

Engineering Procedure

SAEP-321

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Performance Qualification Testing
and Certification of Saudi Aramco Welders

Document Responsibility: Inspection Department

Saudi Aramco DeskTop Standards

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1 Scope

- 1.1 This Engineering Procedure specifies the minimum requirements for the testing, certification and registration of Saudi Aramco welders working for Maintenance. For the purpose of this Engineering Procedure Maintenance shall also include to mean other proponent organizations performing fabrication and maintenance welding activities such as Operations Field Services, Pump Shops, Drilling & Workover, etc.
- 1.2 Unless specifically noted otherwise the term welder shall also mean welding operator.

2 Conflicts and Deviations

Conflicts between this Engineering Procedure and any other Saudi Aramco Standard shall be resolved by the Operations Inspection Division of the Inspection Department in writing.

3 Applicable Documents

Unless stated otherwise, all codes and standards referenced shall be the latest issue (including Revisions and Addenda). Sections of industry codes and standards referenced herein shall be considered as part of this standard.

3.1 Saudi Aramco References

Saudi Aramco Engineering Procedures

<u>SAEP-1101</u>	<i>Test Supplement S01 For Welder Performance Qualification</i>
<u>SAEP-1102</u>	<i>Test Supplement S02 For Welder Performance Qualification</i>
<u>SAEP-1103</u>	<i>Test Supplement S03 For Welder Performance Qualification</i>
<u>SAEP-1104</u>	<i>Test Supplement S04 For Welder Performance Qualification</i>
<u>SAEP-1105</u>	<i>Test Supplement S05 For Welder Performance Qualification</i>
<u>SAEP-1106</u>	<i>Test Supplement S06 For Welder Performance Qualification</i>
<u>SAEP-1107</u>	<i>Test Supplement S07 For Welder Performance Qualification</i>

<u>SAEP-1108</u>	<i>Test Supplement S08 For Welder Performance Qualification</i>
<u>SAEP-1109</u>	<i>Test Supplement S09 For Welder Performance Qualification</i>
<u>SAEP-1110</u>	<i>Test Supplement S10 For Welder Performance Qualification</i>
<u>SAEP-1111</u>	<i>Test Supplement S11 For Welder Performance Qualification</i>
<u>SAEP-1112</u>	<i>Test Supplement S12 For Welder Performance Qualification</i>
<u>SAEP-1113</u>	<i>Test Supplement S13 For Welder Performance Qualification</i>
<u>SAEP-1114</u>	<i>Test Supplement S14 For Welder Performance Qualification</i>
<u>SAEP-1115</u>	<i>Test Supplement S15 For Welder Performance Qualification</i>
<u>SAEP-1116</u>	<i>Test Supplement S16 For Welder Performance Qualification</i>
<u>SAEP-1117</u>	<i>Test Supplement S17 For Welder Performance Qualification</i>

Saudi Aramco Forms

SA 2318-ENG	<i>Welder Qualification Record</i>
SA 3331-ENG	<i>Welder Qualification Card</i>
SA 4758-ENG	<i>Job Clearance Card</i>
SA 4719-A-ENG	<i>Radiography Request/Performance/Interpretation Report</i>

3.2 Industry Codes and Standards

American Society of Mechanical Engineers/Boiler & Pressure Vessel Code

ASME SEC IIC	<i>Welding Rods, Electrodes and Filler Metals</i>
ASME SEC V	<i>Nondestructive Examination</i>
ASME SEC IX	<i>Welding and Brazing Qualifications</i>
ASME B31.3	<i>Process Piping</i>

4 Definitions and Acronyms

Ability Test: An ad hoc test used to determine if a welder has the ability to produce work in accordance with a valid certification. The Ability Test shall be performed on either a production weld or test coupon that falls within the limits of the certification. To be valid the test shall be witnessed and documented by the OIU inspector. Acceptance is based on visual inspection and radiographic examination.

Al: Aluminum.

Anniversary Recertification: The mandatory retesting of all welders every three (3) years on the anniversary date of the issue of their first performance qualification certification (all welding certifications become invalid on that date). Welders shall recertify to each Supplement in the month prior to the anniversary date if welding to that Supplement is to be permitted after that date. Anniversary recertification testing is conducted by the WTC in accordance with approved Test Supplements.

Arc Strike: A discontinuity resulting from an arc caused by the inadvertent striking of a welding electrode against the surface of a metal.

ARD: Anniversary Recertification Date.

ASME B&PVC: American Society of Mechanical Engineers, Boiler and Pressure Vessel Code.

Back Gouging: The removal of weld metal and base metal from the other side of a partially welded joint to assure complete penetration upon subsequent welding from that side.

Backing Ring or Strip: A material (either pipe, flat plate, or rolled plate) placed at the back side of a single groove weld joint to support molten weld metal.

Back Weld: A weld deposited on the backside of a single groove weld.

Certification: See preferred term Welder Certification.

Certified Welder: A welder that has a valid welding certification. A certified welder is only qualified to weld with those welding processes, and within the essential variables, of the valid certification(s).

CRWMO (SMAW) Ability Performance Test: An ad hoc corrosion resistant weld metal overlay performance test given to welders to determine if they have the ability to produce work in accordance with specific job requirements. Testing is conducted by the OIU in accordance with a specific project WPS. The test qualifies the welder for a specific project only (Job Clearance Card is issued by the OIU) and is valid as long as the welder maintains a valid SMAW certification.

CS: Carbon Steel.

Flux Cored Arc Welding (FCAW): An arc welding process which produces coalescence of metals by heating them with an arc between a continuous filler metal (tubular) electrode and the work. Shielding is provided by a flux contained in the tubular filler metal. Additional shielding can be obtained from an externally supplied gas or gas mixture.

Globular Transfer: In arc welding, a type of metal transfer in which molten filler metal is transferred across the welding arc in large droplets (applicable to the GMAW and FCAW welding processes).

Gas Metal Arc Welding (GMAW): An arc welding process which produces coalescence of metals by heating them with an arc between a continuous filler metal (consumable) electrode and the work. Shielding is obtained entirely from an externally supplied gas or gas mixture. Sometimes this process is referred to as MIG or CO₂ welding (nonpreferred terms).

Gas Tungsten Arc Welding (GTAW): An arc welding process which produces coalescence of metals by heating them with an arc between a nonconsumable tungsten electrode and the work. Filler metal is added manually. Shielding is obtained from a gas or gas mixture. It is sometimes referred to as TIG welding (a nonpreferred term).

ID: Inspection Department.

Initial Field Testing: Examination of the first production work produced by a welder immediately after WTC certification testing and OIU registration.

JCC: Job Clearance Card (Form SA 4758-ENG).

Job Clearance Card (Form SA 4758-ENG): An identification card issued by OIU to a welder passing a CRWMO SMAW Ability Test. The JCC lists the welders name, identification symbol and qualification limits of the major essential variables.

LAS: Low Alloy Steel.

Ni: Nickel.

OID: Operations Inspection Division.

OIU: Operations Inspection Unit.

PED: Process Expiry Date.

PT: Penetrant Test.

Qualification: See preferred terms Welder Performance Qualification.

Qualification Card (Form SA 3331-ENG): A photo identity card issued by the WTC to a welder that lists all welding certifications held by the welder. Qualification Cards shall be carried at all times by the welder, and must be presented for review upon request.

Qualification Record (Form SA 2318-ENG): See preferred term welder certification.

Qualified Welder: See preferred term Certified Welder.

Recertification Test: The performance qualification test conducted by the WTC to reinstate a revoked certification.

Registered Welder: A welder whose certification has been reviewed, found to be acceptable, and is on file with the Operations Inspection Unit.

Registration: The act of registering a welder certification, or a photostatic copy thereof. Registration is performed by the responsible Inspection Authority.

Retest: The repeat test that is permitted to be taken when a welder fails the initial certification test to a Test Supplement, or recertification test to reinstate a revoked certification. Only one retest is permitted.

Reverse Polarity (DCEP, DCRP, DC+ or E+): The arrangement of direct current arc welding leads with the work as the negative pole and the electrode as the positive pole of the welding arc.

Revoked Welder Certification: A certification that is no longer valid as a result of a welder not welding with a welding process for six or more consecutive months or not passing an Ability Test (does not include the Corrosion Resistant Overlay Welding Ability Test). When a certification with a process is revoked all certifications with that process are revoked (this does not apply to an Ability Test). Welders whose certifications with a process are revoked must pass a recertification test for each required Test Supplement (conducted by the WTC) prior to resuming production welding with those Test Supplements.

Root Face (land): That portion of the groove face adjacent to the root of the joint.

Root Opening (gap): The separation between members to be joined at the root of the joint.

Root Penetration (pipe): The distance a weld extends past the inside surface of the pipe in a pipe groove weld.

RT: Radiographic Testing.

Shielding Gas: Protective gas used to prevent atmospheric contamination of the molten weld metal in the vicinity of the welding arc.

Straight Polarity (DCEN, DCSP, DC- or E-): The arrangement of direct current arc welding leads in which the work is the positive pole and the electrode the negative pole of the welding arc.

Shielded Metal Arc Welding (SMAW): An arc welding process that produces coalescence of metals by heating them with an arc between a covered metal electrode and the work. Shielding is obtained from the decomposition of the electrode covering.

Spray Transfer: A type of metal transfer in which molten filler metal is propelled axially across the arc in small droplets (applicable to the GMAW and FCAW welding processes).

SS: Stainless Steel.

Submerged Arc Welding (SAW): An arc welding process which produces coalescence of metals by heating them with an arc between a bare metal electrode or electrodes and the work. The arc is shielded by a blanket of granular, fusible material (flux) on the work.

Test Supplement: Contains the performance qualification test requirements needed to perform a welding certification test, and the limitations of that certification.

Undercut: A groove melted in the base metal adjacent to the toe or root of a weld and left unfilled by weld metal.

Underfill: A depression on the face of the weld or root surface extending below the adjacent base metal.

Uncertified Welder: A welder that does not have a valid welding certification.

Unqualified Welder: See preferred term Uncertified Welder.

Weld Reinforcement: Weld metal in excess of the quantity required to fill a joint.

Welder: One who performs a manual or semiautomatic welding operation (this term is sometimes erroneously used to denote a welding machine).

Welder Certification: Certification in writing (i.e., Form 2318-ENG) that a welder has produced a test weld meeting a defined standard.

Welder Performance Qualification: The demonstration of a welders ability to produce a test weld meeting a defined standard.

Welding Operator: One who operates machine or automatic welding equipment.

WPS: Welding Procedure Specification.

WTC: Welder Test Center.

WTS: Welder Tracking System.

5 Responsibilities

5.1 Inspection Department

5.1.1 The Operations Inspection Division (OID) is responsible for:

- a) preparing revisions to this Engineering Procedure;
- b) auditing records of the NDE & Welder Testing Unit;
- c) auditing records of the Operations Inspection Units.

5.1.2 The NDE & Welder Testing Unit of the Operations Inspection Division is responsible for:

- a) administering all welder performance qualification tests;
- b) keeping track of the status of all Saudi Aramco welders.

5.1.3 The Welder Test Center (WTC) of the NDE & Welder Testing Unit is responsible for:

- a) conducting performance qualification testing of welders in accordance with approved Test Supplements;
 - b) conducting recertification testing of welders with revoked certifications;
 - c) preparing certifications (Form SA 2318-ENG) for welders that pass performance qualification or recertification tests;
 - d) inputting certification results (Form SA 2318-ENG) in the WTS for welders that take performance qualification or recertification;
 - e) obtaining welder symbols (assigned automatically) from WTS for all welders who take the performance qualification tests;
 - f) preparing new or updating old Qualification Cards for welders passing certification tests;
 - g) conducting Anniversary Recertification testing of welders every three years;
 - h) sending welder certification information to the WTS Administrator;
 - i) generating new or updating welder records/data in WTS.
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5.1.4 The WTC Welding Inspector is responsible for:

- a) witnessing and evaluating welder performance qualification tests;
- b) witnessing and evaluating recertification tests of welders with revoked certifications.

5.1.5 The WTS Administrator is responsible for:

- a) maintaining the WTS database on the mainframe computer current by inputting performance qualification and recertification test information (Form SA 2318-ENG) into the WTS database;
- b) maintaining the WTS database on the mainframe computer current by terminating revoked welder or brazer certification information from the WTS database;
- c) assigning WTS access to new users and updating their access information;
- d) creating/updating proponent Maintenance Organization or Operations Inspection Unit in WTS.

5.2 Business Line Maintenance Organizations

5.2.1 The Maintenance Superintendent/Foreman is responsible for:

- a) ensuring all welders are properly certified prior to the start of work;
- b) ensuring all welders maintain valid certifications for every process certified through continuous welding;
- c) ensuring all welders undergo the additional training prior to taking a retest;
- d) maintaining a log of welders working in the Organization;
- e) ensuring all welders take the Anniversary Recertification Test Thirty (30) days prior to the ARD;
- f) ensuring all welders working in the Maintenance Organization are available and tracked by WTS; and
- g) notifying the OIU, in advance, through a written correspondence about their welders availability and movement/transfer status.

5.3 Business Line Engineering Organizations

5.3.1 The Operations Inspection Unit (OIU) is responsible for:

- a) ensuring all welder performance certifications are current and up to date through WTS and documentation of welder activity;

- b) ensuring all newly certified welders are capable of making sound welds by conducting Initial Field Testing as per Section 6.3.1 of this procedure;
- c) conducting Ability Testing of welders whose skills may be in doubt;
- d) conducting SMAW Corrosion Resistant Overlay Welding Ability Testing;
- e) registering properly certified Maintenance welders as per Section 6.2.2 of this procedure;
- f) issuing Job Clearance Cards to welders that pass the CRWMO SMAW Ability Test
- g) inputting welder's performance records (Visual and RT inspection results) in WTS in a timely manner within the duration of a process expiry date (PED).

5.3.2 The Operations Inspection Unit Inspector is responsible for:

- a) witnessing and evaluating Initial Field Tests and Ability Tests;
- b) witnessing Corrosion Resistant Overlay Welding Ability Testing;
- c) reporting all field welding inspection results in order to be entered in WTS in a timely manner.

6 Instructions

6.1 Welder Performance Qualification Test

6.1.1 General Information

- 6.1.1.1 Performance qualification testing shall be conducted at a Welder Test Center (WTC) and be witnessed by a WTC welding inspector. SAW and FCAW testing may be performed at a proponent's facility if appropriate equipment is unavailable at the WTC. A flow chart showing the steps involved in testing and certifying welders is shown in Appendix 1.
- 6.1.1.2 When it is impractical to bring welders from remote locations to take a test at the WTC, the Inspection Department shall assign the testing to a local inspection organization.
- 6.1.1.3 Performance qualification testing shall be conducted in accordance with an approved Saudi Aramco Engineering

Procedure Test Supplement. A list and description of all of the approved Test Supplements is given in Appendix 3.

6.1.1.4 Prior to testing the WTC shall verify the performance qualification prerequisites required by each Test Supplement listed have been met (refer to Appendix 4).

6.1.1.5 If at any time it becomes apparent to the WTC welding inspector that a welder does not have the necessary skill to complete the performance qualification test, the test shall be terminated and the welder sent back to the proponent organization for retraining and/or reassignment.

6.1.2 Coupon Fit Up and Welding

6.1.2.1 The welder shall fit up the test coupon as per the Test Supplement. The welder's name and welder's symbol (if applicable) shall be hard stamped on both ends of the fit up test coupon. The WTC welding inspector shall inspect the fit up and hard stamping prior to the start of welding.

6.1.2.2 The test coupon shall be secured in the test position at a height of eighteen (18") inches above the floor of the test booth. The test shall not begin until the WTC welding inspector has verified the test position. The welder shall not move the test coupon until told to do so by the WTC welding inspector at the completion of the test.

6.1.2.3 The WTC welding inspector shall inspect the completed root pass of all SMAW and GTAW pipe test coupons prior to the start of the hot pass. If grinding of the groove side of the test coupon is required (i.e., root passes welded with E6010 electrodes) the WTC welding inspector shall also inspect the completed grinding. If the root pass work is acceptable the welder shall be permitted to weld the fill and cap. If the root pass work is unacceptable it shall be cause for rejection of the coupon (test failure).

6.1.2.4 Grinding, back gouging, welding or any other alteration dressing shall not be performed on the backside of a root pass unless specifically required as part of the performance qualification test. When back gouging or grinding is required by the performance qualification test, the backside of the welding groove shall be inspected by the WTC welding inspector. If the work is acceptable the welder shall be given

permission to start welding the second side. Excessive or unauthorized back gouging, grinding, welding or any other alteration dressing is considered unacceptable and shall be cause for rejection of the coupon (test failure).

6.1.2.5 Grinding may be used in between passes to remove slag and arc strikes, however, excessive grinding is not permitted and shall be cause for rejection of the coupon (test failure).

6.1.2.6 Grinding, filing, or mechanical dressing of the cap pass is not permitted. Any evidence of such shall be cause for rejection of the coupon (test failure).

6.1.3 Visual Examination of the Test Coupon

6.1.3.1 After completion of welding the WTC welding inspector shall perform a visual examination of the test coupon. Coupons that do not meet the following acceptance criteria shall be considered unacceptable (test failure).

6.1.3.2 Weld reinforcement and root penetration shall not exceed the values as shown in Table 1.

Table 1

Test Coupon Wall Thickness	Maximum Weld Reinforcement or Excess Root penetration
1/4" and under	1/16"
greater than 1/4" up to 1/2"	1/8"
greater than 1/2" up to 1"	5/32"
greater than 1"	3/16"

6.1.3.3 Undercut not exceeding 1/32" in depth shall be permitted for a total length of 2" maximum. Undercut exceeding 1/32" in depth is not permitted.

6.1.3.4 Underfill not exceeding 1/16" in depth shall be permitted for a total length of 2" maximum. Underfill exceeding 1/16" in depth is not be permitted

6.1.3.5 Lack of root penetration is unacceptable.

6.1.3.6 Incomplete fusion is unacceptable.

6.1.3.7 Unremoved Arc strikes on the base metal are unacceptable.

6.1.4 Radiographic Examination of the Test Coupon

- 6.1.4.1 Test coupons that meet the visual acceptance criteria of Section 6.1.3 shall be radiographically examined.
- 6.1.4.2 Radiography shall be performed in accordance with the requirements of the ASME SEC V B&PV code.
- 6.1.4.3 Radiographic acceptance criteria shall be as specified in paragraph QW-191 of the ASME SEC IX B&PV code.

6.1.5 Guided Bend Testing

- 6.1.5.1 Guided bend testing, when required, shall be conducted by the WTC Welding Inspector in accordance with the following requirements (see paragraph 6.5.2.5 for special requirements concerning CRWMO SAW test coupons).
- 6.1.5.2 Four guided bend specimens shall be prepared and tested for each position tested as per Table 2.

Table 2

Test Coupon Thickness	Number and Type
Less than 3/8"	2F and 2R
Over 3/8" but less than 3/4"	2F and 2R, or 4S
Equal or greater than 3/4"	4S

- 6.1.5.3 Guided bend specimens shall be either mechanically or flame cut and shall be taken from the locations shown in QW-463 of the ASME SEC IX B&PV Code. If flame cutting is employed, 1/8" shall be removed from each flame cut edge by grinding. During grinding, care shall be taken to ensure that the specimen is not overheated. Excessive grinding of guided bend specimens is not permitted.
- 6.1.5.4 Testing shall be performed in accordance with requirements of paragraph QW-162, of the ASME SEC IX B&PV Code.
- 6.1.5.5 Test acceptance criteria shall be as specified in paragraph QW-163 of the ASME SEC IX B&PV Code.

6.1.6 Retest

- 6.1.6.1 Welders are permitted to take one (1) retest per Test Supplement provided they receive the minimum training specified in Appendix 5 prior to the retest.
- 6.1.6.2 Welders that fail the initial performance qualification test for multiple causes shall undergo a total minimum retraining time equal to the sum of the minimum retraining times for each of the causes given in Appendix 5 prior to the retest.
- 6.1.6.3 Prior to taking the retest the Maintenance Superintendent shall certify in writing that the welder has undergone the required additional training and is fully prepared to take the retest. A copy shall be attached to the request for retest submitted by the OIU to the WTC.
- 6.1.6.4 All retests shall be conducted at the WTC (or the proponents shop if necessary) and witnessed by the WTC Welding Inspector.
- 6.1.6.5 Welders that fail the retest shall not be permitted to take a second retest and shall be prohibited from retaking that welding performance qualification test sooner than three (3) months from the date of the failed retest. During the waiting period the welder shall be given additional training by the Maintenance Organization. If the Maintenance Organization sends the welder to retake the test at the end of three (3) months the Maintenance Superintendent shall certify in writing that the welder has received sufficient training and is fully prepared to take the Supplement Test (the letter shall be attached to the request for test submitted by the OIU to the WTC).

6.2 Certification and Registration of Welders

- 6.2.1 Upon successful completion of the performance qualification test, the WTC shall certify the test result by:
 - a) verifying whether newly tested welder is available in the WTS or not. If yes, WTC is only to update the welder's certification records on the WTS, by selecting "New Cert" icon. If the welder is not found in the WTS, WTC is to select the "New Welder" icon from the certification screen of the WTS;
 - b) inputting the welder's performance qualification test records in the WTS (applies to all welders) and obtaining the welder symbol from

WTS, which is assigned automatically for all welders. The welder symbol is unique and is not transferable. When a welder leaves the employ of the company or his job title is permanently changed to another job description, that welder's symbol shall be retired and terminated from WTS database through a written request submitted by Maintenance Organization and sent to both WTC and the WTS Administrator, and a copy should also be sent to the OIU;

- c) completing Welder and Welding Operator Qualification Record Form SA 2318-ENG. The original shall be kept on file with the WTC. Copies shall be sent to the WTS Administrator and the OIU; and
- d) issuing a Welders Qualification Card (Form SA 3331-ENG). The Qualification Card shall list all valid certifications, including the Anniversary Date, held by the welder. It shall also include a recent photograph of the welder and be carried by the welder at all times. A copy of the card shall be kept on file at the WTC, and also be sent to the OIU and the WTS Administrator. For new welders, one additional recent photograph shall be sent to the WTS Administrator.

6.2.2 Immediately after the successful completion of the performance qualification test, the newly certified welder shall report to the OIU to be registered. Welders shall not be permitted to start production welding without first being registered by the OIU.

6.3 Maintaining Welder Certifications

6.3.1 Initial Field Testing

- 6.3.1.1 The first three (3) production pressure retaining butt welds welded by each newly certified welder, employing each newly qualified certification, shall be 100% radiographed. The OIU inspector shall witness the welding of at least one of these welds. Radiographic acceptance shall be as specified by the applicable design code governing the work.
- 6.3.1.2 If the radiographs are all acceptable the welder shall be permitted to continue production welding. Subsequent production welding shall be radiographed at normal job monitoring levels. All RT inspection results shall be entered by OIU in the WTS utilizing the radiography request form SA 4719-A-ENG.

- 6.3.1.3 If radiography shows that one or two of the first three (3) welds are unacceptable, the OIU inspector shall visually examine all three welds and their corresponding radiographs. If the weld quality is poor, that particular certification shall be revoked. If the weld quality is borderline, the welder may be permitted to continue production welding provided all subsequent welding work is 100% radiographed. If the weld quality improves, the radiography shall be reduced to normal job monitoring levels. If the weld quality does not improve, the newly qualified certification shall be revoked.
 - 6.3.1.4 If radiography shows that all three welds are unacceptable the newly qualified certification shall be revoked.
 - 6.3.1.5 When a new certification is revoked as a result of the Initial Field Test the, OIU shall send that welders Qualification Card and a letter of notification to the WTC. The WTC shall delete the revoked certification from the Qualification Card and return it to the welder through the OIU. A copy of the revised Qualification Card and a letter of notification shall be sent to the WTS Administrator.
 - 6.3.1.6 Welders that have a certification revoked during the Initial Field Test shall not be allowed to retake that certification test for at least three (3) months. During that time the welder shall be given additional training. When the welder is ready to retake the Supplement Test the Maintenance Superintendent shall certify in writing that the welder has been given the required additional training and is fully prepared to take the test. The test shall be scheduled in writing by the OIU with the WTC.
 - 6.3.1.7 Initial Field Test radiographs shall be kept on file by the OIU for at least one (1) year.
 - 6.3.2 General Requirements
 - 6.3.2.1 A flow chart showing the steps involved in maintaining welder certifications is shown in Appendix 2.
 - 6.3.2.2 If a welder does not weld with a process (i.e., SMAW or GTAW) or specialized welding equipment for a period exceeding six (6) consecutive months, all certifications with that process or equipment shall immediately become revoked. Also, if OIU is not entering the required welder performance in
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the WTS within the PED, the welder will automatically become "Inactive" on WTS which requires re-certification of all affected process certifications. The welder shall be re-certified by WTC.

- 6.3.2.3 All pressure containing welds made by a welder after a certification is revoked shall be cut out.
- 6.3.2.4 If there is a specific reason to question a welders ability to make sound welds, the inspector shall request the welder to perform an Ability Test. After completion of the test the weld shall be visually examined and radiographed. If the NDE acceptance criteria of Sections 6.1.3 and 6.1.4 are not met, the certification in question shall be revoked.
- 6.3.2.5 Welders whose certification with a process has been revoked shall not be permitted to weld with that process on production work until they have passed a Recertification Test to the appropriate Test Supplement(s).
- 6.3.2.6 When a welder's certification is revoked, the OIU shall send the welders Qualification Card and a letter of notification to the WTC. The WTC shall delete the revoked certification from the Qualification Card and return it to the welder through the OIU. A copy of the revised Qualification Card and the letter shall be sent to the WTS Administrator.
- 6.3.2.7 A welder certifications shall expire (cease to be valid) every three (3) years on the anniversary date of the issue of the welders first performance certification. During the month prior to the anniversary date welders shall be recertified to every Test Supplement previously held and/or required. This shall be called the Anniversary Recertification Test. Those certifications obtained in the year prior to the anniversary date are exempt from testing until the following anniversary date. The Anniversary Recertification shall be conducted by the WTC. The soon to be expired, Qualification Card shall be surrendered to the WTC at the time of testing. An updated Qualification Card shall be issued by the WTC after completion of testing.

Commentary Note:

A welder will be placed in the Inactive welders list if he did not appear for Anniversary Exam (ARD) within 90 days. The welder will be in the Separated welders list if he did not appear

for ARD after the 90 days period; subsequently to reinstate him in the WTS, a letter from his perspective Maintenance Division head explaining the welder's case shall be sent to the Operations Inspection Division head of the Inspection Department.

- 6.3.2.8 The OIU shall maintain Welder Experience Records to verify the welding activity of each certified welder. Verification of experience shall be by reference to an inspection or radiography report, weld number or similar documentation. A suggested Welder Experience Record is given in Appendix 6.
- 6.3.2.9 The OIU shall also maintain a record of the groove welds made by each welder with each process or combination thereof. Monthly and yearly repair rates shall be calculated on a butt joint and/or lineal inch basis. The method for calculating repair rate limits shall be as defined in the Saudi Aramco Engineering Welding Standards. Welders with high repair rates shall have their certifications with the applicable welding process or processes revoked.
- 6.3.2.10 The Maintenance Foreman shall maintain an up to date log of welders working in the Unit. This welders log shall include a listing of the welders valid certifications, welding activity, Anniversary Recertification date and other vital information.

6.4 Recertification of Welders with Revoked Certifications

- 6.4.1 Welders whose certification with a process becomes revoked shall not be permitted to weld on production work with the process until they have taken and passed the required Recertification Test(s). The Recertification Test(s) shall be conducted by the WTC in accordance with the requirements of Section 6.1 of this Engineering Procedure.
- 6.4.2 The welder Recertification Test shall be scheduled by the OIU with the WTC in writing. It shall not be scheduled sooner than three (3) months from the date the certification was revoked. When the welder is ready to take the Recertification Test the Maintenance Superintendent shall certify in writing that the welder has been given the required training and is fully capable of passing the Recertification Test.
- 6.4.3 Welders that fail the initial Recertification Test shall be permitted to take one retest.
- 6.4.4 Welders that pass the Recertification Test or retest shall be certified and registered in accordance with the requirements of Section 6.2 of this

Engineering Procedure. Subsequent production work shall meet the requirements of Section 6.3.1 (Initial Field Testing).

6.4.5 Welders that fail the retest shall have all of their certifications with the process(es) tested revoked if the certifications were originally revoked as a result of welding inactivity. If the certification was originally revoked as a result of a failed Ability Test, only the particular certification tested shall be revoked.

6.4.6 Welders that fail the retest shall not be permitted to retake the Supplement Test for a period of at least three (3) months. The WTC shall inform the OIU and WTS Administrator of the test results in writing.

6.5 Corrosion Resistant Weld Metal Overlay (CRWMO)

6.5.1 CRWMO SMAW Ability Performance Test

6.5.1.1 Welders with an S03, S04 or S05 certification shall be allowed to perform CRWMO welding within the limits of an approved project WPS provided the welder passes a CRWMO SMAW Ability Performance Test.

6.5.1.2 The CRWMO SMAW Ability Performance Test shall be conducted by the OIU (witnessed by the OIU inspector) in accordance with an approved project WPS.

6.5.1.3 The CRWMO SMAW Ability Performance Test shall consist of a welding coupon (plate or pipe) for each welding position required to be used on the job (the 6G all position test shall not be used). Base metal thickness of the coupon shall not be considered an essential variable.

6.5.1.4 The finished length/width of the weld metal overlay deposited on the test coupon for each position shall be at least four inches (4") by one inch (1"). The thickness of the overlay and number of layers shall be as specified in the WPS.

6.5.1.5 The filler metals (size and type), preheat (if required), and technique (stringer or weave) specified in the approved project WPS shall be used in the test.

6.5.1.6 After the completion of welding, the OIU inspector shall conduct a visual examination of the test coupon. Welds that meet the dimensional requirements specified in the approved WPS (bead size, number of layers, bead width, overlay

thickness, bead overlap, etc.) shall be considered acceptable. Unremoved arc strikes are unacceptable and shall be cause for rejection of the test coupon (failure).

6.5.1.7 If the visual examination of the test coupon is acceptable, the OIU inspector shall perform a PT (liquid penetrant) examination in accordance with Article 6 of the ASME SEC V B&PV Code. Acceptance criteria shall be as specified in paragraph QW-195, of the ASME SEC IX B&PV Code.

6.5.1.8 Welders that pass the CRWMO SMAW Ability Performance Test shall be issued a JCC and only be permitted to perform overlay welding for the particular project in accordance with the approved project WPS used.

6.5.2 CRWMO SAW Welding Operator Performance Qualification Test

6.5.2.1 The CRWMO SAW Welding Operator Performance Qualification Test shall be conducted by the WTC and witnessed by the WTC welding inspector.

6.5.2.2 Performance qualification testing shall be conducted in accordance with an approved Test Supplement.

6.5.2.3 Upon completion of the test, the WTC welding inspector shall visually examine the test coupon. The surface of the weld shall be smooth and even, and the bead spacing uniform.

6.5.2.4 Coupons that pass the visual examination shall be examined using the PT method in accordance with Article 6 of the ASME SEC V B&PV Code. The acceptance criteria shall be as specified in paragraph QW-195 of the ASME SEC IX B&PV Code. The testing shall be conducted by the WTC welding inspector.

6.5.2.5 Following the PT examination, four side bend test specimens shall be cut (perpendicular to the direction of welding) from the test coupon and tested by the WTC welding inspector. The acceptance criteria shall be as specified in paragraph QW-163 of the ASME SEC IX B&PV Code.

6.5.2.6 Welding operators that fail the CRWMO SAW Welding Operator Performance Qualification Test shall be permitted to take one retest no sooner than seven (7) days after the initial test failure.

- 6.5.2.7 Welding operators that pass the CRWMO SAW Welding Operator Performance Qualification Test shall be certified in accordance with the requirements of Chapter 6.2.
 - 6.5.2.8 The Anniversary Recertification testing requirements of paragraph 6.3.2.7 shall not apply to the CRWMO SAW Test.
 - 6.5.3 Job Clearance Card (JCC)
 - 6.5.3.1 Welders that pass CRWMO SMAW Ability Performance Qualification Test shall be registered and issued a JCC for the project by the OIU.
 - 6.5.3.2 The JCC shall remain valid for the duration of the project provided the welders certification with the SMAW process does not become either EXPIRED or REVOKED.
 - 6.5.3.3 After completion of the project the JCC shall be returned to the OIU.
 - 6.6 Corrosion Resistant Strip Lining
 - 6.6.1 Welders installing corrosion resistant strip shall be certified to an approved Test Supplement prior to the start of welding. Only those welders that have the required prerequisites (refer to Appendix 4) shall be permitted to take the performance qualification test.
 - 6.6.2 The corrosion resistant strip lining test shall be conducted by the WTC and witnessed by the WTC welding inspector.
 - 6.6.3 The welder shall remove all mill scale and rust from the test coupon prior to fit up. Failure to do so shall be cause for rejection of the test coupon (test failure).
 - 6.6.4 The welder shall fit up the test assembly as instructed by the WTC welding inspector, who shall check and approve the fit up. The gap between the strip lining and base material shall not exceed one sixteenth inch (1/16").
 - 6.6.5 The welder shall secure the test assembly in the test booth and shall not start welding until instructed by the WTC welding inspector. The welding inspector shall observe the welding of the entire test assembly. The welder shall remove the slag from each weld bead. The end of each weld bead shall be brushed clean prior to the start of welding with the next electrode. Grinding of stop/starts and areas of tightly adhering slag is permitted and should be encouraged. Beads shall not start or end at
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corners. After completion of the welding the welder shall brush clean the entire assembly. All arc strikes shall be removed by grinding. Failure of a welder to adequately perform these tasks shall be cause for rejection (test failure).

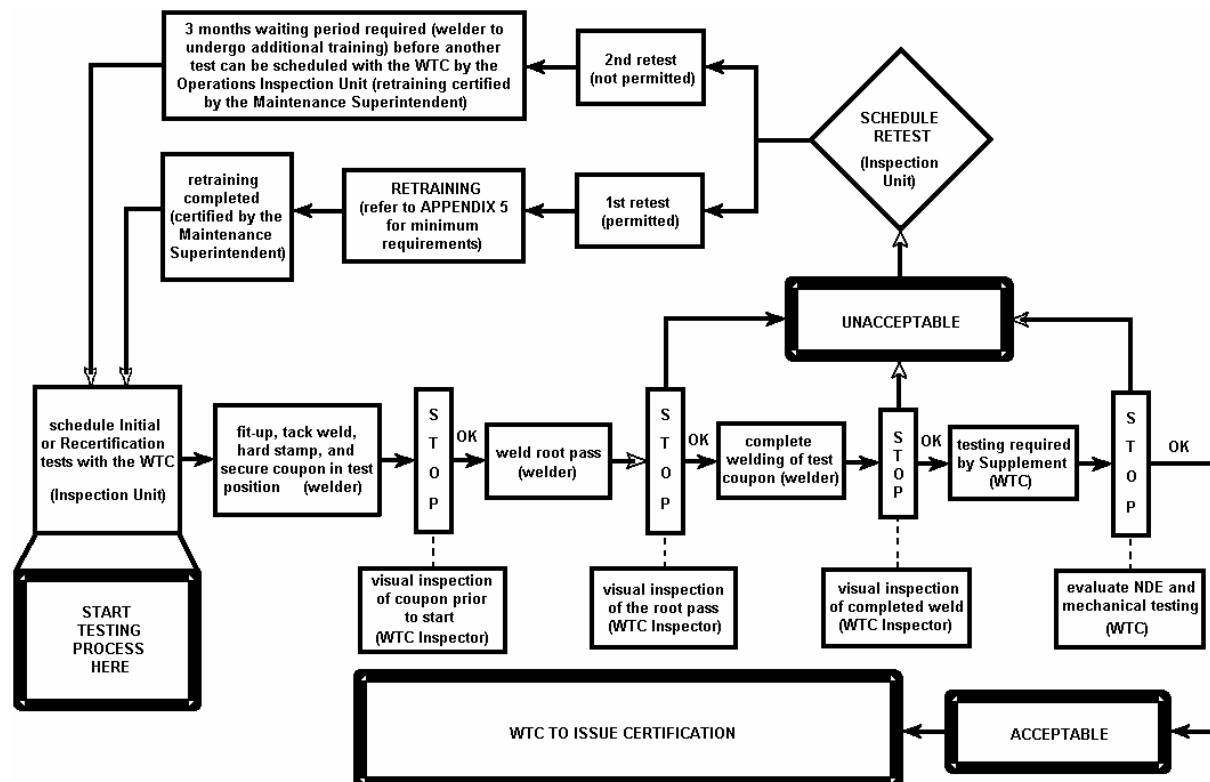
- 6.6.6 After completion of the welding the WTC welding inspector shall visually inspect the test assembly. The surface of the weld beads shall be smooth in appearance. Undercut and underfill in excess of that permitted by Section 6.1.3 is not permitted. Welds that do not meet these criteria shall be rejected (test failure).
- 6.6.7 Test assemblies that pass the visual inspection shall be leak tested by the WTC welding inspector and the welder. A small hand pump (or bulb) shall be used to apply five (5) psig pressure through the 1/4" leak test hole in the strip lining while leak detection solution is applied over the welds. Leaks are not permitted (test failure).
- 6.6.8 Leaks shall be repaired by the welder under the supervision of the WTC welding inspector. After repairs are complete the welder shall be permitted to take one retest. The retest may be rescheduled immediately.
- 6.6.9 Welders that fail the retest shall not be permitted to retake the Supplement Test for a period of at least one (1) month.
- 6.6.10 Welders that pass the initial test or the immediate retest shall be certified in accordance with the requirements of Chapter 6.2 of this Engineering Procedure.

Revision Summary

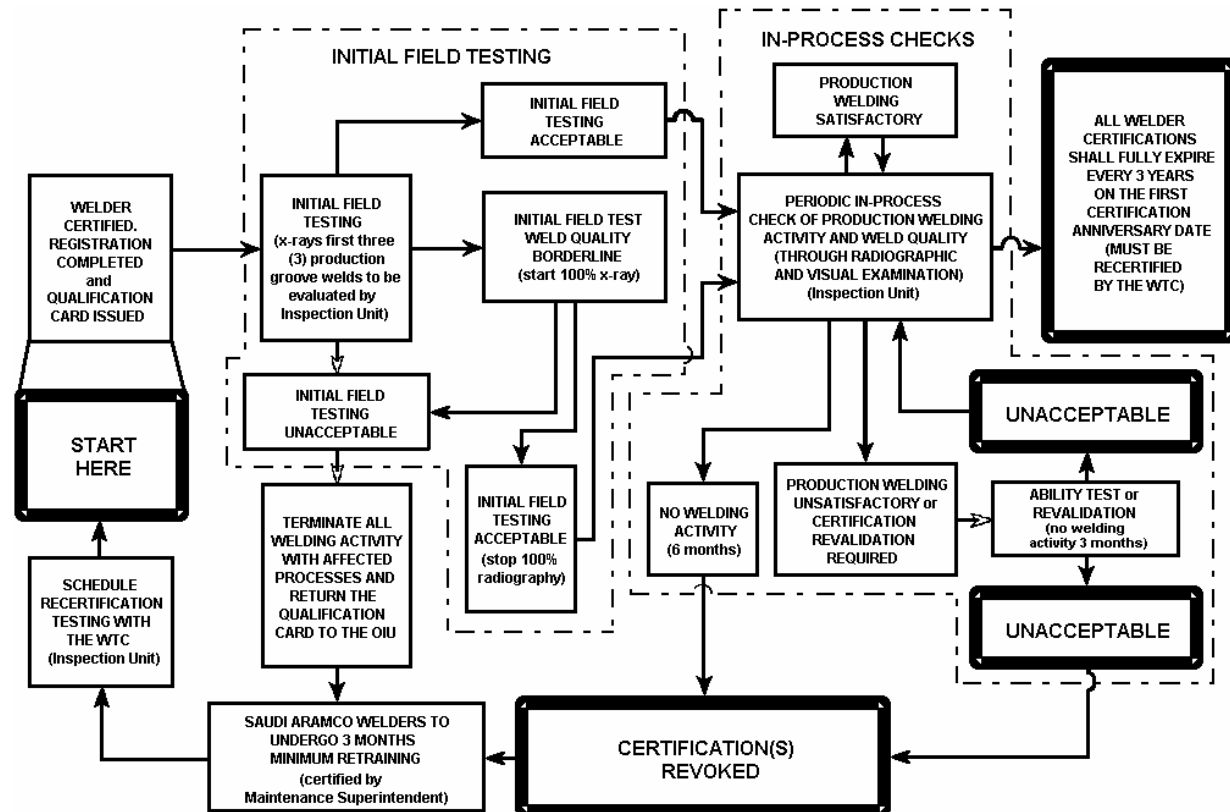
30 June, 2003

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

Appendix 1 – Flow Chart for Testing and Certifying Welders



Appendix 2 – Flow Chart for Maintaining Welder Certification



Appendix 3 – List of Approved Welding Test Supplements

SAEP	Num	Type	Proc	Base Mat'l	Filler Metal	Limitations
1101	S01	Pipe	SMAW	CS	EXX10/EXX18	Vertical up
1102	S02	Pipe	SMAW	CS	EXX10	Vertical down
1103	S03	Pipe	SMAW	SS	EXXX-15/16	Fill/cap only
1104	S04	Pipe	SMAW	SS	EXXX-15/16	Fill/cap only
	---	---	---	Ni Alloys	EXXXXX-X	Fill/cap only
1105	S05	Pipe	SMAW	Ni Alloys	EXXXXX-X	Fill/cap only
1106	S06	Pipe	GTAW	Al Alloys	ERXXXX	Structural only
1107	S07	Pipe	GTAW	CS/LAS/SS	ERXXS-X	-----
	---	---	---	LAS	ERXXS-XX	-----
	---	---	---	SS	ERXXX	-----
1108	S08	Pipe	GTAW	Ni alloys	ERXXX-X	-----
1109	S09	Pipe	GTAW	Al alloys	ERXXXX	-----
1110	S10	Pipe	SAW	CS/LAS	FX-EXXX	-----
1111	S11	Pipe	SAW	CS/LAS	SS & Ni Alloy	CRWMO
1112	S12	Pipe	SMAW	Small Dia CS	EXX10/EXX18	Cat-"D" service
1113	S13	Pipe	FCAW	SS	EXXT-X	Spray/globular
1114	S14	Plate	SMAW	CS	EXX10/E7018	Vertical up
1115	S15	Lap	SMAW	SS to CS	EXXX-15/16	Vertical down
1116	S16	Lap	SMAW	Ni to CS	EXXXXX-X	Vertical down
1117	S17	Fillet	SMAW	CS	BROSCO	Wet Welding
1118	=====RESERVED FOR FUTURE TEST SUPPLEMENTS=====					
1119	=====RESERVED FOR FUTURE TEST SUPPLEMENTS=====					
1120	=====RESERVED FOR FUTURE TEST SUPPLEMENTS=====					
1121	=====RESERVED FOR FUTURE TEST SUPPLEMENTS=====					
1122	=====RESERVED FOR FUTURE TEST SUPPLEMENTS=====					
1123	=====RESERVED FOR FUTURE TEST SUPPLEMENTS=====					
1124	=====RESERVED FOR FUTURE TEST SUPPLEMENTS=====					

NOTE: The X's in the filler metal classifications indicate that multiple ASME SEC IIC Filler Metal Specifications are applicable. For example, EXX18 represents E7018, E8018-B1, E8018-C2, E9018, etc.

Al = Aluminum
Cat-"D" = Category "D" Service as defined in ASME B31.3
CS = Carbon steel
Cu = Copper
LAS = Low alloy steel
Ni = Nickel
SS = Stainless steel

Appendix 4 – Performance Qualification Testing Prerequisites

		<u>S01</u>	<u>S03</u>	<u>S04</u>	<u>S05</u>	<u>S07</u>
S U P P L E M E N T B E I N G T E S T E D	S01	—	—	—	—	—
	S02	—	—	—	—	—
	S03	<u>A</u>	—	—	—	—
	S04	<u>A</u>	—	—	—	—
	S05	<u>A</u>	—	—	—	—
	S06	—	—	—	—	—
	S07	<u>A</u>	<u>B</u>	<u>B</u>	—	—
	S08	<u>A</u>	—	<u>B</u>	<u>B</u>	<u>A</u>
	S09	<u>A</u>	—	—	—	—
	S10	—	—	—	—	—
	S11	—	—	—	—	—
	S12	<u>A</u>	—	—	—	—
	S13	<u>A</u>	—	—	—	—
	S14	—	—	—	—	—
	S15	<u>A</u>	<u>B</u>	<u>B</u>	—	—
	S16	<u>A</u>	—	<u>B</u>	<u>B</u>	—
	S17	—	—	—	—	—

(A) Prior certification to this Supplement is required.

(B) Prior certification to one of two Supplements listed is required.

Appendix 5 – Minimum Retraining Times for Welders Taking the Performance Qualification Retest

Cause of Test Failure	Minimum Retraining Time
Unacceptable root (6.1.2.3/4)	14 days
Excessive grinding (6.1.2.4/6)	7 days
Excessive backgouging (6.1.2.4)	7 days
Final visual (6.1.3.2/3/4/5/6/7)	7 days
Rejection of x-ray (6.1.4.3)	7 days
Bend test failure (6.1.5.5)	7 days
Rejection for cause (6.1.1.5)	30 days

NOTE: Prior to taking the retest the Maintenance Superintendent shall certify in writing that the welder has undergone additional training and is fully prepared to take the retest. Welders that fail the retest shall not be permitted to take a second retest, and are also prohibited from taking that welding performance qualification test sooner than three (3) months from that date.

Appendix 6 – Welder Experience Record

Name _____ Employee Number _____ Welder Symbol _____
Org Code _____ Anniversary Recertification Date _____ 19____

Supplement Number Qualified To

Month	_____	_____	_____	_____	_____	_____
1	_____	_____	_____	_____	_____	_____
2	_____	_____	_____	_____	_____	_____
3	_____	_____	_____	_____	_____	_____
4	_____	_____	_____	_____	_____	_____
5	_____	_____	_____	_____	_____	_____
6	_____	_____	_____	_____	_____	_____
7	_____	_____	_____	_____	_____	_____
8	_____	_____	_____	_____	_____	_____
9	_____	_____	_____	_____	_____	_____
10	_____	_____	_____	_____	_____	_____
11	_____	_____	_____	_____	_____	_____
12	_____	_____	_____	_____	_____	_____

(A) Reference inspection report, RT report, weld/braze number, etc.