

Procedures for Welding or Hot Tapping on Equipment in Service

API RECOMMENDED PRACTICE 2201
FOURTH EDITION, SEPTEMBER 1995



American Petroleum Institute
1220 L Street, Northwest
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Health and Environmental Affairs Department

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FOREWORD

This publication is designed to provide a better understanding of the problems and hazards encountered when welding or installing hot tap connections on piping, vessels or tanks containing flammable or combustible liquids or gases. The essential elements of this publication are based on accumulated knowledge and experience of the petroleum industry, current industry safe operating practices, and existing consensus standards. The practices described in this publication are designed to protect the safety of personnel and the facilities for the work involved. It shall be noted, however, that special problems beyond the scope of this publication are possible. Also, federal, state and local regulations or laws may contain additional requirements that must be taken into account when a hot tap program is developed for a specific facility.

This publication was prepared under the direction of a support group comprised of members of the API Safety and Fire Protection Subcommittee. This document was produced under API standardization procedures that ensure appropriate notification and participation in the developmental process and is designated as an API *recommended practice*. Questions concerning the interpretation of the content of this recommended practice or comments and questions concerning the procedures under which this recommended practice was developed should be directed in writing to the API Safety and Fire Protection Subcommittee.

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Suggested revisions are invited and should be submitted to the director of the Health and Environmental Affairs Department, American Petroleum Institute, 1220 L Street, N.W., Washington, DC 20005.

CONTENTS

	Page
SECTION 1—GENERAL	1
1.1 Scope.....	1
1.2 Referenced Publications.....	1
1.3 Lockout/Tagout Requirements.....	1
 SECTION 2—HOT TAPPING MACHINES	 2
2.1 General.....	2
2.2 Hot Tapping Machine Considerations	2
 SECTION 3—HOT TAP AND WELDING METALLURGY AND DESIGN	 2
3.1 General.....	2
3.2 Burn-Through Prevention	2
3.3 Flow in Lines	2
3.4 Metal Thickness	4
3.5 Fittings	4
3.6 Post Weld Heat Treatment (PWHT)	4
3.7 Metal Temperature	4
3.8 Hot Tap Connection and Welding Design.....	4
3.9 Piping and Equipment Contents.....	4
 SECTION 4—PREPARATIONS	 5
4.1 Written Plans.....	5
4.2 Process Hazard Management.....	5
4.3 Personnel Qualifications	5
4.4 Toxicity Considerations	5
 SECTION 5—SPECIAL CONDITIONS	 6
5.1 Hot Tapping or Welding on Tanks in Service	6
5.2 Hot Tapping or Welding on the Decks of Floating Roof Tanks.....	6
5.3 Hot Tapping or Welding Above or Below Grade	6
5.4 Hot Tapping or Welding on Lined Piping or Lined Equipment or Cased Lines	6
5.5 Hot Tapping Upstream of Equipment and Valves.....	6
 SECTION 6—PROCEDURES	 7
6.1 Preliminary Procedures.....	7
6.2 Welding	7
6.3 Inspecting the Weld.....	7
6.4 Installing the Hot Tapping Machine	7
6.5 Testing the Weld and Hot Tapping Machine.....	7
6.6 Completion.....	7
 APPENDIX A—SUGGESTED HOT TAP CHECKLIST	 9
 Figure	
1—Hot Tapping Machine.....	3

Procedures for Welding or Hot Tapping on Equipment in Service

SECTION 1—GENERAL

1.1 Scope

This publication covers the safety aspects to be considered when hot tapping, or when welding without hot tapping on in-service piping or equipment. It is not a substitute for job planning. A detailed, written procedure for hot tapping and welding should be prepared or reviewed before starting each job to ensure that all proper steps are taken. These procedures may need to be revised in response to unique problems or situations that may arise concerning the safety of personnel and facilities.

The hot tap and welding procedures described in this publication apply to piping and equipment fabricated from ferritic and austenitic steel. Other materials, such as aluminum, copper, plastic, and cast iron may require special hot tap or welding procedures.

Hot tapping is the technique of attaching a mechanical or welded branch fitting to piping or equipment in service, and creating an opening in that piping or equipment by drilling or cutting a portion of the piping or equipment within the attached fitting. Hot tapping is usually performed when it is not feasible, or it is impractical, to take the equipment or piping out of service, or to purge or clean it by conventional methods. A hot tap connection can often be safely made without interfering with the process operation.

1.2 Referenced Publications

The latest editions of the following documents are referenced in this publication:

ACGIH¹

Threshold Limit Values for Chemical Substances and Physical Agents in the Work Environment and Biological Exposure Indices (and documents referenced therein)

ANSI²

Z.88.2 *Practices for Respiratory Protection*

API

Std 510 *Pressure Vessel Inspection Code: Maintenance Inspection, Rating, Repair, and Alteration*

Std 570 *Piping Inspection Code: Inspection, Repair, Alteration, and Rerating of In-Service Piping Systems*

Std 598 *Valve Inspection and Testing*

Std 650 *Welded Steel Tanks for Oil Storage*
 Std 653 *Tank Inspection, Repair, Alteration, and Reconstruction*
 Publ 941 *Steels for Hydrogen Service at Elevated Temperatures and Pressures in Petroleum Refineries and Petrochemical Plants*
 RP 1107 *Pipeline Maintenance Welding Practices*
 Publ 2009 *Safe Welding and Cutting Practices in Refineries, Gasoline Plants, and Petrochemical Plants*

Battelle Institute³

Investigation and Prediction of Cooling Rates During Pipeline Maintenance Welding and Battelle's Hot Tap Thermal Analysis Models

ASME⁴

Boiler and Pressure Vessel Code; Section VIII, "Pressure Vessels" and Section IX, "Welding Qualifications"

ASME/ANSI²

B31.3 *Chemical Plant and Petroleum Refinery Piping*

B31.4 *Liquid Transportation Systems for Hydrocarbons, LPG, etc.*

B31.8 *Gas Transmission Pipelines*

DOT⁵

49 *Code of Federal Regulations* Parts 190-199

OSHA⁶

29 *Code of Federal Regulations* Part 1910

29 *Code of Federal Regulations* Parts 1926.351 and 352, (relative to welding on gas pipelines)

1.3 Lockout/Tagout Requirements

A decision to weld on equipment in service or to perform a hot tap should be made only after careful consideration of the alternatives. The OSHA lockout/tagout regulation, 29 CFR 1910.147 (a) (2) (iii) (B), establishes that the standard does not apply to hot taps when the employer demonstrates that (1) continuity of service is essential, (2) shutdown of the system is impractical, (3) documented procedures are followed, and (4) special equipment is used which will provide effective protection for employees.

³Available from the American Petroleum Institute, Order Desk, 1220 L Street, N.W., Washington DC 20005 (Order No. D12750).

⁴American Society of Mechanical Engineers, 345 E 47th Street, New York, New York 10018.

⁵Department of Transportation, U.S. Government Printing Office, Washington, DC 20402.

⁶Occupational Safety and Health Administration, U.S. Government Printing Office, Washington, DC 20402.

¹American Conference of Governmental Industrial Hygienists, Building D-5, 6500 Glenway Avenue, Cincinnati, Ohio 45211.

²American National Standards Institute, 1430 Broadway, New York, New York 10018.

SECTION 2—HOT TAPPING MACHINES

2.1 General

Although commercial hot tapping machines are available, some companies prefer to build their own. Hot tapping machines may be powered by hand, air, hydraulic fluid, or electricity. These machines must be able to retain and remove the blank or coupon. The seals and materials of construction of the hot tapping machine must be compatible with the contents in the piping or vessel. The material of the drill or cutter must be suitable for effective penetration of the metal of the piping or vessel being tapped. Hot tapping machines must be designed and constructed to withstand the temperatures, pressures, and mechanical stress which may be imposed during their operation.

2.2 Hot Tapping Machine Considerations

Before hot tapping is attempted, the machine, cutter, and pilot bit should be carefully inspected to ensure that they are in satisfactory condition and capable of being left in service, if necessary, in the event of mechanical problems or hot tap valve leakage. All hot tapping machines have maximum and minimum working pressure, and high and low temperature ratings. During hot tapping, consideration must be given to the possibility of operational upsets which may alter the process temperature or pressure. It must also be remembered that the hot tapping machine may have to remain in place for an extended period of time if removal of the machine is not successful (see Figure 1).

SECTION 3—HOT TAP AND WELDING METALLURGY AND DESIGN

3.1 General

The two primary concerns when welding on in-service piping and equipment are burn through and cracking. Burn-through will occur if the unmelted area beneath the weld pool can no longer contain the pressure within the pipe or equipment. Weld cracking results when fast weld cooling rates produce a hard, crack-susceptible weld microstructure. Fast cooling rates can be caused by flowing contents inside the piping and equipment which remove heat quickly.

Consideration should be given to evaluating heat transfer during welding to determine the heat input and related welding variables in order to prevent overheating and burn through of the in-service piping or equipment. Also, consideration should be given to evaluating the expected cooling rate of the weld to determine the heat inputs required to produce welds (and heat affected zones) which are free of cracking. API and Battelle documents (see Section 1.2) contain information regarding these evaluations.

An engineering evaluation should be conducted before in-service welding is performed on materials which contain laminations or other imperfections. Vessels or lines to be welded or hot tapped must also be inspected for adequate wall thickness and absence of imperfections. To minimize the risk of burn through, the metal thickness should be adequate for the pressure (vacuum) and temperature involved so that the hot tapping machine, equipment, and personnel can be safely supported.

A determination shall be made of the metal chemistry. The metallurgy of the weld materials, the hot tap fitting, and the weld rod must be compatible with the metallurgy of the equipment to be welded or hot tapped. For example, low hydrogen electrodes are often advisable to minimize weld

cracking problems. Special welding considerations may be needed for high tensile strength steels to avoid weld cracking and the need for post weld heat treatment (PWHT).

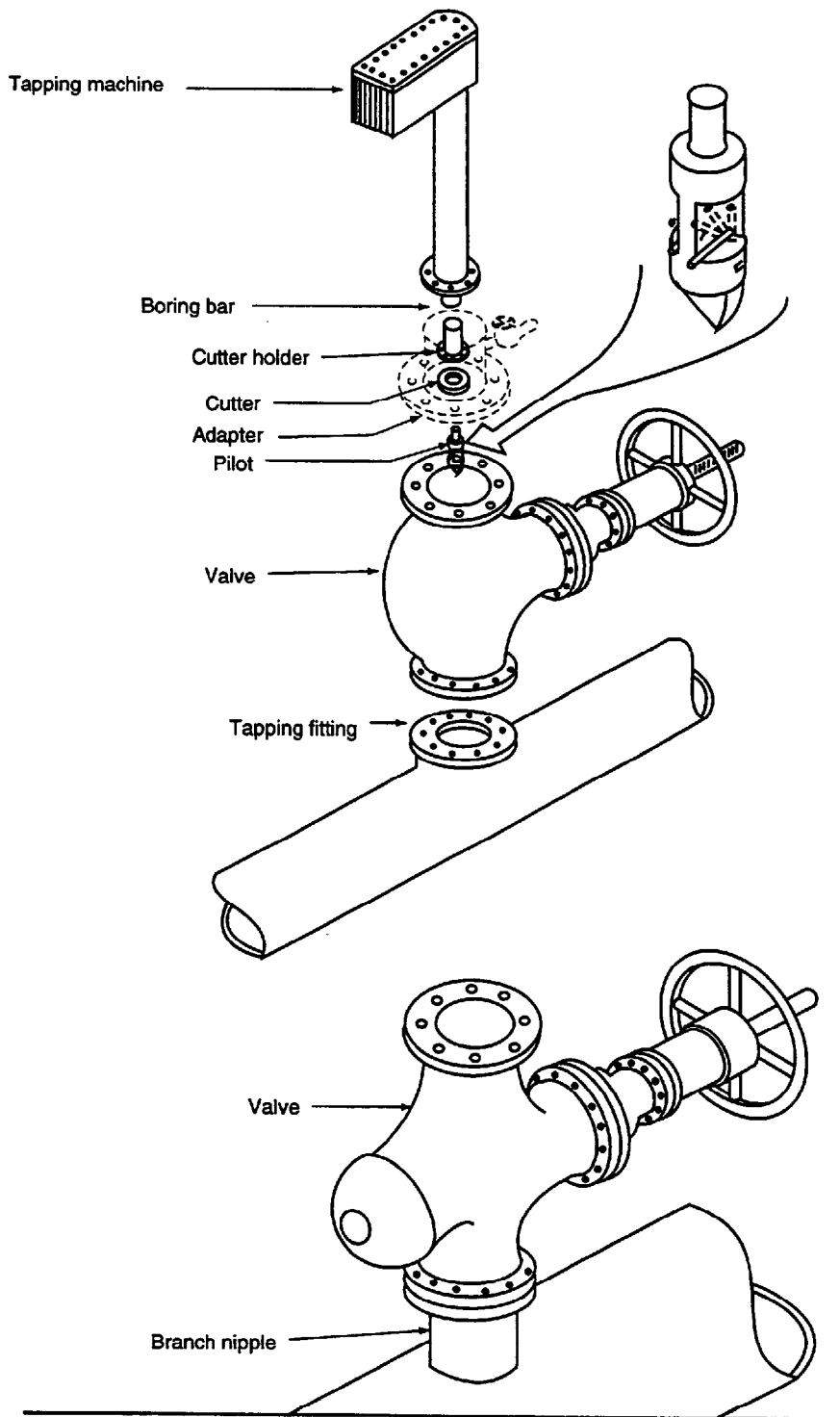
3.2 Burn-Through Prevention

To avoid overheating and burn-through, the welding procedure specifications should be based on experience in performing welding operations on similar piping or equipment, and/or be based on heat transfer analysis. To minimize burn through, the first weld pass to equipment or piping less than $\frac{1}{4}$ inch (6.4 millimeter) thick should be made with a $\frac{3}{8}$ inch (2.4 millimeter) or smaller diameter welding electrode to limit heat input. (Note: the use of low heat input levels can increase the risk of cracking in high carbon equivalent materials). Subsequent passes should be made with a $\frac{1}{2}$ inch (3.2 millimeter) diameter electrode, or smaller if the metal thickness does not exceed $\frac{1}{2}$ inch (12.8 millimeter).

For equipment and piping wall thicknesses greater than $\frac{1}{2}$ inch (12.7 millimeter), where burn-through is not a primary concern, larger diameter electrodes may be used. Where burn-through is of concern, care should be taken by avoiding the use of excessive welding current. In many situations, the use of low hydrogen rods may be preferable to reduce the possibility of burn-through.

3.3 Flow in Lines

For metal thickness less than $\frac{1}{4}$ inch (6.4 millimeters), some flow during hot tapping minimizes the potential of several undesirable conditions. Overheating liquids, burn through caused by elevated metal temperatures, and fluid thermal expansion in closed systems are less likely when flow is maintained. However, higher flow increases the weld



TYPICAL HOT TAP CONNECTION

Figure 1—Hot Tapping Machine

cooling rate and the risk of cracking. Therefore, when welding, it is desirable to provide some minimum level of flow while avoiding high flow rates. The need for a minimum level of flow is a trade-off between the need to minimize the risks of burn-through and cracking (see Section 1.2, reference to Battelle Institute report).

For metal thickness between $\frac{1}{4}$ inch (6.4 millimeters) and $\frac{1}{2}$ inch (12.8 millimeters), flow also increases the weld cooling rate and risk of cracking. Minimizing the flow rate reduces the risk of cracking and keeps the risk of burn through low. For metal thickness greater than $\frac{1}{2}$ inch (12.8 millimeters), the effect of flow on both weld cooling rates and the risk of burn through is negligible.

Under certain conditions, such as when hot tapping or welding on a flare line, there may be insufficient or interrupted flow that results in a flammable mixture during the welding operation. In these circumstances it may be necessary to purge or flood the line with steam, inert gas, or hydrocarbon gas to prevent the formation of flammable mixtures.

3.4 Metal Thickness

The piping or equipment base metal thickness must provide support for the new connection and the hot tapping machine. Alternately, reinforcing pads or auxiliary support of the hot tapping machine may be provided. The base metal must be free of laminations, hydrogen attack, or stress corrosion cracking. Imperfections which might prevent a sound weld from being made must be evaluated by a competent person.

Minimum base thickness requirements shall be stated in the written documentation for the job. A minimum base metal thickness of $\frac{3}{16}$ inch (4.8 millimeters) is recommended for most applications of welding and hot tapping. The actual minimum thickness is a function of the thickness required for strength, plus a safety factor, usually $\frac{1}{2}$ inch (2.4 millimeters), to prevent burn through. Exceptions to the recommended thickness may be permitted when metallurgical requirements and pressure (vacuum) limitations specified by a qualified company specialist are met.

3.5 Fittings

Many types of mechanical and welded fittings are available, such as welded outlet fittings, weld-ends, split tees, saddles, and nozzles. A qualified person shall select the proper fitting for the connection. Fittings must be properly sized to accommodate the hot tapping machine, to allow for full depth of cutter penetration within the travel limits of the machine, and to allow for uninterrupted tapping valve closure when the cutter and cut out coupon are retrieved.

3.6 Post Weld Heat Treatment (PWHT)

Some equipment and piping is unsuitable for welding in service, because the metallurgy or thickness of the metal

and/or the contents require PWHT which normally cannot be done while the equipment or piping is pressurized. In such cases, mechanically attached fittings should be considered.

3.7 Metal Temperature

Consider heating the weld area before welding if the metal temperature is low enough (below the atmospheric dew point) so that moisture forms on the metal surface. Generally, welding should not be performed on lines or equipment when atmospheric temperature is less than -50°F (-45°C) unless special precautions, such as providing temporary shelter, space heaters, and so forth, are taken.

Preheating may be required by the welding procedure to avoid cracking whenever the base metal has high carbon equivalency or high tensile strength.

3.8 Hot Tap Connection and Welding Design

Unless determined by an engineering review to be otherwise acceptable, welding or hot tapping closer than 18 inches (46 centimeters) to a flange or threaded connection, or approximately 3 inches (7 centimeters) to a welded seam (including a longitudinal seam of welded piping) should be avoided. Assure the connection is positioned so as to allow for the installation, operation, and removal of the hot tapping machine.

Hot tap connections and welding repairs and alterations must be designed to the applicable code (see Section 1.2) such as the following:

- a. For piping designed to ASME B31.3, refer to API 570.
- b. For piping designed to ASME B31.4 and B 31.8, refer to ASME/ANSI B31.4.
- c. For oil storage tanks constructed in accordance with API Standard 650, refer to the hot tapping requirements in Standard API 653.
- d. For Pressure Vessels built to Section VIII and the ASME *Boiler and Pressure Vessel Code*, refer to API 510.

The design shall cover the specification of gaskets, valves, and bolts. Reinforcing pads or saddles shall be included in the design when required by the applicable code.

3.9 Piping and Equipment Contents

CAUTION: Welding or hot tapping should not be performed on piping or equipment under vacuum (i.e. operating at less than atmospheric pressure) unless an engineering evaluation is conducted to determine safe operating procedures (see API Publication 2009, Section 6.4).

CAUTION: Welding and hot tapping should not be performed on piping or equipment containing the following materials:

- a. Vapor/air or vapor/oxygen mixtures near or within their flammable explosive range. The heat of welding may cause a vapor mixture to enter the flammable range.
- b. Hydrogen, unless an appropriate engineering review has

been performed by a competent person who approves welding on such equipment. Carbon and ferritic alloy steel is susceptible to high-temperature hydrogen attack during process operations. Therefore, a review must be conducted to ensure that the equipment has been operated within the Nelson curve for the particular steel involved.

c. Peroxides, chlorine, or other chemicals likely to violently decompose or become hazardous from the heat of welding.
d. Caustics, amines, and acids (such as HF acid), if the concentrations and temperatures are such that the fabrication specifications require PWHT. These services may cause cracking in the weld area or heat affected zone.

e. Certain unsaturated hydrocarbons (such as ethylene). These may experience exothermic decomposition due to high temperatures caused by welding, creating localized hot spots on piping or equipment walls that could lead to failure.

f. Oxygen or oxygen enriched atmosphere. (Note: do not say "23.5 percent" or any percentage at all. The amount of oxygen needed for an enriched atmosphere varies with each product's flammable limits). The oxygen may cause a vapor mixture to enter the flammable range and may affect the base metal being welded.

g. Compressed air, unless known to be free of flammables and combustibles, such as lubricating oil residues.

SECTION 4—PREPARATIONS

4.1 Written Plans

Prior to conducting hot tapping or welding on piping or equipment in service, a written plan should be prepared which includes the following:

- a. Connection design.
- b. Hot tap procedure.
- c. Detailed written welding procedure (qualified in accordance with the applicable code) documenting heat input, as appropriate.
- d. Health, safety, fire protection, emergency response, and other appropriate procedures and instructions, including owner and user requirements.

Additional information when developing a written plan may be obtained from Section IX of the *ASME Boiler and Pressure Vessel Code* for qualification of welders and the fundamental ASME Code welding procedures to be employed.

Note: Section IX does not cover the conditions encountered while welding on in-service piping and equipment containing flammable and combustible liquids. Refer to API Recommended Practice 1107 for qualification of welders and the welding procedures to be employed when welding on in-service flammable and combustible liquid piping.

4.2 Process Hazard Management

Consideration shall be given to hazards that may be introduced to the process system as the result of planned use of the hot tap connection. For further information on process safety management requirements, refer to OSHA 29 CFR 1910.119 (I).

4.3 Personnel Qualifications

Welders must be qualified in accordance with the applicable codes and specifications. They should be thoroughly familiar with the welding equipment and hot tap and welding procedures to be used. Only skilled personnel should mount and assemble the hot tapping machine. These skills may be achieved either through on-the-job training or by a formal

training program provided by the manufacturer of the hot tapping machine.

4.4 Toxicity Considerations

Tests have indicated that prolonged or repeated exposure to some petroleum liquids or vapors may be harmful. Identify materials in the area and contained in the piping or equipment to be hot tapped or welded upon. Information concerning health risks associated with a particular substance should be obtained from the employer or the supplier of the material, typically from a Material Safety Data Sheet (MSDS). Additional information may be obtained from governmental health, safety, and environmental agencies.

Toxic fumes may be generated from welding, in particular from welding on metals containing alloys of lead, zinc, cadmium, beryllium, and certain other metals. Some paints, particularly those containing lead, may also produce toxic fumes when heated or burned. Toxicity depends on the composition and quantity of fumes, which depends on the composition and quantity of the materials being welded. The composition of the welding consumables, any coatings or paints, the process used, and the circumstances and condition of use will also affect toxicity.

Additional information on welding toxicity and appropriate protective measures such as respirators may be obtained from the employer or by referring to the following documents listed in Section 1.2 of *ACGIH Threshold Limit Values for Chemical Substances and Physical Agents in the Work Environment*; OSHA 29 CFR 1910 Subpart Q ("Welding, Cutting and Brazing") and Subpart Z ("Toxic and Hazardous Substances"); and OSHA 29 CFR 1926 Subpart J ("Welding and Cutting").

If potential for exposure is possible, provide appropriate control measures, including the following:

- a. Determine the level of exposure through measurement and/or analysis.
- b. Minimize skin contact and breathing of vapors or fumes

through engineering or administrative controls, or by providing appropriate personal protective equipment.

c. Keep work areas clean and well ventilated; clean up spills promptly.

d. Use soap and water or approved cleaner to remove materials which contact skin. Do not use gasoline or similar solvents.

e. Promptly remove and wash oil-soaked clothing, and do not use oil soaked leather gloves, aprons, or other materials.

SECTION 5—SPECIAL CONDITIONS

5.1 Hot Tapping or Welding on Tanks in Service

The hazards associated with tank operations during hot tapping or welding include, but are not limited to the following:

- a. Tank venting, with vapors reaching the exterior area where welding is taking place.
- b. Product within the tank rising and overflowing.
- c. Inadvertently allowing the liquid level within the tank to fall below the point of welding, thereby losing the heat sink provided by the liquid and exposing the vapor space within the tank to an ignition source.

Welding on the exterior of tanks in service shall not be conducted unless controls are established and in place to prevent flammable vapors from reaching the area of welding. Work must be stopped immediately should flammable vapors be detected in the welding area.

When hot tapping or welding on a tank in service, maintain liquid in the tank at a level at least 3 feet (1 meter) above the area where the work is being performed. No attempt should be made to hot tap or weld above this liquid level in atmospheric pressure petroleum storage tanks because of the potential danger of an explosive atmosphere inside the tank vapor space. Measurements of the tank level should be made by a hand tape gauge to verify the accuracy of automatic or remote reading gauges.

5.2 Hot Tapping or Welding on the Decks of Floating Roof Tanks

Welding should not be permitted on the decks of floating roof tanks in service. Floating roof tanks are subject to unique flammability hazards in the following specific locations:

- a. Inside the pontoons.
- b. Between the deck and liquid surface near the tank roof gauge float compartment.
- c. Near the roof seal vent.
- d. Near the floating roof lift leg vent.
- e. Between the primary and secondary seal.
- f. Near the roof drain.

5.3 Hot Tapping or Welding Above or Below Grade

For hot tapping and welding above or below grade, provisions shall be made for an easily accessible means of egress. To assure that the atmosphere in excavations and confined spaces is safe for entry and hot work, tests shall be conducted for oxygen, flammable vapors and toxic air contaminants, and permit(s) issued listing the requirements and approving the entry into the confined space and hot work therein.

If oxygen deficiency, flammable vapors, or hazardous air contaminants are present, an air mover or other positive means of ventilation shall be provided. Respiratory equipment may also be required to provide protection from hazardous contaminants, vapors, or fumes emitted as a result of welding. Air monitoring may also be required during work activity to assure that air quality remains within the permitted safe work levels.

Refer to OSHA 29 CFR 1910 Subpart Q and 29 CFR 1926 Subpart J for specific guidance concerning safe work within confined spaces.

5.4 Hot Tapping or Welding on Lined Piping or Lined Equipment or Cased Lines

Hot tapping or welding should not be permitted on in-service lines or equipment with cladding, or with glass, lead, refractory, plastic, or strip linings, unless specifically authorized by specialized procedures or following an engineering evaluation.

When hot tapping or welding on underground lines which run through casings, care must be taken to assure that the annular space is gas free and that the work is performed on the pipeline and not on the casing.

5.5 Hot Tapping Upstream of Equipment and Valves

Avoid hot tapping upstream of rotating equipment or automatic control valves, unless such equipment is protected from the cuttings by filters or traps.

SECTION 6—PROCEDURES

6.1 Preliminary Procedures

Before proceeding with hot tapping or welding, the following conditions shall be satisfied (see API Publication 2009):

- a. A competent person shall be present during the hot tapping.
- b. The area where the connection is to be made has been identified and physically marked.
- c. The metal thickness has been verified and any metal imperfections that might prevent a proper weld have been evaluated and approved by a competent person.
- d. A plan has been prepared to monitor and control process variables within their required limits while hot tapping or welding is being performed.
- e. All necessary testing for flammable vapors, oxygen, and hazardous air contaminants has been conducted to ensure a safe environment.
- f. Potential safety and health hazards have been assessed, personnel protective equipment provided, and fire retardant clothing used as necessary.
- g. Confined space entry and hot work permits have been issued if the area in which the hot tapping or welding is to be done requires such permits.
- h. A fire watch has been established and equipped with a suitable dry-chemical fire extinguisher or pressurized fire hose.
- i. Signs and barriers have been provided when warranted to isolate the job site from the public and unauthorized personnel.
- j. Procedures have been prepared and are in place to isolate the work area in the event of an emergency.
- k. Personnel are trained and familiar with the hot tap or welding procedures and the use and location of applicable equipment.

6.2 Welding

The following requirements are applicable to the welding operation:

- a. Select and use a welding procedure which is qualified for the specific application.
- b. Assure that the welder is qualified for the specified procedure.
- c. Assure that the fitting is positioned and supported before welding, so that misalignment of the hot tapping machine will not occur.
- d. Protect the weld area during cleaning, preparation, welding, and weld inspection if blowing dirt, snow, or rain is present.

6.3 Inspecting the Weld

Inspect all attachment welds after welding. Dye penetrant, ultrasonic, or magnetic particle inspection is recommended before the hot tapping machine is installed. If these tests are used after the first weld pass, the weld area must be thoroughly cleaned of any foreign material or residues. These procedures should not be relied upon to replace the need for hydrostatic or pneumatic testing.

Note: if reinforcing is specified, the operator may wish to pressure test the nozzle prior to installing the reinforcing pad.

6.4 Installing the Hot Tapping Machine

When installing the hot tapping machine follow the manufacturer's instructions and the following items:

- a. The hot tap valve to be used must be of adequate size and rating, be of proper metallurgy, and be a full opening valve. It should be tested for seat leakage prior to installation (see API 598).
- b. During installation the valve should be centered on the nozzle flange.
- c. Run the boring bar through the valve opening to be sure the cutter does not jam or drag.
- d. Carefully calculate the travel distance of the cutter to ensure that the tap can be completed within the dimensional limits, that the cut will be stopped before the cutter or pilot drill touches the opposite side of the tapped pipe or equipment, and that the retrieved cut-out coupon can be retracted far enough to allow unimpeded closure of the tapping valve.
- e. Confirm that the bleed-off valve will hold pressure and is not plugged.
- f. Ensure that precautions have been established for safe bleed off and disposal of material collected in the machine above the hot tap valve.

6.5 Testing the Weld and Hot Tapping Machine

The welded attachment and hot tapping machine should be tested to assure they are in accordance with applicable codes before the cutting is started, as follows:

- a. Check tightness of bolts, packing, packing nuts, and any bypass line to avoid possible leakage.
- b. If the current temperature of the line or vessel will permit, conduct a hydrostatic test in accordance with the applicable code. The temperature of the metal should be considered to prevent brittle fracture. The test pressure should be at least equal to the operating pressure of the line or vessel to be tapped. But it should not exceed the present internal pressure by more than approximately 10 percent, in order to avoid possible internal collapse of the pipe or vessel wall. However, if prevailing conditions could cause collapse of the

pipe or vessel walls, the test pressure may be reduced (see API Standard 510 for pressure testing precautions).

c. If the temperature is such that a hydrostatic test cannot be conducted, air or nitrogen with soap solution on the weld can be used. At elevated temperatures, air should be used only after a careful evaluation is made in order to avoid a potential flammable mixture.

6.6 Completion

Once work has started it should proceed without interruption until the hot tap has been completed and the valve closed.

a. It is often possible to know when the cut is complete by

the reduced resistance to hand cranking or when the drive motor speeds up.

b. The manufacturer's instructions should be followed when retracting the bore and closing the valve. If the blank or coupon is lost, no attempt should be made to retrieve it with the hot tapping machine. If recovery of the blank or coupon is necessary, it may require shutting down the equipment and depressuring and opening the line.

c. Provisions should be made to assure that adequate containment is available to control liquids and vapors trapped within the hot tapping machine which will be released upon removal of the machine after work is completed.

APPENDIX A—SUGGESTED HOT TAP CHECKLIST

This checklist is intended to be used as a reminder to accomplish the steps involved in hot tap operations in an orderly manner. Particular circumstances of jobs may dictate additional preparatory steps. This checklist may be retained as a record of the job.

Location _____

Date _____

Job _____

Prepared by _____

BEFORE STARTING THE HOT TAP

Each of the following considerations should be satisfied before starting the hot tap:

1. Review/follow manufacturer's instructions.
2. Have the contents of the line or vessel to be hot tapped or welded been assessed, and MSDS's reviewed for health hazards, to assure procedure is appropriate?
3. Is the material in the line or vessel stable under heated conditions (see Section 3)?
4. Has the connection been designed per Section 3 requirements?
5. Do the flanges, bolts, gaskets, pipe, and valve to be installed meet the code for the line or vessel to be hot tapped?
6. Has the welding procedure specification been developed as covered in Section 3?
7. Have approved work permits (Hot Work, Entry, and so forth) been obtained?
8. Review manufacturer's instructions to ensure that the hot tapping machine has suitable pressure, temperature ratings, and adequate cutter travel for this job.
9. Has the valve been pressure tested and the cover fitted to assure that it will work and fit properly?
10. Has the exact location of the hot tap been identified and marked on the line or equipment?
11. Has the area to be welded been inspected for thickness and freedom from existing welds, laminations, hydrogen attack, or other metallurgical imperfections?
12. If laminations or defects have been found, has a thorough engineering evaluation been made to determine if and how to proceed with the work?
13. Has the metallurgy of the line or vessel been established, and is it compatible with the connecting fitting?
14. Can the area support the weight of the hot tapping machine, and is there adequate hoisting and support for the hot tapping machine and subsequent piping?
15. If PWHT of the welded area is required, was an appropriate review conducted in accordance with Section 3?
16. Is there sufficient external clearance to install the hot tapping machine and extract the cutter through the valve?
17. Is there sufficient internal clearance to retract the cutter and coupon through the valve?
18. Is the hot tap fitting of the proper length to accommodate operation of the hot tapping machine?
19. Have oxygen, combustible gas, and toxic atmosphere tests been conducted in the hot tap area?
20. Has a fire watch been assigned and appropriate fire fighting equipment provided?
21. Have all personnel in the area been provided with appropriate personal protective equipment?
22. Is the area to be hot tapped located below the liquid level of the tank, or on a line or vessel in which flow has been established?
23. Is there adequate storage area and room for operational and emergency access?

24. Has a procedure been prepared and in place to isolate the work area in the event of a failure? Are personnel trained to implement the procedure?
25. Have the requirements been defined for weld inspection and for pressure testing, and is all of the testing equipment on hand and in good working condition?

BEFORE WELDING

Each of the following considerations should be satisfied before welding:

1. Are the welders qualified for the approved welding procedure (specification) to be used?
2. Is a preheat of the weld area required?
3. Is the fitting properly positioned so that misalignment of the hot tapping machine will not occur?
4. Have the pressure and temperature of the contained materials been reduced as much as the process operation will allow?
5. Have the flow, pressure, and level considerations of Sections 3, 4, and 5 been considered?

BEFORE CUTTING

Each of the following considerations should be satisfied before cutting:

1. Has the weld been inspected and tested?
2. Has the hot tap fitting been pressure tested?
3. Have the hot tap valve, packing, gasket, and bolts been checked for leakage?
4. Have the packing or seals on the hot tapping machine been checked?
5. Has the bleed off valve been checked to assure it will hold, is operable, and is not obstructed?
6. Are all bolts on the pilot and cutter bit tight?
7. Is the coupon catcher on the pilot bit?
8. Is the valve centered on the flange?
9. Has cutting depth been calculated to avoid cutting the opposite side of the pipe?
10. Has the boring bar been run through the valve to assure free passage?
11. Have the hot tapping machine and valve been purged, if recommended?

BEFORE REMOVING THE HOT TAPPING MACHINE

Each of the following considerations should be satisfied before removing the hot tapping machine:

1. Have the manufacturer's instructions been followed to be sure that the boring bar is fully retracted before closing the hot tap valve?
2. Has the hot tap valve been closed?
3. Has the bleeder valve been opened?
4. Has all of the pressure been bled off of the hot tapping machine before removing the bolts from the flange?
5. Have provisions been made to contain or control any liquid or gas in the hot tapping machine?

AFTER REMOVING THE HOT TAPPING MACHINE

1. The hot tap machine should be cleaned, removing the hydrocarbons/chemicals from the line or equipment.
2. All rags, absorbent pads, and other cleaning materials must be disposed of properly.

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