



Vacuum Group Procedure VA-008.18.1.67  
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## AGS DIPOLE MAGNET VACUUM CHAMBER WELDING PROCEDURE

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### 1. PURPOSE

1.1 To provide a safe and effective procedure for the welding of bellows, flanges, Pick Up Electrode (PUE) feedthrough assemblies and ion pump conduits (hereafter: components) to AGS dipole magnet chambers removed from the AGS.

**NOTE:**

This work must be done in a radiation work area.

### 2. RESPONSIBILITIES

2.1 The welder shall be responsible for the implementation of this procedure with the assistance of AGS Vacuum group technicians.

### 3. DISCUSSION

3.1 This procedure is written such that the welder will be able to attach new components to the chamber in a way which is efficient and safe. Fixturing has been designed and built to aid in both safety and efficiency. All welding shall be done within the weld-screen enclosure of the welding area of Building 975.

### 4. PRECAUTIONS

4.1 The welder shall be aware of radiation levels of the chambers as indicated on the "traveler" sheet attached to each. The welder shall work in a manner which keeps the radiation dose as low as reasonably attainable.

4.2 The welder shall not weld without being properly protected for this work. Properly protected is defined as wearing welding gloves, job-appropriate shield/goggles, welding jacket, long pants and safety shoes.

- 4.3 The chambers will have been steam cleaned prior to welding. Although radioactive, the chambers will be free of contamination.

## **5. PREREQUISITES**

- 5.1 The welder will have been trained in this procedure. This includes training and/or experience in the welding of any combination of: Inconel X7 50, Inconel 625, Inconel 82 (as a filler material), and the following stainless steels: 304L, 316L, 304 or 316.
- 5.2 Activation Worker Training (BNL OH&S Guide 3.5.0) is required for all welder/helpers.
- 5.3 Safety/protective clothing and wearing of a film badge and self-reading dosimeter are required for this procedure. (See 4.2)
- 5.4 All welds on the chambers will be per the appropriate chamber assembly drawing. This drawing number will be indicated on the "traveler sheet" attached to each chamber.
- 5.5 To keep the facility efficient and safe, the welding area will be cleaned and swept at the end of each shift.

## **6. OPERATIONAL PROCEDURE**

- 6.1 Chambers, with the "travelers" attached, will be carried, by a minimum of two (2) people into the welding area. The chamber will be placed in the welding fixture. The weld screens will be closed such that weld-arc flash cannot exit the welding area at eye-level.
- 6.2 With chamber hold down plates swung out of the way, the chamber will be placed in the welding fixture such that ion pump, pumpout stub rests on the narrow NEMA support on the outrigger table. This table will also support the banking plate for the welding of the new ion pump conduit to the pump out stub. The chamber will slide back until the pumpout stub contacts the "Z"-clamp. The clamp will be tightened in place. Both sets of hand-operated "vee-pads" will be cranked snugly against the chamber. The chamber hold down plates will be swung in to place and the fluted knobs tightened.
- 6.3 The conduit to be welded on to the pumpout stub will be placed into the banking plate "cradle". With the ceramic-coated flange flush to the banking plate, secure the conduit in place with the hold down bar and tighten the bar with the knobs.
- 6.4 Slide the "cradle", containing the conduit, towards the pump out stub until the 4" opening of the conduit contacts the stub.
- 6.5 Using a bubble level, or an equivalent device, verify the stub/conduit interface to

be level. Check the chamber length to be level as well. If either of these locations are not true, adjust clamps as required until components are level. (Note: shim as required.)

- 6.6 The purging system will be installed and the argon purge started. With the conduit and stub properly aligned, tack the conduit to the stub. At this time the weld, as indicated in the appropriate drawing, may be made around this tube connection. At least one-half of the weld should be made in this position. The completion of this weld will be made when the fixture is rotated.
- 6.7 The attachment of the flange/bellows assembly to the chamber requires the assistance of a vacuum group technician. The proper required length of the chamber will be determined and a filler welded in place, if necessary. An argon purge will be used during this operation. The vacuum group technician will verify the chamber length and choose a clean and leak checked bellows assembly of the appropriate type. (Note: the vacuum group technician must wear appropriate gloves and shield /goggles when in the weld area while welding is being done.) The argon purging system for the chamber will be installed. The purge will be started. The purge gas will be maintained at a level to prevent weld oxidation before any welding begins. The technician will properly align the bellows assembly. The welder will tack the assembly in place. Once properly aligned and tacked, the top portion of the weld (one-half or more) will be executed in accordance with the drawing.
- 6.8 For chambers requiring it, the PUE is welded on as follows. A new PUE feedthrough will be loosely bolted to the PUE welding support. The side of the welding support without gussets should face the assembler. The PUE should be bolted to the support such that the tube will face to the left. The PUE table must be mounted to the fixture table. Placing the support (with PUE attached) on the PUE table, move the support such that the PUE properly aligns for the weld indicated on the drawing. Tighten the bolts securing the PUE flange to the support. Install the purge system. Purge the area to be welded with argon. Tack and weld the PUE in place. The entire weld must be made from this position.
- 6.9 With the top portion of all assembly and conduit welds complete the fixture must be rotated. The fixture is rotated by releasing the conduit from the cradle and the "Z"-clamp. Once this is done, the conduit is grasped with two hands and swept, by hand, through a counter-clockwise arc. Care should be taken when approaching the opposing outrigger table that the chamber is set down gently. The welder is encouraged to request help in this portion of the procedure.
- 6.10 After rotation of the fixture, the conduit and assembly welds must be completed in accordance with the drawings.

- 6.11 The fixture will be rotated clockwise; the hold bars swung back and the chamber removed from the fixture. The chamber will be removed from the welding area to abeyance or leakchecking.

**7. ACCEPTANCE CRITERIA**

- 7.1 All welds must be as per drawing requirements (i.e.: vacuum tight, free of oxidation, etc.).
- 7.2 The conduits and assemblies will be properly aligned to allow easy replacement of the chambers in their respective type of dipole magnet.
- 7.3 All chambers will be measured to assure the final dimensions agree with the requirement listed on the "traveler sheet". Any discrepancies will be noted on the "traveler".