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SUBJECT: Requests approval to use alternative rules of ASME,Section III,Code Case N-20-4 in lieu of currently required heat exchanger tubing matls,IAW 10CFR50.55a(a)(3).

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September 23, 1999

Document Control Desk
U. S. Nuclear Regulatory Commission
Washington, DC 20555

Subject: Oconee Nuclear Station Units 1, 2, and 3
Docket Nos. 50-269, 50-270, and 50-287
Use of ASME Section III Code Case N-20-4

References:
1. ASME Boiler and Pressure Vessel Code Case N-20-4, approved February 26, 1999 (attached)
2. ASME Boiler and Pressure Vessel Code Case N-20-3, approved November 30, 1988 (attached)

Gentlemen:

The purpose of this letter is to request approval in accordance with 10 CFR 50.55a(a)(3), to use the alternative rules of American Society of Mechanical Engineers Boiler and Pressure Vessel Code (ASME), Section III, Code Case N-20-4 (Reference 1), in lieu of the currently required heat exchanger tubing materials. The use of nickel-chromium-iron Alloy 690 heat exchanger tubing is necessary in the fabrication and installation of the Oconee Units 1, 2 and 3 replacement steam generators. This tubing material has been approved by ASME through Code Case N-20-4 and is designated as UNS N06690 (Alloy 690). Use of this tubing material in the fabrication of replacement steam generators has been previously approved by the NRC through ASME Code Case N-20-3 (Reference 2). Code Case N-20-3 is currently listed as an acceptable code case in Regulatory Guide 1.85, Rev 31 (May 1999), "Materials Code Case Acceptability ASME Section III, Division 1."

The code case revision corrected values for the yield strength and ultimate strength of Alloy 690. At the time of issue of N-20-3, industry experience was primarily limited to Inconel 600. Because of the similarity of the materials it was assumed that properties would be similar. With growth of industry experience with Alloy 690 it was determined that a consistent difference exists in material properties between Inconel 600 and Alloy 690. Alloy 690 has a yield strength approximately 10% lower than Inconel 600 and an ultimate strength less than 10% lower. N-20-4 was subsequently issued to accurately reflect these Alloy 690 material properties. Use of Code Case N-20-4 is considered conservative since relevant design analyses will be performed using accurate rather than the incorrect high values for material strength.

The procurement and fabrication schedule for the Oconee replacement steam generators requires that decisions concerning heat exchanger tubes need to be made in the near future. Duke Energy Corporation requests approval for the use of Code Case N-20-4 by December 1, 1999.

If there are any questions, please contact Robert Sharpe at (704) 382-0956.

Very truly yours,

W. R. McCollum, Jr.
Site Vice President

Attachments

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ATTACHMENT 1

Approval Date: February 26, 1999

See Numeric Index for expiration and any reaffirmation dates.

Case N-20-4
SB-163, Cold Worked UNS N08800; and SB-163 UNS N06600, UNS N06690, and UNS N08800 to Supplementary Requirements S2 of SB-163
Section III, Division 1, Class 1

Inquiry: May SB-163 Cold Worked UNS N08800; and SB-163 UNS N06600, UNS N06690, and UNS N08800 meeting the requirements of Supplementary Requirement S2 of SB-163, be used in the construction of Class 1 components in accordance with Section III, Division 1?

Reply: It is the opinion of the Committee that SB-163 Cold Worked UNS N08800; and SB-163 UNS N06600, UNS N06690, and UNS N08800 meeting the requirements of Supplementary Requirement S2 of SB-163, may be used in the construction of Class 1 components in accordance with Section III, Division 1, providing the following additional requirements are met.

(*a*) The design stress intensity values shall be those listed in Table 1.

(*b*) The yield strength values shall be that listed in Table 2.

(*c*) The tensile strength values shall be that listed in Table 3.

(*d*) For external pressure, the required thickness of the tubing shall be determined in accordance with para. NB-3133, using Fig. 1 for alloys UNS N06600 and UNS N06690 and Fig. 2 for alloy UNS N08800.

(*e*) Welding procedure and performance qualifications shall be in accordance with Section IX. Welding of cold-worked alloy UNS N08800 shall be limited to tube-to-tube sheet welds.

(*f*) This Case number shall be shown in the documentation and marking of the material and in the Certificate Holders Data Report.

TABLE 1
DESIGN STRESS INTENSITY VALUES, S_m, ksi [Note (1)]

For Material Temperature Not Exceeding °F	UNS N06600	UNS N06690	UNS N08800	CW UNS N08800
100	26.7	26.7	25.0	27.7
200	26.7	26.7	25.0	27.7
300	26.7	26.7	25.0	27.7
400	26.7	26.7	25.0	27.5
500	26.7	26.7	25.0	26.9
600	26.7	26.7	24.9	26.7
650	26.7	26.7	24.8	26.6
700	26.7	26.6	24.8	...
750	26.7	26.5	24.7	...
800	26.7	26.4	24.6	...

NOTE:
(1) Due to the relatively low yield strength of these materials, these higher stress values were established at temperatures where the short time tensile properties govern to permit the use of these alloys where slightly greater deformation is acceptable. The stress values in this range exceed 66⅔% but do not exceed 90% of the yield strength at temperature. Use of these stresses may result in dimensional changes due to permanent strain. These stress values are not recommended for the flanges of gasketed joints or other applications where slight amounts of distortion can cause leakage or malfunction. Table Y-2 of Section II, Part D, lists multiplying factors that, when applied to the yield strength values shown in Table 2, will give allowable stress values that will result in lower levels of permanent strain.

TABLE 2
YIELD STRENGTH VALUES [Note (1)]

For Material Temperature Not Exceeding °F	UNS N06600	UNS N06690	UNS N08800	CW UNS N08800
100	40.0	40.0	40.0	47.0
200	36.6	36.2	37.0	43.4
300	35.6	34.1	35.5	41.7
400	35.1	32.7	34.4	40.4
500	34.7	31.9	33.5	39.5
600	34.2	31.5	32.6	38.7
650	33.9	31.5	32.2	38.7
700	33.6	31.5	31.8	...
750	33.2	31.5	31.4	...
800	32.8	31.5	31.0	...

NOTE:
(1) The tabulated values of yield strength are those that the Committee believes are suitable for use in design calculations. At temperatures above room temperature, the yield strength values correspond to the yield strength trend curve adjusted to the minimum specified room temperature yield strength. The yield strength values do not correspond exactly to minimum as this term is applied to a statistical treatment of a homogeneous set of data.

Neither the ASME Material Specifications nor the rules of Section III require elevated temperature testing for yield strengths of production material for use in Code components. It is not intended that results of such tests, if performed, be compared with these tabulated yield strength values for ASME Code acceptance/rejection purposes for materials. If some elevated temperature test results on production material appear lower than the tabulated values by a large amount (more than the typical variability of material and suggesting the possibility of some error), further investigation by retest or other means should be considered.

TABLE 3
TENSILE STRENGTH VALUES [Note (1)]

For Material Temperature Not Exceeding °F	UNS N06600	UNS N06690	UNS N08800	CW UNS N08800
100	80.0	85.0	75.0	83.0
200	80.0	85.0	75.0	83.0
300	80.0	84.0	75.0	83.0
400	80.0	82.0	75.0	82.5
500	80.0	80.8	74.9	80.7
600	80.0	80.2	74.7	80.0
650	80.0	80.0	74.5	79.9
700	80.0	79.8	74.3	...
750	80.0	79.6	74.1	...
800	80.0	79.3	73.8	...

NOTE:
(1) The tabulated values of yield strength are those that the Committee believes are suitable for use in design calculations. At temperatures above room temperature, the yield strength values correspond to the yield strength trend curve adjusted to the minimum specified room temperature yield strength. The yield strength values do not correspond exactly to minimum as this term is applied to a statistical treatment of a homogeneous set of data.

Neither the ASME Material Specifications nor the rules of Section III require elevated temperature testing for yield strengths of production material for use in Code components. It is not intended that results of such tests, if performed, be compared with these tabulated yield strength values for ASME Code acceptance/rejection purposes for materials. If some elevated temperature test results on production material appear lower than the tabulated values by a large amount (more than the typical variability of material and suggesting the possibility of some error), further investigation by retest or other means should be considered.

TABLE 4
TABULAR VALUES FOR FIG. 3

Temperature °F	Tensile Strength Values A	Tensile Strength Values B
100	0.68-03	10,000
	0.48-03	14,100
	0.40-02	18,400
	0.10-01	21,000
	0.20-01	22,400
	0.30-01	23,000
300	0.75-03	10,000
	0.11-02	14,300
	0.20-02	14,800
	0.40-02	16,300
	0.10-01	18,200
	0.20-01	19,500
	0.30-01	20,100
500	0.75-03	10,000
	0.10-02	13,800
	0.20-02	14,400
	0.40-02	15,500
	0.10-01	17,100
	0.20-01	17,400
	0.25-01	17,700
700	0.78-03	10,000
	0.10-02	12,300
	0.20-02	13,200
	0.40-02	14,300
	0.10-01	15,900
	0.20-01	17,200
	0.30-01	18,000

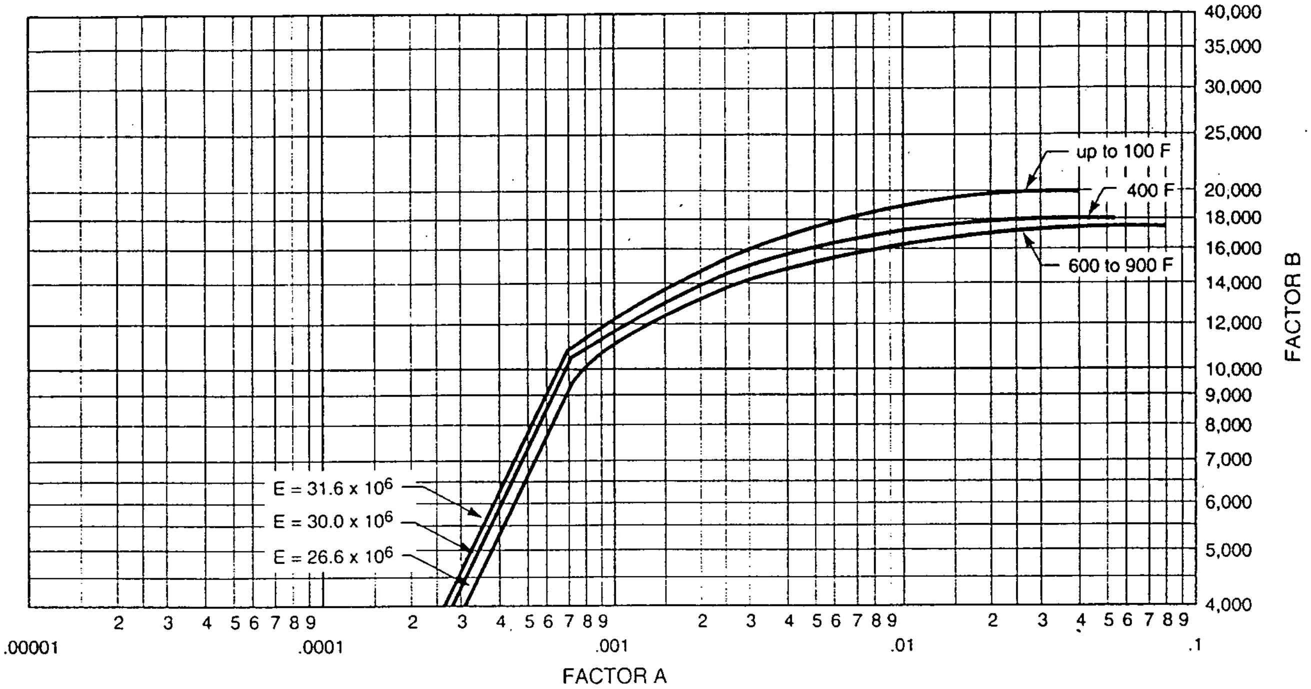

FIG. 1 CHART FOR DETERMINING SHELL THICKNESS OF CYLINDRICAL AND SPHERICAL VESSELS UNDER EXTERNAL PRESSURE SB-163 UNS N06600 and UNS N06690

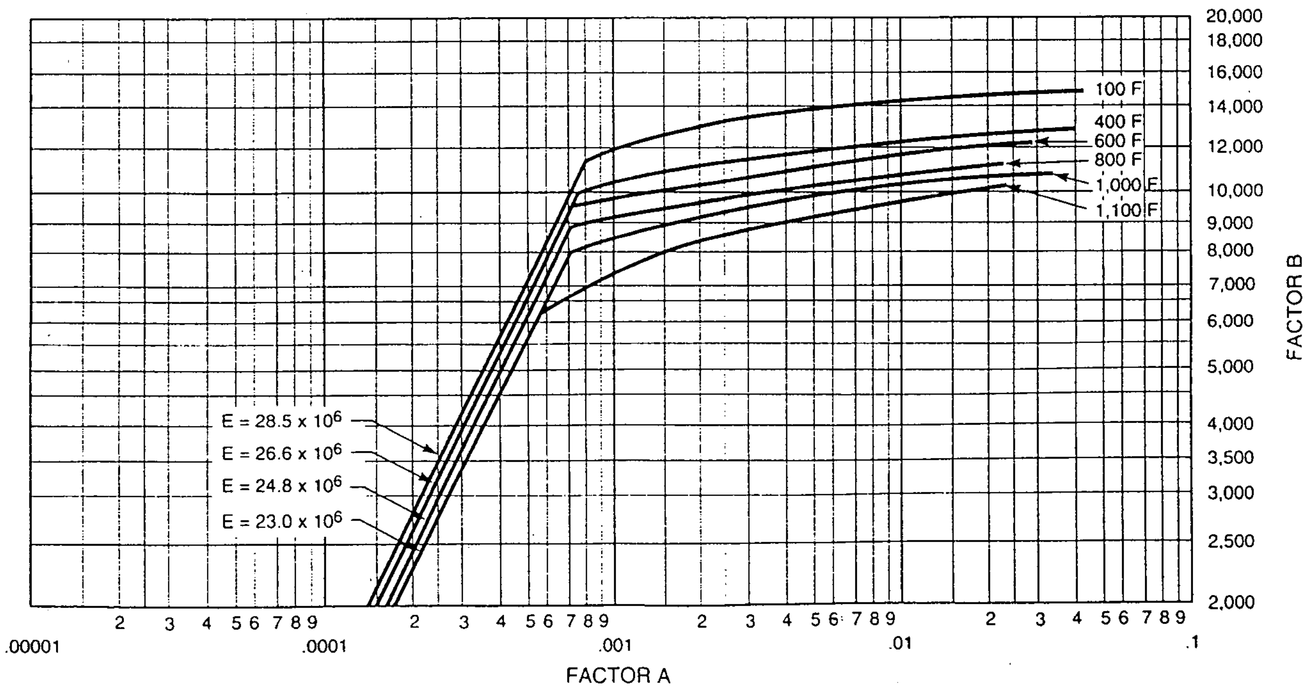

FIG. 2 CHART FOR DETERMINING SHELL THICKNESS OF CYLINDRICAL AND SPHERICAL VESSELS UNDER EXTERNAL PRESSURE WHEN CONSTRUCTED OF SB-163 UNS N08800 (ANNEALED)

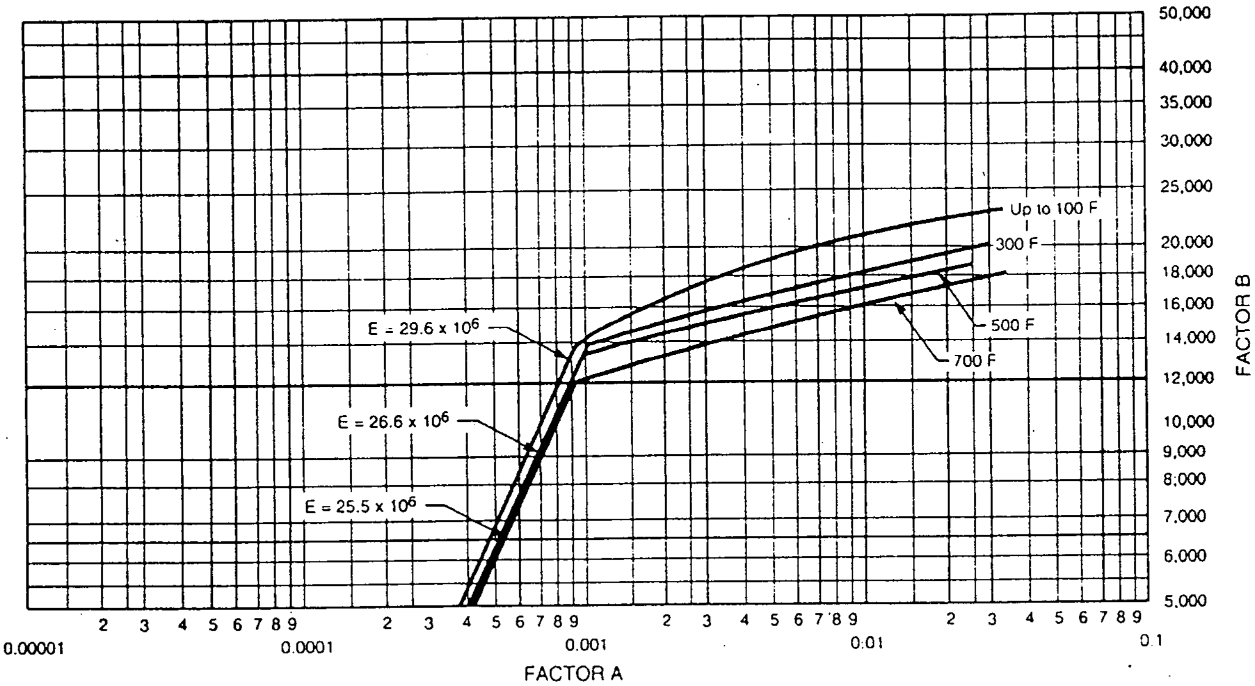

FIG. 3 CHART FOR DETERMINING SHELL THICKNESS OF CYLINDRICAL AND SPHERICAL VESSELS UNDER EXTERNAL PRESSURE WHEN CONSTRUCTED OF SB-163 COLD WORKED UNS N08800

ATTACHMENT -2

Approval Date: November 30, 1988

See Numeric Index for expiration and any reaffirmation dates.

Case N-20-3
SB-163 Nickel-Chromium-Iron Tubing (Alloys 600 and 690) and Nickel-Iron-Chromium Alloy 800 at a Specified Minimum Yield Strength of 40.0 ksi and Cold Worked Alloy 800 at a Yield Strength of 47.0 ksi
Section III, Division 1, Class 1

Inquiry: May nickel-chromium-iron and nickel-iron-chromium alloy seamless condenser and heat exchanger tubing meeting the size range and specified properties as listed in Table 1 and otherwise meeting the requirements of SB-163 for Alloy 600 and 800 and the requirements of SB-163 for Alloy 690 except for the chemistry (Alloy 690 chemistry is listed in Table 3), be used in the construction of Class 1 components in accordance with Section III, Division 1?

Reply: It is the opinion of the Committee that nickel-chromium-iron Alloys 600 and 690 and nickel-iron-chromium Alloy 800 seamless condenser and heat exchanger tubing meeting the requirements given on the Inquiry may be used in the construction of Class 1 components in accordance with Section III, Division 1, provided the tensile, yield strength, and design stress intensity values as listed in Tables 1, 2, and 4, respectively are used. In addition to the marking requirements of SB-163, the tubing shall be identified with this Case number. For external pressure the required thickness of the tubing shall be determined in accordance with Par. NB-3133 using Fig. 1 for Alloys 600 and 690 and using Fig. 2 for Alloy 800. Welding procedure and performance qualifications shall be in accordance with Section IX. Separate welding procedure and performance qualifications are required for Alloy 690. Welding of CW Alloy 800 material shall be limited to tube-to-tube sheet welds.

TABLE 1

Specified Mechanical Properties and Size Ranges

	Min. Spec Tensile Strength, ksi	Spec. Yield Strength ksi (0.2% Offset)		Min. Elongation 2 in., %	Tube Size Range, In.	
		Min.	Max.		O.D.	Wall Thickness
Alloys 600 and 690	80	40	65	30	1/4 to 7/8	Up to 0.100
Alloy 800	80	40	65	30	1/4 to 7/8	Up to 0.100
CW Alloy 800	83	47	70	30	1/4 to 7/8	Up to 0.100

TABLE 2

	Design Stress Intensity Values, S_m, ksi, for Material Temperature Not Exceeding, °F									
	100	200	300	400	500	600	650	700	750	800
Alloys 600 and 690	26.6	26.6	26.6	26.6	26.6	26.6	26.6	26.6	26.6	26.6
Alloy 800	26.6	26.6	26.6	26.0	25.7	25.7	25.7	25.7	25.7	25.7
CW Alloy 800	27.8	27.8	27.8	27.5	26.9	26.6	26.6	...	...	...

TABLE 3

Chemistry — Alloy 690

	Percent Min.	Percent Max.
Cr	27	31
Fe	7	11
C	...	0.05
Si	...	0.50
Mn	...	0.50
S	...	0.015
Co	...	0.10
Cu	...	0.50
Ni	58.0	...

TABLE 4

Yield Strength Values — Alloys 600, 690 and 800

Temp., °F	Y. S. Value Alloys 600 & 690	CW Alloy 800	Alloy 800
100	40.0	40.0	47.0
200	38.2	36.8	42.5
300	37.3	34.6	40.6
400	36.3	33.0	39.2
500	35.7	31.8	38.5
600	35.3	31.1	37.7
650	35.2	30.9	37.3
700	35.0	30.6	...
750	34.9	30.3	...
800	34.8	30.0	...

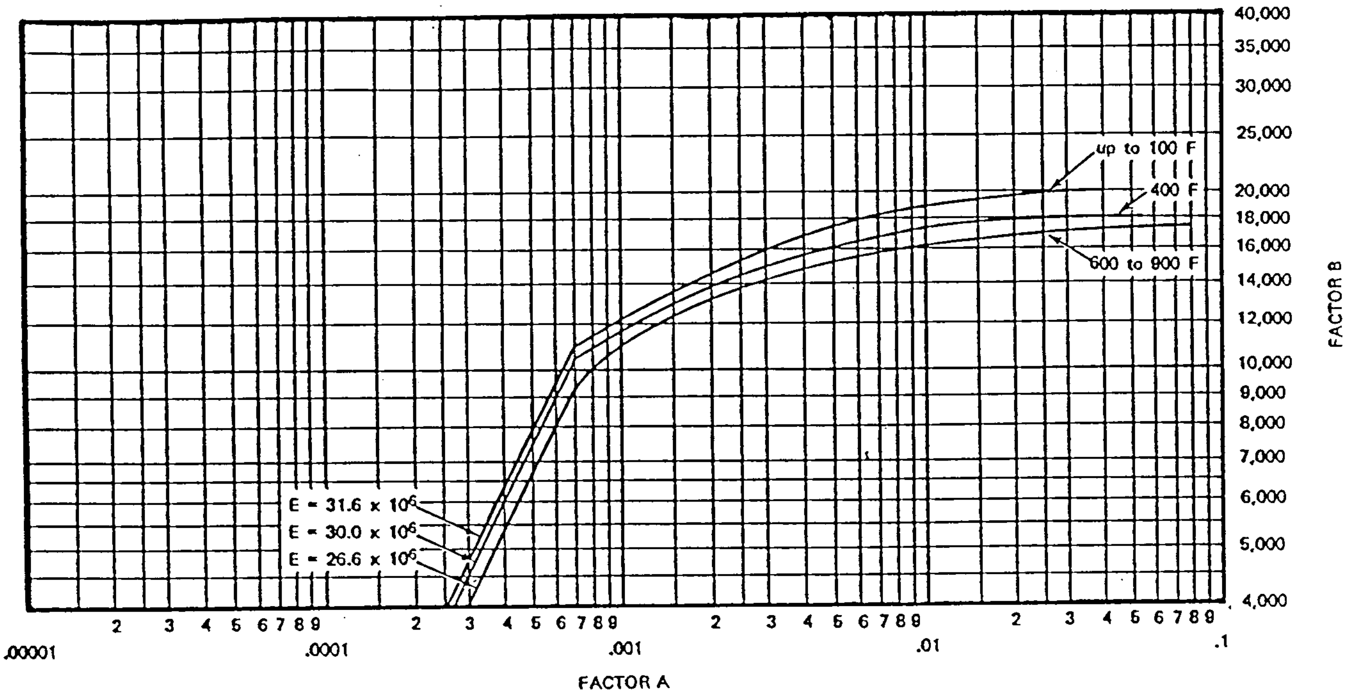

FIG. 1 CHART FOR DETERMINING SHELL THICKNESS OF CYLINDRICAL AND SPHERICAL VESSELS UNDER EXTERNAL PRESSURE
Nickel-Chromium-Iron Alloys 600 and 690 SB-163, S_y min = 40,000 psi

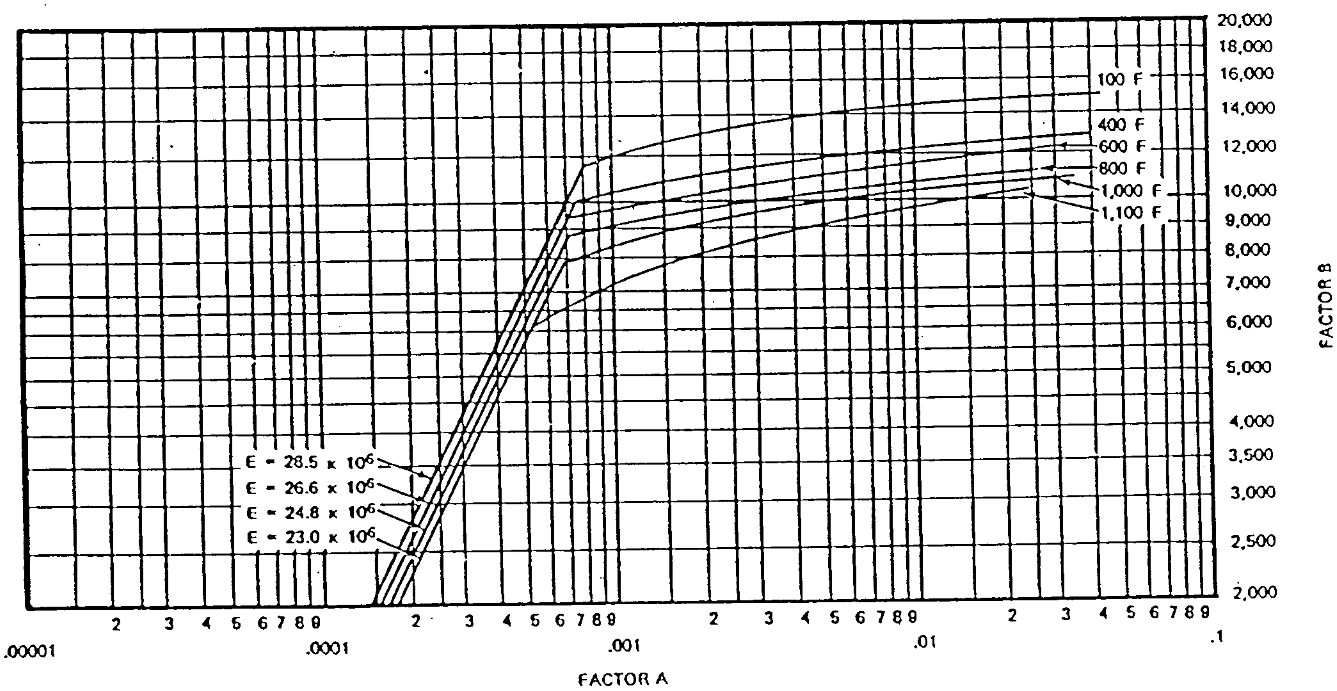

FIG. 2 CHART FOR DETERMINING SHELL THICKNESS OF CYLINDRICAL AND SPHERICAL VESSELS UNDER EXTERNAL PRESSURE WHEN CONSTRUCTED OF NICKEL-IRON-CHROMIUM ALLOY 800 (ANNEALED)

TABLE 5
TUBULAR VALUES FOR FIG. 3

Temp., °F	A	B, psi	Temp., °F	A	B, psi
100	0.68-03	10,000	500	0.75-03	10,000
	0.48-03	14,100		0.10-02	13,800
	0.40-02	18,400		0.20-02	14,400
	0.10-01	21,000		0.40-02	15,500
	0.20-01	22,400		0.10-01	17,100
	0.30-01	23,000		0.20-01	17,400
				0.25-01	17,700
300	0.75-03	10,000	700	0.78-03	10,000
	0.11-02	14,300		0.10-02	12,300
	0.20-02	14,800		0.20-02	13,200
	0.40-02	16,300		0.40-02	14,300
	0.10-01	18,200		0.10-01	15,900
	0.20-01	19,500		0.20-01	17,200
	0.30-01	20,100		0.30-01	18,000

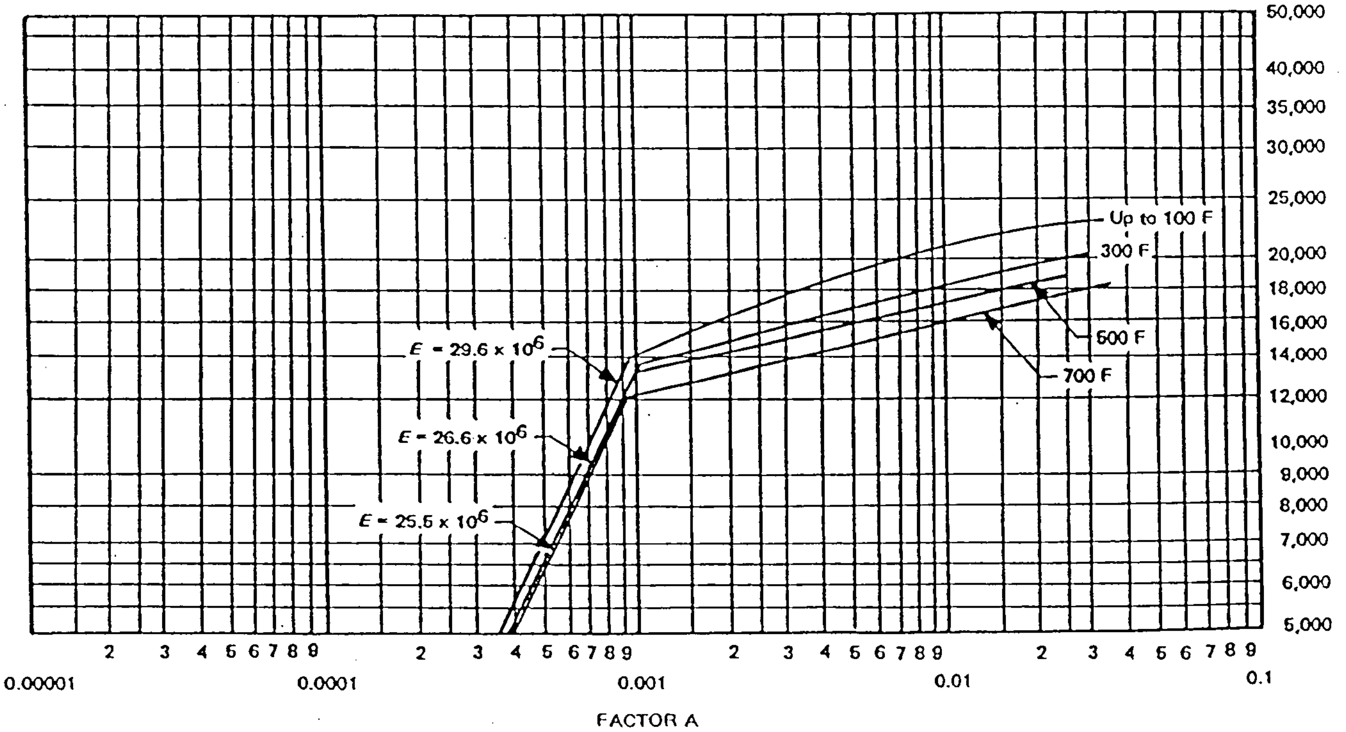

FIG. 3 CHART FOR DETERMINING SHELL THICKNESS OF CYLINDRICAL AND SPHERICAL VESSELS UNDER EXTERNAL PRESSURE WHEN CONSTRUCTED OF NICKEL-IRON-CHROMIUM ALLOY 800 (MODIFIED)