

Engineering Procedure

SAEP-352

31 May, 2003

Welding Procedures Review and Approval

Document Responsibility: Consulting Services Department

Saudi Aramco DeskTop Standards

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1 Scope

- 1.1 This procedure specifies the responsibilities for welding procedure review and approval. This procedure applies to pressure vessels, process equipment or components, piping, pipelines, and structures fabricated to a variety of standards, such as but not limited to ASME I, IV, VIII, B31.1, B31.3, B31.4, B31.8 and API 560, 620 and 650, and AWS D1.1.
- 1.2 Additional requirements may be contained in Scopes of Work, Drawings, or other Instructions or Specifications pertaining to specific items of work.

2 Conflicts and Deviations

Conflicts between this Engineering Procedure and any other Saudi Aramco Standard shall be resolved by the Consulting Services Department in writing.

3 Applicable Documents

Unless stated otherwise, all Standards, Specifications, and Codes referenced in this procedure shall be of the latest issue (including revisions, addenda, and supplements) and are considered a part of this procedure.

3.1 Saudi Aramco References

Saudi Aramco Engineering Standards

<u>SAES-D-008</u>	<i>Repairs, Alterations, and Rerating of Pressured Equipment</i>
<u>SAES-D-108</u>	<i>Storage Tank Integrity</i>
<u>SAES-L-850</u>	<i>Design of Submarine Pipelines and Risers</i>
<u>SAES-L-133</u>	<i>Corrosion Protection Requirements for Pipelines/Piping</i>
<u>SAES-L-460</u>	<i>Pipelines Crossing Under Roads and Railroads</i>
<u>SAES-L-350</u>	<i>Construction Requirements for Metallic Plant Piping</i>
<u>SAES-L-450</u>	<i>Construction Requirements for Cross-Country Pipelines</i>
<u>SAES-M-001</u>	<i>Design and Construction of Fixed Offshore Platforms</i>
<u>SAES-M-005</u>	<i>Design and Construction of Fixed Offshore Platforms</i>

<u>SAES-W-010</u>	<i>Welding Requirements for Pressure Vessels</i>
<u>SAES-W-011</u>	<i>Welding Requirements for On-Plot Piping</i>
<u>SAES-W-012</u>	<i>Welding Requirements for Pipelines</i>
<u>SAES-W-013</u>	<i>Welding Requirements for Offshore Structures</i>
<u>SAES-W-017</u>	<i>Welding Requirements for API Tanks</i>

Saudi Aramco Materials System Specifications

<u>01-SAMSS-010</u>	<i>Fabricated Carbon Steel Piping</i>
<u>01-SAMSS-017</u>	<i>Auxiliary Piping for Mechanical Equipment</i>
<u>01-SAMSS-035</u>	<i>API Line Pipe</i>
<u>01-SAMSS-038</u>	<i>Small Direct Charge Purchases of Pipe</i>
<u>02-SAMSS-001</u>	<i>Piping Components for Low Temperature Services</i>
<u>02-SAMSS-005</u>	<i>Butt Welding Pipe Fittings</i>
<u>02-SAMSS-006</u>	<i>Hot Tap and Stopples Fittings</i>
<u>02-SAMSS-008</u>	<i>Insulating Joints/Spools for Cathodic Protection</i>
<u>02-SAMSS-009</u>	<i>Design and Fabrication of Scraper Traps</i>
<u>02-SAMSS-010</u>	<i>Flanged Insulating Joints/Spools for Cathodic Protection</i>
<u>04-SAMSS-035</u>	<i>General Requirements for Valves</i>
<u>04-SAMSS-049</u>	<i>Inspection and Testing Requirements for API SPEC 6A, 10000</i>
12-SMSS-007	<i>Fabrication of Structural and Miscellaneous Steel</i>
12-SMSS-014	<i>Pre-Engineered Metal Building</i>
31-SMSS-001	<i>Centrifugal Compressor</i>
31-SMSS-004	<i>Centrifugal Pumps</i>
<u>32-SAMSS-004</u>	<i>Manufacture of Pressure Vessels</i>
<u>32-SAMSS-005</u>	<i>Manufacture of Atmospheric Tanks</i>
<u>32-SAMSS-006</u>	<i>Manufacture of Low Pressure Tanks</i>
<u>32-SAMSS-007</u>	<i>Manufacture of Shell and Tube Heat Exchangers</i>
<u>32-SAMSS-009</u>	<i>General Purpose Steam Turbines</i>
<u>32-SAMSS-010</u>	<i>Special Purpose Steam Turbines</i>
<u>32-SAMSS-011</u>	<i>Manufacture of Air-cooled Heat Exchangers</i>

<u>32-SAMSS-019</u>	<i>Manufacture of Plate and Frame Heat Exchangers</i>
<u>32-SAMSS-020</u>	<i>Manufacture of Trays and Packing</i>
<u>32-SAMSS-021</u>	<i>Manufacture of Industrial Boilers</i>
<u>32-SAMSS-022</u>	<i>Manufacture of Components for Flare Systems</i>
<u>32-SAMSS-027</u>	<i>Manufacture of Electric Heat Exchangers</i>
<u>32-SAMSS-028</u>	<i>Manufacture of Double Pipe Heat Exchangers</i>
<u>32-SAMSS-029</u>	<i>Manufacture of Fire Heaters</i>
<u>32-SAMSS-030</u>	<i>Manufacture of Small Tanks</i>
<u>32-SAMSS-031</u>	<i>Manufacture of Clad Vessels and Exchangers</i>

3.2 Industry Codes and Standards

American Petroleum Institute

<i>API STD 560</i>	<i>Fired Heaters for General Refinery Services</i>
<i>API STD 620</i>	<i>Design and Construction of Large, Welded, Low-Pressure Storage Tanks</i>
<i>API STD 650</i>	<i>Welded Steel Tanks for Oil Storage</i>
<i>API STD 1104</i>	<i>Welding of Pipelines and Related Facilities</i>

American Society of Mechanical Engineers

<i>ASME B31.1</i>	<i>Power Piping</i>
<i>ASME B31.3</i>	<i>Process Piping</i>
<i>ASME B31.4</i>	<i>Pipeline Transportation Systems for Liquid Hydrocarbons and other Liquids</i>
<i>ASME B31.8</i>	<i>Gas Transmission and Distribution Piping Systems</i>
<i>ASME SEC I</i>	<i>Rules for Construction of Power Boilers</i>
<i>ASME SEC IV</i>	<i>Rules for Construction of Heating Boilers</i>
<i>ASME SEC VIII</i>	<i>Rules for Construction of Pressure Vessels</i>
<i>ASME SEC IX</i>	<i>Welding and Brazing Qualifications</i>

American Welding Society

<i>AWS D1.1</i>	<i>Structural Welding Code-Steel</i>
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4 Definitions and Acronyms

Application Approval: Approval acquired from Inspection Department to apply technically approved welding procedure. ID generally verifies that the intended application of previously approved welding procedures is within the welding procedure's variables (e.g., diameter, thickness, materials, service, etc.) approval range.

CSD: Consulting Services Department Welding Specialist/Engineer or CSD's Appointed Representative (e.g., Aramco Services Company Welding Specialist/Engineer).

ID: Inspection Department Vendor, Operations or Project Inspector or Inspection Representative.

PMC: A Program Management Contractor.

SAPMT: Saudi Aramco Project Management Team or some one acting on their behalf such as PMC.

PMT Designated Welding Representative: A welding engineer/inspector assigned to and contracted by SAPMT who has the approval authority for project(s) associated welding procedures.

PQR: Performance Qualification Record

Technical Approval: Approval of welding procedures acquired from CSD or PMT Designated Welding Representative. This approval indicates that the welding procedure was qualified to Saudi Aramco and/or industry standards or codes and it is acceptable for the intended application. Every page of the welding procedure specifications should include the reviewer signature and/or approval stamp.

Weld and Line Designation Table: A table that lists the applicable welding procedures, approval conditions (e.g., low temperature, sour service, etc.), welding process, and any general welding information pertinent to those applicable welding procedures.

Weld Map: A schematic one line diagram of pressure containing equipment (e.g., pressure vessel or tank). The map should indicate where each approved welding procedure will be applied.

Welding Master Set (WMS): It is compilation of welding procedures prepared by vendor/fabricator. It is a standardized set of welding procedures that is used with a generic Weld and Line Designation Table and/or generic Weld Map, which include the material and service application information.

WP: Welding Package.

WPS: Welding Procedure Specifications.

5 Instructions and Approval Responsibility

5.1 CSD shall be the technical approval authority for the followings:

- a) "Welding Master Set" submissions for the applications listed in 5.1 and Table 1 from in-Kingdom and Gulf Cooperation Council fabricators. See Appendix I for details on welding master set's preparation and approval. Appendix II is a flowchart that indicates the review process for Saudi Aramco projects. The Welding Master Set (WMS) is submitted to PMT for CSD's one-time technical approval. When WMS is approved by CSD then it can be often used in various Saudi Aramco projects if ID approves the application.

and

- b) Maintenance/repair/alteration applications. Appendix III is a flow chart that indicates the review process.

and

- c) Offshore Structures to [SAES-M-005](#).

Applications that generally require CSD welding procedures approval are:

5.1.1 Pressure Vessels and Heat Exchangers.

5.1.2 Boilers and Fired Heaters.

5.1.3 Piping.

5.1.4 Pipelines

5.1.5 Scraper Traps.

5.1.6 Storage Tanks

- 5.2 A PMT designated welding representative assigned to and contracted by SAPMT shall be the approval authority for project(s) associated welding procedures not covered by 5.1 a, b and c. He must review the welding procedures for all applications listed in section 5.1.1 to 5.1.6, and as requested by PMT. Refer to Table 1 for specific list of applications which requires CSD or PMT Designated Welding Representative review and approval of welding procedures.

CSD will interview and approve the PMT designated welding representative. Written examinations may be requested and prepared by CSD, this will depend on the project scope. With coordination with SAPMT, CSD will periodically audit some of his welding procedures review.

Commentary Note:

Major projects development programs such as RT Refinery Upgrade, Shaybah Development, Hawiyah Gas Plant & Haradh Gas Plant, with complex processes or materials will mandate written examination to the PMT designated welding representative.

- 5.3 For applications not listed in 5.1 (e.g., onshore structures, auxiliary piping, pipe fittings, etc.) the qualified welding procedures shall be available at the fabrication/welding site (e.g., vendor shop, field fabrication, etc.) for review by the Inspector, if requested. The procedures shall be included in the project or shop documentation record books.

Table 1 – Welding Procedure Technical Approval Responsibility

Component	Application	Specification	Welding Standard	Review/Approval Responsibility		
				CSD (Note 1)	PMT (Note 2)	Not Required (Note 3)
Pressure vessel		32-SAMSS-004	SAES-W-010	X	X	
Pressure vessel	Repair and Alterations	SAES-D-008	SAES-W-010	X	X	
Heat exchanger	Shell and tube	32-SAMSS-007	SAES-W-010	X	X	
Heat exchanger	Air cooled	32-SAMSS-011	SAES-W-010	X	X	
Heat exchanger	Plate and frame	32-SAMSS-019	SAES-W-010	X	X	
Heat exchanger	Electric	32-SAMSS-027	SAES-W-010	X	X	
Heat exchanger	Double pipe	32-SAMSS-028	SAES-W-010	X	X	
Vessels/Heat exchanger	Clad	32-SAMSS-031	SAES-W-014	X	X	
Vessels	Trays	32-SAMSS-020	None Applicable			X
Boilers, ASME I		32-SAMSS-021	SAES-W-010	X	X	
Fired heaters	Coils only	32-SAMSS-029	SAES-W-011	X	X	
B31.3 Piping		(01-SAMSS-010)	SAES-W-011	X	X	
B31.3 Piping		SAES-L-350	SAES-W-011	X	X	
B31.4/B31.8 Pipelines		(01-SAMSS-010)	SAES-W-012	X	X	
B31.4/B31.8 Pipelines		SAES-L-850/460/450	SAES-W-012	X	X	
Pipelines/Piping	Corrosion Protection	SAES-L-133	SAES-W-011/012	X	X	
Auxiliary piping	Mechanical Equipment	01-SAMSS-017	None Applicable			X
Line Pipe	API SPEC 5L	01-SAMSS-035	None Applicable			X
Line Pipe	Small quantity	01-SAMSS-038	None Applicable			X
Pipe fittings	Low temp	02-SAMSS-001	None Applicable			X
Pipe fittings	Butt welding	02-SAMSS-005	None Applicable			X
Pipe fittings	Hot tap	02-SAMSS-006	None Applicable			X
Scraper Traps		02-SAMSS-009	SAES-W-011/012	X	X	
Flare systems		32-SAMSS-022	None Applicable			X
Insulating spools		02-SAMSS-008	None Applicable			X
Insulating spools	Flanged	02-SAMSS-010	None Applicable			X
Valves		04-SAMSS-035	None Applicable			X
Valves	10K psi	04-SAMSS-049	None Applicable			X
API tanks	API STD 650	32-SAMSS-005	SAES-W-017	X	X	
API tanks	API STD 620	32-SAMSS-006	SAES-W-017	X	X	
Small tanks		32-SAMSS-030	SAES-W-017	X	X	
Storage Tanks	Storage Tanks Integrity	SAES-D-108	SAES-W-017	X	X	
Pumps		31-SAMSS-004 (major repairs)	None Applicable			X
Compressors		31-SAMSS-001 (brazed impellers)	None Applicable			X
Steam turbines	General purpose	32-SAMSS-009 (major repairs)	None Applicable			X
Steam turbines	Special purpose	32-SAMSS-010 (major repairs)	None Applicable			X
Offshore platforms		SAES-M-005	SAES-W-013	X		
Structural steel		12-SAMSS-007	None Applicable			X
Pre-engineered buildings		12-SAMSS-014	None Applicable			X

Notes:

1. Only for "Welding Master Set" submissions from in-Kingdom/Gulf Cooperation Counsel vendors, or maintenance/repair/alterations applications, or offshore structures
2. CSD may delegate approval authority to PMT designated welding representative assigned to PMT
3. Formal approval is not required. However, all WPS/PQR/Weld Map documents must be available for the inspector review or verification upon his request.

Revision Summary

31 May, 2003

New Saudi Aramco Engineering Procedure.

Appendix I – Welding Master Set Preparation and Approval

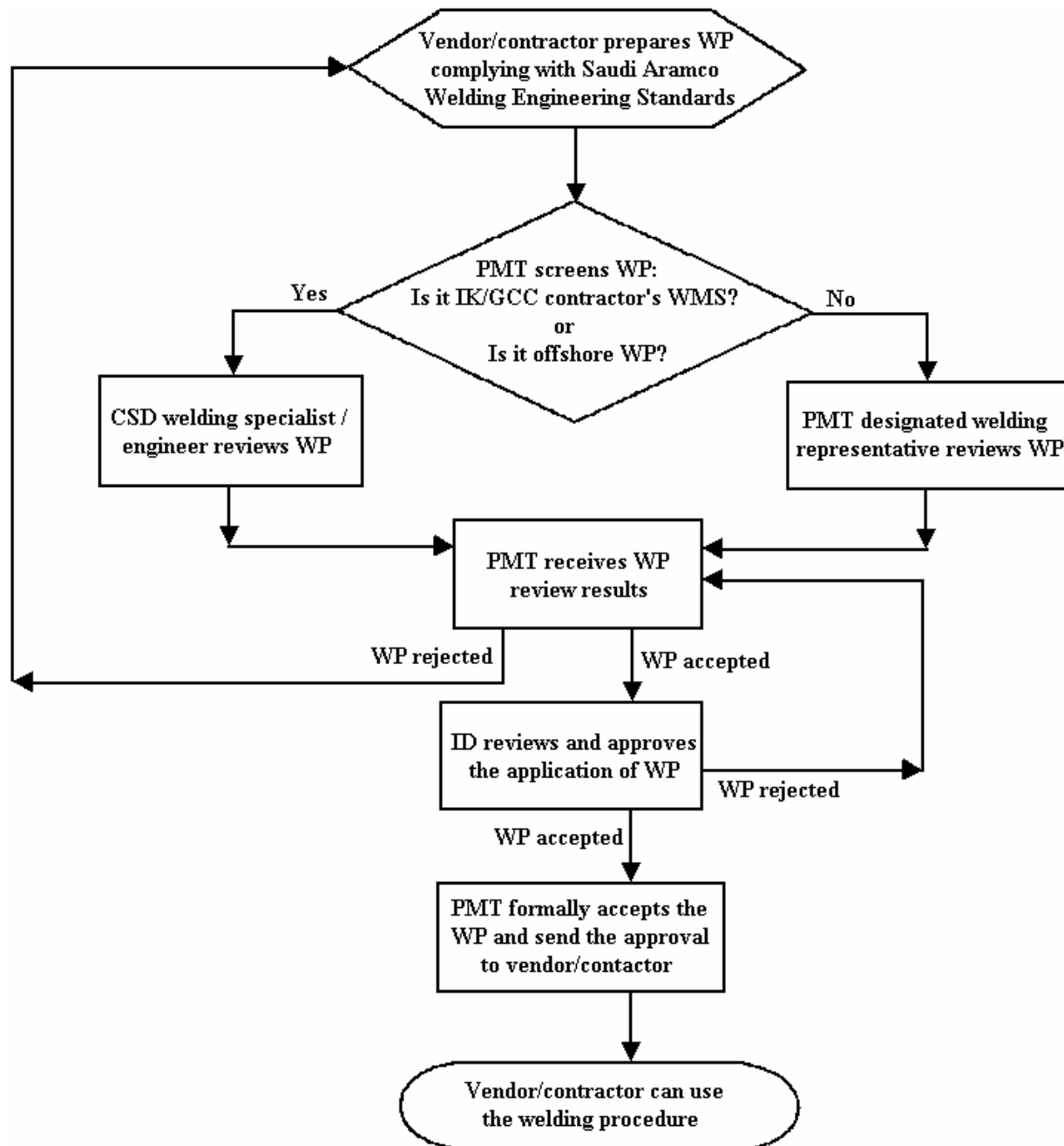
1. Each fabricator/vendor awarded a contract or purchase order will compile all CSD previously approved welding procedures and any welding procedures, intended to be used in the project.
2. Previously approved welding procedures must be submitted in new forms, unsigned, and the approved copy is attached to compare welding parameters between the two copies.
3. The master set must include typical "Weld Maps", "Weld Description" sheet, "Request for Welding Procedure Approval" form and any supporting document required to be submitted by Saudi Aramco Welding Standard (SAES-W-10, [SAES-W-011](#), etc.). It is recommended that a distinct identification system is used for the WPS and the revision number (e.g., WPS # is WMS P1-P8-1 and the revision # is M0, here both **WMS** and **M** indicate that the welding procedure is part of welding master set).
4. The PQRs must be either the original copies or certified/stamped copies. The qualification tests must be performed by independent testing agency approved by Saudi Aramco.
5. The time required to review each master set will depend on the number of the submitted welding procedures and the pertinent technical welding requirements (e.g., PWHT, hardness test, impact toughness test, etc.). The table below lists the estimated time to review welding master sets.

Estimated Time to Review Welding Master Sets

Number of MS Welding Procedure	Time to Complete Review
Up to 50	6 Weeks
>50 to 100	10 Weeks
> 100	16 Weeks

6. After the initial technical approval, the welding procedures can be applied in various company projects if ID approves the application.
7. The fabricator/vendor must continuously review those approved welding procedures to ensure their conformance with the latest applicable Saudi Aramco Welding Standards and Industry Codes.

Appendix II – Welding Package Review and Approval Process for Company Projects



Appendix III – Welding Package Review and Approval Process for Repair/Maintenance/Alterations

