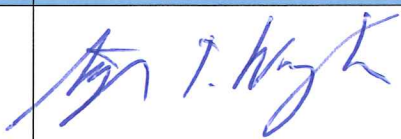








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Brazing Procedure

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Approval

<i>Approving Authority</i>	<i>Name</i>	<i>Signature</i>	<i>Date</i>
Quality Assurance Manager	Stephen Washington		15 NOV 2018
Process Systems Manager	Michael Delgado		07 JAN 2019
V.P. Engineering	Steve Rusconi		11 DEC 2018
Operations Manager	Steve Hansen		11 DEC 2018
President	Joseph Parisi		11 Dec 2018

Revision History

<i>Revision #</i>	<i>Description of Change</i>	<i>Effective Date</i>	<i>DCR#</i>
4	Process modifications	7/29/03	03046
5	Text Clarifications	03/06/12	10009
6	Data Format Modifications	07 JAN 2019	17009



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Purpose

- 1.1 To establish a standard procedure for the qualification of all Therma brazers and the brazing procedures they employ in making high purity copper brazed joints with the torch brazing (TB) process.

2 Scope

- 2.1 This procedure applies to the preparation of Brazing Procedure Specifications (BPS), Procedure Qualification Records (PQR), and Brazer Performance Qualifications (BPQ) as employed in torch brazing high purity copper piping and tool hookup assemblies.

3 Responsibilities

- 3.1 All brazing procedures and performance qualifications will be carried out under direct guidance and supervision of Therma QA/QC personnel.
- 3.2 All qualified brazers shall be responsible for performing production brazing as per procedures set out herein.
- 3.3 The Quality Control Manager (QCM) shall assign the appropriate BPS for the work per the project specifications, base metals and code requirements.

4 Reference

- 4.1 ASME Code Section IX, Part QB Brazing, current edition.

5 Procedures

- 5.1 Review project specifications and ensure that Brazing Procedure Specifications, and Procedure Qualification Records as recorded in FN 5.013.1 and FN 5.013.2 satisfy the torch brazing requirements for each particular job.
- 5.2 Make sure that filler metal alloy, 95/5 or 15% Silvalloy matches job specification requirements.
- 5.3 Examine tubing and fitting materials to verify compliance with specs for cleaning, bagging, etc., and to verify that cleanliness has been maintained.



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- 5.3.1 If any materials do not conform, document the details and perform required cleaning (NFPA-99 & CGA G-4.1) or remove from work area.
- 5.3.2 Cleaned tube and fittings shall be placed into heat sealed bags individually and labeled. Each label shall appear as follows:
 - 5.3.2.1 Cleaned by THERMA per NFPA-99 & CGA G-4.1
- 5.4 Verify that purging/backing gas source meets specifications. Purge gas shall be High Purity Nitrogen NF or per job specs.
 - 5.4.1 Nitrogen National Formulary (NF- especially pure in content and particulate) shall be used for MEDGAS installations.
 - 5.4.2 Nitrogen cylinders shall have purity documentation attached and visible.
- 5.5 Verify all tools and equipment have been cleaned and free of oil or hydrocarbon contaminants.
- 5.6 Seal the ends of the piping assembly by means of suitable plastic bags.
- 5.7 Examine the piping assembly for proper orientation(s), dimensions and visible damage.
- 5.8 Remove plastic bags off the ends of the piping assembly.
- 5.9 Install a purge restrictor to the outlet of the purged assembly. Prepare the document with the following parameters:
 - 5.9.1 The purge restrictor shall be a compression cap or plug with a hole drilled through its center. Restriction holes can be 1/8" to 1/4" depending on the OD of the pipe.
 - 5.9.2 The purge restrictor shall be a minimum of 8" from the joint being brazed.
- 5.10 Adjust purge flow rate proportionate to pipe and restriction hole size. In case of complex configurations brazer shall use a magnehelic gauge for proper backpressure settings.
 - 5.10.1 The purge line shall consist of a clean regulator, flow meter, and a flexible line such as clean Teflon.



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- 5.10.2 No valves shall be installed on the purge line.
- 5.11 Pre-purge for at least 5 minutes for each 20 feet of tubing length.
- 5.12 Start brazing from the joint closest to the purge inlet.
 - 5.12.1 For Brazer Performance Qualification (BPQ) test coupons, use a 1-1/2" TEE fitting and braze both ends of the run on the tee.
 - 5.12.1.1 The first BPQ test joint shall be in the flat-flow, horizontal position with an angular deviation of maximum ± 15 degrees.
 - 5.12.1.2 The second BPQ test joint shall be with axis vertical ± 15 degrees, and filler flows vertically upwards.
- 5.13 Start preheating the pipe away from the fitting with torch moving constantly.
- 5.14 After preheating the pipe, move on to preheat the fitting.
- 5.15 Continue heating both, pipe and fitting, until they are a uniform red in color.
- 5.16 Apply filler metal alloy first to the bottom of the joint and work it up each side until the entire circumference of the joint is covered. Same applies to vertical joints with appropriate application angle offset.
- 5.17 While applying the filler metal alloy, keep the heat on the fitting.
- 5.18 After the entire circumference of the joint is covered, move torch around the end of the fitting cup and apply filler cap bead.
- 5.19 Let pipe and fittings cool naturally. The purge gas flow shall be maintained until after completion of the joint until it is cool enough to hold with bare hands, approximately 110 °F
- 5.20 Record the brazing data on the brazing map (spool drawing) and the Brazing Joint Log form FN5.013.4 as required per project specifications.
 - 5.20.1 Record on the map the Brazer's ID# & joint # at the location for the joint on the map.



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- 5.20.1.1 Each Brazer shall ID their joints beginning with the #01 on each brazing map.
 - 5.20.2 Record the joint ID# on the log.
 - 5.20.3 Record the purge gas flow rate on the log.
 - 5.20.4 Record the Brazer's ID # and name on the log.
 - 5.20.5 Record the Date and Time on the log.
 - 5.21 Therma Quality Control Examiner (QCE) shall examine brazed joints as required and record results on the Braze Joint Log form.
 - 5.21.1 If 3rd Party Inspections are required, the Inspector shall record the results on the log.
 - 5.22 Turn off flow meter and disconnect the purge line.
 - 5.23 Disconnect the purge restrictor and tape plastic bag over the purge restrictor.
 - 6 When braze joint is for a Brazer Performance Qualification (BPQ) test coupon, remove and prepare specimen as per QB 463.2(c) in ASME Code Section IX. (Polish each side of the specimen and deliver to the QA/QC Dept. for examination).
 - 6.1 The QC Examiner shall examine the specimen as per QB-463.2(a) with at least a four power magnifying glass. If the specimen meets acceptance criteria, as per QB-181, the QCE shall notify the QC Manager to qualify the brazer
 - 6.2 The QCM shall complete the Brazer Performance Qualification (BPQ) form FN 5.013.3, sign and date it.
 - 7 Review and Approval
 - 7.1 When qualifying a new Brazing Procedure Specification (BPS) and the test coupon meet the acceptance criteria, The Quality Control Manager shall sign and date on Procedure Qualification Record (PQR) form FN 5.013.2.
 - 7.2 The QCM shall periodically review this procedure and update as required.