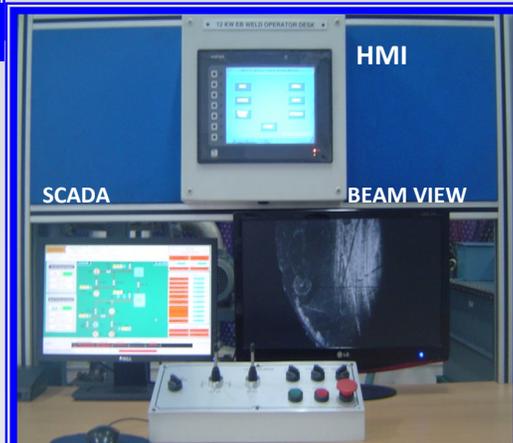
Complete system control through SCADA

Password protected control

Trouble-shooting through touch screen HMI

Prompts operator for system maintenance

Pop-up error messages for easy operation



Operator control desk



Process chamber with job handling table

Non-magnetic construction

Servo driven work handling system

Independent pumping modules for gun chamber (Turbo-molecular pump) and process chamber (Diffusion pump)

Easy to change tantalum emitter

Triode electron gun

Automated Gun diagnostics

Gun close safety interlock



Electron gun with emitter (inset)

VACUUM SYSTEM	MANUAL WELD CYCLE	AUTO WELD CYCLE	SEAM TRACKING	EB GUN CONDITIONING	REPORTS	STATUS			
VIEW MACHINE UTILITIES	VIEW ALARM LOG	VIEW I/O STATUS	MAINTANANCE SCHEDULER	SCADA CONFIGURATION	EXIT	VACUUM SYSTEMS			
LINEAR WELD SELECT WELD AXIS END POSITION 70.00 mm AXIS SPEED 1000 mm/min START STOP CIRCULAR WELD ROTATION ANGLE 360 Deg ROTATION SPEED 0.0 Rpm CURRENT POSITION 0 START STOP MACHINE CENTER HOME MOTION SYSTEM RESET		X-AXIS MOTOR ENABLE DISABLE X-AXIS HOME X-AXIS CO-ORDINATES -0.00 mm Y-AXIS MOTOR ENABLE DISABLE Y-AXIS HOME Y-AXIS CO-ORDINATES -0.00 mm THETA AXIS MOTOR ENABLE DISABLE THETA AXIS HOME THETA AXIS CO-ORDINATES 0.00 Deg		ACCELERATION SUPPLY ON OFF SET ACC VOLT 0.00 kV FILAMENT BIAS SUPPLY ON OFF SET FILAMENT CURRENT 0.00 A DEFLECTION SUPPLY ON OFF SET DEFLECTION DISTANCE X 0.00 mm SET DEFLECTION DISTANCE Y 0.00 mm		FOCUS SUPPLY ON OFF SET FOCUS CURRENT 0.00 mA OSCILLATION SUPPLY ON OFF SET OSCILLATION RADIUS 0.00 mm SET OSCILLATION FREQUENCY 0.00 Hz BEAM CURRENT ON OFF SET BEAM CURRENT 0.00 mA BEAM CURRENT 0.0 mA BEAM RAMP UP TIME 0 Sec BEAM RAMP DOWN TIME 0 Sec		Gun Chamber Vacuum Not Ready Work Chamber Vacuum Not Ready Gun Ch Vacuum 5.7e-005 mb WorkCh Vacuum 8.3e-004 mb Isolation Valve Close Machine Not Ready	
WELD MODE MANUAL WELD TACK PILOT BEAM TRIP TEST TRIP RESET						EB POWER SOURCE Acceleration Supply OFF V 0 KV Filament Supply OFF I 0 A Beam Supply OFF I 0 mA Focus Supply OFF I 0 mA Deflection Supply X-OFF XI -0.00 mm Deflection Supply Y-OFF YI +0.00 mm Oscillation Supply OFF RX 0.00 mm Oscillation Supply OFF RY 0.00 mm Oscillation Supply OFF F 0.00 Hz Bias Supply OFF V 0.00 kV			
ALARM Alarm Description Time ON Time OFF Time ACK Duration Ack All (Ctrl+A) Y Axis Not Enabled 03/29/2012 10:12:46 AM 03/29/2012 10:12:46 AM 0:00:00:00 Reset All (Ctrl-R)						WORK HANDLING SYSTEM X - Axis Not Ready Y - Axis Not Ready Theta - Axis Servo Fault Manual			
CURRENT MACHINE STATUS SCADA Mode Selected EB PLC COMMUNICATION FAILURE									

SCADA control menu



Electrical feedthrough



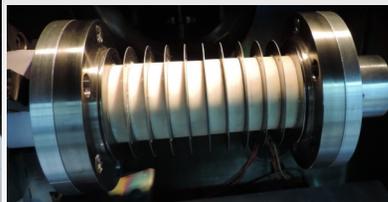
Aluminium Tube to Tube



Copper to Copper



Full Range Vacuum Gauge



Accelerator Tube



Hermetically sealed motor

Vignettes of EB welding