

Engineering Standard

SAES-L-052

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Hot Tap Connections

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Saudi Aramco DeskTop Standards

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1 Scope

This standard defines minimum mandatory requirements for pressure piping connections to existing pipelines, tanks and pressure vessels by hot tapping.

2 Conflicts And Deviations

- 2.1 Any conflicts between this standard and other applicable Saudi Aramco Engineering Standards (SAESs), Materials System Specifications (SAMSSs), Standard Drawings (SASDs), or industry standards, codes, and forms shall be resolved in writing by the Company or Buyer Representative through the Manager, Consulting Services Department of Saudi Aramco, Dhahran.
- 2.2 Direct all requests to deviate from this standard in writing to the Company or Buyer Representative, who shall follow internal company procedure [SAEP-302](#) and forward such requests to the Manager, Consulting Services Department of Saudi Aramco, Dhahran.

3 References

The selection of material and equipment, and the design, construction, maintenance, and repair of equipment and facilities covered by this standard shall comply with the latest edition of the references listed below, unless otherwise noted.

3.1 Saudi Aramco References

Saudi Aramco Engineering Procedures

SAEP-302	<i>Instructions for Obtaining a Waiver of a Mandatory Saudi Aramco Engineering Requirement</i>
SAEP-311	<i>Installation of Hot Tapped Connections</i>
SAEP-315	<i>Installations of Stopple Fittings</i>

Saudi Aramco Engineering Standards

SAES-A-004	<i>Pressure Testing</i>
SAES-B-006	<i>Fireproofing in Onshore Facilities</i>
SAES-D-108	<i>Storage Tank Integrity</i>
SAES-L-003	<i>Design Stress Criteria for Pressure Piping</i>
SAES-L-045	<i>Scraper Trap Station Piping and Appurtenances</i>
SAES-L-056	<i>Pressure Testing of Plant Piping and Pipelines</i>

SAES-W-010	<i>Welding Requirements for Pressure Vessels</i>
SAES-W-011	<i>Welding Requirements for On-Plot Piping</i>
SAES-W-012	<i>Welding Requirements for Pipelines</i>

Saudi Aramco Materials System Specification

02-SAMSS-006	<i>Hot Tap and Stopples Fittings</i>
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3.2 Industry Codes and Standards

American Petroleum Institute

<i>API 650</i>	<i>Welded Steel Tanks for Oil Storage</i>
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American Society of Mechanical Engineers

<i>ASME B31.3</i>	<i>Process Piping</i>
<i>ASME SEC VIII D1</i>	<i>Boiler and Pressure Vessel Code</i>

4 Limitations

- 4.1 Loss Prevention office in the appropriate area shall be notified of all hot tap work and provided with procedures for review.

Hot tap connections shall not be made in the following cases unless a detailed design and installation procedure has been approved by the Manager of Consulting Services Department.

- a) The pipe or vessel contains acid, caustic, elemental sulfur, oxygen, chlorine, ammonia or other potentially toxic materials (see [SAES-B-006](#) section 4 for definitions of toxic and flammable materials mentioned below);
- b) The pipe or vessel contains flammable materials below atmospheric pressure or combustible mixtures;
- c) The material to be welded may suffer metallurgical or physical deterioration from heating or requires post weld heat treatment;
- d) The pipe or vessel has a corrosion or heat resistant lining such as metal lining or cladding. This restriction does not include internal coatings but should be considered by the Operating Department.
- e) Hot tapping on surface temperatures at or below 0 deg C;

- f) The operating pressure during tapping exceeds 9930 kPa at 38 deg C (1440 psig at 100 deg F) or 4830 kPa at 370 deg C (700 psig at 700 deg F) for T.D. Williamson models 360, 660, or 1200 tapping machines;
 - g) The operating pressure during tapping exceeds 8270 kPa up to 93 deg C (1200 psig up to 200 deg F) for T.D. Williamson model 2400 tapping machine;
 - h) Connections on tanks designed per API 650. Refer to [SAES-D-108](#) for additional tank hot tapping requirements.
- 4.2 Hot taps on tanks shall be made at least 1 m below the liquid level.
- 4.3 Hot taps shall not be made on air lines or vessels with compressed air if there is any possibility of hydrocarbon contamination, unless the equipment being tapped is thoroughly cleaned or inerted prior to welding.
- 4.4 Hot taps shall not be made upstream of rotating machinery or in-line rotating instruments unless facilities exist to prevent chips and shavings from entering the equipment. Normal in-line suction screens are not considered adequate for this purpose. When hot tapping 2-inch connections (e.g. Cosasco fitting) and smaller, the requirement for preventing chips and shavings from entering the equipment is at the discretion of the proponent.

5 Design

- 5.1 The dimensions of the connection, the hot tap valve, and the clearances shall be within the limits specified for the hot tapping equipment to be used (See Pipeline Maintenance Department, Hot-Tap and Stopple Unit). The minimum bore of the valve shall be large enough to pass the cutter and/or stopple plug. If lugs on the valve seats restrict the opening they shall be removed.
- 5.2 A tap equal to the nominal size of the header (such as required for stoppling of a pipeline) shall be made only when the accurate positioning of the cutter can be guaranteed e.g. by the use of a shop-fabricated split tee in accordance with [02-SAMSS-006](#). In all other cases the cutter shall be at least one pipe size smaller than the pipe to be tapped.
- 5.3 Welding on Pipelines Under Pressure
- 5.3.1 The hot tapping procedure shall set limits for the maximum internal pressure in the pipeline. The pressure in the pipe during welding shall not exceed that calculated by the following formula:
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$$P_{\max} = \frac{2S(t - 0.10)F}{OD}$$

Where:

P_{\max} = Maximum operating pressure of the pipeline during welding, psig

S = Specified minimum yield strength of the pipe, psi

t = Minimum measured wall thickness of the weld area, inch

F = Design factor of the pipeline (Refer to SAES-L-003)

OD = Outside diameter of the pipe, inch

Commentary Notes:

- 1. The minus 0.10 inch wall thickness takes into account the molten and heat affected portion of the base metal which does not contribute to pressure containment.*
- 2. For in-plant piping designed to ASME B31.3, replace S and F in the formula with the allowable stress in Table A-1 of ASME B31.3.*

To ensure the wall thickness is thoroughly measured, a continuous UT scan shall be conducted around the circumference of the pipe weld areas.

5.3.2 To further minimize the possibility of "weld blow-out", no welding shall be allowed in areas with a wall thickness below 5 mm nor below the pressure design thickness of the piping being tapped. Refer to paragraph 4.1 for other limitations.

5.4 If the hot tap valve is a gate valve and the centerline of the tapping direction is not in the vertical, the valve shall be installed with the stem horizontal so that the cuttings are not likely to fall into and be trapped at the bottom of the body where they would interfere with the closure of the valve. If this is not possible, the hot tap valve shall be provided with a valved drain of not less than 3/4 inch NPS to permit flushing of the valve if needed.

5.5 If the hot tap valve is to be removed after tapping (such as in the case of stoppling), a Lock-O-Ring (R) flange and plug (or equal) shall be used unless the equipment can be depressurized and drained prior to removal of the valve.

If hot taps are made in pipelines which require scraper bars per SAES-L-045, a Lock-O-Ring (R) flange and plug (or equal) and matching insert, to which the bars or guide plate are attached, shall be installed.

6 Installation

- 6.1 The welded branch or split tee shall be accurately positioned so that the axis of the cutter will intersect the axis of the pipe or vessel being tapped at a 90 degree angle unless an angled tap has been specifically approved in the hot tapping procedure per [SAEP-311](#) "Installation of Hot Tapped Connections". The branch position shall be verified by the assigned inspector prior to making the cut.
- 6.2 The installation, pressure testing, welding and cutting, and all safety precautions shall be in accordance with [SAEP-311](#) "Installation of Hot Tapped Connections", [SAEP-315](#) "Installation of Stopple Fittings", [SAES-W-010](#), [SAES-W-011](#) and [SAES-W-012](#) as applicable.

7 Pressure Testing

- 7.1 The hot tap valve shall have a pressure test applied to the seats and body in accordance with [SAEP-311](#).

At the completion of the sticker weld and again after the completion of the branch assembly welds, pressure testing shall be conducted per paragraphs 7.2 to 7.4 before making the tap. The reinforcing pad of a welded branch shall be provided with a vent hole. The hole shall be plugged with heavy grease before leaving the job.

- 7.2 The procedure and selection of test fluid shall be in accordance with [SAES-A-004](#). In addition, special attention shall be given to the possibility of boiling or flashing of the test liquid if the surface to be tapped is hot.

- 7.3 The test pressure for the hot tap connection shall be the lower of the following two cases:

- a) The minimum pressure in the pipe or vessel being tapped, while the test is in progress, plus a calculated differential pressure. The differential pressure shall be 1.25 times the allowable external pressure calculated per the ASME SEC VIII D1, paragraph UG-28. For this calculation the value of L shall be the total length of the split tee or the inside diameter of the welded nozzle.
- b) Maximum test pressure of branch connection flange or wall thickness.

Commentary Notes:

The total test pressure (internal plus external pressure) shall be as high as possible. This can be accomplished by raising the internal pressure of the header, or equipment being tapped until it is limited by either:

- *The design pressure of the header/equipment*
- *The current maximum operating pressure of the header/equipment*

The test pressure of the hot tap connection may be lower than the original hydrostatic test pressure of the pipe or vessel being tapped. This is acceptable since the purpose of the test is to provide some assurance of the integrity of the connection weld. It is not a proof test of the connection. The system being tapped should not be derated because of the lower test pressure of the hot tap connection.

- 7.4 The supply of the test pressure shall be provided with a relief valve to prevent inadvertent over pressure which could cause buckling of the wall to be tapped.

8 Inspection

In addition To hydrotest as required by paragraph 7.1, at the option of the Saudi Aramco inspector, the sticker and reinforcing pad welds may be inspected by magnetic particle examination. Alternatively, dye penetrant examination may be used provided surface preparation is made as required where surface irregularities could mask indications of unacceptable discontinuities.

Revision Summary

29 July 1998 Editorial revision to paragraphs 3.1, 3.2, 4.1(a), 7.1, 7.3 and Commentary Notes.
Next Planned Update set to August 1, 2001.