lengths. Make these measurements with a sharp pointed micrometer accurate to at least 0.001 in. The micrometer must be suitable for measuring the small features in the surface after testing. Typical pin micrometers have tapered anvils with a tip radius of less than 0.015 in.

S7.7 Immerse the samples into the solution. Add boiling chips and bring to a boil. Allow the chips to remain boiling throughout the test. The time of testing shall be that which is required to remove 40 to 60% of the original base-metal thickness (usually 2 h or less). If more than 60% of the base-metal thickness remains, the sample may be removed after 24 h.

S7.8 At the end of the test period, remove the samples from the solution, rinse with distilled water, and dry.

S7.9 After exposure to the test solution, repeat the tube-thickness measurement as in S7.6. If the thinning is not uniform across the width of the weld, then two sets of weld-metal measurement are required. One set of measurements is to be taken along the centerline of the weld. The second set of measurements is to be taken in the thinnest area of the weld.

S7.10 Calculate the corrosion ratio, \( R \), for both sections of the weld as follows in eq (1):

\[
R = \frac{W_o - W}{B_o - B}
\]

where:

\( W_o \) = average weld-metal thickness before the test,
\( W \) = average weld-metal thickness after the test,
\( B_o \) = average base-metal thickness before the test, and
\( B \) = average base-metal thickness after the test

S7.10.1 A corrosion ratio of 1.25 or less for the thinnest section of the weld is permissible. Other criteria, such as a ratio of 1.00 or less, may be specified upon agreement between the producer and the purchaser.

S8. Special Applications

S8.1 For special applications, such as hydraulic expansion of tubes into tube sheets, there shall be no dimensional indication of the weld. Tubes ordered to this requirement shall bear the additional marking of NB.

S9. Additional Testing of Welded Tubing per ASME Request

S9.1 Each tube shall be subjected to an ultrasonic inspection employing Practices E 273 or E 213 with the rejection criteria referenced in Specification A 1016/A 1016M.

S9.2 If Practice E 273 is employed, a 100% volumetric inspection of the entire length of each tube shall also be performed using one of the nondestructive electric tests permitted by Specification A 1016/A 1016M.

S9.3 The test methods described in the supplement may not be capable of inspecting the end portions of tubes. This condition is referred to as end effect. This portion, as determined by the manufacturer, shall be removed and discarded.

S9.4 In addition to the marking prescribed in Specification A 1016/A 1016M, “S9” shall be added after the grade designation.
NOTES TO TABLE 1A (CONT'D)

NOTES - WELDING REQUIREMENTS (CONT'D)

W5 Welded, with the tensile strength of the Section IX reduced tension test less than 100 ksi but not less than 95 ksi.

W6 This material may be welded by the resistance technique.

W7 In welded construction for temperatures above 850°F, the weld metal shall have a carbon content of greater than 0.05%.

W8 Welding and oxygen or other thermal cutting processes are not permitted when carbon content exceeds 0.35% by heat analysis.

W9 For Section I applications, for pressure retaining welds in 2¼Cr–1Mo materials, other than circumferential butt welds less than or equal to 3⅛ in. in outside diameter, when the design metal temperatures exceed 850°F, the weld metal shall have a carbon content greater than 0.05%.

W10 For Section III applications, material that conforms to Class 10, 13, 20, 23, 30, 33, 40, 43, 50, or 53 is not permitted for Class 2 and Class 3 construction when a weld efficiency factor of 1.00 is used in accordance with Note W12.

W11 For Section VIII applications, Section IX, QW–250 Variables QW–404.12, QW–406.3, QW–407.2, and QW–409.1 shall also apply to this material. The variables shall be applied in accordance with the rules for welding of Part U.P.

W12 These S values do not include a longitudinal weld efficiency factor. For Section III applications, for materials welded without filler metal, ultrasonic examination, radiographic examination, or eddy current examination, in accordance with NC–2550, shall provide a longitudinal weld efficiency factor of 1.00. Materials welded with filler metal meeting the requirements of NC–2560 shall receive a longitudinal weld efficiency factor of 1.00. Other longitudinal weld efficiency factors shall be in accordance with the following:

(a) for single butt weld, with filler metal, 0.80;
(b) for single or double butt weld, without filler metal, 0.85;
(c) for double butt weld, with filler metal, 0.90;
(d) for single or double butt weld, with radiography, 1.00.

W13 For Section I applications, electric resistance and autogenous welded tubing may be used with these stresses, provided the following additional restrictions and requirements are met:

(a) The tubing shall be used for boiler, waterwall, superheater, and economizer tubes that are enclosed within the setting.
(b) The inside diameter shall be 3⅛ in.
(c) The weld seam of each tube shall be subjected to an angle beam ultrasonic inspection per SA–450.
(d) A complete volumetric inspection of the entire length of each tube shall be performed in accordance with SA–450.
(e) Material test reports shall be supplied.

W14 These S values do not include a weld factor. For Section VIII, Division 1 and Section XII applications using welds made without filler metal, the tabulated tensile stress values shall be multiplied by 0.85. For welds made with filler metal, consult UW–12 for Section VIII, Division 1, or TW–130.4 for Section XII, as applicable.

W15 The Nondestructive Electric Test requirements of SA–53 Type E pipe are required for all sizes. The pipe shall be additionally marked "NDE" and so noted on the material certification.
NOTES TO TABLE 1A (CONT'D)
NOTES – WELDING REQUIREMENTS (CONT'D)

W6 This material may be welded by the resistance technique.

W7 In welded construction for temperatures above 450°C, the weld metal shall have a carbon content of greater than 0.05%.

W8 Welding and oxygen or other thermal cutting processes are not permitted when carbon content exceeds 0.35% by heat analysis.

W9 For Section I applications, for pressure retaining welds in 2¼Cr-1Mo materials, other than circumferential butt welds less than or equal to 89 mm in outside diameter, when the design metal temperatures exceed 450°C, the weld metal shall have a carbon content greater than 0.05%.

W10 For Section III applications, material that conforms to Class 10, 13, 20, 23, 30, 33, 40, 43, 50, or 53 is not permitted for Class 2 and Class 3 construction when a weld efficiency factor of 1.00 is used in accordance with Note W12.

W11 For Section VIII applications, Section IX, QW-250 Variables QW-404.12, QW-406.3, QW-407.2, and QW-409.1 shall also apply to this material. These variables shall be applied in accordance with the rules for welding of Part UF.

W12 These S values do not include a longitudinal weld efficiency factor. For Section III applications, for materials welded without filler metal, ultrasonic examination, radiographic examination, or eddy current examination, in accordance with NC-2550, shall provide a longitudinal weld efficiency factor of 1.00. Materials welded with filler metal meeting the requirements of NC-2560 shall receive a longitudinal weld efficiency factor of 1.00. Other longitudinal weld efficiency factors shall be in accordance with the following:

(a) for single butt weld, with filler metal, 0.80
(b) for single or double butt weld, without filler metal, 0.85
(c) for double butt weld, with filler metal, 0.90
(d) for single or double butt weld, with radiography, 1.00

W13 For Section I applications, electric resistance and autogenous welded tubing may be used with these stresses, provided the following additional restrictions and requirements are met:

(a) The tubing shall be used for boiler, waterwall, superheater, and economizer tubes that are enclosed within the setting.
(b) The maximum outside diameter shall be 89 mm.
(c) The weld seam of each tube shall be subjected to an angle beam ultrasonic inspection per SA-450.
(d) A complete volumetric inspection of the entire length of each tube shall be performed in accordance with SA-450.
(e) Material test reports shall be supplied.

W14 These S values do not include a weld factor. For Section VIII, Division 1, and Section XII applications using welds made without filler metal, the tabulated tensile stress values shall be multiplied by 0.85. For welds made with filler metal, consult UWW-12 for Section VIII, Division 1, or TW-130.4 for Section XII, as applicable.

W15 The Nondestructive Electric Test requirements of SA-53 Type E pipe are required for all sizes. The pipe shall be additionally marked "NDE" and so noted on the material specification.

/SA-1016M