Standard Operating Procedure	SOP No.
Gas Tungsten Arc Welding (GTAW) – AL- 6XN Alloy	5.046

DCR No.: 10016
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1 Purpose

1.1 To establish a standard operating procedure (SOP) for tacking, orbital/automatic and manual gas tungsten arc welding (GTAW) for AL-6XN alloy (UNS Designation # N08367).

2 Scope

2.1 This procedure applies to high-purity AL-6XN super austenitic stainless steel tubing and tool hookup assemblies requiring GTAW.

3 Responsibility

3.1 Therma general foreman (GF) manages the welders and verifies compliance with this procedure.

3.2 The welders certified as per SOP # 7.009 (GTAW Welder Performance Qualification) shall be responsible for the following procedures.

4 Reference

4.1 American Society of Mechanical Engineers (ASME) Boiler & Pressure Vessel Code, Section IX for Welding and Brazing Qualifications, current edition/addenda.

5 Procedures

5.1 Perform the welds as per fabrication/isometric drawing.

5.2 Review SOP # 7.005 (GTAW Weld Examination) for acceptance criteria of welds and SOP # 7.024 (Coupons) for frequency of coupon fabrication.

5.3 Use piping and materials prepared under SOP # 5.004 (Materials Preparation for GTAW in Pharmaceutical).

5.4 Check for proper alignment. Over-matched alloy insert rings (625, C22) shall be placed in every joint.

5.5 All weld joints shall be tacked prior to automatic and/or manual welding. Either side of the ring shall be tacked to the tube, fitting, or valve to hold the joint connected. Tacks shall be done by fusing the edges of the rings to the joint surfaces so that the height of the tacks does not exceed the height of the rings (e.g., .022" for 1.5" OD)

Note: Tacks must be made with the sole purpose of holding the weld joint(s) connected. Thus, tacks shall not exceed final weld bead width, nor shall they fully penetrate the wall thickness of the base material. Such tacks are commonly referred to as "feather" or "skin" tacks.

5.6 Clean outside diameter (OD) discoloration around tack weld by wire brush and/or emery cloth. Wipe off residuals with IPA (isopropyl alcohol) soaked lint-free cloth.

5.7 Verify the following:

5.7.1 The orbital welding machine is connected to a dedicated electrical circuit. This is done to prevent an electrical surge in the power supply.

Note: The electrode is sharpened to the manufacturer's recommendations.

5.8 Ensure the weld program parameters are set to perform the weld. The weld program must be an approved weld program as documented under SOP # 5.024 (Weld Programs). Welding operator shall make note of the arc gap to accommodate for the height of the insert ring and more frequent tungsten electrode changes. Arc gap shall be noted on the parameter sheet printed by the welding machine. When the first weld made with new electrode cannot be borescope inspected due to configuration limitations, welding operator shall make a new weld sample coupon to ensure that weld bead characteristics are within weld acceptance criteria.

Note: Final weld beads of AL-6XN joints will be wider than standard stainless steel fusion joints due to the higher heat input necessary to melt the insert rings along with the base metal in each joint and additional joint gap (e.g., .031" for 1.5" OD). Final weld bead shall not exceed 2.5T or 2.5 X base material wall thickness.

5.9 Perform Weld.

5.10 Post weld purge and wire brush exterior of weld using a stainless steel brush to minimize OD discoloration and label the weld with a Therma weld number as per step 5.11.1.

5.11 Weld labeling

5.11.1 All welds shall be serialized with an alphanumeric identification. The first three numbers identify the Therma orbital machine serial number. Followed by an alphanumeric characters (SW) or (FW) for shop or field weld. The subsequent numeric digits identify the weld number, on that job. Example: 049SW010 is the tenth shop weld made with welding machine "049".

5.11.2 All weld coupons shall be serialized with alphanumeric identification. The first three numbers identify the Therma orbital machine serial number. Followed by alphanumeric characters (SC) or (FC) for shop or field coupon. Example: 049SC010 is the tenth shop coupon made with welding machine "049".

5.11.3 The following information must be filled in by the welder after a weld has been made, use Weld & Coupon Log. Form, # FN 5005.1 and Orbital Weld Log, Form # FN 5005.5 found on the back of each fabrication/isometric drawing.

5.11.3.1 Welding machine model & serial #

5.11.3.2 Weld head model & serial #

5.11.3.3 Welder/Operator's initials

5.11.3.4 Date

5.11.3.5 Weld number

5.11.3.6 Time

5.11.3.7 Fabrication/isometric drawing # & Revision #

5.11.3.8 Weld program

5.11.3.9 Size (e.g. OD)

5.11.3.10 Heat numbers for joints

5.11.3.11 Bulk argon or dewar serial #

5.11.4 Label the weld as per project specifications. Place number by the weld on the tube.

5.11.5 Enter the same weld number on the fabrication/isometric drawing. Same as SOP 5.005.

5.12 Indicate on the Form # FN 5.005.1 (Weld & Coupon Log), mandatory weld examination if the weld was made under the following conditions.

5.12.1 The welding machine was not operated for more than 30 minutes. This applies to the first weld of a shift.

5.12.2 The weld head was changed for a new diameter.

5.12.3 A new purge gas has been used.

5.12.4 Power interruption.

5.12.5 New or re-sharpened electrode.

5.13 Welds requiring repair

5.13.1 If the welder deems that the weld does not meet the examination criteria prior to documenting the weld on the Form # FN 5.005.1 (Weld & Coupon Log), cut out the weld and make a new weldment using the same weld number.

5.13.2 If a weld does not meet the weld requirement and can be rectified by one additional weld pass, redo the weld and label the weld in the weld log with the suffix R. Example 049-010 is identified as 049-010-R in the log only.

5.13.3 If the rejected weld cannot be repaired by means of a second pass, then the following shall apply:

5.13.3.1 Cut out the weld.

5.13.3.2 Perform the new weld.

5.13.3.3 Update/revise the fabrication/isometric drawing.

5.13.3.4 Assign the weld a new number.

5.13.3.5 Log the weld as indicated in step 5.11 (Weld Labeling).

5.13.3.6 Amend the Form # FN 5.005.1 Weld & Coupon Log and Form # FN 5.005.5 Orbital Weld Log found on the back of each fabrication/isometric drawing to indicate under the comment column that the particular weld has been replaced by a new weld number.

5.14 If the welding is being performed in the prefab shop, repeat steps 5.2 through 5.12 until the prefabrication assembly is complete.

5.15 Notify Quality Control Examiner (QCE) of completion and forward the fabrication/isometric drawing to the Examiner.

5.16 General note: The orbital welding machines are to be left running during any single shift and not to be turned off during breaks and lunches.

6 Review and Approval

6.1 The QCE shall examine and approve welds as prescribed in SOP # 7.005 (GTAW weld examination).

6.2 The QCE is to fill in the balance of the columns in the Form # FN 5.005.1 Weld & Coupon Log and Form # FN 5.005.5 Orbital Weld Log found on the back of each fabrication/isometric drawing.

Document Approval

Steve Russoni
Engineering Manager

11/14/11
Date

Field / Operations Manager

12-27-11
Date

Process Systems Manager

17 FEB 12
Date

Quality Assurance Manager

05 JAN 12
Date