

Engineering Procedure

SAEP-322

30 June, 2003

Performance Qualification Testing
and Certification of Saudi Aramco Brazers

Document Responsibility: Inspection Department

Saudi Aramco DeskTop Standards

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1 Scope

This Engineering Procedure specifies the minimum requirements for the testing, certification and registration of Saudi Aramco brazers 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.

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 Engineering Procedure.

3.1 Saudi Aramco References

Saudi Aramco Engineering Procedure

[SAEP-1125](#)

Test Supplement S25 for Brazer Performance Qualification

Saudi Aramco Forms

SA 2318-ENG

Welder and Welding Operator Qualification Record

SA 3331-ENG

Welder Qualification Card

SA 4758-ENG

Job Clearance Card

3.2 Industry Codes and Standards

American Society of Mechanical Engineers/Boiler & Pressure Vessel Code

ASME SEC IIC

Welding Rods, Electrodes and Filler Metals

ASME B31.3

Process Piping

4 Definitions and Acronyms

Ability Test: An ad hoc test used to determine if a brazer has the ability to produce work in accordance with a valid certification. The Ability Test shall be performed on

either a production braze 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. Test acceptance is based on sectioning, polishing and visual examination of cross sections.

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

ART: Anniversary Recertification Test

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

Braze: A joint between two metals produced by brazing.

Brazer: One who performs a brazing operation.

Brazer Certification: Certification in writing (i.e., Form SA 2318-ENG) that a brazer has produced a test braze meeting a defined standard.

Brazer Performance Qualification: The demonstration of a brazers ability to produce a test braze meeting a defined standard.

Brazing: A group of metal joining processes which produce coalescence of materials by heating them to a suitable temperature, and by using a filler metal having a liquidus above 840 Fahrenheit and below the solidus of the base materials. The filler is distributed between the closely fitted surfaces of the joint by capillary action.

Brazing Flux: Material applied to the braze and used to prevent, dissolve, or facilitate removal of oxides and other undesirable surface substances during brazing.

Brazing Temperature: The temperature to which the base materials are heated to enable the filler metal to wet the base materials and form a brazed joint.

Certification: See preferred term Brazer Certification.

Certified Brazer: A brazer that has a valid certification for one or more brazing processes. A certified brazer is only qualified to braze with those brazing processes, and within the essential variables, of the valid certification(s).

Cu: Copper.

ID: Inspection Department.

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

OID: Operations Inspection Division.

OIU: Operations Inspection Unit.

PT: Penetrant Test.

Qualification: See preferred terms Brazer Performance Qualification.

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

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

Qualified Brazer: See preferred term Certified Brazer.

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

Registered Brazer: A brazer whose certifications have been reviewed, found to be acceptable, and are on file with the Operations Inspection Unit.

Registration: The act of registering a brazer 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 brazer fails the initial certification test to a Test Supplement, or the recertification test to reinstate a revoked certification. Only one retest is permitted.

Revoked Brazer Certification: A certification with a brazing process that is no longer valid as a result of a brazer (1) not brazing with a brazing process for six (6) or more consecutive months, or (2) not passing an Ability Test. A brazer whose certification(s) with a process become REVOKED is required to pass a recertification test (Test Supplement) conducted by the WTC prior to resuming production brazing.

TB: Torch Brazing.

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

Torch Brazing (TB): A brazing process in which the heat required is supplied by a fuel gas flame.

Uncertified Brazers: A brazers that does not have a valid brazing certification.

Unqualified Brazers: See preferred term Uncertified Brazers.

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 brazers performance qualification tests;
- (b) Keeping track of the status of all Saudi Aramco brazers.

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

- (a) Conducting performance qualification testing of brazers in accordance with approved Test Supplements;
 - (b) Conducting recertification testing of brazers with revoked certifications;
 - (c) Preparing certifications (Form SA 2318-ENG) for brazers who pass performance qualification or recertification tests;
 - (d) Inputting certification results 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 brazers passing certification tests;
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- (g) Conducting Anniversary Recertification testing of brazers every three years;
- (h) Sending brazers certification information to the WTS Administrator;
- (i) Generating new or updating welder records/data in WTS.

5.1.4 The WTC Welding Inspector is responsible for:

- (a) Witnessing and evaluating brazer performance qualification tests;
- (b) Witnessing and evaluating recertification tests of brazers 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 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

The Maintenance Superintendent/Foreman is responsible for:

- (a) Ensuring all brazers are properly certified prior to the start of work;
- (b) Ensuring all brazers maintain valid certifications for every process certified through continuous brazing;
- (c) Ensuring all brazers undergo the additional training prior to taking a retest;
- (d) Maintaining a log of brazers working in the Unit.

5.3 Business Line Engineering Organizations

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

- (a) Ensuring all brazer performance certifications are current and up to date through documentation of brazing activity;
- (b) Ensuring all newly certified brazers are capable of making sound welds by conducting Initial Field Testing;
- (c) Conducting Ability Testing of brazers whose skills may be in doubt;
- (d) Registering properly certified Maintenance brazers;
- (e) Reporting Initial Field and Ability Testing results to Maintenance Organizations;
- (f) Conducting Ability Testing of brazers if no production activity is performed within three months to avoid revoked certification.
(Revise Appendix II Flow Chart).

5.3.2 The Operations Inspection Unit Inspector is responsible for: witnessing and evaluating Initial Field Tests and Ability Tests.

6 Instructions

6.1 Brazer 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. A flow chart showing the steps involved in testing and certifying brazers is shown in Appendix 1.
- 6.1.1.2 When it is impractical to bring brazers from remote locations to the WTC for testing, 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 brazing Test Supplements is given in Appendix 3.
- 6.1.1.4 If it becomes apparent to the WTC welding inspector at any time that a brazer does not have the necessary skill to complete the performance qualification test, the test shall be terminated and the brazer sent back to the proponent organization for retraining and/or reassignment.

6.1.2 Coupon Preparation and Brazing

- 6.1.2.1 The brazer shall mechanically clean the test coupons and mark the brazers name (or welder symbol if currently certified) on both ends of the test coupon.
- 6.1.2.2 After the WTC welding inspector has inspected and approved the cleaning and marking, the test coupons shall be secured in the required test positions at a height of eighteen (18") inches above the floor of the test booth. They shall remain fixed throughout the test until after the final inspection of the completed coupons by the WTC welding inspector.
- 6.1.2.3 Grinding, filing, or mechanical dressing of the completed braze is not permitted. Evidence of such shall be cause for rejection of the test coupon (test failure).

6.1.3 Visual Examination of the Test Coupon

- 6.1.3.1 After completion of brazing the WTC welding inspector shall perform a visual examination of the external and internal (after sectioning) surfaces of the test coupons. The ends of the mating surfaces shall be completely filled with braze metal. The appearance of voids at the lap ends shall be cause for rejection of the test coupon.
- 6.1.3.2 The test coupons shall be sectioned longitudinally (cut with a hacksaw) through the braze into quarters. The cross sections (all) shall be polished using either sand paper or emery cloth and examined with a four power (4X) magnifying glass. The sum of the lengths of the unbrazed areas on any side, considered individually, shall not exceed twenty percent (20%) of the joint overlap in any one section.

6.1.4 Retest

- 6.1.4.1 Brazers are permitted one (1) retest per Test Supplement provided they receive additional training in accordance with the schedule given in Appendix 4. Brazers that fail the performance qualification test for multiple causes shall undergo a total minimum retraining time equal to the sum of the minimum retraining times for each cause.
- 6.1.4.2 Prior to taking the retest the Maintenance Superintendent shall certify in writing that the brazer 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.

6.1.4.3 All retests shall be conducted by the WTC.

6.1.4.4 Brazers that fail the retest shall not be permitted to take a second retest. They shall also be prohibited from retaking that brazing performance qualification test sooner than one (1) month from the date of the failed retest. During the waiting period the brazer shall be given additional training by the Unit. If the Unit sends the brazer to retake the test at the end of one (1) month the Maintenance Superintendent shall certify in writing that the brazer has received sufficient training and is capable of passing the Supplement Test (attached to the request submitted by OIU to the WTC).

6.2 Certification of Brazers

6.2.1 Upon successful completion of the performance qualification test, the WTC shall certify the results by:

- (a) Obtaining the brazer a welder symbol (if required) from WTS. When a brazer leaves the employ of the company that welder symbol shall be retired and a letter of notification should be sent to the WTS Administrator to terminate that symbol from WTS database;
- (b) Completing 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
- (c) Issuing the brazer with a new/revised Qualification Card (Form SA 3331-ENG). The Qualification Card shall list all valid certifications held by the brazer. It shall also include a photograph of the brazer and be carried by the brazer at all times. A copy shall be kept on file at the WTC, and also be sent to the OIU and the WTS Administrator.

6.2.2 Immediately after the successful completion of the performance qualification test newly certified brazers shall report to the OIU to be registered. Brazers shall not be permitted to start production brazing without first being registered by the OIU.

6.3 Maintaining Brazer Certifications

6.3.1 Initial Field Testing

- 6.3.1.1 After certification and registration, but prior to the start of production brazing, each brazer shall braze a test coupon in the field for each test position qualified. The test shall be witnessed by an inspector of the OIU.
- 6.3.1.2 Each test braze shall be visually examined in accordance with the requirements of section 6.1.3 of this Engineering Procedure.
- 6.3.1.3 If the test brazes are satisfactory the brazer shall be permitted to start production brazing.
- 6.3.1.4 If any of the test brazes are unsatisfactory the brazers certification shall be revoked. The brazers Qualification Card shall be sent by the OIU to the WTC for updating along with a letter of notification. The WTC shall return the revised Qualification Card to the brazer through the OIU. A copy of the revised Qualification Card (and the letter of notification) shall be sent to the WTS Administrator.
- 6.3.1.5 Brazers that have a certification revoked during the Initial Field Test shall not be allowed to take another certification test to that Supplement for at least one (1) month. During that time the brazer shall be given additional training. When the brazer is ready to retake the Supplement Test the Maintenance Superintendent shall certify in writing that the brazer has been given the required additional training and is fully capable of passing the Supplement Test. The test shall be scheduled in writing by OIU with the WTC.

6.3.2 General Requirements

- 6.3.2.1 A flow chart showing the steps involved in maintaining brazer certifications is shown in Appendix 2.
- 6.3.2.2 If a brazer does not braze for a period of at least six (6) consecutive months, all brazing certifications shall become revoked. The brazer shall not be permitted to perform any production brazing prior to being recertified by the WTC in accordance with section 6.1 of this Engineering Procedure. All brazes made by a brazer after a certification is revoked shall be cut out.

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.

- 6.3.2.3 If there is a specific reason to question a brazers ability to produce sound braze joints, OIU inspector can require that the brazer perform an Ability Test on a test coupon (the brazing shall be witnessed by the inspector). The test coupon can be any size qualified by the certification. The test shall be conducted in the vertical upflow position. The completed test braze shall be visually examined externally, sectioned and polished (through the cross section). If the coupon does not meet the visual acceptance criteria of paragraph 6.1.3 the brazers certification shall be revoked.
- 6.3.2.4 Brazers with revoked certifications shall be retested and recertified in accordance with the requirements described in section 6.4 prior to resuming production brazing.
- 6.3.2.5 When a brazers certification becomes revoked the OIU shall send the brazers Qualification Card to the WTC along with a letter of notification. The WTC shall delete the revoked certifications from the Qualification Card and return the card to the brazer through the OIU. The WTC shall send a copy of the letter and revised Qualification Card to the WTS Administrator.
- 6.3.2.6 A brazers certifications shall expire (cease to be valid) every three (3) years on the anniversary date of the issue of the brazers first performance certification (welding or brazing). During the month prior to the anniversary date brazers shall recertify to every brazing Test Supplement previously held and/or required. This blanket recertification shall be called the Anniversary Recertification and shall be conducted by the WTC. Those certifications obtained in the year prior to the anniversary date are exempt from retesting until the following anniversary date. The soon to be expired Qualification Card shall be surrendered to the WTC by the brazer prior to the test.

A new Qualification Card shall be issued after completion of testing.

6.3.2.7 The OIU shall maintain a Brazer Experience Record for each certified brazer. Verification of brazing experience can be by reference to a braze inspection report, braze number or any similar type of documentation. Records shall be reviewed during Inspection Department audits of OIU. A suggested Brazer Experience Record Form is given in Appendix 5.

6.3.2.8 The Maintenance Foreman shall maintain an up to date log of brazers working in the Unit. The brazers log shall include a listing of valid certifications, anniversary date and any other pertinent information.

6.4 Recertification of Brazers with Revoked Certifications

6.4.1 Brazers with a revoked certification shall not be permitted to braze on production work using the certification until they have been recertified. The Recertification Test shall be conducted by the WTC in accordance with the requirements of section 6.1 of this Engineering Procedure.

6.4.2 The OIU shall schedule the brazers Recertification Test with the WTC in writing. The test shall not be scheduled sooner than one (1) month from the date the certification was revoked. The Maintenance Superintendent shall certify in writing that the brazer has been given the required additional training and is fully capable of passing the Recertification Test. The test shall then be scheduled in writing by the OIU with the WTC.

6.4.3 Brazers that fail the Recertification Test may take only one retest as permitted in paragraph 6.1.4.

6.4.4 Brazers 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 Brazers that fail the Recertification Test retest shall have all certifications with the process tested revoked if the certification was originally revoked as a result brazing inactivity. If the certification was revoked as a result of a failed Ability Test only the particular certification tested shall be revoked.

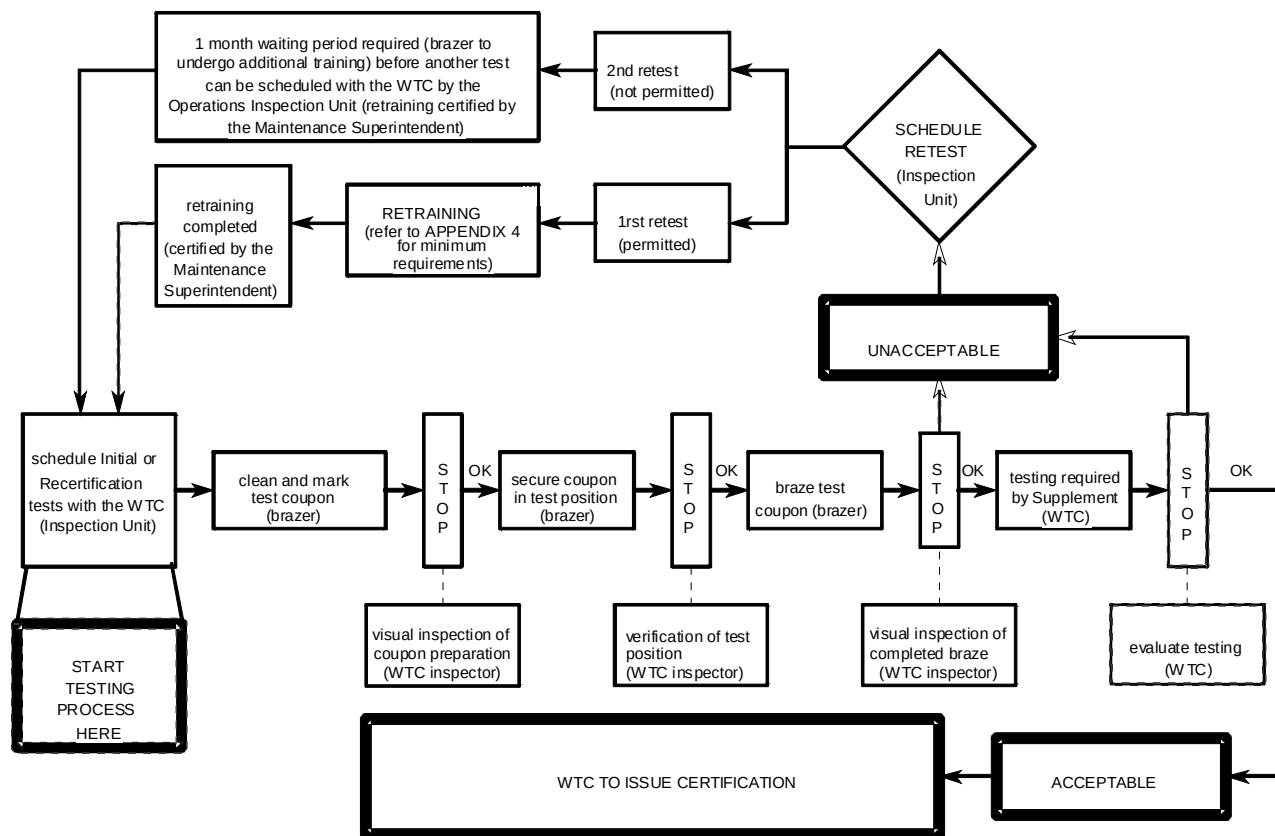
- 6.4.6 Brazers that fail the retest shall not be permitted to retake the Supplement Test for a period of at least one (1) month from the date of the test failure. The WTC shall inform the OIU and WTS Administrator of the test results in writing.

Revision Summary

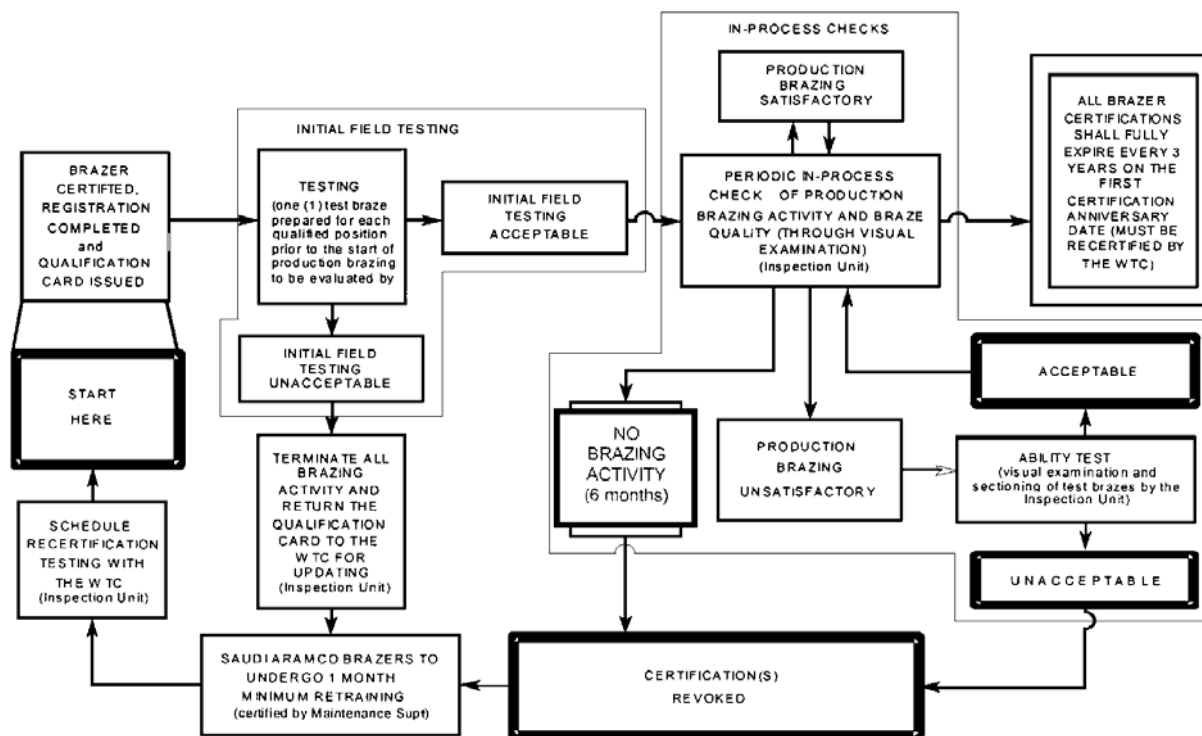
30 June, 2003

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

Appendix 1 – Flow Chart for Testing and Certifying Brazers



Appendix 2 – Flow Chart for Maintaining Brazer Certification



Appendix 3 – List of Approved Brazing Test Supplements

SAEP	Num	Type	Proc	Base Mat'l	Filler Metal	Limitations
1125	S25	Tube	Torch	Cu Alloys	Bag-3, Bag-7	Vertical up
1126	=====RESERVED FOR FUTURE TEST SUPPLEMENTS=====					
1127	=====RESERVED FOR FUTURE TEST SUPPLEMENTS=====					
1128	=====RESERVED FOR FUTURE TEST SUPPLEMENTS=====					
1129	=====RESERVED FOR FUTURE TEST SUPPLEMENTS=====					
1130	=====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 – Minimum Retraining Times For Welders Taking the Performance Qualification Retest

Cause of Test Failure	Minimum Retraining Time
Excessive grinding filling or mechanical dressing (6.1.2.3)	7 days
Visual inspection - external appearance (6.1.3.1)	7 days
Visual inspection - cross section (6.1.3.2)	7 days
Rejection for cause (6.1.1.4)	14 days

NOTE: Prior to taking the retest the Maintenance Superintendent must certify in writing that the brazer has undergone additional training and is fully prepared to take a second retest, and are also prohibited from retaking that brazing performance qualification test sooner than one (1) months from that date.

Appendix 5 – Brazers Experience Record

Name _____ Employee Number _____ Welder Symbol _____

Org Code _____ Anniversary Recertification Date _____

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.