APPENDIX 1
BASIS FOR ESTABLISHING STRESS VALUES IN TABLES 1A AND 1B

1-100

In the determination of allowable stress values for materials, the Committee is guided by successful experience in service, insofar as evidence of satisfactory performance is available. Such evidence is considered equivalent to test data where operating conditions are known with reasonable certainty. In the evaluation of new materials, the Committee is guided to a certain extent by the comparison of test information with available data on successful applications of similar materials. These values are established by the Committee only.

Nomenclature:

F_{avg} = multiplier applied to average stress for rupture in 100,000 hr. At 1500°F and below, F_{avg} = 0.67. Above 1500°F, it is determined from the slope of the log time-to-rupture versus log stress plot at 100,000 hr such that log $F_{avg} = 1/n$, but it may not exceed 0.67.

R_T = ratio of the average temperature dependent trend curve value of tensile strength to the room temperature tensile strength

R_Y = ratio of the average temperature dependent trend curve value of yield strength to the room temperature yield strength

S_C = average stress to produce a creep rate of 0.01%/1000 hr

S_{Ravg} = average stress to cause rupture at the end of 100,000 hr

S_{Rmin} = minimum stress to cause rupture at the end of 100,000 hr

S_T = specified minimum tensile strength at room temperature, ksi

S_Y = specified minimum yield strength at room temperature, ksi

n = a negative number equal to Δ log time-to-rupture divided by Δ log stress at 100,000 hr

NA = not applicable

The maximum allowable stress shall be the lowest value obtained from the criteria in Table 1-100. The mechanical properties considered, and the factors applied to establish the maximum allowable stresses, are as given below.

(a) At temperatures below the range where creep and stress rupture strength govern the selection of stresses, the maximum allowable stress value is the lowest of the following:

(1) the specified minimum tensile strength at room temperature divided by 3.5;

(2) the tensile strength at temperature divided by 3.5;

(3) two-thirds of the specified minimum yield strength at room temperature;

(4) two-thirds of the yield strength at temperature.

In the application of these criteria, the Committee considers the yield strength at temperature to be $S_Y R_Y$, and the tensile strength at temperature to be $1.1 S_T R_T$.

Two sets of allowable stress values are provided in Tables 1A and 1B for austenitic materials and specific nonferrous alloys. The higher alternative allowable stresses are identified by a footnote to the tables. These stresses exceed two-thirds but do not exceed 90% of the minimum yield strength at temperature. The higher stress values should be used only where slightly higher deformation is not in itself objectionable. These higher stresses are not recommended for the design of flanges or other strain sensitive applications.

(b) At temperatures in the range where creep and stress rupture strength govern the selection of stresses, the maximum allowable stress value for all materials is established by the Committee not to exceed the lowest of the following:

(1) 100% of the average stress to produce a creep rate of 0.01%/1000 hr;

(2) $100F_{avg}$% of the average stress to cause rupture at the end of 100,000 hr;

(3) 80% of the minimum stress to cause rupture at the end of 100,000 hr.

Stress values for high temperatures are based, whenever possible, on representative uniaxial properties of the materials obtained under standard ASTM testing conditions or equivalent. The stress values are based on basic properties of the materials and no consideration is given for corrosive environment, for abnormal temperature and stress conditions, or for other design considerations.

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TABLE 1-100
CRITERIA FOR ESTABLISHING ALLOWABLE STRESS VALUES FOR TABLES 1A AND 1B

Product/Material	Below Room Temperature		Room Temperature and Above					
	Tensile Strength	Yield Strength	Tensile Strength		Yield Strength		Stress Rupture	Creep Rate
Wrought or cast ferrous and nonferrous	$\frac{S_T}{3.5}$	$\frac{2}{3}\ S_Y$	$\frac{S_T}{3.5}$	$\frac{1.1}{3.5}\ S_T R_T$	$\frac{2}{3}\ S_Y$	$\frac{2}{3}\ S_Y R_Y$ or $0.9\,S_Y R_Y$ [Note (1)]	$F_{\text{avg}}\,S_{R\,\text{avg}}$	$0.8\,S_{R\,\text{min}}$	$1.0\,S_c$
Welded pipe or tube, ferrous and nonferrous	$\frac{0.85}{3.5}\ S_T$	$\frac{2}{3} \times 0.85\,S_Y$	$\frac{0.85}{3.5}\ S_T$	$\frac{(1.1 \times 0.85)}{3.5}\ S_T R_T$	$\frac{2}{3} \times 0.85\,S_Y$	$\frac{2}{3} \times 0.85\,S_Y R_Y$ or $0.9 \times 0.85\,S_Y R_Y$ [Note (1)]	$(F_{\text{avg}} \times 0.85)\,S_{R\,\text{avg}}$	$(0.8 \times 0.85)\,S_{R\,\text{min}}$	$0.85\,S_c$

NOTE:
(1) Two sets of allowable stress values may be provided in Table 1A for austenitic materials and in Table 1B for specific nonferrous alloys. The lower values are not specifically identified by a footnote. These lower values do not exceed two-thirds of the minimum yield strength at temperature. The higher alternative allowable stresses are identified by a footnote. These higher stresses may exceed two-thirds but do not exceed 90% of the minimum yield strength at temperature. The higher values should be used only where slightly higher deformation is not in itself objectionable. These higher stresses are not recommended for the design of flanges or for other strain sensitive applications.

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