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## Weld Procedure Produces Quality Welds for Thick Sections of Hastelloy-X

**The problem:**

To produce premium quality, multipass welds in heavy tube sections of Hastelloy-X. Characteristics of this nickel base alloy are its inherent susceptibility to hot cracking and microfissuring from the thermal strains induced by the welding cycle. The repeated thermal stresses imposed by multipass welding increases the susceptibility of the alloy to this cracking phenomenon.

**The solution:**

A welding program to develop semiautomatic tungsten/inert gas (TIG) procedures, weld wire procurement specifications, material weld properties, welder-operator training, and nondestructive testing (NDT) inspection techniques and procedures to produce the high quality welds required.

**How it's done:**

Tube is rotated in tilt table positioner beneath a stationary TIG semiautomatic weld torch. Welding amperage, voltage, wire feed rate, shielding gas flow, and rotational travel speeds are preset. Weld passes are deposited following an alternating ID/OD pass sequence to balance weld shrinkage forces and minimize distortion. Tube is tilted on longitudinal axis, as required for each pass, to present joint area being welded in a horizontal position relative to vertical alignment of torch, and to prevent lack of fusion caused by gravity flow of molten weld metal.

**Notes:**

1. Premium weld quality was attained by adherence to approved weld procedures which evolved during a development program, by use of high quality weld wire produced to requirements of procurement specification, and by utilizing specially trained welding operators for this specific task.
2. This procedure may be used to advantage in the welding of chemical equipment (autoclaves, flanges) and high-temperature processing facilities (furnace mufflers, grates, etc.).
3. Additional details are contained in a technical paper, *Welding of Thick Sections of Hastelloy-X for the PHOEBUS-2 Nozzle,* by C. W. Fletcher, F. J. Flens, and L. F. Glasier, Jr., 19 August 1966, for the American Welding Society. Copies of this paper are available from:

   Technology Utilization Officer
   AEC–NASA Space Nuclear Propulsion Office
   U.S. Atomic Energy Commission
   Washington, D.C. 20545
   Reference: B67-10195

**Patent status:**

No patent action is contemplated by AEC or NASA.

Source: C. W. Fletcher, F. J. Flens, and L. F. Glasier, Jr. of Aerojet General under contract to AEC–NASA Space Nuclear Propulsion Office (NUC-10048)

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