

Engineering Standard

SAES-L-420

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Scraper Trap Station and Appurtenances

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Saudi Aramco DeskTop Standards

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1 Scope

- 1.1 This standard defines the minimum mandatory requirements governing the design of piping and appurtenances for permanent pipeline scraper launching and receiving stations.
- 1.2 This standard supplements ASME B.31.3, ASME B31.4, and ASME B31.8 codes for pressure piping and design requirements contained in other Saudi Aramco Piping Standards.
- 1.3 This standard does not apply to valves of special design (such as ITAG) which can be used to launch or receive small size scrapers. Their application is not in violation of this standard.

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 Procedure

[SAEP-302](#)

*Instructions for Obtaining a Waiver of a
Mandatory Saudi Aramco Engineering
Requirement*

Saudi Aramco Engineering Standards

[SAES-L-100](#)

*Applicable Codes and Standards for Pressure
Piping Systems*

<u>SAES-L-101</u>	<i>Regulated Vendor List for Pipes, Fittings and Gaskets</i>
<u>SAES-L-102</u>	<i>Regulated Vendor List for Valves</i>
<u>SAES-L-108</u>	<i>Selection of Valves</i>
<u>SAES-L-310</u>	<i>Design of Plant Piping</i>
<u>SAES-L-410</u>	<i>Design of Pipelines</i>

Saudi Aramco Materials System Specification

<u>02-SAMSS-009</u>	<i>Design and Fabrication of Scraper Traps</i>
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Saudi Aramco Standard Drawings

<u>AC-036541</u>	<i>P&ID for P/L Scraper Trap Stations</i>
<u>AC-036548</u>	<i>Guide Bar Details for Tees and Branches in Pipelines with Scraping Facilities</i>
<u>DC-950069</u>	<i>Dimensions of Bi-Directional Scraper Trap, ASME Class 150 through 600</i>
<u>DC-950070</u>	<i>Dimensions of Bi-Directional Scraper Trap, ASME Class 900 and 1500</i>
<u>DC-950071</u>	<i>Dimensions of Scraper Trap for Instrumented Scrapers</i>
<u>DC-950072</u>	<i>Dimensions of Scraper Traps of Vertical Scraper Launcher for Cleaning and Batching Scraper</i>

3.2 Industry Codes and Standards

American Society of Mechanical Engineers

<i>ASME B31.3</i>	<i>Process Piping</i>
<i>ASME B31.4</i>	<i>Liquid Transportation Systems for Hydrocarbons, Liquid Petroleum Gas, Anhydrous Ammonia, and Alcohols</i>
<i>ASME B31.8</i>	<i>Gas Transmission and Distribution Piping Systems</i>
<i>ASME SEC VIII D1</i>	<i>Boiler and Pressure Vessel Code</i>

4 Definitions

Scraper: This term in this standard includes all devices for internal cleaning, gauging, inspection (instrumented tools), batching, and inflatable spheres.

Trap: This term refers to the devices used for launching or receiving the scrapers.

5 General Requirements

- 4.1 Permanent scraper traps shall be installed on the pipeline if periodic scraping is required as stipulated by [SAES-L-410](#).

The specific type of scrapers to be used, such as those defined in section 4, shall be identified during the Project Proposal stage.

- 4.2 Scraper trap stations shall be designed for onstream scraping (uninterrupted delivery) at the flow rate which corresponds to the maximum recommended scraper velocity.
- 4.3 The pipeline system shall have provisions to control the velocity of the scraper at all times and to receive and dispose of liquid slugs and/or solids brought in by the scraper.
- 4.4 Scraper trap stations shall be designed for bi-directional scraping whenever there is possibility for bi-directional flow such as:
- a) The pumping is in either direction (shuttle lines).
 - b) The source of water and/or the disposal site of water used for hydrostatic testing may be on either end of the pipeline.
- 4.5 All pipes, fittings, gaskets, closure doors and valves shall be sourced from approved sources per [SAES-L-101](#) and [SAES-L-102](#).

6 System Design

Scraper trap station piping for onstream scraping operations shall be in accordance with Standard Drawing [AC-036541](#) (P&ID) and shall consist of the following:

- 5.1 Scraper trap closure as detailed in paragraph 7.2 (standardized designs shall be used where they meet all operating requirements without substantial cost increase).
- 5.2 A full bore trap isolation valve of the same nominal size as the pipeline.
- 5.3 A barred tee in the mainline. The distance between the centerline of the branch and the near end of the trap isolation valve shall be kept to a minimum and, if more than three pipe diameters, shall be sloped back to the branch.
- 5.4 A tieline valve at the branch of the tee at the minimum practical distance from the mainline.
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- 5.5 A bypass line between the tieline valve and the trap with a kicker valve and a second block valve to provide tight shut-off in the bypass line. (See also paragraph 6.1).
 - 5.6 Small size pressure equalizing valves around the trap isolation valve and around the kicker valve. A small size equalizing line with locked open block valve shall be provided to connect the small diameter end of the trap with the other end to prevent unwanted pressure differential when a scraper seals off the narrow part of the trap. The equalizing valves shall be suitable for throttling and give tight shut off.
 - 5.7 A blinded valve for test water inlet/outlet.
 - 5.8 A double valved drain system sized to permit drainage of the trap within approximately 15 minutes. A check valve shall be installed if back flow from the disposal system could otherwise occur. See also paragraph 6.1.
 - 5.9 A vent system to provide safe disposal of gas and vapors before the trap closure is opened. Sour gas from gas lines, pressure crude and multi-phase flowlines shall be depressurized to a closed flare or drain system and subsequently vented to atmosphere. Sweet gas and sour vapors from liquid crude or water shall be vented to atmosphere at a safe location not less than 6 m above grade near the trap.
 - 5.10 A purge connection shall be provided on all traps handling sour gas and/or liquid and may be required by the Proponent on all hydrocarbon systems.
 - 5.11 A sampling connection shall be installed at the bottom of the scraper receiver if connections with valves for the injection of chemicals at launching stations are required.
 - 5.12 A pressure gauge shall be provided near the trap closure and another one on the mainline near the trap isolation valve.
 - 5.13 Scraper passage indicators per paragraph 7.6 shall be located as follows:
 - a) on the mainline, one scraper length downstream and beyond the barred tee on each launcher,
 - b) near the small diameter side of the reducer on each receiver,
 - c) at approximately 1.5 km upstream of onshore receiver stations if required by the Operating Department. (See also paragraph 6.2.).
 - 5.14 A proposed pipeline shall not have valves, fittings or connections installed that may impede the travel of the scraper.
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7 Water Injection Systems

- 6.1 A disposal line with a special throttling valve shall be provided at scraper receiver stations at water injection wells to divert dirty water ahead of the scraper from being injected into the well. The disposal line shall start from the drain system which provides the second block valve for tight shut off.
- 6.2 The throttling valve shall be designed to manually control the pipeline flow to the disposal site while the tieline valve is closed until the scraper has landed. The valve shall not have flow passages smaller than 12 mm to prevent possible plugging.
- 6.2 The volume of contaminated fluid to be disposed shall be kept to a minimum and shall be determined by the location of the upstream scraper passage indicator. The volume shall normally be based on the amount of flow at maximum scraping velocity during the opening stroke of the trap isolation valve plus five minutes of the flow rate.

8 Design of Components

7.1 Scraper traps

- 7.1.1 Scraper traps shall be designed and manufactured in accordance with [02-SAMSS-009](#). The available Standard Drawings listed below are typical installation drawings for overall dimensions and main features which should be followed when applicable.

[DC-950069](#) *Dimensions of Bi-Directional Scraper Traps, ASME Class 150 through 600*

[DC-950070](#) *Dimensions of Bi-Directional Scraper Traps, ASME Class 900 and 1500*

[DC-950071](#) *Dimensions of Scraper Traps for Instrumented Scrapers*

[DC-950072](#) *Dimensions of Scraper Traps of Vertical Launchers for Launching Cleaning and Batching Scrapers.*

- 7.1.2 Bi-directional traps shall permit launching of one scraper and receiving two scrapers with the maximum length of the scraper type (excluding instrumented scrapers) to be used. Refer to Appendix A for the length of normal (cleaning and batching) scrapers and of instrumented scrapers. Appendix A also provides guidance for designing special launchers and receivers not covered by the Standard Drawings.

7.2 Trap Closures

Scraper traps shall be provided with tight sealing end closures. The closures shall be quick opening, hinge or davit supported, and provided with mechanical devices needed to assist in opening and closing. Safety devices shall be provided in accordance with the ASME SEC VIII, Division 1, Paragraph UG-35 to ensure that:

- a) The closure cannot be opened as long as there is pressure inside the trap, and that a warning will be given if an attempt is made to disengage the locking mechanism while the trap is still under pressure.
- b) Pressure will be released and a warning given when an attempt is made to pressurize the trap before the locking mechanism is fully engaged.

Commentary Note:

For traps on existing pipelines, there have been cases where Operating Department modified the corroded closure by using blind flange with hinge or davit. This is not permitted for new construction.

7.3 Valves

Valve types shall be selected in accordance with [SAES-L-108](#). All valves with mechanical assistance actuator shall be provided with a manual override. Powered actuators, including those for the trap isolation valve and the tieline valve, shall permit operating personnel to instantaneously stop the valve stroke and reverse from closing to opening or vice-versa at any point of the stroke.

7.4 Tees

All tees and other branch connections in the pipeline with permanent scraping facilities shall allow the free passage of sphere scrapers, scrapers with cups or discs and/or gauging plates, and instrumented scrapers. The branch shall be provided with guide bars when the branch bore exceeds 60 percent of the run bore, or for branch pipe sizes of 6-inch NPS and larger if cleaning scrapers with spring mounted brushes will be used as required by the Operating Department. Standard Drawing [AC-036548](#) is a typical installation drawing for guide bars in extruded tees.

7.5 Bends

Long radius bends shall be used in pipelines with permanent scraping facilities.

The bend radius shall not be less than eight diameters (8D) for lines up to 8-inch NPS, 5D for lines of 10-inch NPS through 14-inch NPS, and 3D (either bends or forged elbows) for lines of 16-inch NPS and larger if 5D cannot be used because

of space limitation, or difficulty in procurement, subject to review and approval by the Chairman of Piping Standards Committee in Consulting Services Department.

7.6 Scraper Passage Indicators

Scraper passage indicators (SPI) shall be bi-directional, shall give positive indication of scraper passage and shall not solely dependent on a superficial or painted marking or other method that can become obliterated. The indicators shall be designed for manual reset and allow replacement of all moving parts with pressure in the line. Scraper passage indicators installed on a buried portion of the pipeline shall have an extended stem, with 4-inch NPS protective sleeve, such that the dial or pointer will be approximately 50 cm above ground.

7.7 Supports

Horizontal scraper traps shall have sliding supports. Similar supports shall be provided for the trap isolation and the tieline valves as well as the kicker line, drain line and other above ground piping.

7.8 Scraper Handling Equipment

For pipeline diameters larger than 16-inch NPS onshore and 10-inch NPS offshore, a mechanical scraper loading device with suitable lift and span shall be provided to assist in the loading and the receiving of normal cleaning and batching scrapers. The lifting capacity shall be not less than 900 kg for line sizes up to 36-inch and not less than 1800 kg for larger diameter lines. Offshore installations may deviate from this requirement subject to approval from the Manager of Operating Department.

9 Station Layout

8.1 When scraper traps are provided at the ends of pipelines near a plant area onshore, they shall be in a scraper trap area inside of the plant SSD fence. The lateral piping between trap and plant shall be constructed above grade except as permitted per [SAES-L-310](#).

8.2 Scraper traps orientation shall be as follows:

8.2.1 Generally, the scraper trap shall be oriented away from any critical equipment per [SAES-L-100](#) as possible and 8.2.2 and 8.2.3 provide minimum acceptable orientation. This is to ensure that scraper projectile will not collide with these equipments.

- 8.2.2 For on-land and near shore pipelines, the distance between from critical plant equipment per [SAES-L-100](#) measured from the closure door shall not be less than 45 m.
- 8.2.3 Onshore and offshore scraper traps shall be oriented such that no equipment nor above grade piping are within a sectorial area, 45 m radius by 20 degrees, (10 degrees to each side of the centerline of the trap) from the closure door.
- 8.2.4 Launchers for use on offshore platforms may be of vertical orientation
- 8.3 Platforms shall be provided for easy access to valve actuators and closure operating mechanism. All valves shall be accessible from one side of the trap.
- 8.4 For onshore, a suitable work floor shall be provided with sufficient room around the traps for loading and unloading scrapers and for access by moving equipment such as a fork lift truck. The clearance between the bottom of the trap and finished grade in onshore plants shall be approximately 1 m. A surface drainage system shall be provided to collect any spill from the trap and wash water.
- 8.5 At all scraper trap stations, the piping that cross connects the upstream and downstream pipelines, and associated kicker and equalizer lines shall be constructed above grade.

Revision Summary

30 September, 2003 Minor revision to renumber the standard from SAESL-045 to SAES-L-420 and update references to provide more clarity

Appendix A - Scarper Trap Design Guidelines

- A.1 Appendix A provides design guidelines for scraper traps not covered by the Standard Drawings in section 7.
- A.2 The nominal size of the barrel shall normally be 2 inches larger than the line for pipelines up to 10-inch NPS, 4 inches larger for pipelines 12 to 28-inch NPS, and 6 inches larger for pipelines 30-inch NPS and larger.
- A.3 Unless more up-to-date information is available on various types of instrumented scrapers, the trap length should be based on the maximum scraper lengths for normal and for instrumented scrapers listed in Table 1:

Table 1 - Scarper Length

Nominal Line Size (Inches)	Scraper Length "A" Normal	Scraper Length "B" Instrumented
6	0.71 m	2.87 m
8	0.81 m	3.71 m
10 - 14	0.86 m	3.91 m
16	0.86 m	4.17 m
18	0.91 m	3.00 m
20	1.02 m	3.25 m
22	1.12 m	3.25 m
24	1.22 m	3.33 m
26	1.32 m	3.33 m
28	1.42 m	3.45 m
30	1.52 m	3.78 m
32	1.63 m	4.57 m
34	1.73 m	4.22 m
36	1.83 m	4.57 m
38	1.55 m	4.57 m
40	1.63 m	4.57 m
42	1.70 m	4.57 m
44	1.78 m	6.20 m
46	1.88 m	6.20 m
48	1.96 m	6.20 m
56	2.29 m	(1)
60	(1)	(1)

Note (1) : Check with specific supplier

- A.4 The length from the smaller end of the reducer to the centerline of the kicker line shall be at least equal to the maximum scraper length. The length of the smaller diameter portion shall be sufficient to permit installation of the required piping connections and, in case of a receiver, not less than the maximum scraper length.

A.5 The scraper passage indicator on receivers shall be located at 150 mm upstream of the reducer. The distance from the centerline of the kicker line to the attachment weld of the closure door collar shall not exceed one trap diameter.

A.5 Trap Closures

There are various types of quick opening trap closures on the market with various locking mechanisms. Only manufacturers that have been surveyed and approved by Saudi Aramco for the size range and pressure ratings involved shall be allowed to supply. The safety mechanism on the closure shall comply with ASME SEC VIII, Division 1, UG-35. The ASME stamp is not required since the trap is designed to piping codes rather than to ASME BPV code.

A.6 Valves

The block valves shall be of a design which provides tight shut off.

Scraper launching and receiving can be complicated and mistakes in opening or closing of valves are not uncommon. Therefore, the operator must be able to immediately close a valve after it has just started to open. Powered actuators, electric or hydraulic, must be able to stop immediately and reverse the stroke if needed. Actuators that cannot meet this requirement (i.e. they can be reversed only at the end of a stroke) are not acceptable.