Requirements/Specifications for an 18" cube chamber/

60kV Electron Beam Welder

1.0 Specifications

1.1 The vacuum chamber shall be made out of fully welded stainless steel with internal dimensions of 18 in. x 18 in. x 18 in. cube with a nominal wall thickness of 0.75 in.

1.2 The left side plate of chamber shall have an approximate 9 in. diameter port to which a 14 in. O.D diameter blank flange is attached via an O ring during acceptance testing and shipment. Once delivered to NASA, the blank flange will be removed and NASA's existing 14 in. flanged, 10 in. O.D. x 16 in. long horizontal extension tube shall be attached to the left side plate opening. Exact bolt-hole pattern and vacuum sealing surface dimensions shall be provided after receipt of order. Cost to implement this feature shall be included in the quote.

1.3 The beam viewing must have visualizations displayed on computer screen or separate HD monitor.

1.4 The high voltage power supply shall provide a minimum of 3kW /60kV with an adjustable beam current up to at least 50 ma.

1.5 The welding system shall have a PC based integrated control system for welding parameters, vacuum system functions, data storage and CNC control.

1.6 A touch screen operating panel shall display various functions and status such as EB weld parameters, vacuum status, machine history and servicing data.

1.7 A CNC controllable, double rail, 9 in. square, fully integrated X-Y table shall be installed inside the chamber. Length of rails can be up to 18 in. long. The control system must incorporate CNC backlash compensation.

1.8 A function/circle generator with a beam pulser system must be incorporated to enable widening and narrowing of the electron beam depending on size of parts to be welded without rotation of the part.

1.9 A horizontal rotator must be mounted on the right hand side of chamber.

1.10 A high precision, CNC controllable, internally mounted, manually tiltable, rotator shall be provided.

1.11 The vacuum chamber shall be pumped by an oil free turbo molecular pump and a dry roughing pump. The electron gun section shall be separately pumped by its own oil free turbo

molecular pump and a dry roughing pump. Size of the pumps shall be sufficient to enable pump down of the vacuum chamber to ~ $1x10^{-4}$ mbar, as measured in the vacuum chamber, in 45 – 60 secs. The vent valve shall incorporate a micron size filter.

1.12 An isolation valve shall be provided between the vacuum chamber and electron gun section to keep the electron gun under vacuum during chamber venting.

1.13 A closed loop chiller shall be provided.

1.14 A back-scattered electron beam imaging system shall be provided that will enable an enhanced viewing of the welding area as well as the ability to more precisely determine the exact position of the welding seam.

2.0 Documentation to be provided

2.1 Operating manuals

2.2 Maintenance and Service manuals for all equipment

2.3. CNC programming manual

2.4 Circuit diagrams

2.5 Wiring and cable layout

2.6 Safety Instructions

2.7 Assembly drawings

2.8 Electronic copy of software, drivers and computer system shall be included.

2.0 Recommended spare parts list

3.0 Acceptance Testing

3.1 Acceptance testing will be done at the vendor's plant. Travel expenses will be borne by NASA for the acceptance testing.

4.0 Installation and training

4.1 Installation will be done by the vendor followed by 2 days of on-site training at NASA/GSFC's facility. Two to three GSFC personnel who will be doing the electron beam welding shall receive the training. Cost of the installation and training shall be noted in the vendor's quote.

5.0 Shipping charges

5.1 Shipping charges and any custom duties and fees shall be included in the quotation.

6.0 Delivery Schedule

6.1 Delivery shall be 30 weeks upon receipt of order or sooner.

7.0 Trade in of current NASA electron beam welder

7.1 NASA is currently using a Cambridge Vacuum Engineering Electron Beam welder model CW 604 which is available as an exchange sale trade-in. If interested, vendors may list a trade-in value in their quotation which would be subtracted from the total cost of their proposed electron beam welder. Cost of moving the existing welder from GSFC shall be borne by the vendor.

8.0 On-site visit at vendor's plant

8.1 Each vendor that submits a proposal/quotation must have an electron beam welder having similar critical features that can be viewed by Goddard personnel on-site at the vendor's plant if deemed necessary. Features should include: 1) the optical viewing system, 2) a CNC controlled X-Y table no larger than 12" square, 3) the electron beam generator system that will enable widening and narrowing of the electron beam without rotation of the part, 4) a high precision, CNC controllable, manually tiltable, rotator that is mounted internally inside the eb welder vacuum chamber, 5) example of the pumping system that will be provided for the vacuum and electron gun systems.

The performance, precision and quality of these features will be part of the proposal evaluation process.