

## Fabricate pipe to industry standards

The Pipe Fabrication Institute (PFI) has issued, reaffirmed and revised standards for pipe fabrication:

- **ES-2, *Method of Dimensioning Piping Assemblies***, shows how to dimension a pipe drawing for a fabricator. Using fixed reference planes or consecutive segments, it requires dimensions for radius bends, elbows, gasket allowances, pipe o.d. and wall thickness, connections, and for designation of flange location and field-welded joints, tolerances, and material.

- **ES-3, *Fabricating Tolerances***, recommends tolerances for bending and welding of pipe segments, flanges, elbows, and attachments for pre-fabricated assemblies.

- **ES-5, *Cleaning of Fabricated Pipe***, describes applications and acceptance criteria for wire brushing, grinding, blasting, pickling, and degreasing.

- **ES-11, *Permanent Marking on Piping Materials***, specifies methods to mark carbon and chrome-moly steel, high-alloy and nickel-alloy steels, and non-ferrous materials.

- **ES-22, *Recommended Practice for Color Coding of Piping Materials***, updates pipe-identification coding for carbon steel 70 ksi and higher for identification during storage and fabrication. The spec covers carbon, carbon-moly, chrome-moly, and stainless steels, and aluminum alloys and includes a color-code table. Revisions: mark the full length of pipe and do not color code carbon steels under 70,000 lb/in.<sup>2</sup> tensile strength.

- **ES-24, *Pipe Bending Methods, Tolerances, Process and Material Requirements***, details methods for hot and cold bending; linear and angular tolerances; and material allowances and requirements.

- **ES-26, *Welded Load Bearing Attachments to Pressure Retaining Piping Materials***, covers location, type of welds, tolerances, preheat and postheat weld treatment, and nondestructive examination of integral load-bearing supports in piping systems.

- **ES-35, *Nonsymmetrical Bevels and Joint Configurations for Butt Welds***, explains end preparation for pipe joints welded by GMAW, FCAW, SMAW, SAW, and GTAW.

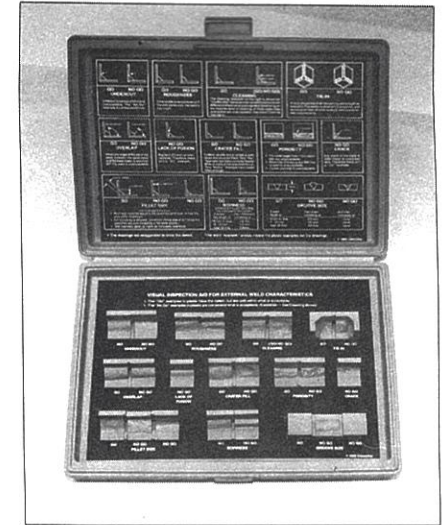
Order from Pipe Fabrication Institute, P.O. Box 173, Springdale, PA 15144; (412) 274-4722; \$1 each; ES-24 and ES-26, \$2. each. Complete set of PFI standards including binder and postage, \$50. □

## Glossary defines inspection terms

Newly issued ASTM E270-90, *Standard Terminology Relating to Liquid Penetrant Examination*, and E500-86b, *Standard Terminology Relating to Ultrasonic Examination*, contain commonly used terms for these inspection techniques. Order from ASTM, 1916 Race Street, Philadelphia, PA 19103; (215) 299-5585; \$6.40 each for ASTM members, \$8. list. □

## Train and calibrate with weld samples

A weld-replica kit distributed by Hane Industrial Training, Inc., Terre Haute, Ind., helps welders to distinguish between acceptable and nonacceptable welds. Cross sections of 12 sample welds show undercut, tie-in, porosity, lack of fusion, and over- and undersize fillets. The kit contains schematic illustrations, examples, and numerical



The weld-replica kit shown here gives welders practical examples of porosity, weld size, undercut, and lack of fusion.

specifications and comes with a 16-page workbook and carrying case. For more information, circle 461. □

## ASME Section IX Subcommittee issues 1989 addenda

Walter J. Sperko, ASME Section IX subcommittee member, summarizes 1989 Addenda to Section IX, *Welding and Brazing Qualifications*, of the ASME Boiler and Pressure Vessel Code, mandatory July 1:

- **Welding parameters.** An editorial revision to paragraph Q clarifies requirements for qualification of supplemental essential variables. These parameters must be qualified only when the Construction Code (Section VIII, Section III, B31.3, etc.) requires qualifying a welding procedure specification (wps) for impact testing.

- **Non-Boiler-Code Metals.** Since the issue of Section IX in 1941, P-numbers were assigned only to alloys used in construction codes (Section 1, Section IV, XIII, etc.). Any other alloy qualified as an unassigned alloy according to QW-424. Six years ago, the ANSI B31 Code for Pressure Piping became an ASME code. Many alloys listed as acceptable for construction in B31 were not assigned P-numbers by ASME Section IX. A new Appendix C lists all metals in the B31 codes, such as API pipe, B88 copper tubing, and AISI grades of metal, assigning both welding and brazing S-numbers.

A wps can be written for a test coupon welded with metals

assigned P-numbers in QW-422 for metals with the same P-numbers and corresponding S-numbers from Appendix C. Test coupons welded with an S-number alloy may not support a wps to weld metals with P-numbers. Brazing procedures follow the same rule. For welder qualification, testing with either an S- or P-number test coupon qualifies the welder on alloys with both the corresponding S- or P-numbers. The same rule applies to brazer qualification. Appendix C, however, contains a printing error: the heads of each table should read as follows:

A	Grade	Welding	Brazing	Min.			
Spec.	Class	S	S	Tensile,	UNS	Nom.	Product
No.	or Type	Group	No.	ksi	No.	Comp.	Form
		No.	No.				

This corrects P-number to S-number in the third column, and separates welding S-numbers from brazing S-numbers. The corrected table will appear in the next addendum.

- **Buttering welds.** QW-283 covers buttering. The paragraph was originally written to distinguish between buttering and corrosion-resistant overlay, requiring that tensile and bend testing be performed. Corrosion-resistant-overlay-

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qualification rules require only bend testing, never demonstrating the strength of the joint. The revised QW-283 still makes this distinction, referring to the load-bearing welds as buttered and non-load-bearing welds as overlay. The addenda clarify requirements for qualification testing for buttering, expanding coverage to all metal alloys, not just steels.

QW-283 applies when buttering and welding with the same process and different essential variables. If a welder at a fabrication shop butters a weld bevel with stainless steel, and a welder in the field completes the joint with the same procedure, no additional qualification is required. If the buttered pass is heat-treated before completing the weld with no additional heat treatment of the weld, the procedure must be qualified per QW-283.

The new requirement effectively requires that a test coupon be welded using the same essential variables as the final joint. The minimum thickness of buttering (after machining and before making the final weld) must be stated in the wps; if less than 3/16 inch thick, it must be qualified using the maximum heat input used in production welding per QW-409.1. This limits the effects of subsequent welding on the base metal beneath the buttering when the final joint is made. The new QW-283 also contains provisions if buttering is done by one organization and final welding by another.

- **Welder qualifications for copper and nickel alloys.** QW-423 revision permits welders qualified on copper-nickel alloys (P-34 metals) to weld on nickel-copper (Monel) alloys (P-42) and vice-versa without requalifying.

- **Fillet-weld test.** Welders usually qualify to make fillet welds by testing with groove welds—any groove-weld test allows the welder to make any size fillet weld on any thickness base metal. Tables QW-452.4 and QW-452.5 allow welders to test for fillet welding only by making a fillet-weld mock-up and testing that coupon. When the test coupon is over 3/16 inch thick, the welder qualifies to make any size fillet weld on any thickness of base metal. If the welder tests on base metal less than 3/16 inch thick, he may weld only on base metal from the thickness of the test coupon to 2× the thickness. Giving fillet-weld tests on metal over 3/16 inch thick avoids the need to track this detail.

- **Brazing.** Editorial changes make the brazing section parallel the welding section. Content remains unchanged.

- **F-numbers.** Several inquiries published recently imply that it is not necessary to record deposit thickness for each F-number electrode when using more than one F-number electrode in a welder-qualification test coupon. Fabricators should take time to measure and record approximate deposit thickness for each F-number electrode in the "actual value" column on welder-qualification records. In the "range qualified" column, record 2× the total deposit thickness for each process (except GMAW-S) rather than total deposit thickness for each F-number electrode or filler metal. This allows fabricators to take advantage of the liberal interpretation that allows the welder to weld up to 2× the deposit thickness of the test coupon based on process only, but to have the necessary data recorded in case the committee reverses the interpretation. If a change occurs, employers can easily change records to revise the maximum deposit thickness for which a welder is qualified.

*These remarks represent Mr. Sperko's opinions and are not official dicta of the Section IX Subcommittee. Mr. Sperko welcomes questions. Call him at Sperko Engineering Services, 4803 Archwood Drive, Greensboro, N.C. 27406; (919) 674-0600. ■*