



Welding Inspection FAQ's

WELDING - QUALIFICATION OF PROCEDURES & WELDERS

1. What is the American Welding Society (AWS) Structural Welding Code – Steel, D1.1-2010?

AWS D1.1 is the code for fabricating and erecting welded steel structures. The code was specifically developed for welded steel structures that utilize carbon or low alloy steels that are 1/8 in or thicker.

2. What is a prequalified Welding Procedure Specification (WPS)?

A welding procedure specification that is in compliance with the stipulated conditions of the Code of Reference or project specification and therefore acceptable for use under that code or specification without a requirement for qualification testing. A WPS is basically the 'recipe' that the welder follows to ensure that he will produce a sound weld.

3. Does the Welding Procedure Specification (WPS) need to be approved and dated?

In order to be valid, a welding procedure specification (WPS) must be approved and dated by the organization that authorized the WPS.

4. Do I need a Welding Procedure Specification (WPS) for each process and weld type?

Yes, you need a separate WPS for each process (SMAW, FCAW) and for each weld type – CJP, PJP, fillet.

5. Does a Welding Procedure Specification (WPS) need to be in written form?

Yes

6. What does a Welding Procedure Specification (WPS) actually represent?

The WPS documents the base metal(s), weld filler metals(s), weld processes, and the welding technique used to make a sound weld.

7. What is a Welder Performance Qualification (WPQ) or Welder Certification?

A written verification that a welder has satisfactorily produced welds meeting the prescribed standards of welder performance set forth in the Code of Reference.

8. What is a Procedure Qualification Record (PQR)?

Commonly referred to as a PQR. A record of the actual welding variables used to produce a test weldment that documents the results of tests conducted on the weldment to qualify a welding procedure specification.

9. Do I need a Procedure Qualification Record (PQR) if my required weld is not prequalified?

Yes



10. If a weld procedure is prequalified, do I need a Procedure Qualification Record (PQR) for the procedure?

No. However, a written WPS is still required.

11. What are the three general approaches to welding procedure qualification?

- a. Prequalified procedures*
- b. Actual procedure qualification testing*
- c. Mock-up tests for special applications (not addressed here)*

12. Where can I find prequalified welding procedures?

There are numerous welding procedures which are prequalified in AWS D1.1.

13. If my filler metal is not identical from my WPS to my WPQ, is that an issue?

No, filler metal is not an essential variable change for welder personnel performance.

14. If my welding electrode for (SMAW) is not identical from my WPS to my WPQ, is that an issue?

It may be. You would be required to retest the welder if the electrode F# (group designation) is changed to a higher F#. In other words, going from an E6010 (group designation F3) up to an E7018 (group designation F4). See Table 4.12 of AWS D1.1.

15. My welder qualified with an E7018 electrode (SMAW). Does he need to requalify for an E8018 electrode?

No. E7018 and E8018 electrodes are within the same group designation, F4, in Table 4.12 of AWS D1.1.

16. Do I need a procedure qualification record (PQR) for a non-prequalified procedure?

Yes

17. Do I need a welder performance qualification (WPQ) or welder certification for each welder?

Yes

18. What does period of effectiveness mean with respect to my welder's credentials?

Commonly referred to as continuity; AWS D1.1 Section 4.2.3 Period of Effectiveness states that the welder's qualification shall be considered as remaining in effect indefinitely unless the welder is not engaged in a given process of welding for longer than six (6) months (AWS D1.1; 4.2.3.1). Documentation of welder continuity should be maintained or recertification may be required.

19. Do I need to prove my welder's continuity?

Yes, documentation certifying this should be maintained and submitted every six (6) months.

20. What continuity paperwork is required?

A letter or other document from the welding contractor certifying that the welder has been welding with the qualified process during the last six (6) months.



21. Can I use a weld filler material greater than 100 ksi?

No, that is outside the scope of the AWS D1.1 Code.

22. Who is responsible to maintain the welding documentation?

The welding contractor is responsible for the development and documentation of all welding procedures and for the qualification of their welding personnel.

23. If our welder is qualified for flat CJP groove welds (1G) and horizontal CJP groove welds (2G), is he qualified to run an upward progression weld?

No, a vertical weld progression is a welding personnel performance essential variable change (AWS D1.1 Table 4.12). In other words, if the welder did not qualify in a vertical welding progression, then he is not qualified to run vertical.

24. Can my welder run in the vertical downward progression?

Not without a supporting PQR, WPS, and WPQR (welder certification) for this progression.

WELD INSPECTION - NON-DESTRUCTIVE WELD EXAMINATION

1. What is nondestructive examination (NDE)?

The act of determining the suitability of a material or a component for its intended purpose using techniques not affecting its serviceability.

2. What is nondestructive testing (NDT)?

A nonstandard term when used for nondestructive testing.

3. Why is NDE of the original base plate weld a good idea?

The base plate connects the pole via the anchor bolts to the foundation; this joint is a shop fabricated welded connection and is non-redundant. The structural adequacy and integrity of this connection is crucial to structure performance. A failure of this connection will result in a catastrophic collapse. Tower owner business models are based on maximizing the load carrying capacity of their structures, thereby adding more load to this critical connection.

4. Are cracks in the base connection of a pole detrimental?

Left in place without repair, cracks may propagate over time and loading and can cause failure of this connection. AWS Structural Welding Code D1.1 does not allow a crack to be left in the weldment after inspection per Table 6.1, Part 1, regardless of size or location

5. Where do cracks normally occur in the base weld connection of a pole?

Cracks are typically observed in the pole shaft wall in the toe above the base weld at the bend points in polygonal tubular structures.



6. What is magnetic particle testing (MT)?

An NDE technique. Magnetic particle testing is conducted by creating a magnetic field in a part and applying iron particles onto the surface of the part. It is utilized to assess surface and near-surface cracks in welded joints. It is performed with an electric or battery-powered yoke and iron particles.

7. What is ultrasonic testing (UT)?

An NDE technique. Ultrasonic testing uses high frequency sound waves, well above the range of human hearing, to measure geometric and physical properties in materials. The test utilizes ultrasonic waves that are interrupted by any material inconsistency (crack) in the joint and can 'see' through the material. Ultrasonic testing determines the presence of any defect in a CJP connection and is performed with a transducer and an electric base unit.

8. What is a toe crack?

A crack observed at the weld toe. At the base plate weld in pole structures typically observed at the upper weld toe in the thin pole shaft material.

9. Can UT be performed over galvanizing?

This depends on the thickness of the galvanized coating and the experience of the inspector.

10. Who should perform NDE inspections?

MT and/or UT should be conducted by an inspector with American Society for Non-Destructive Testing (ASNT) Level II Certifications.

11. Can previous structural modifications impede performing NDE?

Yes, they can depending on the location and geometry of members. Existing welds that are covered are not typically able to be inspected with conventional NDE techniques.

12. How often should NDE be performed on the base weld of a pole structure?

Every 5 years unless an issue is discovered during inspection. A more frequent time interval is then recommended.

WELD INSPECTION - CERTIFIED WELD INSPECTION

1. What does CWI mean?

A certified weld inspector per the American Welding Society.

2. What does a CWI entail?

A thorough inspection of the welding process including adherence to governing code, verification of base material and welding electrodes, verification of documentation including qualification records and welding procedure specifications, welding performance qualification records, welder continuity, electrode storage, surface preparation, preheat confirmation, interpass temperature verification, and adherence to project drawings regarding weld size, location, and



length. Goal is to identify any abnormalities in the weld joints to AWS D1.1 Table 6.1 criteria; cracks, weld/base-metal fusion, crater cross section, weld profile, undersized welds, undercut, porosity.

3. What is undercut?

A groove melted into the base metal adjacent to the weld toe or weld root and left unfilled by weld metal.

4. What is porosity?

Cavity-type discontinuities formed by gas entrapment during solidification of the weld metal.

5. What is spatter?

The metal particles expelled during fusion welding that do not form part of the weld.

6. What is incomplete fusion?

A weld discontinuity in which fusion did not occur between the weld metal and the fusion faces or the adjoining weld beads.

7. What is an inclusion?

Entrapped foreign solid material, such as slag or flux.

8. What does complete joint penetration (CJP) mean?

A groove weld condition in which weld metal extends through the joint thickness.

9. What does partial joint penetration (PJP) mean?

A groove weld condition in which incomplete joint penetration exists.

10. What does SMAW mean?

Shielded metal arc welding – an arc welding process with an arc between a covered electrode and the weld pool. The process is used with shielding from the decomposition of the electrode covering, without the application of pressure, and with filler metal from the electrode.

11. What does FCAW mean?

Flux cored arc welding – an arc welding process with an arc between a continuous filler metal electrode and the weld pool. The process is used with shielding gas from a flux contained within the tubular electrode, with or without additional shielding from an externally supplied gas, and without the application of pressure.

12. What is preheat temperature?

The temperature of the base metal in the volume surrounding the point of welding immediately before welding is started. Regardless of ambient temperature, locally preheat the area to be welded prior to any welding. All components being welded must be at or above the minimum preheat required. In winter construction, it is important that the preheat temperatures are maintained and appropriate methods are in place (tenting, etc.) to maintain the temperatures. If the



welding operation is interrupted or repairs are required, the specified preheat shall be re-established prior to resuming welding operations.

13. Is welding electrode storage important?

Yes. Welding electrodes must be properly stored prior to arriving at site and while on site. SMAW electrodes with low hydrogen coatings, such as E7018 or E8018, must be kept very dry since hydrogen induced cracking can easily occur.

14. Can I weld over galvanizing?

No. Remove all of the galvanizing coating within 2 inch on both sides of the members being welded. This must be done on all members being welded including the base plate if required. The areas of the weld must be 100% free of galvanizing zinc. The surfaces to be welded shall also be free from scale, slag, rust, moisture, grease or any other foreign material that would prevent proper welding. A pre-welding visual inspection to verify the removal of galvanizing or other material from the surface is required. Welding over galvanizing is not permitted in any circumstances.

15. What is an arc strike?

A discontinuity resulting from an arc, consisting of any localized remelted metal, heat-affected metal, or change in the surface profile of any metal object. Care should be taken when arc striking. Arc strikes shall be ground smooth and inspected visually and via a non-destructive weld examination.

16. Can I run my root pass with an E6010 electrode?

No. A root pass performed with an E6010 electrode to burn-off the galvanizing coating is not permitted.

17. Can I run vertical downhill?

Not without a supporting PQR, WPS, and WPQR (welder certification) for this progression.