Preparing Tank Bottoms for Hot Work

API PUBLICATION 2207
FIFTH EDITION, SEPTEMBER 1998

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Health and Environmental Affairs Department
Safety and Fire Protection Subcommittee

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Preparing Tank Bottoms for Hot Work

1 General

1.1 INTRODUCTION

This publication outlines safety precautions for preventing accidental fires and explosions when hot work is performed on tank bottoms. The term hot work, as used in this publication, is defined as an operation that can produce a spark or flame hot enough to ignite flammable vapors.

This publication may not contain all safety precautions and procedures that may be required prior to or during a specific hot work activity. All hot work should be performed in compliance with applicable national, state and local regulatory requirements and recognized industry practices, including but not limited to: confined space procedures, lockout/tagout procedures, and requirements for personal protective equipment (see OSHA Regulations 29 *CFR* part 1910 and API Publications 2015 and 2217).

Tanks that have contained flammable or combustible liquids, regardless of their age and type of construction, must be considered unsafe for hot work until approved by safety inspections. These inspections include gas testing to determine if the oxygen content of each tank is between 19.5 and 22.5 percent. Special techniques are required in the performance of hot work on tank bottoms to prevent the ignition of flammable vapors that may be trapped under the tank.

Although each repair of tank bottoms must receive careful consideration, the safety procedures described in this publication provide various methods for preparing tank bottoms for hot work. These procedures will apply to most situations.

2 Referenced Publications

The most recent editions of the following standards, codes, and specifications are cited in this publication.

API

Publ 2009	*Safe Welding and Cutting Practices in Refineries, Gasoline Plants, and Petrochemical Plants*
Publ 2015	*Cleaning Petroleum Storage Tanks*
Publ 2202	*Dismantling and Disposing of Steel from Aboveground Leaded Gasoline Storage Tanks*
Publ 2217	*Guidelines for Confined Space Work in the Petroleum Industry*
Publ 2217A	*Guidelines for Work in Inert Confined Spaces in the Petroleum Industry*

ANSI[1]

Z49.1	*Safety in Cutting and Welding*

HTC[2]

Safe Tank Cleaning
(audiovisual/workbook training program)

OSHA[3]

29 *Code of Federal Regulations*, Part 1910

3 Precautions

3.1 GENERAL PRECAUTIONS

3.1.1 The tank must be isolated, cleaned, ventilated, and tested for toxic and flammable vapors and oxygen deficiency. All tests should be performed in compliance with applicable national, state and local regulatory requirements and recognized industry practices including but not limited to: confined space procedures, lockout/tagout procedures, and requirements for personal protective equipment (see OSHA Regulations 29 *CFR* part 1910 and API Publications 2015 and 2217).

3.1.2 A visual inspection of the hot-work area is necessary. A competently trained or experienced person should be responsible for authorizing the hot work and should designate the necessary safety precautions.

3.1.3 Adequate first aid and fire-fighting equipment, such as fire extinguishers and water hose lines, should be available and ready for instant use. Workers should be instructed in the proper use of this equipment.

3.2 SPECIFIC PRECAUTIONS

3.2.1 The work permits for the job, tank entry, and hot work must be properly signed and issued prior to starting the work.

3.2.2 An air-mover rated for the appropriate electrical classification should be in operation at all times during entry and hot work. The capacity of the air-mover must be large enough to provide enough fresh air for workers inside the tank.

3.2.3 Lines to and from the tank shall be disconnected, blanked off, or otherwise isolated and should not be disturbed during entry and hot work.

3.2.4 Tank surfaces that have been in contact with leaded gasoline should be scraped down to bare metal. On each side of a line that might be heated excessively by welding or other operations, an area of at least 30 centimeters (12 inches) should be scraped down to bare metal.

[1]American National Standards Institute, 11 West 42nd Street, New York, NY 10036.

[2]Howell Training Company, 13831 Northwest Freeway, #520, Houston, Texas 77040.

[3]Occupational Safety and Health Administration, U.S. Department of Labor, Washington, D.C. 20402.

As an alternative to scraping down to bare metal, welders should use air-supplied respiratory equipment. If the area described above is not scraped down to bare metal and as long as frequent air-quality tests during the hot work indicate a safe atmosphere, it may be unnecessary for other personnel in the tank to wear air-supplied respiratory equipment (see API Publication 2015).

3.2.5 Grounding leads from the welding machine should be attached directly to a bared surface on the tank shell on which hot work is to be performed. Welding leads should be carefully inspected for insulation abrasions, cuts, scuffs, or breaks; any of these can cause shorting.

3.2.6 Compressed-gas cylinders used for cutting operations should be securely fastened in an upright position and kept outside the tank at a safe distance from the open manholes. When not in use, cutting torches and hoses must be shut off at the cylinder valves and kept outside the tank. Compressed-gas supply hoses and hose connections should be inspected for leaks prior to being taken inside the tank.

To prevent a possible flammable mixture with air from forming in the tank, compressed-gas supply hoses must be protected from damage outside the tank and from burns, cuts, breaks, or other damage inside the tank.

3.2.7 While work is in progress, all work areas must be monitored for oxygen deficiency and combustible and toxic atmospheres.

4 Inspection Procedures

4.1 GENERAL PROCEDURES

The tank bottom must be inspected, when repairs are planned, regardless of its suspected condition.

4.2 SPECIFIC PROCEDURES

Appropriately sized small openings are sometimes made in the tank bottom by cold cutting or by drilling holes in each area where hot work is to be performed. These openings facilitate visual inspection and freeing the interior from gas. When such openings are made, care must be taken to avoid a source of ignition that could result in a fire or explosion arising from flammable vapors or liquid that might be released from under the tank bottom. A coolant should be applied to the cutting edge of tools to reduce friction heat. The use of open-type electric drilling machines is not recommended.

If tank-bottom-to-shell repairs are to be made, care must be taken to remove any exterior insulation on the bottom of the tank shell that could be oil soaked; hot work conducted internally could cause oil-soaked insulation to ignite. Before the insulation is removed, its type should be determined so that it can be removed properly.

5 Safe Work Procedures

5.1 GENERAL

The work procedures adopted will depend on the condition of the tank bottom, the type and extent of the hot-work repairs to be performed, and the results of the inspection. The safe work procedures described in 5.2 through 5.6 apply only to those situations in which flammable liquids or vapors are known or suspected to be present. These procedures are not intended to cover all the different types of tank-bottom or hot-work repairs that may be encountered; they do, however, describe a variety of situations in which these safety principles can be applied. Safe work procedures should be written and approved by a competent, trained or experienced person.

5.2 MINOR REPAIRS

Minor repairs usually involve welding corrosion pits and patches or other localized jobs, such as welding supports or braces. If the bottom is not in good condition, the following procedure may be used:

a. Drill and tap a hole for a 13 millimeter (½ inch) pipe adjacent to the repair area.

b. Connect a supply of carbon dioxide or other inert gas to the 13 millimeter (½ inch) tap, using metal tubing. A pressure control valve with a flow indicator should be used to prevent over-pressuring of the tank bottom.

c. Prior to beginning the hot work, establish a flow of inert gas under the tank bottom in the vicinity of any proposed welding to ensure that any flammable vapors have been swept away or diluted so that they cannot support combustion.

d. When using inert gas, continuously monitor the area to assure that the oxygen content remains between 19.5 and 22.5 percent.

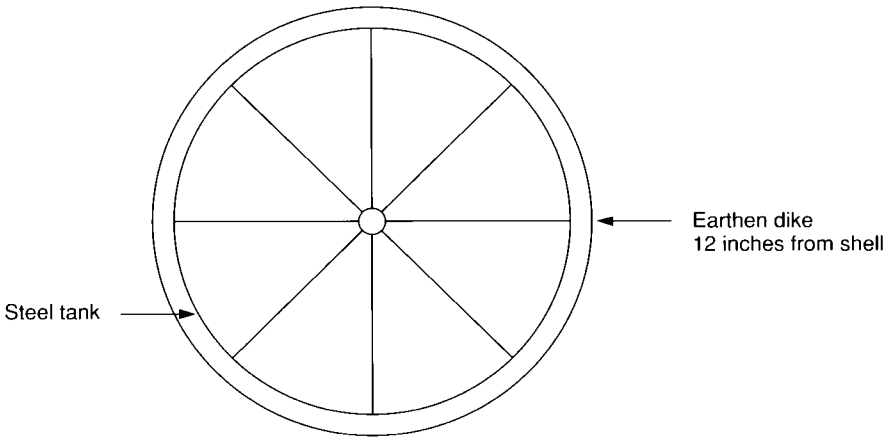
e. When the welding has been finished in a localized area, stop the flow of inert gas, remove the tubing, plug the hole with a tapered pin or other device, and back weld promptly before moving to another area.

5.3 MAJOR REPAIRS

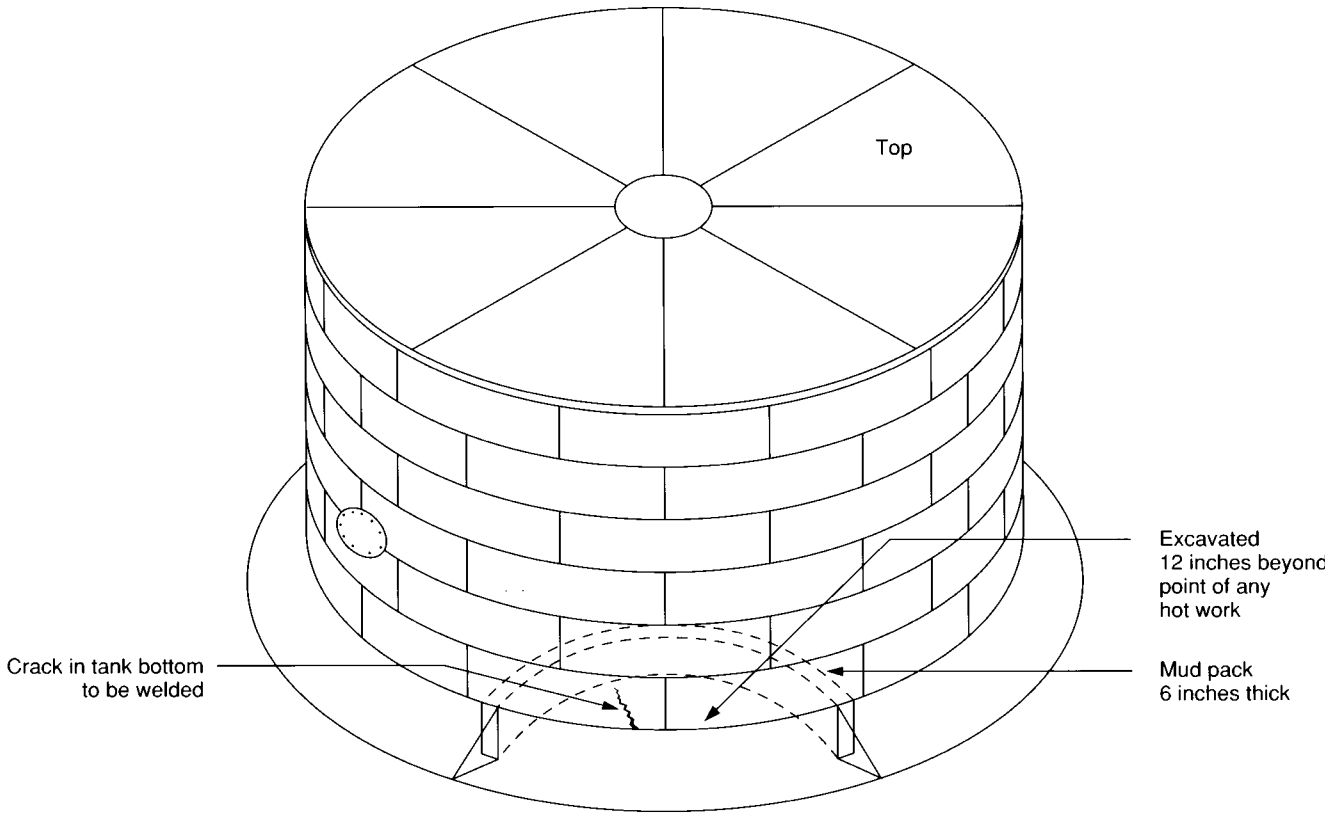
When repairs involve most of the tank bottom, it may be desirable to displace the flammable liquids beneath the tank by water flooding. This may be done as follows:

a. Around the tank's outer shell, construct an earthen dike higher than the highest floor plate in the tank (see Figure 1).

b. At the highest points in the tank bottom, drill and tap holes for 13 millimeter (½ inch) pipe. These holes should be located to ensure that all flammable liquids or vapors under the tank will be displaced with water.



TOP VIEW



PERSPECTIVE VIEW

Figure 1—Preparing a Tank for Repairs

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