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PART ULT
ALTERNATIVE RULES FOR PRESSURE VESSELS CONSTRUCTED OF MATERIALS HAVING HIGHER ALLOWABLE STRESSES AT LOW TEMPERATURE

GENERAL

ULT-1 SCOPE

The alternative rules in Part ULT are applicable to pressure vessels or vessel parts that are constructed of materials for which increased design stress values have been established for low temperature applications. When applied, these rules shall be used in conjunction with the requirements in Subsection A and Part UW of Subsection B. The requirements of Subsection C do not apply except when referenced in Part ULT.

ULT-2 CONDITIONS OF SERVICE

(a) Measures shall be taken to avoid stresses at any temperature that are in excess of the maximum allowable stress applicable to that temperature. For example, the membrane stress at the maximum allowable working pressure at 100°F (38°C) shall never exceed the maximum allowable stress for 100°F (38°C). See ULT-27.

(b) Vessel use shall be restricted to fluids specifically considered for the design of the vessel. The physical characteristics of the contained fluid shall be such that a maximum operating temperature can be determined for the liquid phase at the maximum allowable working pressure of the vessel. The safety relief valve setting thus controls the maximum operating temperature of the vessel for the specific fluid.

(c) The allowable stress at 100°F (38°C) shall be used for the design of vessel parts that are exposed to the static head of cryogenic fluid but are not actually contacted by the fluid, such as, as in a dead-end cylinder connected to the bottom of a vessel that contains a gas cushion.

(d) Insulation shall be applied external to the pressure vessel.

ULT-5 GENERAL

(a) Materials covered by this Part subject to stress due to pressure shall conform to one of the specifications given in Section II and shall be limited to those listed in Table ULT-23. The allowable stress values of Table ULT-23 are limited to those materials which will be in contact with the cold liquid when subject to liquid head.

(b) Materials not covered by Part ULT may be used for vessel parts, provided such materials shall conform to one of the specifications in Section II and shall be limited to those materials permitted by another Part of Subsection C. The maximum allowable stress for such parts shall be determined at 100°F (38°C). All applicable requirements of that Part of Subsection C shall be met including any required impact tests.

(c) The 5%, 8%, and 9% nickel steels listed in Table ULT-23 shall be tested for notch ductility as required by UHT-5(d) and (e) and UHT-6. These ductility tests shall be conducted at the lowest temperature at which pressure will be applied to the vessel or the minimum allowable temperature to be marked on the vessel, whichever is lower.

(d) For 5083 aluminum the provisions and requirements of UNF-65 for low temperature operation apply.

(e) For 5%, 8%, and 9% nickel steel vessels, all structural attachments and stiffening rings which are welded directly to pressure parts shall be made of materials of specified minimum strength equal to or greater than that of the material to which they are attached.

(f) The weldments of Type 304 stainless steel shall be Charpy impact tested as required by UG-84(h), except that the exemptions fo UHA-51 do not apply. These impact tests shall be conducted at the lowest temperature at which pressure will be applied to the vessel or the minimum allowable temperature to be marked on the vessel, whichever is lower. The applicable

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minimum lateral expansion opposite the notch for all specimen sizes shall be as required in UHT-6(a)(3) and (a)(4). All requirements of UHT-6(a)(3) and (a)(4) shall apply.

(g) For Type 304 stainless steel vessels, all structural attachments and stiffening rings that are welded directly to pressure parts shall be made of the same material as the pressure part to which they are attached.

DESIGN

ULT-16 GENERAL

(a) The rules in the following paragraphs apply specifically to the design of pressure vessels and vessel parts that are constructed of materials listed in Table ULT-23 and shall be used in conjunction with the requirements for Design in Subsection A and Part UW of Subsection B.

(1) The thermal stresses resulting from the differences between the base metal and the weld metal shall be considered in the design.

(2) For vessels made of 5%, 8%, and 9% nickel steels, the minimum thickness after forming of a section subject to pressure shall be $^{3}/_{16}$ in. (4.8 mm) and the maximum thickness of the base metal at welds shall be 2 in. (51 mm).

ULT-17 WELDED JOINTS

(a) All Category A, B, C, and D joints (UW-3) shall be full penetration welds.

(b) The alignment of longitudinal joints in adjacent cylindrical sections or heads shall be displaced at least five times the thickness of the thicker material.

(c) In vessels of 5%, 8%, or 9% nickel steels, all Category D joints shall be in accordance with Fig. UHT-18.1 or UHT-18.2 when the nominal shell thickness at the opening exceeds 1 in. (25 mm).

(1) All joints of Category D attaching a nozzle neck to the vessel wall, and to a reinforcing pad if used, shall be full penetration groove weld conforming to Fig. UHT-18.1 or Fig. UHT-18.2 or any of the sketches in Fig. UW-16 having full penetration welds.

(2) All joints of Category A shall be Type No. (1) of Table UW-12.

(3) All joints of Category B shall be Type No. (1) or (2) of Table UW-12.

(4) All joints of Category C shall be full penetration welds extending through the entire section at the joint.

(5) Joint alignment requirements of UHT-20 shall be met.

(d) Butt welds with one plate edge offset [Fig. UW-13.1 sketch (k)] are prohibited anywhere in the vessel.

ULT-18 NOZZLES AND OTHER CONNECTIONS

(a) Nozzles shall not be located in Category A or B joints. When adjacent to Category A or B joints, the nearest edge of the nozzle-to-shell weld shall be at least five times the nominal thickness of the shell from the nearest edge of the Category A or B joint.

(b) The attachment of pipe and nozzle necks to vessel walls shall be by welded construction only.

ULT-23 MAXIMUM ALLOWABLE STRESS VALUES

Table ULT-23 gives the maximum allowable stress values at the temperatures indicated for materials conforming to the specifications listed therein. Values may be interpolated for intermediate temperatures (see UG-23).

ULT-27 THICKNESS OF SHELLS

The minimum thickness of any vessel part shall be the greater of the following:

(a) the thickness based on the MAWP at the top of the vessel in its normal operating position plus any other loadings per UG-22, including the static head of the most dense cryogenic liquid to be contained. The permissible stress value shall be determined for the applicable material in Table ULT-23 at the operating temperature corresponding to the saturation temperature at MAWP of the warmest cryogenic fluid contained. The maximum allowable compressive stress shall be determined in accordance with UG-23(b) at 100°F (38°C) and the requirements of UG-23(c) shall be met.

(b) the thickness determined by using the permissible stress value at 100°F (38°C) based on the MAWP at the top of the vessel in its normal operating position plus any other loadings per UG-22, except that no static head need be included.

ULT-28 THICKNESS OF SHELLS UNDER EXTERNAL PRESSURE

(a) Cylindrical and spherical shells under external pressure shall be designed by the rules in UG-28 using

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TABLE ULT-23
MAXIMUM ALLOWABLE STRESS VALUES IN TENSION FOR 5%, 8%, AND 9% NICKEL STEELS, TYPE 304 STAINLESS STEEL, AND 5083-0 ALUMINUM ALLOY AT CRYOGENIC TEMPERATURES FOR WELDED AND NONWELDED CONSTRUCTION

5% Nickel Steels, Customary Units				8% and 9% Nickel Steels, Customary Units			
Plates: SA-645[2]				Plates:[2] SA-353, SA-553 Type I, and SA-553 Type II Pipes and Tubes: SA-333 Grade 8 and SA-334 Grade 8 Forgings: SA-522			
		Welded Construction[3,4]				Welded Construction[3,4]	
Temperature,[1] °F	Nonwelded Construction, ksi	UTS 100 ksi	UTS 95 ksi	Temperature,[1] °F	Nonwelded Construction, ksi	UTS 100 ksi	UTS 95 ksi
−320	43.1	38.9	36.9	−320	43.9	38.9	36.9
−300	39.4	37.9	36.1	−300	42.6	37.9	36.1
−250	37.0	36.3	34.6	−250	39.8	36.3	34.6
−200	36.0	35.0	33.3	−200	37.3	35.0	33.3
−150	34.5	33.5	31.8	−150	35.1	33.5	31.8
−100	32.9	32.1	30.5	−100	33.2	32.1	30.5
−50	31.3	31.0	29.5	−50	31.6	31.0	29.5
0	27.1	27.1	27.1	0	28.6	28.6	27.1
100	27.1	27.1	27.1	100	28.6	28.6	27.1

Type 304 Stainless Steel, Customary Units

		Specified Minimum Strengths at Room Temperature		Maximum Allowable Stress, ksi, for Temperatures,[1] °F, Not Exceeding								
Spec. No.	Grade	Tensile, ksi	Yield, ksi	−320	−300	−250	−200	−150	−100	−50	0	100
SA-240 nonwelded construction	304	75.0	30.0	35.5	35.0	33.4	31.7	29.7	27.5	25.3	20.0	20.0
SA-240 welded construction	304	75.0	30.0	23.6	23.4	23.1	22.8	22.4	22.1	21.8	20.0	20.0

Table continues on following page

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TABLE ULT-23
MAXIMUM ALLOWABLE STRESS VALUES IN TENSION FOR 5%, 8%, AND 9% NICKEL STEELS, TYPE 304 STAINLESS STEEL, AND 5083-0 ALUMINUM ALLOY AT CRYOGENIC TEMPERATURES FOR WELDED AND NONWELDED CONSTRUCTION (CONT'D)

5083-0 Aluminum Alloy, Customary Units

Spec. No.	Alloy	Temper	Thickness, in.	Specified Minimum Strengths at Room Temperature		Maximum Allowable Stress, ksi, for Metal Temperature,[1] °F, Not Exceeding								
				Tensile, ksi	Yield, ksi	–320	–300	–250	–200	–150	–100	–50	0	100
Sheet and Plate														
SB-209	5083	0	0.051–1.500	40	18	15.6	15.3	14.5	13.8	13.1	12.5	12.1	11.4	11.4
			1.501–3.000	39	17	14.7	14.4	13.7	13.0	12.4	11.8	11.5	11.1	11.1
			3.001–5.000	38	16	13.9	13.6	12.9	12.2	11.6	11.1	10.8	10.7	10.7
			5.001–7.000	37	15	13.0	12.7	12.1	11.5	10.9	10.4	10.1	10.0	10.0
			7.001–8.000	36	14	12.1	11.9	11.3	10.7	10.2	9.7	9.4	9.3	9.3
Rods, Bars, and Shapes														
SB-221	5083	0	Up thru 5.000	39	16	13.9	13.6	12.9	12.2	11.6	11.1	10.8	10.7	10.7
Seamless Extruded Tube														
SB-241	5083	0	Up thru 5.000	39	16	13.9	13.6	12.9	12.2	11.6	11.1	10.8	10.7	10.7

Table continues on following page

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TABLE ULT-23
MAXIMUM ALLOWABLE STRESS VALUES IN TENSION FOR 5%, 8%, AND 9% NICKEL STEELS, TYPE 304 STAINLESS STEEL, AND 5083-0 ALUMINUM ALLOY AT CRYOGENIC TEMPERATURES FOR WELDED AND NONWELDED CONSTRUCTION (CONT'D)

5% Nickel Steels, SI Units				8% and 9% Nickel Steels, SI Units			
Plates: SA-645[2]				Plates:[2] SA-353, SA-553 Type I, and SA-553 Type II Pipes and Tubes: SA-333 Grade 8 and SA-334 Grade 8 Forgings: SA-522			
		Welded Construction[3,4]				Welded Construction[3,4]	
Temperature,[1] °C	Nonwelded Construction, MPa	UTS 689 MPa	UTS 655 MPa	Temperature,[1] °C	Nonwelded Construction, MPa	UTS 689 MPa	UTS 655 MPa
−196	260	234	223	−196	265	234	223
−184	238	229	218	−184	256	229	218
−156	223	219	209	−156	240	219	209
−129	217	211	201	−129	225	211	201
−101	208	202	192	−101	211	202	192
−73	199	194	184	−73	200	194	184
−46	189	187	178	−46	191	187	178
−18	163	163	163	−18	172	172	163
38	163	163	163	38	172	172	163

Type 304 Stainless Steel, SI Units

Spec. No.	Grade	Specified Minimum Strengths at Room Temperature		Maximum Allowable Stress, MPa, for Temperatures,[1] °C, Not Exceeding								
		Tensile, MPa	Yield, MPa	−196	−184	−156	−129	−101	−73	−46	−18	38
SA-240	304	517	207	143	142	140	138	136	134	132	130	130

Table continues on following page

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TABLE ULT-23
MAXIMUM ALLOWABLE STRESS VALUES IN TENSION FOR 5%, 8%, AND 9% NICKEL STEELS, TYPE 304 STAINLESS STEEL, AND 5083-0 ALUMINUM ALLOY AT CRYOGENIC TEMPERATURES FOR WELDED AND NONWELDED CONSTRUCTION (CONT'D)

5083-0 Aluminum Alloy, SI Units

Spec. No.	Alloy	Temper	Thickness, mm	Specified Minimum Strengths at Room Temperature		Maximum Allowable Stress, MPa, for Metal Temperature,[1] °C, Not Exceeding								
				Tensile, MPa	Yield, MPa	–196	–184	–156	–129	–101	–73	–46	–18	38
Sheet and Plate														
SB-209	5083	0	1.30–38.10	276	124	92	91	83	76	72	70	69	69	69
			38.13–76.20	269	117	87	86	81	74	70	68	68	67	67
			76.23–127.00	262	110	82	81	79	72	68	66	66	66	66
			127.03–177.80	255	103	77	76	74	70	66	65	64	63	63
			177.83–203.20	248	97	72	71	69	67	64	63	62	62	62
Rods, Bars, and Shapes														
SB-221	5083	0	Up thru 127.00	269	110	82	81	79	74	70	68	68	67	67
Seamless Extruded Tube														
SB-241	5083	0	Up thru 127.00	269	110	82	81	79	74	70	68	68	67	67

NOTES:
(1) Stress values at intermediate temperatures may be interpolated.
(2) Minimum thickness after forming any section subject to pressure shall be $^{3}/_{16}$ in. (4.8 mm), and maximum thickness of the base metal at welds shall be 2 in. (51 mm).
(3) The minimum tensile strength of the reduced tension specimen in accordance with QW-462.1 shall not be less than 100 ksi (689 MPa) or 95 ksi (655 MPa), respectively, at room temperature. Choice of UTS depends on welding process and filler metal used in the construction.
(4) Welded construction allowable stresses apply only to butt joints.

the applicable figures in Subpart 3 of Section II, Part D at 100°F (38°C).

(b) Examples illustrating the use of the charts in the figures for the design of vessels under external pressure are given in Appendix L.

ULT-29 STIFFENING RINGS FOR SHELLS UNDER EXTERNAL PRESSURE

Rules covering the design of stiffening rings are given in UG-29. The design shall be based on the appropriate chart in Subpart 3 of Section II, Part D for the material used in the ring at 100°F (38°C).

ULT-30 STRUCTURAL ATTACHMENTS

(a) See ULT-5(g) for limitations on material used in permanent structural attachments in 5%, 8%, or 9% nickel steel vessels. See ULT-5(g) for limitations on material used in permanent structural attachments in Type 304 stainless steel vessels.

(b) The structural details of supporting lugs, rings, saddles, straps, and other types of supports shall be given special design consideration to minimize local stresses in attachment areas.

(c) Attachments to 5%, 8%, or 9% nickel steel vessels shall be made using a weld procedure qualified to Section IX.

(d) Attachments to Type 304 stainless steel vessels shall be made using a weld procedure meeting ULT-82.

ULT-56 POSTWELD HEAT TREATMENT

(a) For 5%, 8%, or 9% nickel steels, the provisions of UHT-56, UHT-80, and UHT-81 apply.

(b) For 5083 aluminum, the provisions of UNF-56 apply.

(c) For Type 304 stainless steel vessels, the provisions of UHA-32 apply

ULT-57 EXAMINATION

(a) All butt joints shall be examined by 100% radiography, except as permitted in UW-11(a)(7).

(b) All attachment welds, and all welded joints subject to pressure not examined by radiography or ultrasonic testing, shall be given a liquid penetrant examination either before or after hydrotest. Relevant indications are those which result from imperfections. Any relevant linear indication greater than $^1/_{16}$ in. (1.6 mm) shall be repaired or removed.

When a pneumatic test is required by ULT-99(b), these liquid penetrant examinations shall be performed prior to pneumatic test.

(c) For 5083 aluminum, the requirements of UNF-91 apply.

FABRICATION

ULT-75 GENERAL

The rules in the following paragraphs apply specifically to the fabrication of pressure vessels and vessel parts that are constructed to this Part and shall be used in conjunction with the requirements for fabrication in Subsection A and Part UW of Subsection B.

ULT-79 FORMING SHELL SECTIONS AND HEADS

The requirements and limitations of UNF-77 apply for 5083 aluminum, and of UHT-79 for 5%, 8%, or 9% nickel steel.

ULT-82 WELDING

(a) A separate welding procedure qualification shall be made, as prescribed in Section IX, Part QW, except that the procedure qualification tests on tension specimens conforming to QW-462.1 and prescribed in QW-451 shall be four in number, two of which when tested at room temperature shall meet the minimum tensile strength requirements for room temperature as listed in Table ULT-82 and two of which when tested at or below the vessel minimum allowable temperature shall meet the minimum tensile strength requirements for that test temperature as listed in the applicable table, except that the requirements for the two tests at vessel minimum allowable temperature shall not be applied to procedure qualification for 5083 aluminum welded with 5183 aluminum filler metal.

(b) For 5%, 8%, or 9% nickel steels, the provisions of UHT-82, UHT-83, UHT-84, and UHT-85 apply.

(c) For Type 304 stainless steel vessels, the following provisions apply.

(1) The welding processes that may be used are limited to gas metal arc, gas tungsten arc, and submerged arc.

(2) Filler metal is limited to SFA-5.9, AWS Classifications ER308L and ER308L(Si). The filler metal

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TABLE ULT-82
MINIMUM TENSILE STRENGTH REQUIREMENTS FOR WELDING PROCEDURE QUALIFICATION TESTS
ON TENSION SPECIMENS CONFORMING TO QW-462.1

Temp.,[1] °F	SA-645, Customary Units, Welded Construction		SA-353, SA-553 Types I and II, SA-333 Grade 8, SA-334, SA-522, Customary Units, Welded Construction	
	UTS 100 ksi	UTS 95 ksi	UTS 100 ksi	UTS 95 ksi
−320	136	129	136	129
−300	133	126	133	126
−250	125	121	125	121
−200	122	116	122	116
−150	117	111	117	111
−100	112	107	112	107
− 50	108	103	108	103
0	95	95	100	95
100	95	95	100	95

5083-0 Aluminum Alloy, Customary Units										
		Minimum Tensile Strength, ksi, for Metal Temperature,[1] °F, Not Exceeding								
Spec. No.	Thickness, in.	−320	−300	−250	−200	−150	−100	−50	0	100
Sheet and Plate										
SB-209	0.051–1.500	55.2	53.3	48.2	43.8	41.4	40.4	40	40	40
	1.501–3.000	53.8	52	47	42.7	40.4	39.4	39.1	39	39
	3.001–5.000	52.5	50.7	45.8	41.6	39.4	38.4	38.1	38	38
	5.001–7.000	51.1	49.3	44.6	40.5	38.3	37.4	37.1	37	37
	7.001–8.000	49.7	48	43.4	39.4	37.3	36.4	36.1	36	36
Rods, Bars, and Shapes										
SB-221	Up thru 5.000	53.8	52	47	42.7	40.4	39.4	39.1	39	39
Seamless Extruded Tube										
SB-241	Up thru 5.000	53.8	52	47	42.7	40.4	39.4	39.1	39	39

Type 304 Stainless Steel, Customary Units									
	Minimum Tensile Strength, ksi, for Metal Temperature,[1] °F, Not Exceeding								
Spec. No.	−320	−300	−250	−200	−150	−100	−50	0	100
SA-240	82.7	82.1	80.9	79.7	78.5	77.4	76.2	75.0	75.0

Table continues on following page

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TABLE ULT-82
MINIMUM TENSILE STRENGTH REQUIREMENTS FOR WELDING PROCEDURE QUALIFICATION TESTS
ON TENSION SPECIMENS CONFORMING TO QW-462.1 (CONT'D)

	SA-645, SI Units		SA-353, SA-553 Types I and II, SA-333 Grade 8, SA-334, SA-522, SI Units		5083-0 Aluminum Alloy, SI Units									
	Welded Construction		Welded Construction				Minimum Tensile Strength, MPa, for Metal Temperature,[1] °C, Not Exceeding							
Temp.,[1] °C	UTS 689 MPa	UTS 655 MPa	UTS 689 MPa	UTS 655 MPa	Spec. No.	Thickness, mm	–196	–184	–156	–129	–101	–73	–46	–18	38
–196	938	889	938	889	Sheet and Plate										
–184	917	869	917	869											
–156	862	834	862	834	SB-209	1.30–38.10	381	368	332	302	285	279	276	276	276
						38.13–76.20	371	359	324	294	279	272	270	269	269
–129	841	800	841	800		76.23–127.00	362	350	316	287	272	265	263	262	262
–101	807	765	807	765		127.03–177.80	352	340	308	279	264	258	256	255	255
–73	772	738	772	738		177.83–203.20	343	331	299	272	257	251	249	248	248
–46	745	710	745	710											
–18	655	655	689	655	Rods, Bars, and Shapes										
38	655	655	689	655											
					SB-221	Up thru 127.00	371	358	324	294	279	272	270	269	269
					Seamless Extruded Tube										
					SB-241	Up thru 127.00	371	358	324	294	279	272	270	269	269

	Type 304 Stainless Steel, SI Units								
	Minimum Tensile Strength, MPa, for Metal Temperature,[1] °C, Not Exceeding								
Spec. No.	–196	–184	–156	–129	–101	–73	–46	–18	38
SA-240	570	566	558	550	541	534	525	517	517

NOTE:
(1) Strength values at intermediate temperatures may be interpolated.

shall conform to the SFA specified percentage composition limits.

(3) A determination of delta ferrite of each lot of filler metal shall be made by the use of the chemical analysis from (c)(2) above, in conjunction with Fig. ULT-82. Additionally, for submerged arc welds, a determination of delta ferrite shall be made in conjunction with Fig. ULT-82, by the use of the chemical analysis of lots of electrode and flux used for production welds. The acceptable delta ferrite shall not be less than 6 FN nor greater than 14 FN.

ULT-86 MARKING ON PLATE AND OTHER MATERIALS

For 5%, 8%, or 9% nickel steel the requirements of UHT-86 apply. For the use of other markings in lieu of stamping, see UG-77(b).

INSPECTION AND TESTS

ULT-90 GENERAL

The provisions for inspection and testing in Subsections A and B shall apply to vessels and vessel parts constructed of materials covered by this Part, except as modified herein.

01 ULT-99 PRESSURE TEST

The vessel shall be hydrostatically pressure tested at ambient temperature in the operating position for a minimum of 15 min, using the following requirements of (a) or (b), whichever is applicable.

(a) Except for vessels covered by (b) below, a hydrostatic test shall be performed in accordance with UG-99, except that the ratio of stresses is not applied, and the test pressure shall be at least 1.4 times the design pressure at 100°F (38°C).

(b) When the test procedure in (a) above will cause a nominal membrane stress greater than 95% of specified minimum yield strength or 50% of specified minimum tensile strength of the material in any part of the vessel, the hydrostatic test may be conducted at a pressure that limits the nominal membrane stress at such part to the lesser of those values. When these conditions limit the hydrostatic test pressure to a value less than 110% of the maximum allowable working pressure at 100°F (38°C), a pneumatic test in accordance with UG-100 shall also be conducted, except that the ratio of stresses is not applied.

(c) Vessels which are to be installed in the vertical position may be tested in the horizontal position provided all components of the vessel are hydrostatically tested for a minimum of 15 min at a pressure not less than 1.4 times the design pressure at 100°F (38°C) plus the equivalent of the head of the test liquid in the operating position.

MARKING AND REPORTS

ULT-115 GENERAL

The provisions for marking and reports in UG-115 through UG-120 shall apply to vessels constructed to this Part, with the following supplements to the marking and Manufacturer's Data Reports:

(a) The vessel markings shall be in accordance with UG-116 except:

(1) the letters ULT shall be applied below the U Symbol;

(2) the following markings shall be used instead of those in UG-116(a)(3) and UG-116(b)(1)(a):

Maximum Allowable Working Pressure: ____ psi at 100°F
Minimum Allowable Temperature: Minus ____°F

Service Restricted to the Following	Operating Temperature
Liquid _____	Minus ____°F
Liquid _____	Minus ____°F
Liquid _____	Minus ____°F
Liquid _____	Minus ____°F

NOTES APPLICABLE TO MARKINGS:

(1) Minimum allowable temperature is the temperature of the coldest cryogenic liquid which will be admitted to or stored within the vessel.

(2) Operating temperature for the cryogenic liquid is its saturation temperature at MAWP. All liquids that may be contained in the vessel shall be listed.

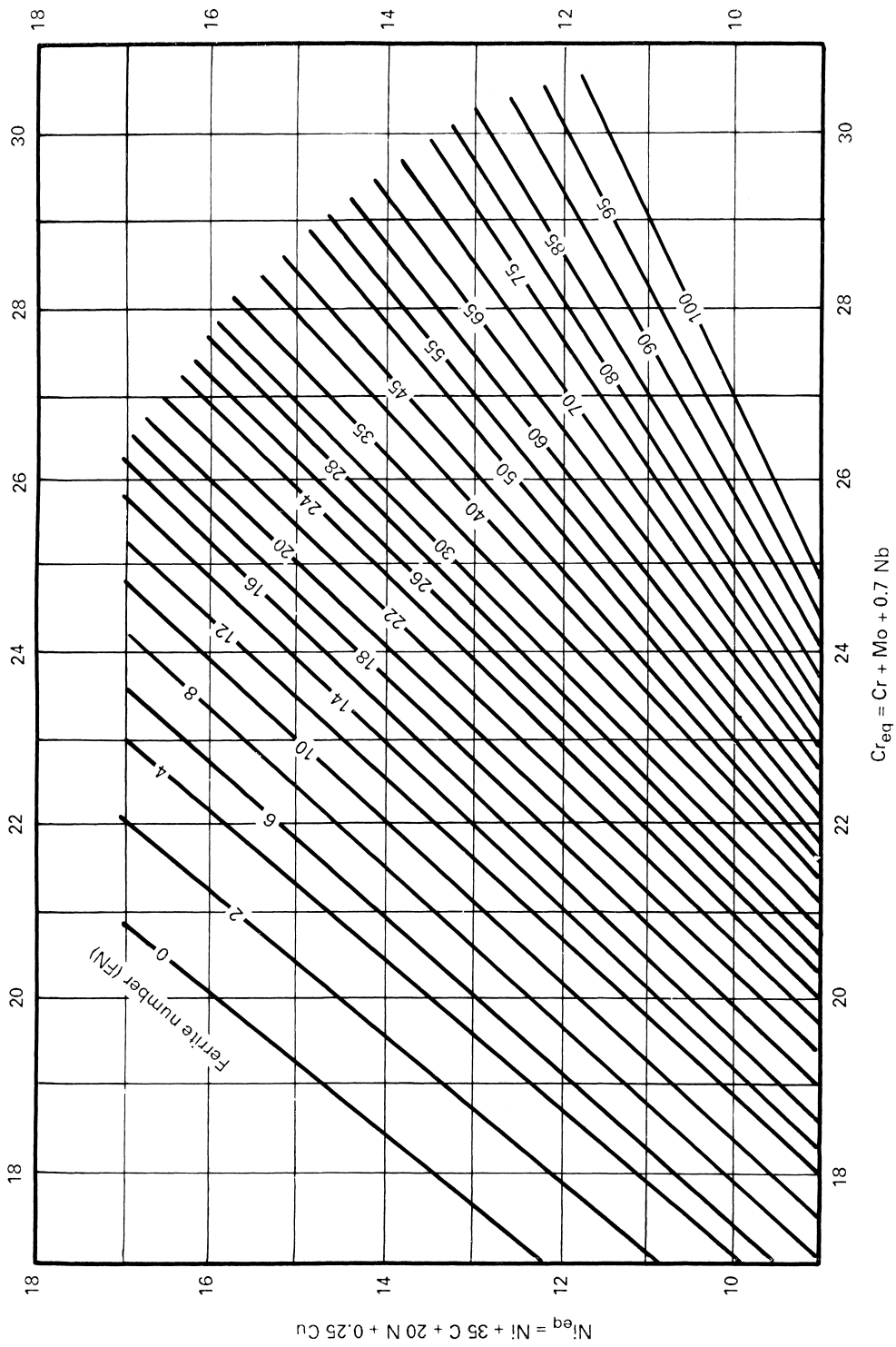
(b) On the Manufacturer's Data Report, under Remarks, show the additional marking notations from (a) above.

(c) Unless the requirements of (c)(1) and (2) below are met, for 5%, 8%, and 9% nickel steels, the use of nameplates is mandatory for shell thicknesses below $\frac{1}{2}$ in. (13 mm); nameplates are preferred in all thicknesses.

(1) The materials shall be limited to aluminum as follows: SB-209 Alloys 3003, 5083, 5454, and 6061; SB-241 Alloys 3003, 5083, 5086, 5454, 6061, and 6063; and SB-247 Alloys 3003, 5083, and 6061.

(2) The minimum nominal plate thickness shall be 0.249 in. (6.32 mm), or the minimum nominal pipe thickness shall be 0.133 in. (3.38 mm).

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GENERAL NOTES:
(a) The actual nitrogen content is preferred. If this is not available, the following applicable nitrogen value shall be used:
(1) GMAW welds - 0.08%, except that when self shielding flux cored electrodes are used - 0.12%.
(2) Welds made using other processes - 0.06%.
(b) This diagram is identical to the WRC-1992 Diagram, except that the solidification mode lines have been removed for ease of use.

FIG. ULT-82 WELD METAL DELTA FERRITE CONTENT

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PRESSURE RELIEF DEVICES

ULT-125 GENERAL

The provisions of UG-125 through UG-136 shall apply to vessels constructed to this Part; the vessel shall be equipped with a safety relief valve suitable for low temperature service and installed to remain at ambient temperature except when relieving.

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