An Explanation of

CERTIFIED WELDING

National Certified Pipe Welding Bureau

Core Purposes of the NCPWB

To engage in research and educational work that will assist the contractor in furnishing the public with safe and dependable installations through the use of certified welding

To keep members of the Bureau informed of the latest scientifically proven methods and supply information and data in connection with certified welding

To establish uniform procedures that conform with ANSI/ASME Codes for various methods of welding and to promote and develop certified welding

To assist the NCPWB member contractor in providing the owner with quality welding at reduced costs through the use of certified welding

We Believe in Codes

The National Certified Pipe Welding Bureau has a deep and abiding belief in codes and has always promoted compliance with them. Such compliance produces sound welds and is economical for both contractor and owner. It saves resources that would otherwise be wasted in going back to correct errors.

Certified Welding

Qualified Procedures/Qualified Welders

The term certified welding is often used in the trade without knowledge of its meaning.

The contractor is required to certify that the welding procedure and the welder are qualified in accordance with the requirements of Section IX of the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code.

This is where the term "certified welder" came into use. It is the contractor, certifying that the work will be done according to qualified welding procedures by welders who have been tested, and whose qualification test sheets are available, attesting to their ability to weld in accordance with the contractor's Welding Procedure Specifications. Responsible contractors will provide their certified Welding Procedure Specifications and qualification test records attesting to the welder's ability to perform in accordance with code requirements.

What is a Welding Procedure?

A procedure is the description of the technique adopted to perform quality welding as required by the applicable code.

Through the years, standards have been established for pipe dimensions, flange and fitting dimensions or various pressures, pipe thread dimensions, and pitch. The tool industry has provided cutting and threading tools for these standards, and everyone in the industry accepts them, giving little thought as to how they were established.

With the application of welding to pipe fabrication and installation, a standard was required. The standard qualifications for welding procedures, made in accordance with the ANSI/ASME Boiler and Pressure Vessel Code and the ANSI/ASME B31 Codes for Pressure Piping to ensure competent workmanship, are the generally accepted standards. The requirements are not complicated, but are frequently misunderstood.

The ASME Code simply states that those contractors responsible for providing welding shall establish a method (Welding Procedure Specification) and prove that sound welds can be made through the use of these procedures.

Your Contractor Certifies that His Welders are Qualified

Contractor/Membership

Contractors who are members of the National Certified Welding Bureau can guarantee that the welding is performed in accordance with established national standards.

Qualification of Procedures

Section IX of the American Society of Mechanical Engineers Boiler and Pressure Vessel Code sets forth in complete detail the step-by-step process necessary to qualify a procedure, including the necessary tests to establish the results.

It is not easy to comply with these provisions. Qualifying a procedure can be a very expensive endeavor, particularly in the hands of the inexperienced. It is a matter of trial and error. The cost of materials, especially in alloys, can be very high, and many man-hours of technical supervision and labor can be expended before satisfactory results are obtained.

The code bodies recognized that requiring each welding fabricator or erector to qualify every welding procedure they were using would represent an extremely wasteful practice, and would cost American industry a great many unnecessary dollars without improving welding technology or fabricated product quality.

The Mechanical Contractors Association of America, Inc. recognized this fact and in 1944 organized the National Certified Pipe Welding Bureau for the purpose of jointly developing and qualifying procedures with its members. These Welding Procedure Specifications are written based on thoroughly tested and qualified Procedure Qualification Records (PQRs) donated by members of the NCPWB Technical Committee and reviewed by the Hartford Steam Boiler Inspection and Insurance Company before publication.

Under the B31 Codes for Pressure Piping, Welding Procedure Specifications that have been qualified by a technically competent group or agency, such as the NCPWB, may be used by other member companies of that group or agency, providing that each user of the procedure qualifies at least one welder using the Welding Procedure Specification and accepts responsibility for same. The provisions for use of procedures developed by the NCPWB for piping work covered by the rules of the ASME Boiler and Pressure Vessel Code are set forth in paragraph PW-28 of Section I of that code, and respective paragraphs of the ASME Codes for Pressure Piping; para. 127.5.3 for B31.1—Power Piping Code; para. 328.2 for B31.3—Process Piping Code; para. 527.5 for B31.5—Refrigeration Piping Code; and para. 927.5 for B31.9—Building Services Piping Code.

Welding Procedure Qualification Responsibility

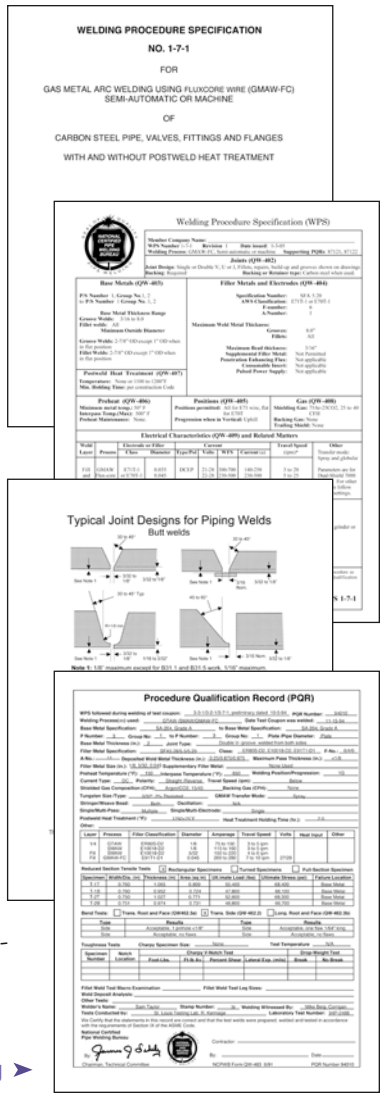
Each employer shall be responsible for qualifying any welding procedure that he intends to have used by personnel of his organization. However, to avoid duplication of effort, and subject to approval of the owner, welding procedures qualified by a technically competent group or agency may be used. (Para. 127.5.3 ANSI/ASME B31.1—Power Piping)

Documentation of Procedure Qualification

The Welding Procedure Specification describes all the essential, non-essential, and supplementary essential (when required) variables for each welding process used in the Welding Procedure Specification. Welding Procedure Specifications jointly developed for use by Bureau members are documented on NCPWB Form QW-482.

Each Welding Procedure Specification shall reference the supporting Procedure Qualification Record(s), which is a record of variables recorded during the welding of the test coupon and the results of the tested specimens. The Procedure Qualification Record(s) that support the Bureau Welding Procedure Specifications are detailed on NCPWB Form QW-483.

The Bureau now has more than 100 Welding Procedure Specifications qualified in accordance with code requirements. The policy of the Bureau states



Sample welding procedure supporting documentation.

that before any pipe welding is performed, the contractor member shall submit to the owner, or his authorized representative, a copy of his Welding Procedure Specifications with proof of its qualification.

All NCPWB Welding Procedure Specifications (WPSs) have been reviewed by the Hartford Steam Boiler Inspection and Insurance Company, which has stated in writing that the NCPWB WPSs meet the qualification requirements of Section IX, ASME Boiler and Pressure Vessel Code.

Welding Procedure Specifications that Meet the Requirement

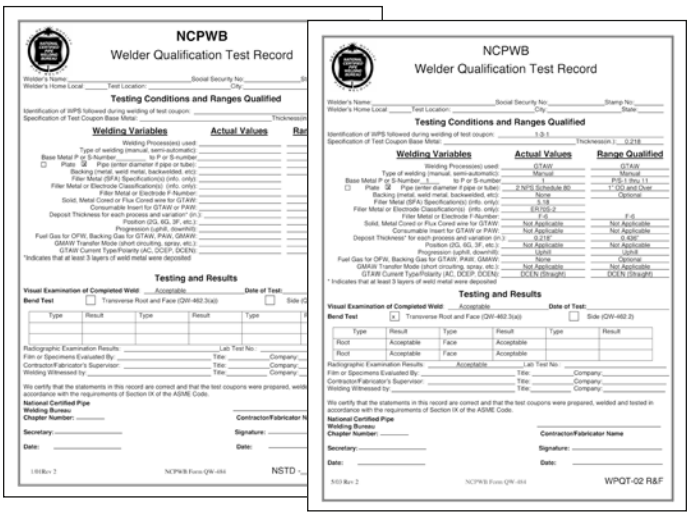
The purpose of the Welding Procedure Specifications (WPS) and Procedure Qualification Record (PQR) is to determine that the weldment proposed for the construction is capable of providing the required properties for its intended application.

Documentation of Welder Qualification

The employer shall maintain certified welder records and make them available to the purchaser or his agent and the inspector. These records show the procedures used by the employer, the date and results of the procedure and performance qualification, and the identification symbol assigned to each performance qualification (para. 127.6 ASME B31.1, Power Piping).

Record of Test

The record of welder/welding operator performance qualification shall include the essential variables, the type of test, and test results and the ranges qualified in accordance with QW-452. This information is recorded on NCPWB Form QW-484.



NCPWB form QW-484 and pre-completed Welder Performance Qualification Test (WPQT) form.

To reduce the amount of research and preparation time required to complete the NCPWB Form QW-484, the NCPWB has prepared for its membership pre-completed Welder Performance Qualification Test forms which have actual values and the ranges qualified for each essential variable completed. These forms have been prepared to meet the requirements of Section IX, ASME Boiler and Pressure Vessel Code for processes that are most commonly encountered in production welding or "code" work.

Welder Qualification and Renewal Requirements

Performance Qualification and Testing

The ASME Code specifies that welders shall be required to demonstrate their skill, under supervised tests, to make sound welds using the contractor's Welding Procedure Specifications.

The ability of thousands of welders to make quality welds using National Certified Pipe Welding Bureau Welding Procedure Specifications has been proven for all types of piping materials in general use throughout the mechanical construction industry.

The National Certified Pipe Welding Bureau and the United Association of Journeymen & Apprentices of the Plumbing and Pipe Fitting Industry (UA) have consolidated their efforts to make the welder qualification process more cost effective for the construction user. Under the joint effort, union welders are tested at the UA Authorized Test Facilities under the supervision and control of a contractor representative and an Authorized Test Representative (ATR). All test coupons are radiographed by an independent testing laboratory to determine which of the welders taking the test qualified. Appropriate Welder Performance Qualification Test Record forms are completed and made available to UA signatory contractors through the UA and the NCPWB.

The requirements of ASME Section IX state that the Welding Procedure Specification under which the welder is to be qualified shall be followed in every respect when making test welds to qualify a welder. The WPSs used during the test will be those outlined in the UA Welder Certification Program Manual. For NCPWB members, the NCPWB national office has identified equivalent WPSs that conform to the essential variables provided in the UA WPSs.

Renewal of Welder Qualifications

Under ASME Section IX requirements, paragraph QW-322, the performance qualification test of a welder is considered permanently effective unless a welder does no welding for a period of six months or more, or where there is specific reason to question the welder's ability to make sound welds. The UA and the NCPWB work closely with the contractors who employ the welders to document the dates when the welders last welded with a particular process and maintain records that show continuity of a welder's qualification in accordance with paragraph QW-322.

NCPWB local chapters keep records of the names and social security numbers of thousands of welders qualified by NCPWB members and in the UA Authorized Test Facilities (ATFs).

Quality Is Economy In Pipe Welding

Remember, qualified procedures and proper performance qualifications are but two steps on the road toward welding quality. A third requirement is the continuing supervision and inspection during welding that is clearly the responsibility of the contractor. These three steps ensure a quality of work that can meet any final inspection and testing.

Interchange of Welder Qualifications

The ASME B31 Codes for Pressure Piping also provide for the interchange of welders. In paragraph 127.5.3 of ASME B31.1—Power Piping, it is specifically stated that to avoid duplication of effort, an employer may accept a Welder Performance Qualification (WPQ) made by a previous employer, subject to the approval of the owner or his agent, on piping using the same or equivalent procedure. To complete the interchange, the new employer shall obtain from the previous employer a copy of the WPQ that shows the name of the employer by whom the welder was qualified, the date of such qualification, and evidence that the welder has maintained qualification in accordance with paragraph QW-322 of Section IX.

To further facilitate the interchange of welders, NCPWB has established a National Welder Database. This database contains the names of welders along with the dates, locations, and processes on which they have qualified. The location identifies the NCPWB local chapter that has the welder's original WPQ form signed by the qualifying contractor. This database continues to grow as more segments of the industry become familiar with the interchange provisions available under the Code.

Through this database, an NCPWB member contractor can determine the availability of qualified welders in any part of the United States.

Welder Interchange

Welders and welding operators of a member manufacturer or contractor must pass their performance test on each of the organization's Welding Procedure Specifications they are to weld under, except as otherwise permitted in Section IX. The Performance Qualification Test Records are placed on file with the organization. When such welders or welding operators are employed by another member manufacturer or contractor, their performance qualification records are made available to their new employer by the organization and performance requalification is not required for those Welding Procedure Specifications under which they qualified previously. (Interpretation I-78-06; ASME Boiler and Pressure Vessel Code.)

NCPWB Welding Procedure Specification Numbering System

The new NCPWB Welding Procedure Specification numbering system clearly defines the type of metals to be welded, the welding process used, and allows for identification of variations in a process. This numbering system will be used on all Welding Procedure Specifications revised or developed by the NCPWB in the future.

Welding Procedure Specification Number Format

X-Y-Z (for a P-Number Base Metal welded to itself)
X1:X2-Y-Z (for two different P-Number Metals welded to each other)
X1/X2-Y-Z (for two different P-Number Cladded Metals)

In this Numbering System

X is the P-Number of the Base Metal(s)

Y is the Welding Process Number based on the following list:

- **1** SMAW using F-3 Electrodes (E3010, E7010-A1, E6011, etc.)
- **2** SMAW using other than F-3 Electrodes (E7018, E308-16, etc.)
- **3** GTAW without Consumable Insert
- **4** GTAW with Consumable Insert
- **5** GMAW-S (Short Circuiting Transfer Mode)
- **6** GMAW (Globular, Spray, or Pulsed Transfer Mode)
- **7** FCAW (Fluxcored Wire Variation of GMAW)
- **8** SAW (Submerged Arc welding)
- **9** OFW (Oxyfuel)

Z identifies a Variation of a Process

Please note that the Z values will be assigned in simple chronological sequence identifying a variation of process using the same base metals—with no consistent meaning from procedure to procedure.

Examples

WPS 1-12-1 (said as: *WPS one dash twelve dash one*)
This WPS would be Carbon Steel (P-1) to itself using a F-3 classification electrode followed by an electrode which is not a F-3 classification.

WPS 4:1-42-2 (said as: *WPS four to one dash forty-two dash two*)
This WPS is for welding Cr-Mo Steels from P-Number 4 to Carbon Steel from P-Number 1 using GTAW with Consumable Insert followed by SMAW using an electrode which is not F-3.

WPS 1/8-32-2 (said as: *WPS 1 Clad 8 dash thirty-two dash two)*
This WPS is for carbon steel with stainless steel cladding using GTAW followed by SMAW

National Certified Pipe Welding Bureau Index Of Welding And Brazing Procedures

The Procedure Specifications listed below are the results of research. They have been developed by members or through technical representatives of the members of NCPWB and the costs thereof have been defrayed through the dues and contributions of members of NCPWB. They are thus available to and for the use of NCPWB members only. A correlation between the old and the new numbering system is included for reference.

WPS/BPS NUMBER	TITLE OF WELDING AND BRAZING PROCEDURE SPECIFICATION
1-1-1	SMAW using E6010 and uphill progression without PWHT
1-1-2	SMAW using E6010 and downhill progression without PWHT
1-1-3	SMAW using E6011 with AC Current without PWHT
1-1-10	SMAW using E6010 or E7010 (AWS D1.1)
1-12-1	SMAW using E6010 followed by E7018
1-12-2	SMAW using E6010 followed by E7018 with PWHT
1-2-1	SMAW using E7018 without PWHT
1-2-10	SMAW using E7018, E7018R or E7018R-H4 (AWS D1.1)
1-3-1	GTAW using ER70S-2 without PWHT
1-3-2	GTAW using ER70S-2, 3 or 6 without PWHT (TIP-TIG)
1-32-1	GTAW followed by SMAW using E7018 with or without PWHT
1-37-1	GTAW followed by GMAW-FC manual/semi-automatic and with or without PWHT
1-38-1	GTAW followed by SAW without supplemental filler metal
1-4-1	GTAW using INMs-1/ER70S-2 with insert and without PWHT
1-42-1	GTAW with insert followed by SMAW using E7018 with or without PWHT
1-47-1	GTAW followed by GMAW-FC with consumable insert and with or without PWHT
1-48-1	GTAW followed by SAW with consumable insert
1-5-1	GMAW Short Circuiting Transfer using ER70S-6, CO2 Shielding Gas without PWHT
1-5-2	GMAW Short Circuiting Transfer using ER80S-D2, CO2 Shielding Gas without PWHT
1-5-3	GMAW Short Circuiting Transfer using ER70S-2, 75% Argon, 25% CO2 Shielding Gas without PWHT
1-52-1	GMAW Short Circuiting Transfer followed by SMAW without PWHT
1-52-2	GMAAW Short Circuiting Transfer followed by SMAW with PWHT
1-56-1	GMAW Short Circuiting Transfer followed by GMAW Spray Transfer Mode
1-56-4	GMAW Short Circuiting Transfer followed by GMAW Spray (Pulsed Power Supply – SST or RMD)
1-57-1	GMAW-S followed by GMAW-FC with or without PWHT
1-58-1	GMAW Short Circuiting Transfer followed by SAW semi-automatic/machine without PWHT
1-7-1	GMAW-FC with and without PWHT
1-8-1	SAW – Submerged Arc Welding
1-9-1	OFW – Oxyfuel Gas Welding

WPS/BPS NUMBER	TITLE OF WELDING AND BRAZING PROCEDURE SPECIFICATION
1/8-32-2	GTAW/SMAW, ER317L and E317L-15 or -16 (carbon steel with SS cladding)
1/8-32-1	GTAW/ SMAW, ERNiCrMo-3 and ENiCrMo-3 (carbon steel with SS cladding)
3-12-1	SMAW using E7010-A1 followed by E7018-A1 without PWHT
3:1-12-1	SMAW using E7010-A1 followed by E7018-A1 without PWHT
4-2-1	SMAW using E8018-B2 with PWHT and preheat
4-2-2	SMAW using E8018-B2 without PWHT with preheat – Grade 11 (1-1/4% Cr-1/2% Mo)
4-3-1	GTAW using ER80S-B2 with PWHT – Grade 11 (1-1/4% Cr-1/2% Mo)
4-3-2	GTAW using ER80S-B2 without PWHT – Grade 11 (1-1/4% Cr-1/2% Mo)
4-32-1	GTAW using ER80S-B2 followed by SMAW using E8018-B2 with PWHT – Grade 11 (1-1/4% Cr-1/2% Mo)
4-32-2	GTAW using ER80S-B2 followed by SMAW using E8018-B2 without PWHT – Grade 11 (1-1/4% Cr-1/2% Mo)
4-42-1	GTAW with IN-515 insert and ER80S-B2 followed by SMAW using E8018-B2 with PWHT – Grade 11 (1-1/4% Cr-1/2% Mo)
4-42-2	GTAW with IN-515 insert and ER80S-B2 followed by SMAW using E8018-B2 without PWHT – Grade 11 (1-1/4% Cr-1/2% Mo)
4:X-2-1	SMAW using E8018-B2 with PWHT – Grade 11 (1-1/4% Cr-1/2% Mo)
4:X-2-2	SMAW using E8018-B2 without PWHT – Grade 11 (1-1/4% Cr-1/2% Mo)
4:X-3-1	GTAW using ER80S-B2 with PWHT – Grade 11 (1-1/4% Cr-1/2% Mo)
4:X-3-2	GTAW using ER80S-B2 without PWHT – Grade 11 (1-1/4% Cr-1/2% Mo)
4:X-32-1	GTAW with ER80S-B2 followed by SMAW using E8018-B2 with PWHT – Grade 11 (1-1/4% Cr-1/2% Mo)
4:X-32-2	GTAW with ER80S-B2 followed by SMAW using E8018-B2 without PWHT – Grade 11 (1-1/4% Cr-1/2% Mo)
4:X-42-1	GTAW with IN-515 insert and ER80S-B2 followed by SMAW using E8018-B2 with PWHT – Grade 11 (1-1/4% Cr-1/2% Mo)
4:X-42-2	GTAW with IN-515 insert and ER80S-B2 followed by SMAW using E8018-B2 without PWHT – Grade 11 (1-1/4% Cr-1/2% Mo)
5A-2-1	SMAW using E9018-B3 with PWHT
5A-2-2	SMAW using E9018-B3 without PWHT
5-2-3	SMAW using E502-16 with PWHT
5A-3-1	GTAW using ER90S-B3 with PWHT
5A-3-2	GTAW using ER90S-B3 without PWHT
5A-7-1	GMAW-FC using E91T1-B3 or E90T1-B3
5-3-3	GTAW using ER502 filler metal with PWHT
5A-32-1	GTAW using ER90S-B3 followed by SMAW using E9018-B3 with PWHT
5A-32-2	GTAW using ER90S-B3 followed by SMAW using E9018-B3 without PWHT
5-32-3	GTAW using ER502 followed by SMAW using E502-16 with PWHT
5A-42-1	GTAW with IN-521 insert and ER90S-B3 followed by SMAW using E9018-B3 with PWHT
5A-42-2	GTAW with IN-521 insert and ER90S-B3 followed by SMAW using E9018-B3 without PWHT
5A:X-2-1	SMAW using E9018-B3 with PWHT
5A:X-2-2	SMAW using E9018-B3 without PWHT
5:1-2-3	SMAW using E502-16 with PWHT
5A:X-3-1	GTAW using ER90S-B3 with PWHT (2-1/4% Cr)
5A:X-3-2	GTAW using ER90S-B3 without PWHT (2-1/4% Cr)
5A:X-32-1	GTAW with ER90S-B3 followed by SMAW using E9018-B3 with PWHT (2-1/4% Cr)
5A:X-32-2	GTAW with ER90S-B3 followed by SMAW using E9018-B3 without PWHT (2-1/4% Cr)
5:1-32-3	GTAW with ER502 followed by SMAW using E502-16 with PWHT
5A:X-42-1	GTAW with IN-521 insert and ER90S-B3 followed by SMAW using E9018-B3 with PWHT
5A:X-42-2	GTAW with IN-521 insert and ER90S-B3 followed by SMAW using E9018-B3 without PWHT
5:1-42-3	GTAW with IN-502 insert and ER502 followed by SMAW using E502-16 with PWHT
8-2-1	SMAW using EXXX-16 filler metal without PWHT
8-3-1	GTAW using ERXXX filler metal without PWHT
8-3-2	GTAW of thin wall pipe without consumable insert
8-3-3	Automatic Orbital GTAW Welding-Single Pass with no forward travel during high current pulses (w/o filler metal) Autogenously welding (A fusion welding process using heat without the addition of filler metal)
8-3-4	Automatic Orbital GTAW Welding-Single Pass and continuous forward travel (w/o filler metal) Autogenously welding (A fusion welding process using heat without the addition of filler metal)
8-3-6	GTAW Using ERXXX without PWHT – (TIP-TIG)
8-32-1	GTAW with ERXXX followed by SMAW using EXXX-16 filler metal without PWHT
8-4-1	GTAW of thin wall pipe with consumable insert
8-42-1	GTAW with IN-XXX insert and ER-XXX followed by SMAW using EXXX-16 filler metal without PWHT
8-5-1	GMAW Short Circuiting Transfer, using He/Ar/CO2 shielding gas and Ar gas backing
8-5-2	GMAW Short Circuiting Transfer, using He/Ar/Co2 Shielding gas with no Backing gas
8-37-1	GTAW using EXXX followed by GMAW-FC using EXXT-1 without PWHT
8-57-1	GMAW Short Circuiting Transfer, using EXXX, Followed by GMAW-FC using EXXT-1 without PWHT
8:1-2-1	SMAW using E309-16 electrodes without PWHT
8:1-2-2	SMAW using ENiCrFe-3 electrodes without PWHT
8:1-3-1	GTAW using ER309 filler metal
8:1-32-1	GTAW with ER309 followed by SMAW using E309-16 without PWHT
8:1-32-2	GTAW with ERNiCr-3 followed by SMAW using ENiCrFe-3 without PWHT
8:1-4-1	GTAW with consumable insert followed by ER309
8:1-42-1	GTAW with consumable insert and ER309 followed by SMAW using E309-16
8:4-2-1	SMAW using E309-16 without PWHT
8:5-2-1	SMAW using ENiCrFe-3 without PWHT
8:5-32-1	GTAW with ERNiCr-3 followed by SMAW using ENiCrFe-3 filler metal
10H-32-1	GTAW followed by SMAW using ER2209 followed by E2209-16 without PWHT (Duplex SS)
15E-32-1	GTAW followed by SMAW using ER90S-B9/E9018-B9 with PWHT- Grade 91 (9% Cr-1% Mo)
15E:1-32-1	GTAW followed by SMAW using ER90S-B3/E9018-B3 with PWHT- Grade 91 (9% Cr-1% Mo)
15E:4-32-1	GTAW followed by SMAW using ER90S-B3/E9018-B3 with PWHT- Grade 91 (9% Cr-1% Mo) to Grade 22 (1-1/4% Cr-1/2% Mo)

WPS/BPS NUMBER	TITLE OF WELDING AND BRAZING PROCEDURE SPECIFICATION
15E:5A-32-1	GTAW followed by SMAW using ER90S-B3/E9018-B3 with PWHT- Grade 91 (9% Cr-1% Mo) to Grade 11 (1/4% Cr-1/2% Mo)
21-3-1	GTAW of Aluminum pipe using ER1100
23-3-1	GTAW of Aluminum pipe using ER ER4043
23-6-1	GMAW of Aluminum pipe using ER ER4043
41-2-1	SMAW of Nickel 200 Pipe using ENi-1 without shielding gas
41-3-1	GTAW of Nickel 200 Pipe using ERNi-1 with shielding gas
41-32-1	GTAW of Nickel pipe followed by SMAW using ERNi/ENi filler metal
42-3-1	GTAW of Nickel Copper Alloy (MONEL) using ERNiCu-7 filler metal
42:1-3-1	GTAW of Nickel Alloy (MONEL 1) using ERNi-1 filler metal
43-2-1	SMAW of Nickel Alloy 600 and 601 using ERNiCrFe-3 without shielding gas – Inconel
43-3-1	GTAW of Nickel Alloy 600 and 601 using ERNiCr-3 with shielding gas – Inconel
43-32-1	GTAW followed by SMAW of Nickel Alloy 600 and 601 using ERNiCr-3-1/EniCrFe-3 filler metal – Inconel
43-32-2	GTAW of Nickel Alloy C-276 followed by SMAW using ERNiCrMo-4 filler metal (N10276) Hastalloy
43:8-3-1	GTAW of P-43 Nickel Alloy to P8 Stainless Steel using ERNiCr-3 filler metal – Inconel
45-3-1	GTAW of Nickel Alloy [UNS N08366(AL6-X) & N08367 (AL6-XN)] using ERNiCrMo-3, without PWHT
45-32-1	GTAW followed by SMAW of Nickel Alloy 20 (UNS N08020) using ER320 and ER320-16 filler metal
45-32-2	GTAW followed by SMAW of Nickel Alloy 20 (UNS N08020) using ERNiCr Mo-4 filler metal
45-32-3	GTAW of Nickel Alloy (800&800HT) using ERNiCr-3 followed by SMAW using ENiCrFe-2, without PWHT – Inconel
51-3-1	GTAW of P-51 Titanium using ERTi-2 filler metal
107-1	Torch Brazing of Cu Alloys 102, 120, 122, 142, 192 using BCuP-3 through 7 filler metal without flux
107-2	Torch Brazing of Cu Alloy 107 using BAg-7 filler metal with AWS 3A Type flux
107:101-1	Torch Brazing of Cu Alloy 107 to P/S No. 101 Carbon Steel using BAg-7 filler metal with AWS 3A Type flux
107A-1	Torch Brazing of P/S No. 107 Metals per NFPA-99, 1995 Edition using BCuP-3 through 7 filler metal without flux

Learn more about NCPWB membership by contacting your local NCPWB chapter listed at www.mcaa.org/ncpwb/NCPWB_Contacts.pdf.

Or, you may contact NCPWB Executive Director Dariush (Nick) Nikpourfard at 800-556-3653 or nnikpourfard@mcaa.org for additional information.

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