## BRAZING PROCEDURE QUALIFICATION TRAVELER BPQR No.

## LANL Welding Program

**PART I: To be Completed by the LANL Welding Program Administrator**

**A. Code Edition and Addenda:**

☐ ASME Section IX: Edition: 200 Addenda:
☐ AWS D1.1: Edition: Addenda:
☐ API: Edition: Appendix:
☐ Other Applicable Documents:

**B. Base Metal:**

1. Material Spec., Type & Grade: to
2. ASME P-No. and Group: to
3. Carbon Equivalent: to
4. Thickness of Weld Test Coupons: to
5. Diameter (if applicable): to
6. Type of Backing:
7. Other Requirements: Clean to bright metal with abrasive cloth and alcohol or equivalent

**C. Braze Filler Metal:**

| | | | |
|---|---|---|---|
| 1. | ASME Specification: | SFA | |
| 2. | AWS Classification: | | |
| 3. | ASME Weld Metal Analysis A No.: | A- | |
| 4. | ASME Filler Metal Group F No.: | F- | |
| 5. | Filler Metal Size/Shape/Form: | | |

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**D. Brazing Process and Parameters:**

1. Process: Oxy/fuel (acetylene/Apache/or equal)
Fill: 100% - Full flow
2. Fuel Gas: ______ at ______ psi cfh______
3. Back Purge Gas: ______ at ______ CFH
For Number of Passes ______
$O_2$ Content of Purge Gas Before Welding ______ $CO_2$
4. Preheat Minimum: Ambient (room temp. ~73°F
5. Interpass Temperature: ______ °F maximum (achieve for at least one pass)
6. Electrical Characteristics: (List by Brazing Process)
Process ______ Current ______ Polarity ______ Transfer Mode ______
Process ______ Current ______ Polarity ______ Transfer Mode ______
7. Filler Placement Technique: Neutral flame – Full flow
8. Single Pass or Multipass Technique: S
9. Brazing Position to be Tested: Horizontal and Vertical (5F & 2F)
Type of Progression: Vertical up flow and Horizontal flow
10. Process parameters

| Process | Pass | Filler Metal Diameter | Tip Size | | | | |
|---|---|---|---|---|---|---|---|
| TB | 1 | | | | | | |

11. Joint Design to Use ***(See next page)***

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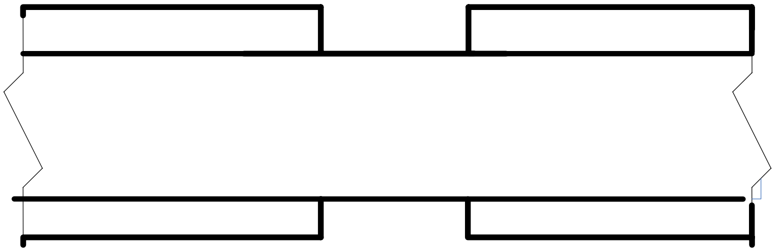

Lap Length = I.D Tube= O.D. Tube

12. Post Braze Heat Treatment: (PBHT) ☐ Yes ☐ No

Temperature: ____________________ °F

Time @ Temperature: ____________________ hr

**E. Tests to be Performed:**

1. Mechanical Test:

a. Tensile Tests: ☐ Yes ☐ No

Number of Specimens: __________ Type: __________ Per Fig.: 462.1 (c)__________

Location of Specimens: Per QB 461.1 (e)

Acceptance Per: 451.3__________ psi

b. Peel Tests: ☐ Yes ☐ No

Number of Side Bend Specimens: __________Per Fig.: __________

Number of Peel Specimens: __________Per Fig.: QB 462.3

Location of Specimens: QB 463.1 (e)

Acceptance Per: QB 451.3

1. Test Temperature: Room temp. (~73°

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2. Number of Specimens: Base Metal: ___________Filler Metal: _____________________

Location of Specimens: ________________________________________________

Per Figure: ________________________Visual Inspection:________________________

Minimum Acceptance: _____________Ft-Lbs _____________Mils Lateral Expansion

2. Metallographic Tests

a. Macro Etch Section Tests: ☐ Yes ☐ No

Number of Specimens: ______________________________________________________

Inspected at:_______________________________________________ % magnification

Acceptance Per: ___________________________________________________________

3. Nondestructive Tests: ☐ Yes ☐ No

Radiographic:______________________________________________________________

Acceptance Per: ____________________________________________________________

4. Other Required Tests: ______________________________________________________

______________________________________________________________________

______________________________________________________________________

______________________________________________________________________

**LANL Welding Program Administrator DATE**

| | Specification | Manufacturer (Trade Name) | Heat/Lot No. |
|---|---|---|---|
| Base Metal | | | |
| Base Metal | | | |
| Backing Strap Material | | | |
| Purge Gas | | | |
| Filler Metal | | | |
| Flux | | | |

| | Oxygen Analyzer | Amp Meter | Volt Meter | Shield Gas Flow meter |
|---|---|---|---|---|

1. Fit-up: ☐ Satisfactory ☐ Unsatisfactory
2. Pre-test Cleaning: ☐ Satisfactory ☐ Unsatisfactory

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Verified By:________________________________ Z No. __________________ Date:_______________

**E. In-process Inspection:**

1. Purge: Oxygen Analyzer Reading:_______________________________________________
2. Preheat Temp:. Ambient (Room temp ~73°F)________________________________________
3. Brazing Progression: ☐ V/Up & Horizontal ☐ Downhill
4. Current Type and Polarity

   GTAW ☐ DCEP ☐ DCEN ☐ AC

   Other: _________ ☐ ☐ ☐
5. Type of Brazing: ☐ Manual ☐ Semi-automatic ☐ Automatic
6. Verify: # Tip
   a. Supplemental filler metals used: (Flux) ☐ Yes ☐ No
   b. Supplementary powdered filler metals used: ☐ Yes ☐ No
   c. Rolling direction to weld: ☐ Parallel ☐ Perpendicular
7. Initial and interpass cleaning method: Abrasive cloth/file/SS brush___________________________

8. Document weld parameters (for each pass): See Braze Parameter Sheet
   a. Record on the brazing parameter sheet for each pass, ~ the temperature, and feed placement technique
   b. Prepare a sketch on the weld parameter sheet showing the braze joint configuration.

9. Record the maximum interpass temperature:_______________________________________
10. Post Braze Cleaning: ☐ Satisfactory ☐ Unsatisfactory

Verified By: ______________________________ Z No. _______________ Date ______________________

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| Date | Pass | Process | Filler Metal Size | Gas | Flow | Tip |
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### F. Final Inspection:

Visual Inspection: ☐ Satisfactory ☐ Unsatisfactory

Verified By: ________________________________ Z No. __________ Date: ______________

### G. Post Braze Heat Treatment (PBHT)

Time @ Temperature:

☐ Satisfactory ☐ Unsatisfactory ☐ N/A

Temperature: ______________________ °F Duration: _________________________ hrs./min.

Verified By: ________________________________ Z No. ________________ Date: ____________

### H. Test Specimen Preparation:

Verify the number of test specimens, specimen geometry, size, location, and orientation are documented for the following:

Tensile Tests: ☐ Satisfactory ☐ Unsatisfactory ☐ N/A

Peel Tests: ☐ Satisfactory ☐ Unsatisfactory ☐ N/A

Macro Etch Section Tests: ☐ Satisfactory ☐ Unsatisfactory ☐ N/A

Other: ______________________ ☐ Satisfactory ☐ Unsatisfactory ☐ N/A

Verified By: ____________________________ Z No. ___________________ Date: ____________

### I. Mechanical Test Results:

1. Tensile Tests:

| Specimen No. | Dimensions | | Area (sq. in.) | Ultimate Total Load (lbs.) | Ultimate Tensile Strength (ksi) | Location and Type of Failure |
|---|---|---|---|---|---|---|
| | Width | Thickness | | | | |
| **T-1 V** | | | | | | |
| **T-2 V** | | | | | | |
| **T-3 H** | | | | | | |
| **T-4 H** | | | | | | |

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2. Bend Back Tests:

| Type and Figure No. | Results |
|---|---|
| **BB-1** | |
| **BB-2** | |
| **BB-3** | |
| **BB-4** | |

3. Peel Tests:

| Specimen No. | Location | Specimen Size | Test. Temp. | Peel Values | | |
|---|---|---|---|---|---|---|
| | | | | | % Shear | Mils |
| **P-1 V** | | | | | | |
| **P-2 V** | | | | | | |
| **P-3 H** | | | | | | |
| **P-4 H** | | | | | | |
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**J. Metallographic Test Results:**

1. Macro Etch Section Test Results:

Inspection Magnification: ____________________

Findings: ____________________

2. Magnetic Verification of Delta-Ferrite Tests Results:

50% Weld Level:____________________

Completed Weld:____________________

**K. Nondestructive Tests:**

Radiography: ☐ Accepted ☐ Rejected

Film Interpreted by: ____________________

If Rejected, explain problem: ____________________

____________________

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**L.** **Other Required Tests: ______________________________________________**

**DATE**

**M.** **Laboratory Test Data and Results Certified Correct:**

______________________________________________ ______________

**LANL Welding Program Administrator** **DATE**