

## Chapter V Fabrication, Assembly, and Erection

### 127 WELDING

#### 127.1 General

Piping systems shall be constructed in accordance with the requirements of this Chapter and of materials that have been manufactured in accordance with the requirements of Chapter IV. These requirements apply to all fabrication, assembly, and erection operations, whether performed in a shop or at a construction site. The following applies essentially to the welding of ferrous materials. The welding of aluminum, copper, etc., requires different preparations and procedures.

**127.1.1** The welding processes that are to be used under this part of this Code shall meet all the test requirements of Section IX of the ASME Boiler and Pressure Vessel Code.

#### 127.2 Material

**127.2.1 Electrodes and Filler Metal.** Welding electrodes and filler metal, including consumable inserts, shall conform to the requirements of the ASME Boiler and Pressure Vessel Code, Section II, Part C. An electrode or filler metal not conforming to the above may be used provided the WPS and the welders and welding operators who will follow the WPS have been qualified as required by ASME Section IX. Unless otherwise specified by the designer, welding electrodes and filler metals used shall produce weld metal that complies with the following:

(A) The nominal tensile strength of the weld metal shall equal or exceed the minimum specified tensile strength of the base metals being joined.

(B) If base metals of different tensile strengths are to be joined, the nominal tensile strength of the weld metal shall equal or exceed the minimum specified tensile strength of the weaker of the two.

(C) The nominal chemical analysis of the weld metal shall be similar to the nominal chemical analysis of the base metal, including consideration of both major and essential minor alloying elements [e.g., 2¼% Cr, 1% Mo steels should be joined using 2¼% Cr, 1% Mo filler metals; see also para. 124.2(D)].

(D) If base metals of different chemical analysis are being joined, the nominal chemical analysis of the weld metal shall be similar to either base metal or an intermediate composition, except as specified below for austenitic steels joined to ferritic steels.

(E) When austenitic steels are joined to ferritic steels, the weld metal shall have an austenitic structure.

(F) For nonferrous metals, the weld metal shall be that recommended by the manufacturer of the nonferrous metal or by industry associations for that metal.

(G) Filler metals not meeting the requirements of (A) through (F) above may be accepted by agreement between the fabricator/erector and the designer. Examples of conditions where this may apply include (but may not be limited to) where unusual materials or combinations of materials are used; where highly corrosive environments may require a more electrochemically noble weld metal; where dissimilar materials are welded; or where it is desired to achieve a weld with different mechanical properties than the base material.

**127.2.2 Backing Rings.** Backing rings, when used, shall conform to the following requirements:

(A) *Ferrous Rings.* Ferrous metal backing rings that become a permanent part of the weld shall be made from material of weldable quality, compatible with the base material and the sulfur content shall not exceed 0.05%.

(A.1) Backing rings may be of the continuous machined or split band type.

(A.2) If two abutting surfaces are to be welded to a third member used as a backing ring and one or two of the three members are ferritic and the other member or members are austenitic, the satisfactory use of such materials shall be determined by the WPS qualified as required in para. 127.5.

(A.3) Backing strips used at longitudinal welded joints shall be removed.

(B) *Nonferrous and Nonmetallic Rings.* Backing rings of nonferrous or nonmetallic materials may be used for backing provided they are included in a WPS as required in para. 127.5. Nonmetallic or nonfusing rings shall be removed.

**127.2.3 Consumable Inserts.** Consumable inserts may be used provided they are made from material compatible with the chemical and physical properties of the base material. Qualification of the WPS shall be as required by para. 127.5.

#### 127.3 Preparation for Welding

(A) *End Preparation*

(A.1) Oxygen or arc cutting is acceptable only if the cut is reasonably smooth and true, and all slag is