

# Engineering Standard

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SAES-L-130

29 June 2005

## Material for Low Temperature Service

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## Saudi Aramco DeskTop Standards

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## 1 Scope

This Standard covers toughness requirements for carbon and low alloy steels used for pipe and piping components in service at a design minimum temperature within the range of -18°C to -45°C. The requirements in this standard are more restrictive than those in the ASME B31.3 code.

For definitions of design minimum temperatures, including auto-refrigeration service, refer to [SAES-L-310](#), or [SAES-L-410](#) as applicable.

### *Commentary Note:*

*Piping materials for temperatures lower than -45°C are not covered in Saudi Aramco engineering standards, but are selected in accordance with the ASME B31.3 code, project design documents, process license guidelines, and recommendations from Consulting Services Department.*

## 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's 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's Representative, who shall follow internal company procedure [SAEP-302](#) and forward such requests to the Manager, Consulting Services Department of Saudi Aramco.

## 3 References

### 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-133](#)

*Corrosion Protection Requirements for Pipelines/Piping*

[SAES-L-310](#)

*Design of Plant Piping*

[SAES-L-410](#)

*Design of Pipelines*

### Saudi Aramco Materials System Specifications

<a href="#"><u>02-SAMSS-001</u></a>	<i>Piping Components for Low Temperature Service</i>
<a href="#"><u>02-SAMSS-011</u></a>	<i>Forged Steel Weld Neck Flanges for Low and Intermediate Temperature Service</i>

### 3.2 Industry Codes and Standards

#### American Petroleum Institute

<i>API SPEC 5L</i>	<i>Specification for Line Pipe</i>
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#### American Society of Mechanical Engineers

<i>ASME B31.3</i>	<i>Process Piping</i>
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#### American Society for Testing and Materials

<i>ASTM A333</i>	<i>Seamless and Welded Steel Pipe for Low Temperature Service</i>
<i>ASTM A350</i>	<i>Carbon and Low-Alloy Steel Forgings, Requiring Notch Toughness Testing for Piping Components</i>
<i>ASTM A420</i>	<i>Piping Fittings of Wrought Carbon Steel and Alloy Steel for Low Temperature Service</i>
<i>ASTM A516</i>	<i>Pressure Vessel Plates, Carbon Steel, for Moderate- and Lower-Temperature Service</i>
<i>ASTM A671</i>	<i>Electric Fusion Welded Steel Pipe for Atmospheric and Lower Temperatures</i>

## 4 Materials

4.1 Carbon steel piping materials shall be as specified in this section (Section 4) when the design minimum temperature is within the range of -18°C to -45°C.

*Exception:*

*The impact testing and special requirements of this standard are not applicable if:*

- a) *The maximum allowable operating pressure of the pipe does not exceed 25% of the maximum design pressure allowed by ASME B31.3 at ambient temperature, and*
  - b) *The combined longitudinal stress due to pressure, dead weight, and displacement strain does not exceed 41 MPa (6 ksi).*
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- 4.2 Except that ERW pipe shall not be used, pipe purchased in accordance with the specifications listed below may be used if longitudinal Charpy V-notch impact tests at -45°C demonstrate absorbed energies of 34/27 J (25/20 ft-lbs):
- a) API SPEC 5L, PSL 2
  - b) ASTM A333 Grade 6
  - c) ASTM A671, Class 22, Grade CC60 or CC65, Supplementary Requirement S-2 (Charpy V-Notch Test)
- 4.3 Carbon steel pipe, except for ERW, in accordance with API SPEC 5L PSL 2, ASTM A333 Grade 6, or ASTM A671 (Class 22, Grade CC60 or CC65, S2) may be used for low temperature service under the following conditions:
- a) Design minimum temperature not lower than -29°C, or
  - b) When certified as having been tested at temperature of at least 20°C below the design minimum temperature.
- 4.4 Nickel-containing steels in accordance with ASTM A333 or ASTM A671 may be used as long as the service is not sour.
- 4.5 ANSI B16.11 socket-welding and threaded fittings, less than 2-inch NPS, in accordance with ASTM A350 Grade LF2, may be used to a design minimum temperature of -45°C.
- 4.6 Piping components that do not qualify for the exception in Para. 4.1 shall comply with the requirements of [02-SAMSS-001](#). Acceptable materials are ASTM A420 Grade WPL 3, ASTM A420 Grade WPL 6, and ASTM A350 Grade LF2. ASTM A516 plate may be used for blind flanges, spectacle plates, spacers and slip blinds.
- Piping components include butt welding pipe fittings such as elbows, tees, welding outlets, reducers, caps and lap joint stub ends  $\leq$  NPS 24; as well as blind flanges, spectacle plates, spacers and slip blinds. Pipe is not included as a piping component, but is addressed in Para. 4.1 through 4.4 above.
- 4.7 All weld neck flanges, and any lap joint flanges larger than NPS 24, shall comply with requirements specified in [02-SAMSS-011](#).
- 4.8 Pipe and piping components for wet, sour service shall comply with the provisions in [SAES-L-133](#) Section 9.
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## 5 Material Selection and Testing Subcommittee

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### Revision Summary

29 June 2005

Revised the "Next Planned Update". Reaffirmed the contents of the document, and reissued with minor changes.