

<b>PRINCETON PLASMA PHYSICS LABORATORY</b>	<b>ENGINEERING STANDARD</b>	<b>No. ES-MECH-006, Rev. 0 Page 1 of 2</b>
<b>Subject:  CRYOGENIC PIPE/TUBING, FITTINGS AND BELLOWS WELDING STANDARD</b>	<b>Effective Date:</b>  <b>June 21, 2002</b>	<b>Initiated:</b>  F.O.M. Division
	<b>Supersedes:</b>  New	<b>Approved:</b>  Engineering & Technology Infrastructure Department Head

**Applicability:** This Engineering Standard provides the criteria for seal welds for cryogenic piping and tubing. These seal welds are designed to be leak tight to high vacuum standards and to provide leak tight barriers for the cryogenic fluids. These welds are seal welds only and reinforcing welds or tacks are not shown but can be used on an as needed basis.

**Introduction:** This standard specifies the welding for cryogenics components such as pipe/tubing, fittings and bellows. It is important that vacuum integrity be maintained and that high vacuum standards and leak tightness be employed for all welds. This standard delineates those welding methods.

**Reference Documents:**

- PPPL Procedure EM-002, General Welding and Brazing Requirements
- ASME Code B31.3, Process Piping, Category D
- B-8AG103, Cryogenic Pipe/Tube and Fittings Welding Standard (drawing)
- B-8AG104, Cryogenic Bellows Welding Standard (drawing)
- OP-VV-74, Leak Checking Using an HMSLD
- ES-MECH-005, Seal Welds on Conflat Flanges

**Standard:**

The arrangements for various cryogenic components are shown in the drawing references above. All of the welds shown are seal welds. Reinforcing welds or tacks (not shown) can be used on an as-needed basis.

**Welding Requirements:**

- All of the welding shall be performed in accordance with the requirements of the ASME Code B31.3, Process Piping, Category D and PPPL Procedure EM-002.
- The weld size shall match the wall thickness of the thinner component as a minimum.
- All bellows should be welded or formed bellows only.
- Do not use resistance welded ends.
- Internal seal welds will be used if feasible and external seal welds used otherwise.
- In no case are both an internal and external seal weld to be used on the same joint, thereby precluding trapped volumes.
- When a bellows is welded to a flange, the flange should be machined to the thickness of the bellows.
- When necessary, insulation should be wrapped in aluminum foil to protect it during the welding process.

**Materials:**

- All components should be Type 304, 304L or 316 stainless steel in accordance with applicable ASTM standards listed in ASME B31.3.

**Leak Checking:**

- All internal welds should be leak checked before being captured precluding any further welding of the seal.
- Leak checking shall be performed in accordance with approved PPPL leak checking practices.
- Welds should be leak checked at cryogenic temperatures when possible.

**Inspections:**

- Visual inspections are to be performed on all welds.