1 Purpose

1.1 To establish a standard procedure for the final tie-in of new medical gas piping to an existing in use medical gas piping system within health care facilities requiring Level 1 Medical Piped Gas and Vacuum Systems as per National Fire Protection Association (NFPA) 99C, 2005 Edition.

2 Scope

2.1 This procedure applies to medical gas final tie-in installation under requirements of Level 1 Medical Piped Gas and Vacuum Systems as per NFPA 99C, 2005 Edition.

2.2 Level 1 Medical Piped Gas and Vacuum Systems define the systems serving occupancies where interruption of the piped medical gas and vacuum system would place patients in imminent danger of morbidity or mortality.

3 Responsibility

3.1 Therma's general foreperson (GF), who is working on a job site, is responsible for ensuring that brazers and installers are fully in compliance with this procedure.

3.2 GF is responsible for ensuring that the final tie-in is completed before giving a notification for inspection.

3.3 GF shall notify General Contractor, orally or in writing, which said work is ready for inspection. Such notification shall be given not less than twenty-four (24) hours before the work is to be inspected.

3.4 Therma's project manager (PM) shall oversee the compliance and retention of all inspection documents after completion of final tie-in.

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4 References

4.1 2007 California Plumbing Code, Chapter 13 for Health Care Facilities Medical Gas and Vacuum Systems.

4.2 NFPA 99C – Standard on Gas and Vacuum Systems, 2005 Edition.

5 Material Requirements

5.1 Copper-to-copper joints shall be brazed without flux using a copper-phosphorus or copper phosphorus-silver brazing filler metal (BCuP series).

5.2 Dissimilar metals shall be brazed using an approved or listed proper flux and a silver (BAg) brazing filler. The flux shall be applied sparingly. After brazing, all remaining flux shall be removed by washing the joint with hot water.

5.3 Purge gas shall be oil free dry nitrogen at a flow rate sufficient to maintain an oxygen-free environment, to prevent the formation of scale within the tubing during brazing.

5.4 Threaded joints in piping accessories shall be applied with polytetrafluorethylene such as Teflon™ tape or with other non-oil based thread sealant approved for oxygen service.

5.5 Clean, lint-free white cloth

6 Procedures

Pre Final Tie-In

6.1 Before proceeding with an actual work, GF shall inform General Contractor about the precise location of the upcoming final tie-in, so that proper shutdown arrangements can be made with health care facilities management.

Note: Make sure that there is an isolation valve immediately downstream of the upcoming final tie-in location. The isolation valve shall be closed until the final tie-in is done and all necessary testing completed. The necessary tests are listed in steps 6.2, 6.3, 6.5, 6.8, 6.9, 6.10, 6.11, & 6.12.

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6.2 Prior to performing the actual final tie-in of new medical gas piping to an existing in use medical gas piping system, brazers or installers shall complete the following installer performed tests for the new medical gas piping and document the test results.

6.2.1 Initial Blow Down Test (Ref. NFPA 99C section 5.1.12.2.2)

6.2.2 Initial Pressure Test (Ref. NFPA 99C section 5.1.12.2.3)

6.2.3 Cross Connection Test (Ref. NFPA 99C section 5.1.12.2.4)

6.2.4 Piping Purge Test (Ref. NFPA 99C section 5.1.12.2.5)

6.2.5 Standing Pressure Test (Ref. NFPA 99C section 5.1.12.2.6)

6.3 After completion of the installer performed tests, certified testing agency shall perform the following tests for the new medical gas piping.

6.3.1 Standing Pressure Test (Ref. NFPA 99C section 5.1.12.3.2)

6.3.2 Cross Connection Test (e.g. individual pressurization or pressure differential method) (Ref. NFPA 99C section 5.1.12.3.3)

6.3.3 Valve Test (Ref. NFPA 99C section 5.1.12.3.4)

6.3.4 Alarm Test (Ref. NFPA 99C section 5.1.12.3.5)

6.3.5 Piping Purge Test (Ref. NFPA 99C section 5.1.12.3.6)

6.3.6 Piping Particulate Test (Ref. NFPA 99C section 5.1.12.3.7)

6.3.7 Piping Purity Test (Ref. NFPA 99C section 5.1.12.3.8)

6.4 In order to minimize the impact on the operation of the health care facility, the shutdown shall always be restricted to one single zone and/or the shortest isolated segment of the existing in-use piping system.

Final Tie-In

6.5 During brazing, internal piping shall be continuously purged with oil free dry nitrogen at a sufficient flow rate from the nearest access point. The direction of the purge flow shall be downstream and away from existing piping system.

6.6 If material of the final tie-in joint is copper-to-copper, BCuP serial filler metal shall be used for brazing.

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6.7 If material of the final tie-in joint is dissimilar metals (e.g. copper/brass), the filler metal shall be a flux-coated BAg type.

6.8 After brazing, the flow of purge gas (i.e. oil free dry nitrogen) shall be maintained until the joint is cool to the touch.

6.8.1 Piping must be allowed to cool naturally, with no additional means to hasten its cooling.

6.9 After brazing, the outside of the joint shall be cleaned by washing with water and a clean lint free white cloth.

6.9.1 Where flux has been used, the wash water shall be hot.

Post Final Tie-In

6.10 After cleaning the outside surfaces, brazers/installers shall inspect the brazed final tie-in joint visually per the following defect criteria (Ref. NFPA 99C section 5.1.10.5.7.4).

6.10.1 Flux or flux residue (When flux or flux coated BAg series rods are used with dissimilar metals).

6.10.2 Base metal melting or erosion

6.10.3 Unmelted filler metal.

6.10.4 Failure of the filler metal to be clearly visible all the way around the joint at the interface between the socket and the tube.

6.10.5 Cracks in the tube or component

6.10.6 Cracks in the braze filler metal.

6.10.7 Failure of the joint to hold the test pressure under the installer-performed initial pressure test and standing pressure test

6.11 Once the visual inspection is passed, brazers/installers shall perform leak-test for the brazed final tie-in joint (i.e. joint in between the new work and the existing system) with the gas of system designation at the normal operating pressure by means of soapy water or other means safe for use with oxygen.

6.12 After the final tie-in is made and leak testing is done, a heavy and intermittent purging with oil free dry nitrogen of the pipeline shall be done by brazers/installers.

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6.12.1 The purge gas (i.e. oil free dry nitrogen) flow rate shall be at least 8 standard cubic feet per minute (SCFM) on each outlet.

Note: SCFM is a unit to measure a volume of gas at standard conditions (68°F/20°C) and 1 atmosphere of pressure.

6.12.2 After the purge with oil free dry nitrogen is started, it shall be rapidly interrupted several times until purge produces no discoloration in a white clean cloth.

6.13 After completion of steps 6.5 to 6.12, brazers/installers shall notify GF that the final tie-in and new piping system are done.

Note: Brazers/installers shall NOT open the isolation valve, which has been tied-in to the new piping system.

6.14 GF shall ensure that the isolation valve is closed.

6.15 GF shall notify the General Contractor, orally or in writing, which said work is ready for the certified testing agency to perform an operational pressure test and a medical gas concentration test. Such notification shall be given not less than twenty-four (24) hours before the work is to be performed.

6.16 Before the new piping system is used for patient care, the certified testing agency will carry out an operational pressure test and a medical gas concentration test. Installers are not responsible for these tests. However, a successful final tie-in is official only after the completion of these tests.

6.16.1 Operational pressure test (Ref. NFPA 99C section 5.1.12.3.10)

6.16.2 Medical gas concentration test (Ref. NFPA 99C section 5.1.12.3.11)

Note: The certified testing agency is responsible for opening the isolation valve, which has been tied-in to the new piping system.

7 Review and Approval

7.1 GF shall receive the documentation of the tests listed in steps 6.3 & 6.16 and forward them to PM for permanent retention.

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Document Approval

Steve Rusconi — Vice President — Aug 31 09 — Date

Project Manager AL CANCILLA — 9-1-09 — Date

Engineering Manager — 9/1/09 — Date

Quality Control Manager — 09/01/09 — Date

Quality Assurance Manager — 09/01/09 — Date

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