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SPECIAL REQUIREMENTS
FOR METAL PRODUCTS

MAY 1974

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FOREWORD

This standard supersedes the February 1974 issue of RDT F 3-37T and incorporates those changes to that issue of the standard that were approved for publication in this revision. These changes are identified by the following marginal notations:

- C Change
- D Deletion
- E* Editorial change for clarification
of applicability of requirements
- N Addition

*Minor editorial changes that were made during preparation of this revision are not identified.

MASTER

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UNITED STATES ATOMIC ENERGY COMMISSION
DIVISION OF REACTOR RESEARCH AND DEVELOPMENT

RDT F 3-37T
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UNITED STATES ATOMIC ENERGY COMMISSION
DIVISION OF REACTOR RESEARCH AND DEVELOPMENT

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SPECIAL REQUIREMENTS FOR METAL PRODUCTS

1. SCOPE

This standard provides requirements for the manufacture, examination, or test of materials which, when specified by a referencing RDT standard or ordering document, shall be satisfied in addition to all other requirements for the material. Some of these must be performed due to requirements of the ASME Boiler and Pressure Vessel Code, Section III (the Code), or other RDT standard requirements. Others are stated for the convenience of the designer or user who may specify them for reasons not related to the Code.

Special requirements contained in this standard are intended to be equivalent to or more stringent than similar requirements of the Code or ASTM specifications required for a given application. The user of this standard shall be responsible for obtaining and applying the editions and revisions that apply to the Code edition and addenda that are in legal effect at the time it is invoked.

2. APPLICABLE DOCUMENTS

The following documents are a part of this standard to the extent specified herein. The issue of a document in effect on the date of invitation to bid, including any amendments also in effect on that date, shall apply unless otherwise specified. Where this standard appears to conflict with the requirements of a referencing or referenced document, such conflict shall be brought to the attention of the purchaser for resolution prior to any implementing action.

2.1 RDT Standards.

RDT E 15-2T	Requirements for Nuclear Components (Supplement to ASME Boiler and Pressure Vessel Code, Section III)
RDT F 3-6T	Nondestructive Examination
RDT F 6-10T	Repair of Materials by Welding

2.2 American Society for Mechanical Engineers (ASME) Standards.

ASME SA-370	Methods and Definitions for Mechanical Testing of Steel Products
ASME Boiler and Pressure Vessel Code, Section III,	Nuclear Power Plant Components
ASME Boiler and Pressure Vessel Code, Section IX,	Welding and Brazing Qualifications
ASME SFA 5.1	Specification for Mild Steel Covered Arc-Welding Electrodes
ASME SFA 5.5	Specification for Low-Alloy Steel Covered Arc-Welding Electrodes

2.3 American Society for Testing and Materials (ASTM) Standards.

ASTM A 20	General Requirements for Delivery of Steel Plates for Pressure Vessels
ASTM A 262	Detecting Susceptibility to Intergranular Attack in Stainless Steels
ASTM E 71	Reference Radiographs for Steel Castings up to 2 Inches in Thickness
ASTM E 122	Estimating the Average Grain Size of Metals
ASTM E 186	Reference Radiographs for Heavy-Walled (2 to 4 1/2 inches) Steel Castings
ASTM E 208	Conducting Drop-Weight Test to Determine Nil-Ductility Transition Temperature of Ferritic Steels
ASTM E 280	Reference Radiographs for Heavy-Walled (4 1/2 to 12 inches) Steel Castings
ASTM A 609	Longitudinal-Beam Ultrasonic Inspection of Carbon and Low-Alloy Steel Castings

3. FRACTURE TOUGHNESS REQUIREMENTS

Carbon steel, alloy steel, and chromium stainless (series 4XX) shall be tested for fracture toughness in accordance with the following requirements when specified. Such tests are not required for austenitic stainless steels or nonferrous materials.

3.1 Types of Tests.

3.1.1 Dropweight Tests. Dropweight tests required by 3.3.1, shall be performed in accordance with ASTM E 208 using specimen Type P1, P2 or P3 to test materials 5/8 inch or more in section thickness and whose other dimensions are sufficient to provide specimens of required dimensions.

3.1.2 Charpy V-notch (Cv) Tests. When required by 3.3.1 or 3.4, tests shall be performed in accordance with ASME SA-370 to test material 1/2 inch or more in section thickness. Type A specimens shall be prepared in accordance with ASME SA-370 and 3.3.1 and 3.3.2 of this standard. For materials 5/8 inch or more in section thickness, full size 10 x 10 mm specimens shall be used. For thinner materials, subsize specimens may be used (see 3.3.2).

3.2 Test Specimens.

3.2.1 Location. All types of impact test specimens, regardless of heat treatment, shall be removed from the location specified for tensile test specimens in each product form in accordance with the referencing RDT material standard. For bolting, the Cv test specimen shall be taken with the longitudinal axis of the specimen located at least 1/2 radius or 1 inch below the surface plus the machining allowance per side, whichever is less. The fracture plane of the specimens shall be at least one diameter or thickness from the heat treated end.

3.2.2 Orientation. Specimens for Cv tests shall be oriented as follows.

(a) Specimens from forgings, except for bolting and bars, shall be oriented in a direction normal to the principal direction in which the material was worked (other than the thickness direction).

(b) Specimens from materials for pipe, tube, and fittings, except for those made from plate and castings, shall be oriented in the axial direction. Specimens from pipe materials used for nozzles in vessels shall be oriented in a direction normal to the principal direction in which the material was worked (other than the thickness direction).

(c) Specimens from bolting materials and bars shall be oriented in the axial direction.

(d) Specimens from all plate materials, including those used for pipe, tube, and fittings, shall be oriented in a direction normal to the principal rolling direction (other than the thickness direction).

(e) Specimens from cast materials shall have their axes oriented the same as the axes of the tensile specimens.

(f) In addition to the requirements of (a) and (d), Cv test specimens for materials subject to high neutron irradiation* shall also be oriented in the direction parallel to that in which the material was worked (other than the thickness direction).

(g) In (a) through (f), the length of the notch of the Cv test specimen shall be normal to the surface of the material.

3.3 Test Requirements and Acceptance Criteria.

3.3.1 Materials of all product forms (except bolting) 5/8 inch or more in section thickness shall be tested as follows.

*See Application Supplements and Basis of Purchase of referencing RDT material standard.

(a) Establish a reference temperature, RT_{ndt} , as follows.

(1) Determine a temperature, T_{ndt} , which is at or above the nil-ductility transition temperature by dropweight tests. (The maximum permissible T_{ndt} will be specified in Basis of Purchase of referencing RDT material standard.)

(2) At a temperature not greater than $(T_{ndt} + 60^{\circ}\text{F})$, each specimen of the Cv test specified by 3.1.2 shall exhibit at least 0.035 inch lateral expansion and not less than 50 ft-lb absorbed energy. Retesting in accordance with 3.10 is permitted. When these requirements are met, T_{ndt} is the reference temperature RT_{ndt} .

(3) In the event the requirements of (2) are not met, additional Cv tests (in groups of three specimens, per 3.1.2) shall be conducted to determine the temperature, T_{Cv} , at which they are met. In this case the reference temperature RT_{ndt} would be $(T_{Cv} - 60^{\circ}\text{F})$. Thus the reference temperature, RT_{ndt} , is the higher of T_{ndt} and $(T_{Cv} - 60^{\circ}\text{F})$.

(4) When a Cv test has not been performed at $(T_{ndt} + 60^{\circ}\text{F})$, or when the Cv test at $(T_{ndt} + 60^{\circ}\text{F})$ does not exhibit a minimum of 50 ft-lb and 0.035 inch lateral expansion, a temperature representing a minimum of 50 ft-lb and 0.035 inch lateral expansion may be obtained from a full Cv impact curve developed from the minimum data points of all the Cv tests performed.

(b) Acceptance criteria for the RT_{ndt} determined (see NB-2300 of the Code and NNB-2121(f) of RDT E 15-2) shall be as specified in Basis of Purchase section of the referencing RDT material standard or purchasing document.

3.3.2 Materials of all product forms (except bolting) 1/2 inch or more but less than 5/8 inch in section thickness, and bolting 1/2 inch through 1 inch, shall be tested as follows.

(a) Cv tests shall be performed in accordance with ASME SA-370. Type A specimens shall be prepared in accordance with ASME SA-370 and 3.2 of this standard.

(b) A Cv acceptance test shall consist of a set of three Type A specimens tested at the lowest of 60°F below the hydrotest temperature,* 60°F below the lowest service metal temperature,* or a lower temperature to be specified by the referencing RDT standard or the purchaser but in no case higher than 10°F . The specimens shall break at energies no less than those indicated in Table 1 by steel grade, and the absorbed energy values shall be reported. The test temperature, the lateral expansion in inches, and the percent ductile fracture area for each specimen shall be reported. Impact absorbed energy value requirements for material types included in referencing standards but not included in Table 1 shall be a matter of agreement between the manufacturer and purchaser.

*Specified in Basis of Purchase of referencing RDT material standard.

Table 1. C_v Impact Test Requirements

Nominal Composition	P- No.	Product Form ¹	Specification Number	Grade	V-Notch Average of Three Specimens ²
THIN MATERIALS					
CARBON STEELS					
	1	Plate	SA-285	A	15
...	1	Welded Pipe	SA-155	C45	15
...	1	Smls Pipe	SA-106	A	15
...	1	Plate	SA-285	B	15
...	1	Welded Pipe	SA-155	C50	15
...	1	Plate	SA-285	C	15
C-Si	1	Plate	SA-442	55	15
C-Si	1	Plate	SA-515	55	15
C-Si	1	Plate	SA-516	55	15
...	1	Welded Pipe	SA-155	C55	15
				KC55	
...	1	Wld & Smls Pipe	SA-333	1	15
...	1	Wld & Smls Pipe	SA-334	1	15
...	1	FFBS	SA-105	1	15
...	1	FFBS	SA-181	1	15
...	1	FFBS	SA-266	1	15
...	1	FFBS	SA-350	LF1	15
...	1	Casting	SA-216	WCA	15
C-Si	1	Plate	SA-442	60	15
C-Si	1	Plate	SA-515	60	15
C-Si	1	Plate	SA-516	60	15
...	1	Welded Pipe	SA-155	KC60	15
				KCF60	
...	1	Smls Pipe	SA-106	B	20
...	1	Wld & Smls Pipe	SA-333	6	20
...	1	Wld & Smls Pipe	SA-334	6	20
...	1	Welded Tube	SA-178	C	20
...	1	Smls Tube	SA-210	...	20
C-Si	1	Plate	SA-515	65	20
C-Si	1	Plate	SA-516	65	20
...	1	Welded Pipe	SA-155	KC65	20
				KCF65	
...	1	Casting	SA-352	LCB	

(Continued)

Table 1. C_v Impact Test Requirements (Continued)

Nominal Composition	P- No.	Product Form ¹	Specification Number	Grade	V-Notch Average of Three Specimens ²
C-Mn-Si over 1.25 in	1	Plate	SA-537	A	20
...	1	FFBS	SA-266	11	20
...	12A	FFBS	SA-508	1	20
...	Sub 1				
...	12A	FFBS	SA-541	1	20
...	Sub 1				
...	1	FFBS	SA-105	11	20
...	1	FFBS	SA-181	11	20
...	1	Casting	SA-216	WCB	20
C-Si	1	Plate	SA-515	70	20
C-Si	1	Plate	SA-516	70	20
...	1	Welded Pipe	SA-155	KC70 KCF70	20
...	1	Smls Pipe	SA-106	C	20
...	1	Casting	SA-216	WCC	20
C-Mn-Si 1.25 in. & Less	1	Plate	SA-537	A	20
...	1	FFBS	SA-266	111	20
C-Mn-Si Over 1 in.	1	Plate	SA-299	...	20
C-Mn-Si 1 in. & Under	1	Plate	SA-299	...	20
C-Mn-Si Over 1.25 in. Sub 2	12B	Plate	SA-537	B	30
C-Mn-Si 1.25 in. & Less	1	Plate	SA-537	B	30
...	1	Fittings	SA-234	WPA	} Note 3
...	1	Fittings	SA-234	WPAW	
...	1	Fittings	SA-234	WPB	
...	1	Fittings	SA-234	WPBW	
...	1	Fittings	SA-234	WPC	
...	1	Fittings	SA-234	WPCW	
...	1	Fittings	SA-420	WPL6	
...	1	Fittings	SA-420	WPL6W	

(Continued)

Table 1. C_v Impact Test Requirements (Continued)

Nominal Composition	P- No.	Product Form ¹	Specification Number	Grade	V-Notch Average of Three Specimens ²
LOW ALLOY STEELS					
C- $\frac{1}{2}$ Mo	3	Smls Pipe	SA-335	P1	15
$\frac{1}{2}$ Cr- $\frac{1}{2}$ Mo	3	Smls Pipe	SA-335	P2	15
C- $\frac{1}{2}$ Mo	3	Smls Pipe	SA-369	FP1	15
C- $\frac{1}{2}$ Mo	3	Smls Pipe	SA-369	FP2	15
	3	Cast Pipe	SA-426	CP1	15
	3	Cast Pipe	SA-426	CP2	15
$\frac{1}{2}$ Cr- $\frac{1}{2}$ Mo Annealed	3	Plate	SA-387	A	15
1 Cr- $\frac{1}{2}$ Mo Annealed	4	Plate	SA-387	B	15
Annealed	3	Welded Pipe	SA-155	$\frac{1}{2}$ CR	15
Annealed	4	Welded Pipe	SA-155	1CR	15
5 Cr- $\frac{1}{2}$ Mo	5	Plate	SA-357	...	15
5 Cr- $\frac{1}{2}$ Mo	5	Welded Pipe	SA-155	5CR	15
5 Cr- $\frac{1}{2}$ Mo	5	Smls Tube	SA-213	T5	15
7 Cr- $\frac{1}{2}$ Mo	5	Smls Tube	SA-213	T7	15
9 Cr-1 Mo	5	Smls Tube	SA-213	T9	15
5 Cr- $\frac{1}{2}$ Mo	5	Smls Pipe	SA-335	P5	15
7 Cr- $\frac{1}{2}$ Mo	5	Smls Pipe	SA-335	P7	15
9 Cr-1 Mo	5	Smls Pipe	SA-335	P9	15
5 Cr- $\frac{1}{2}$ Mo	5	Smls Pipe	SA-369	FP5	15
7 Cr- $\frac{1}{2}$ Mo	5	Smls Pipe	SA-369	FP7	15
9 Cr-1 Mo	5	Smls Pipe	SA-369	FP9	15
$2\frac{1}{4}$ Cr-1 Mo Annealed	5	Plate	SA-387	D	15
3 Cr-1 Mo Annealed	5	Plate	SA-387	E	15
$2\frac{1}{4}$ Cr-1 Mo Annealed	5	Welded Pipe	SA-155	$2\frac{1}{4}$ CR	15
2 Cr- $\frac{1}{2}$ Mo	4	Smls Tube	SA-213	T3b	15
$1\frac{1}{4}$ Cr- $\frac{1}{2}$ Mo-Si	4	Smls Tube	SA-213	T11	15
1 Cr- $\frac{1}{2}$ Mo	4	Smls Tube	SA-213	T12	15
3 Cr-0.9 Mo	5	Smls Tube	SA-213	T21	15
$2\frac{1}{4}$ Cr-1 Mo	5	Smls Tube	SA-213	T22	15
$1\frac{1}{4}$ Cr- $\frac{1}{2}$ Mo-Si	4	Smls Pipe	SA-335	P11	15
1 Cr- $\frac{1}{2}$ Mo	4	Smls Pipe	SA-335	P12	15
3 Cr-0.9 Mo	5	Smls Pipe	SA-335	P21	15

(Continued)

Table 1. C_v Impact Test Requirements (Continued)

Nominal Composition	P- No.	Product Form ¹	Specification Number	Grade	V-Notch Average of Three Specimens ²
2¼ Cr-1 Mo	5	Smls Pipe	SA-335	P22	15
2 Cr-½ Mo	4	Smls Pipe	SA-369	FP3b	15
1¼ Cr-½ Mo-Si	4	Smls Pipe	SA-369	FP11	15
1 Cr-½ Mo	4	Smls Pipe	SA-369	FP12	15
3 Cr-1 Mo	5	Smls Pipe	SA-369	FP21	15
2¼ Cr-1 Mo	5	Smls Pipe	SA-369	FP22	15
1¼ Cr-½ Mo-Si	4	Cast Pipe	SA-426	CP11	15
1 Cr-½ Mo	4	Cast Pipe	SA-426	CP12	15
3 Cr-1 Mo	5	Cast Pipe	SA-426	CP21	15
2¼ Cr-1 Mo	5	Cast Pipe	SA-426	CP22	15
5 Cr-½ Mo	5	FFBS	SA-182	F5	15
5 Cr-½ Mo	5	Cast Pipe	SA-426	CP5	15
7 Cr-½ Mo	5	Cast Pipe	SA-426	CP7	15
9 Cr-1 Mo	5	Cast Pipe	SA-426	CP9	15
½ Cr-½ Mo	3	Smls Tube	SA-213	T2	15
1¼ Cr-½ Mo-Si Annealed	4	Plate	SA-387	C	20
1¼ Cr-½ Mo-Si Annealed	4	Welded Pipe	SA-155	1¼CR	20
C-½ Mo	3	Casting	SA-217	WC1	20
C-½ Mo	3	Casting	SA-352	LC1	20
C-½ Mo	3	Plate	SA-204	A	20
	3	Welded Pipe	SA-155	CM65	20
1 Cr-½ Mo Norm & Tmpd	4	Plate	SA-387	B	20
1 Cr-½ Mo Norm & Tmpd	4	Welded Pipe	SA-155	1CR	20
C-½ Mo	3	Plate	SA-204	B	20
	3	Welded Tube	SA-155	CM70	20
C-½ Mo	3	FFBS	SA-182	F1	20
C-½ Mo	3	FFBS	SA-336	F1	20
Ni-Cr-½ Mo	4	Casting	SA-217	WC4	20

(Continued)

Table 1. C_v Impact Test Requirements (Continued)

Nominal Composition	P- No.	Product Form ¹	Specification Number	Grade	V-Notch Average of Three Specimens ²
LOW ALLOY STEELS (CONT'D)					
1 Cr- $\frac{1}{2}$ Mo	4	FFBS	SA-182	F12	20
$1\frac{1}{4}$ Cr- $\frac{1}{2}$ Mo	4	FFBS	SA-182	F11	20
3 Cr-1 Mo	5	FFBS	SA-182	F21	20
$2\frac{1}{4}$ Cr-1 Mo	5	FFBS	SA-182	F22	20
1 Cr- $\frac{1}{2}$ Mo	4	FFBS	SA-336	F12	20
$1\frac{1}{2}$ Cr- $\frac{1}{2}$ Mo	4	Casting	SA-217	WC5	20
$1\frac{1}{4}$ Cr- $\frac{1}{2}$ Mo	4	Casting	SA-217	WC6	20
$2\frac{1}{4}$ Cr-1 Mo	5	Casting	SA-217	WC9	20
C- $\frac{1}{2}$ Mo	3	Plate	SA-204	C	20
	3	Welded Pipe	SA-155	CM75	20
$1\frac{1}{4}$ Cr- $\frac{1}{2}$ Mo-Si	12B	Plate	SA-387	C	30
Norm & Tmpd	Sub3				
$2\frac{1}{4}$ Cr-1 Mo	12B	Plate	SA-387	D	30
Norm & Tmpd	Sub4				
3 Cr-1 Mo	12B	Plate	SA-387	E	30
Norm & Tmpd	Sub4				
$2\frac{1}{4}$ Cr-1 Mo	5	Welded Pipe	SA-155	$2\frac{1}{2}$ CR	30
Norm & Tmpd					
$2\frac{1}{4}$ Cr-1 Mo	5	FFBS	SA-336	F22	30
5 Cr Norm&Tmpd	5	Plate	SA-357	5	30
$1\frac{1}{4}$ Cr- $\frac{1}{2}$ Mo	4	Welded Pipe	SA-155	$1\frac{1}{2}$ CR	30
Mn- $\frac{1}{2}$ Mo	3	Plate	SA-302	A	30
Mn- $\frac{1}{2}$ Mo	3	Plate	SA-302	B	30
...	12B	Plate	SA-533	D	30
	Sub1				
Mn- $\frac{1}{2}$ Mo	3	Plate	SA-302	C	30
Mn- $\frac{1}{2}$ Mo	3	Plate	SA-302	D	30
C-Mn-Mo	12B	Plate	SA-533	A	30
	Sub1				
C-Mn-Mo	12B	Plate	SA-533	Class 1 B	30
0.4-0.7 Ni	Sub1			Class 1	
C-Mn-Mo	12B	Plate	SA-533	C	30
0.7-1.0 Ni	Sub1			Class 1	
C- $\frac{1}{2}$ Mo-Cr-Ni	12B	FFBS	SA-508	2	30
	Sub1				
C-Mn-Mo	12B	FFBS	SA-508	3	30
0.4-0.8 Ni	Sub1				
C- $\frac{1}{2}$ Mo-Cr-Ni	12B	FFBS	SA-541	2	30
	Sub1				

(Continued)

Table 1. C_v Impact Test Requirements (Continued)

Nominal Composition	P-No.	Product Form ¹	Specification Number	Grade	V-Notch Average of Three Specimens
C-Mn-Mo 0.4-0.8 Ni	12B Sub1	FFBS	SA-541	3	30
13 Cr	6	FFBS	SA-182	F6	30
13 Cr	6	FFBS	SA-336	F6	30
13 Cr-½ Mo	6	Casting	SA-351	CA13	30
2¼ Cr-1 Mo	5	Casting	SA-487	8N	30
½ Ni-½ Cr	5	Casting	SA-487	4N	30
C-Mn-Mo	12C Sub1	Plate	SA-533	A Class 2	30
C-Mn-Mo	12C Sub1	Plate	SA-533	B Class 2	30
0.4-0.7 Ni	12C Sub1	Plate	SA-533	C Class 2	30
C-Mn-Mo	12C Sub1	Plate	SA-533	D Class 2	30
0.7-1.0 Ni	12C Sub1	Plate	SA-533	D Class 2	30
C-Mn-Mo	11A Sub5	Plate	SA-533	A Class 3	35
C-Mn-Mo	11A Sub5	Plate	SA-533	B Class 3	35
0.4-0.7 Ni	11A Sub5	Plate	SA-533	C Class 3	35
C-Mn-Mo	11A Sub5	Plate	SA-533	D Class 3	35
0.7-1.0 Ni	11A Sub5	Plate	SA-533	D Class 3	35
12 Cr-Al	7	Plate	SA-240	405	15
13 Cr	7	Plate	SA-204	410S	15
C-Mo	3	Fitting	SA-234	WP1	} Note 3
C-Mo	3	Fitting	SA-234	WP1W	
1 Cr-½ Mo	4	Fitting	SA-234	WP12	
1 Cr-½ Mo	4	Fitting	SA-234	WP12W	
1¼ Cr-½ Mo	4	Fitting	SA-234	WP11	
1¼ Cr-½ Mo	4	Fitting	SA-234	WP11W	
2¼ Cr-1 Mo	5	Fitting	SA-234	WP22	
2¼ Cr-1 Mo	5	Fitting	SA-234	WP22W	
5 Cr-½ Mo	5	Fitting	SA-234	WP5	
5 Cr-½ Mo	5	Fitting	SA-234	WP5W	

(Continued)

Table 1. C_v Impact Test Requirements (Continued)

Nominal Composition	Specification Number and Class	Grade or Type	Notes	V-Notch Average of Three Specimens
BOLTING MATERIALS				
LOW-ALLOY STEELS				
1 & Cr	SA-193	B7	4	35
0.2% Mo	SA-193	B7	4	35
	SA-193	B7	4	35
1% Cr	SA-193	B16		35
1/2% Mo-V	SA-193	B16		35
	SA-193	B16		35
2% Ni-0.8% Cr-	SA-320	L43		35
1/4% Mo				35
Cr-Mo-V	SA-540-CL. 1	B21		35
Cr-Mo	SA-540-CL. 1	B22	5, 6	35
Cr-Ni-Mo	SA-540-CL. 1	B23	6	35
Cr-Ni-Mo	SA-540-CL. 1	B24	7	35
Cr-Mo-V	SA-540-CL. 2	B21		35
Cr-Mo	SA-540-CL. 2	B22	5	35
Cr-Ni-Mo	SA-540-CL. 2	B23	6	35
Cr-Ni-Mo	SA-540-CL. 2	B24	7	35
Cr-Mo-V	SA-540-CL. 3	B21		35
Cr-Mo	SA-540-CL. 3	B22	5	35
Cr-Ni-Mo	SA-540-CL. 3	B23	6	35
Cr-Ni-Mo	SA-540-CL. 3	B24	7	35
Cr-Mo-V	SA-540-CL. 4	B21		35
Cr-Mo	SA-540-CL. 4	B22	5	35
Cr-Ni-Mo	SA-540-CL. 4	B23	6	35
Cr-Ni-Mo	SA-540-CL. 4	B24	7	35
Cr-Mo-V	SA-540-CL. 5	B21		35
Cr-Mo	SA-540-CL. 5	B22	5	35
Cr-Ni-Mo	SA-540-CL. 5	B23	6	35
Cr-Ni-Mo	SA-540-CL. 5	B24	7	35
Cr-Mo-V	SA-540-CL. 6	B21		35
Cr-Mo	SA-540-CL. 6	B22	5	35
Cr-Ni-Mo	SA-540-CL. 6	B23	6	35
Cr-Ni-Mo	SA-540-CL. 6	B24	7	35

(Continued)

Table 1. C_v Impact Test Requirements (Continued)

Nominal Composition	Specification Number and Class	Grade or Type	Notes	V-Notch Average of Three Specimens
HIGH-ALLOY STEELS				
13% Cr 8 Ni-Ti	SA-193	B6	8	35
20% Cr-10 Ni	SA-453	651A	9	35
20% Cr-10 Ni	SA-453	651A	9	35
20% Cr-10 Ni	SA-453	651B	9	35
20% Cr-10 Ni	SA-453	651B	9	35
25% Ni- 15 Cr-Mo	SA-453	660	9	35
NICKEL BASE ALLOYS				
Ni-Cr-Fe-	SA-461	688	10	35
Ti-Al	SA-461	688	11	35
	SA-461	688	11	35
NICKEL-COPPER ALLOYS				
Ni-Cu-Fe-Mn	SB-165-CL.A		12	35
	SB-164-CL.B		12	35
	SB-164-CL.A		13	35
	SB-164-CL.B		13	35
	SB-164-CL.A		14	35
	SB-164-CL.A		15	35
	SB-164-CL.B		16	35
	SB-164-CL.B		16	35

NOTES:

- The following are the abbreviations used for Product Forms:
 - Wld-Welded
 - Smls-Seamless
 - FFBS-Fittings, Forgings, Bars, Shapes
- The minimum ft-lb value for one individual specimen shall be no more than 5 ft-lb less than that given for the average of three specimens.
- Impact values for carbon steel fittings shall be the same as values assigned to the material from which the fitting is made. Fittings shall be made only from materials listed in this Table.

(Continued)

Table 1. C_v Impact Test Requirements (Continued)

4. AISI 4140, 4142, 4145.
5. AISI 4142-H.
6. AISI D-4340-H.
7. AISI 4340 Mod.
8. AISI Type 416, 415 Se, 410.
9. Hot-Cold worked, stress-relief annealed.
10. Solution treated + stabilized + precipitation hardened.
11. Equalize + precipitation harden.
12. Annealed.
13. Hot-finished.
14. Cold-drawn (stress-relieved).
15. Cold-drawn (stress-equalized).
16. Cold-drawn (as drawn).

3.4 Test Requirements and Acceptance Criteria for Bolting. Bolting materials 5/8 inch or more in nominal size, including studs, nuts, and bolts shall be tested as follows.

(a) For bolting materials, including studs, nuts, and bolts, three Cv specimens shall be tested at a temperature no higher than the preload temperature* or the lowest service temperature*, whichever is less.

(b) To be acceptable, all three specimens shall break with an attendant lateral expansion of 0.025 inch minimum. In addition, specimens representing materials over 4 inches in diameter shall have an absorbed energy value of 45 ft-lb, minimum.

3.5 Number of Impact Tests Required. The number of tests required for each product form shall be as follows.

(a) Plates. One test shall be made for each plate as heat treated. Where plates are furnished in the un-heat treated condition and qualified by heat treated test specimens, one test shall be made from each plate as rolled.

(b) Tubular Products. One test shall be made to represent each lot as defined by the tensile test requirement for the individual referencing standards.

(c) Forgings and Castings. Where the weight of an individual forging or casting is less than 500 lb, one test shall be made to represent each heat in each heat treatment charge. When heat treatment is performed in continuous-type furnaces equipped with temperature controls and recording pyrometers so that complete heat treatment records are available, a heat treatment charge shall be considered as any continuous run not exceeding 8 hours duration. One test shall be made on each forging or casting weighing 500 to 10,000 lb. Larger ring or disk forgings or castings shall have two tests on each part, and the location of dropweight and Cv test specimens shall be selected so that an equal number of specimens is obtained from positions in the forgings 180 degrees apart. When a separate test piece is used, one test shall be required and the specimens shall conform to the requirements of 3.9(d)(4) or 3.9(c)(4).

(d) Bars. One test shall be made for each diameter or size of each lot (A lot is defined as one continuous operation.) not to exceed 6000 lb.

*Specified in Basis of Purchase of referencing RDT material standard.

(e) Bolting Materials. One test shall be made for each lot of material (A lot is defined as one heat of material heat treated in one charge or as one continuous operation.) not to exceed the following.

To 1-3/4 inch diameter	1500 lb
Over 1-3/4 inch to 2-1/2 inch diameter	3000 lb
Over 2-1/2 inch to 5 inch diameter	6000 lb
Over 5 inch diameter	10,000 lb

3.6 Material Test Coupons for Test Specimen Heat Treatment. Where ferritic steel products are subjected to heat treatment during manufacturing processes, the test specimens representing those products shall be heat treated in the same manner except that the total time at temperature or temperatures for the test specimens may be performed in a single cycle.

3.7 Special Test Specimen Requirements Where Normalizing or Accelerated Cooling Heat Treatments Are Employed. Test specimens representing ferritic steel products that are subjected to normalizing or accelerated cooling from the austenitizing temperature during product manufacturing processes, shall be cooled at a rate similar to and no faster than the main body of the product except in the case of certain forgings and castings (see 3.9(d)(3) and 3.9(e)(3)). The rule shall apply for specimens taken directly from the products as well as those taken from separate test coupons representing the product, and one of the general procedures described in 3.8 or one of the specific procedures described in 3.9 shall be used for each product form.

3.8 General Procedures Which Meet the Requirements of 3.7. The following general procedures may be applied to all product forms or test coupons representing the product, provided the specimens are taken relative to the surface of the product in accordance with 3.9. Further specific details of the methods to be used shall be the responsibility of the materials manufacturer.

(a) Any procedure which can be demonstrated to produce a cooling rate in the test specimen that matches the cooling rate of the main body of the product within 25°F and 20 sec at all temperatures after cooling begins may be used.

(b) If cooling rate data for the product and cooling rate control devices for the test specimens are available, the test specimens may be heated in the device to represent the product provided the provisions of (a) above are met.

(c) When any of the specific procedures described in 3.9 are used, faster cooling rates at product edges may be compensated for by:

1. Taking the test specimens at least 1 t from a quenched edge where t equals the product thickness.
2. Attaching (by the use of a partial penetration weld) a steel pad at least 1 t wide to the product edge where specimens are to be removed.
3. Using thermal barriers or insulation at the product edge where specimens are to be removed.

3.9 Specific Procedures Which Meet the Requirements of Section 3.7.

(a) Plates.

(1) The number of tension tests shall be taken in accordance with ASTM A 20, except that carbon steel plates weighing 42,000 lb and over and alloy steel plates weighing 40,000 lb and over shall require two tension test specimens, one representing the top end of the plate and one representing the bottom end of the plate.

(2) Specimens shall be taken at least $1/4$ t from a rolled surface, and 1 t from any heat treated edge, where t is the nominal thickness of the material.

(3) Where a separate test coupon is used to represent the material, it shall be of sufficient size to ensure that the cooling rate of the area where the test specimens are removed represents the cooling rate of an area at least 1 t from any edge of the product. Unless cooling rates applicable to the bulk pieces or product are simulated in accordance with 3.6(c), the dimensions of the coupon shall be not less than $3\ t \times 3\ t \times 1\ t$ where t is the nominal material thickness.

(b) Tubular Products.

(1) For wall thicknesses 2 inches and over, specimens shall be taken at least $1/4$ t from the outside surface, and no closer than one wall thickness from a heat treated end.

(2) For wall thickness less than 2 inches, the specimens shall be taken with their longitudinal axis on a surface midway between the outside and inside surfaces and no closer than one wall thickness from a heat treated end.

(c) Bars and Bolting Materials.

(1) For bars with diameters or thicknesses over 2 inches, specimens shall be at least $1/4$ t from the outside or rolled surface, and no closer than one diameter or thickness from a heat treated end, where t is either the diameter or thickness of the bar.

(2) For bars with diameters or thicknesses 2 inches or less, the specimens shall be taken with their longitudinal axes on a line representing the center of thickness and shall be no closer than one diameter or thickness from a heat treated end.

(3) For bolting, the specimens shall be taken in accordance with the applicable RDT material standard and shall be no closer than one diameter or thickness from a heat treated end.

(d) Forgings.

(1) For forgings with a maximum thickness of 2 inches, the specimens shall be taken from the midplane of the thickness or the center of the cross section and shall be at least 2 inches from any second surface.

(2) For forgings exceeding a thickness of 2 inches, the specimens shall be taken at least $1/4$ t of the maximum heat treat thickness from one surface and 1 t from a second surface. This is normally referred to as $1/4$ t x 1 t where t is the maximum heat treated thickness. A thermal buffer may be used to achieve the above conditions.

(3) For massive forgings such as contoured nozzles, thick tube sheets, vessel flanges, and other complex forgings that are contour shaped or machined to essentially the finished product configuration prior to heat treatment, the purchaser will specify the surfaces of the finished product to be subjected to high tensile stresses in service. Test specimens for these products shall be removed from prolongations or other stock provided on the product at a distance below the nearest heat treated surface equivalent at least to the greatest distance that the indicated high-tensile-stress surface will be from the nearest surface during heat treatment, and a minimum of twice this distance from a second heat treated surface, except that specimen removal shall not be nearer than $3/4$ inch to a heat treated surface and 1-1/2 inches from a second heat treated surface.

(4) With prior approval of the purchaser, test specimens for flat-ring and simple-ring forgings may be taken from a separately forged piece under the following conditions.

(a) The separate test forging shall be of the same heat of steel and shall receive substantially the same reduction and working as the production forging it represents.

(b) The separate test forging shall be heat treated in the same furnace charge and under the same conditions as the production forging.

(c) The separate test forging shall be of the same nominal thickness as the production forging. Test specimen material shall be removed from the region midway between mid-thickness and the surface shall not be nearer any heat treated edge than a distance equal to the forging thickness.

(e) Castings.

(1) The conventional ASTM separate cast test coupon meets the intent of 3.7 where normalizing or accelerated cooling heat treatments are employed on castings with a maximum thickness of 2 inches.

(2) For castings exceeding 2 inches in thickness, the specimens shall be taken from the casting (or an extension of the casting at least 1/4 t of the maximum heat treated thickness from one surface and 1 t from a second surface. A thermal buffer may be used.

(3) For massive castings that are cast or machined to essentially the finished product configuration prior to heat treatment, the purchaser will specify the surfaces of the finished product to be subjected to high tensile stresses in service. Test specimens for these products shall be removed from the prolongations or other stock provided on the product at a distance below the nearest heat treated surface equivalent at least to the greatest distance that the indicated high-tensile-stress surface will be from the nearest surface during heat treatment, and a minimum of twice this distance from a second heat treated surface, except that specimen removal shall not be nearer than 3/4 inch to a heat treated surface and 1-1/2 inches from a second heat treated surface.

(4) With prior approval of the purchaser, test specimens may be taken from a separately cast test coupon under the following conditions.

(a) The separate test coupon shall be of the same heat and shall receive substantially the same casting practices as the production casting it represents.

(b) The separate test coupon shall be heat treated in the same furnace charge and under the same conditions as the production casting unless cooling rates applicable to the bulk casting are simulated in accordance with 3.6(c).

(c) The separate test coupon shall be of the same nominal thickness as the production casting. Test specimen material shall be removed from the region midway between mid-thickness and the surface and shall not be nearer than one thickness from a second surface.

3.10 Retests.

(a) For Cv tests required by 3.3 and 3.4, one retest at the same temperature may be conducted provided:

1. The average values of the test results meet the minimum requirements.
2. Not more than one specimen per test is below the minimum requirements.
3. The specimen not meeting the minimum requirements is not lower than 10 ft-lb or 0.005 inch below the specified requirements.

(b) A retest consists of two additional specimens taken as near as practicable to the failed specimens. For acceptance of the retest, both specimens shall meet the minimum requirements.

3.11 Reports. Reports of Cv and dropweight tests shall include the following in addition to other reporting requirements of ASME SA-370 and ASTM E 208 for Cv and dropweight tests respectively.

(a) For all tests, sketches showing location and orientation of specimens relative to parent metal surfaces and rolling, forging or forming directions.

(b) For Cv tests, sketches showing orientation of notches relative to specimen orientation description required by (a) above.

(c) For Cv tests, the test temperature, lateral expansion, absorbed energy, and percent shear fracture shall be entered on the material manufacturer's certified test report.

3.12 Cv Impact Transition Curve. When specifically required by a referencing standard or Ordering Data, the Cv impact transition curve shall be furnished in accordance with Section 4.

4. CHARPY V-NOTCH IMPACT TRANSITION CURVE

4.1 Test Specimens. Sufficient Charpy V-notch impact specimens shall be taken from the test material, subsequent to all heat treatments, to establish a temperature-impact energy transition curve. The location of the specimens shall be as specified in 3.2.

4.2 Test Temperature Range. The test temperature range shall be wide enough to establish the upper and lower shelf foot-pound energies, with sufficient testing at intermediate temperatures to permit plotting a reasonably smooth curve. The absorbed energy values, the test temperatures, the lateral expansion in inches and the percent ductile fracture area for each specimen shall be reported.

4.3 Reports. Reports required by 3.10 for Charpy V-notch tests shall be furnished.

5. NONDESTRUCTIVE EXAMINATION REQUIREMENTS

Unless otherwise specified in the applicable subdivision of this standard or the referencing standard, acceptance examination shall be performed on the material in the final surface and heat treated condition. N

5.1 Materials.

5.1.1 Plate, Sheet, and Strip. When specified, the following examinations apply.

(a) Ultrasonic Examination, Straight Beam. Plates in all thicknesses shall be ultrasonically examined in accordance with RDT F 3-6, T-521.1. Equipment shall be calibrated at Level L-2 for thicknesses 1 inch through 3 inches, and L-4 for thicknesses greater than 3 inches. C

Acceptance Criteria. The following indications or conditions are unacceptable:

(1) For thicknesses 1 inch and over, any indication with amplitude equal to or greater than the signal from the reference hole or distance-amplitude correction curve.

(2) For all thicknesses, any condition which causes 90 percent loss of back reflection.

(b) Ultrasonic Examination, Angle Beam. Plates 2 inches or less in thickness shall be ultrasonically examined in accordance with the requirements of RDT F 3-6, T-521.2. C

Acceptance Criteria. The following are unacceptable:

(1) Any indication with an amplitude equal to or greater than that produced by the reference notch.

(c) Magnetic Particle Examination. Magnetic particle examination shall be performed in accordance with RDT F 3-6, T-710. C

Acceptance Criteria.

(1) For materials less than 3/16 inch thick, the following relevant indications are unacceptable:

a. Any cracks.

b. Linear indications.

c. Rounded indications with dimensions exceeding 1/32 inch. Rounded indications separated by 1/16 inch or less edge to edge shall be evaluated as a single indication.

d. Rounded indications separated by less than the larger of 4T or 1/2 inch.

e. Ten or more indications in any 6 square inches of surface with the major dimension of this area not to exceed 6 inches with the area taken in the most unfavorable location relative to the indications being evaluated.

(2) For materials 3/16 inch thick and greater, the following relevant indications are unacceptable (only indications with major dimensions greater than 1/16 inch are considered relevant):

a. Indications with dimensions greater than 1/16 inch for material less than 5/8 inch thick.

b. Indications with dimensions greater than 1/8 inch for material 5/8 inch thick and greater.

c. Four or more indications in a line separated by 1/16 inch or less edge to edge.

d. Ten or more indications in any 6 square inches of surface with the major dimension of this area not to exceed 6 inches with the area taken in the most unfavorable location relative to the indications being evaluated.

(d) Liquid Penetrant Examination. Liquid penetrant examination shall be performed in accordance with RDT F 3-6, T-610. C

Acceptance Criteria.

(1) For materials less than 3/16 inch thick, the following indications are unacceptable:

- a. Any cracks.
- b. Linear indications.
- c. Rounded indications with dimensions exceeding 1/32 inch. Rounded indications separated by 1/16 inch or less edge to edge shall be evaluated as a single indication.
- d. Rounded indications separated by less than the larger of 4T or 1/2 inch.
- e. Ten or more indications in any 6 square inches of surface with the major dimension of this area not to exceed 6 inches with the area taken in the most unfavorable location relative to the indications being evaluated.

(2) For materials 3/16 inch thick and greater, the following relevant indications are unacceptable (only indications with major dimensions greater than 1/16 inch are considered relevant):

- a. Indications with dimensions greater than 1/16 inch for material less than 5/8 inch thick.
- b. Indications with dimensions greater than 1/8 inch for material 5/8 inch thick and greater.
- c. Four or more indications in a line separated by 1/16 inch or less edge to edge.
- d. Ten or more indications in any 6 square inches of surface with the major dimension of this area not to exceed 6 inches with the area taken in the most unfavorable location relative to the indications being evaluated.

5.1.2 Forgings and Bars. When specified by a referencing standard, the requirements of (a) apply for ultrasonic examination, (b) or (c), as appropriate, for magnetic particle or liquid penetrant examination, and (d) for radiography (where permitted by the referencing material standard in lieu of ultrasound). E

(a) Ultrasonic Examination. Forgings and bars shall be ultrasonically examined in accordance with RDT F 3-6, T-522. For longitudinal wave examination equipment shall be calibrated at Level L-2 for thicknesses 1 inch through 3 inches, and Level L-4 for thicknesses greater than 3 inches. C

Acceptance Criteria. The following indications or conditions are unacceptable:

(1) For longitudinal wave examination of material thickness 1 inch and over, any indication with an amplitude equal to or greater than the amplitude of the signal from the reference hole or distance-amplitude correction curve.

(2) For longitudinal wave examination of all material thicknesses, any condition which causes 90 percent loss of back reflection.

(3) For angle beam examination, any indication with an amplitude equal to or greater than that produced by the reference notch.

(b) Magnetic Particle Examination. Magnetic particle examination shall be performed in accordance with RDT F 3-6, T-710. C

Acceptance Criteria.

(1) For materials less than 3/16 inch thick, the following indications are unacceptable:

- a. Any cracks.
- b. Linear indications.
- c. Rounded indications with dimensions exceeding 1/32 inch. Rounded indications separated by 1/16 inch or less edge to edge shall be evaluated as a single indication.
- d. Rounded indications separated by less than the larger of 4T or 1/2 inch.
- e. Ten or more indications in any 6 square inches of surface with the major dimension of this area not to exceed 6 inches with the area taken in the most unfavorable location relative to the indications being evaluated.

(2) For materials 3/16 inch thick and greater, the following relevant indications are unacceptable (only indications with major dimensions greater than 1/16 inch are considered relevant):

- a. Indications with dimensions greater than 1/16 inch for material less than 5/8 inch thick.

b. Indications with dimensions greater than 1/8 inch for material 5/8 inch thick and greater.

c. Four or more indications in a line separated by 1/16 inch or less edge to edge.

d. Ten or more indications in any 6 square inches of surface with the major dimension of this area not to exceed 6 inches with the area taken in the most unfavorable location relative to the indications being evaluated.

(c) Liquid Penetrant Examination. Liquid penetrant examination shall be performed in accordance with RDT F 3-6, T-610. C

Acceptance Criteria.

(1) For materials less than 3/16 inch thick, the following indications are unacceptable:

a. Any cracks.

b. Linear indications.

c. Rounded indications with dimensions exceeding 1/32 inch. Rounded indications separated by 1/16 inch or less edge to edge shall be evaluated as a single indication.

d. Rounded indications separated by less than the larger of 4T or 1/2 inch.

e. Ten or more indications in any 6 square inches of surface with the major dimension of this area not to exceed 6 inches with the area taken in the most unfavorable location relative to the indications being evaluated.

(2) For materials 3/16 inch thick and greater, the following relevant indications are unacceptable (only indications with major dimensions greater than 1/16 inch are considered relevant):

a. Indications with dimensions greater than 1/16 inch for material less than 5/8 inch thick.

b. Indications with dimensions greater than 1/8 inch for material 5/8 inch thick and greater.

c. Four or more indications in a line separated by 1/16 inch or less edge to edge.

d. Ten or more indications in any 6 square inches of surface with the major dimension of this area not to exceed 6 inches with the area taken in the most unfavorable location relative to the indications being evaluated.

(d) Radiographic Examination. Radiographic examination of forgings shall be performed in accordance with the requirements for radiographic examination of castings specified in 5.1.6(a).

Acceptance criteria shall meet requirements for welds specified in 5.2.1.

5.1.3 Bolts, Studs, and Nuts. When specified by a referencing standard, (a) and (b) apply for ultrasonic examination, and (c) or (d) as appropriate, apply for magnetic particle and liquid penetrant examination. E

(a) Ultrasonic Examination, Straight, and Angle Beam Scan. Bolts, studs, and nuts 5/8 inch or greater in nominal diameter shall be ultrasonically examined in accordance with requirements of RDT F 3-6, T-525, after final heat treatment and prior to threading where threading is involved. C

Acceptance Criteria.

(1) Radial Scan. Any part containing a discontinuity which causes an indication in excess of 20 percent of the height of the first back reflection as established during calibration or any condition which causes loss of back reflection equal to 50 percent of the calibration amplitude is unacceptable.

(2) Angle Beam Scan. Any part containing a discontinuity which causes an indication with an amplitude equal to or greater than that produced by the reference notch during calibration is unacceptable.

(b) Ultrasonic Examination, Straight Beam, End Scan. All bolts, studs, and nuts over 1 inch nominal diameter shall be ultrasonically examined from each end surface for 100 percent of their volume in accordance with the requirements of RDT F 3-6, 7.2.2.2, of T-525. Such examination shall be performed after heat treatment and, where feasible, before threading where threading is involved. C

Acceptance Criteria. For end scan examination, any discontinuity which causes an indication equal to or greater than that produced by the calibration hole in the reference specimen as corrected by the distance-amplitude curve is unacceptable.

(c) Magnetic Particle Examination. Magnetic particle examination shall be performed in accordance with RDT F 3-6, T-710. Such examination shall be made after final heat treatment in the finished component after threading where threading is involved. C

Acceptance Criteria. The following indications are unacceptable (only those indications with major dimensions greater than 1/64 inch are considered relevant for item (5)):

(1) Any cracks.

(2) Any laps or seams.

(3) Any linear non-axial indication.

(4) Any linear indication axially oriented with dimension exceeding 10 percent of the nominal bolt diameter of 1/8 inch, whichever is smaller.

(5) Rounded indications with dimensions exceeding 5 percent of the nominal bolt diameter or 1/8 inch, whichever is smaller.

(6) Four or more indications in a line separated by 1/16 inch or less edge to edge.

(7) Aligned indications in which the average of the center to center distance between any one indication and the two adjacent indications in a straight line is less than 3/16 inch.

(d) Liquid Penetrant Examination. Liquid penetrant examination shall be performed in accordance with RDT F 3-6, T-610. Such examination shall be made after final heat treatment in the finished component after threading where threading is involved. C

Acceptance Criteria. The following indications are unacceptable (only those indications with major dimensions greater than 1/64 inch are considered relevant for item (5)):

(1) Any cracks.

(2) Any laps or seam.

(3) Any linear non-axial indication.

(4) Any linear indication axially oriented with dimension exceeding 10 percent of the nominal bolt diameter or 1/8 inch, whichever is smaller.

(5) Rounded indications with dimensions exceeding 5 percent of the nominal bolt diameter or 1/8 inch, whichever is smaller.

(6) Four or more indications in a line separated by 1/16 inch or less edge to edge.

(7) Aligned indications in which the average of the center to center distance between any one indication and the two adjacent indications in a straight line is less than 3/16 inch.

5.1.4. Nuts. When specified by a referencing standard, the requirements of (a) apply for ultrasonic examination, and (b) or (c), as appropriate, for magnetic particle or liquid penetrant examination of starting materials for nuts.

(a) Ultrasonic Examination. The starting material for nuts (such as forgings or bars) shall be ultrasonically examined in accordance with the requirements of RDT F 3-6, T-522. C

For longitudinal wave examination, equipment shall be calibrated at Level L-2 for thicknesses 1 inch through 3 inches, and Level L-4 for thicknesses greater than 3 inches.

Acceptance Criteria. The following indications or conditions are unacceptable:

(1) For longitudinal wave examination of material thicknesses 1 inch and over, any indication with an amplitude equal to or greater than the amplitude of the signal from the reference hole or distance-amplitude correction curve.

(2) For longitudinal wave examination of all material thicknesses, any condition which causes 90 percent loss of back reflection.

(3) For angle beam examination, any indication with an amplitude equal to or greater than that produced by the reference notch.

(b) Magnetic Particle Examination. When required by a referencing standard, magnetic particle examination shall be performed in accordance with RDT F 3-6, T-710.

C
D

Acceptance Criteria. The following indications are unacceptable (only those indications with major dimensions greater than 1/64 inch are considered relevant for item (3)):

(1) Any cracks.

(2) Any laps, seams or linear indications.

(3) Rounded indications with dimensions exceeding 10 percent of the nominal radial section thickness for the bolt size or 1/8 inch, whichever is smaller.

(4) Four or more rounded indications in a line separated by 1/16 inch or less edge to edge.

(5) Aligned indications in which the average of the center to center distance between any one indication and the two adjacent indications in a straight line is less than 3/16 inch.

(c) Liquid Penetrant Examination. When required by a referencing standard, liquid penetrant examination shall be performed in accordance with RDT F 3-6, T-610.

C

Acceptance Criteria. The following indications are unacceptable (only those indications with major dimensions greater than 1/64 inch are considered relevant for item (3)):

(1) Any cracks.

(2) Any laps, seams or linear indications.

(3) Rounded indications with dimensions exceeding 10 percent of the nominal radial section thickness for the bolt size or 1/8 inch, whichever is smaller.

(4) Four or more rounded indications in a line separated by 1/16 inch or less edge to edge.

(5) Aligned indications in which the average of the center to center distance between any one indication and the two adjacent indications in a straight line is less than 3/16 inch.

5.1.5 Tubular Products. When required by a referencing standard, (a)(1) applies for ultrasonic examination. When specifically required as an invoked option, (a)(2) applies for ultrasonic, (b) or (c), as appropriate, applies for magnetic particle or liquid penetrant, and (d) applies for eddy current examination. E

(a) Ultrasonic Examination.

(1) Materials shall be ultrasonically examined in accordance with the requirements of RDT F 3-6, T-523, without application of the optional provision for transverse notches. Calibration Level S-2 shall be employed. C

(2) Materials shall be ultrasonically examined in accordance with the requirements of RDT F 3-6, T-523, including the optional provision for transverse notches. Calibration Level S-4 shall be employed for both longitudinal and transverse notches except that the transverse notch shall have a maximum length of 1/8 inch. C

Acceptance Criteria. Any indication with an amplitude equal to or greater than that produced by the reference notch is unacceptable.

(b) Magnetic Particle Examination. Magnetic particle examination shall be performed in accordance with RDT F 3-6, T-710. C

Acceptance Criteria.

(1) For materials less than 3/16 inch thick, the following indications are unacceptable:

- a. Any cracks.
- b. Linear indications.
- c. Rounded indications with dimensions exceeding 1/32 inch. Rounded indications separated by 1/16 inch or less edge to edge shall be evaluated as a single indication.
- d. Rounded indications separated by less than the larger of 4T or 1/2 inch.
- e. Ten or more indications in any 6 square inches of surface with the major dimension of this area not to exceed 6 inches with the area taken in the most unfavorable location relative to the indications being evaluated.

(2) For materials 3/16 inch thick and greater, the following relevant indications are unacceptable (only indications with major dimensions greater than 1/16 inch are considered relevant):

a. Indications with dimensions greater than 1/16 inch for material less than 5/8 inch thick.

b. Indications with dimensions greater than 1/8 inch for material 5/8 inch thick and greater.

c. Four or more indications in a line separated by 1/16 inch or less edge to edge.

d. Ten or more indications in any 6 square inches of surface with the major dimension of this area not to exceed 6 inches with the area taken in the most unfavorable location relative to the indications being evaluated.

(c) Liquid Penetrant Examination. Liquid penetrant examination shall be performed in accordance with RDT F 3-6, T-610. C

Acceptance Criteria.

(1) For materials less than 3/16 inch thick, the following indications are unacceptable except that for heat exchanger tubing no indications are permissible:

a. Any cracks.

b. Linear indications.

c. Rounded indications with dimensions exceeding 1/32 inch. Rounded indications separated by 1/16 inch or less edge to edge shall be evaluated as a single indication.

d. Rounded indications separated by less than the larger of 4T or 1/2 inch.

e. Ten or more indications in any 6 square inches of surface with the major dimension of this area not to exceed 6 inches with the area taken in the most unfavorable location relative to the indications being evaluated.

(2) For materials 3/16 inch thick and greater, the following relevant indications are unacceptable. (Only those indications with major dimensions greater than 1/16 inch are considered relevant.) For heat exchanger tubing, no indications are permissible.

a. Indications with dimensions greater than 1/16 inch for material less than 5/8 inch thick.

b. Indications with dimensions greater than 1/8 inch for material 5/8 inch thick and greater.

c. Four or more indications in a line separated by 1/16 inch or less edge to edge.

d. Ten or more indications in any 6 square inches of surface with the major dimension of this area not to exceed 6 inches with the area taken in the most unfavorable location relative to the indications being evaluated.

(3) For examination of the internal surfaces of tubes, the examination shall be performed on specimens from tube lots as provided in 5.1.5(c)(3)a. All indications shall be explored for depth by grinding filing, or machining and reexamined to confirm removal of the source of indications. If shot, grit, or vapor blasting has been approved by the purchaser and employed internally in tube processing, the surfaces to be liquid penetrant examined shall be prepared by machining, grinding, or pickling (see T-641 of RDT F 3-6).

a. Procedure for Internal Surface Examination. Five percent of the tubes in each lot shall be selected at random. A piece not less than 12 inches long shall be cut from one end only of each selected tube, sectioned longitudinally and liquid penetrant examined as described above. If all 12-inch sections are acceptable (see 5.1.5(c)(3)b for acceptance criteria), the remainder of the tube represented by the worst 12-inch sample in each lot shall be sectioned longitudinally and inspected in the same way as the 12-inch sample. For a lot of 20 tubes or less, one tube shall be sectioned longitudinally and inspected.

b. Acceptance Criteria. When the removal of any indication reduces the wall thickness locally by 0.004 inch or more, the entire lot of tubes represented by any of the sectioned 12-inch lengths or by the sectioned full-length tube, shall be rejected.

(d) Eddy Current Examination. Eddy current examination shall be performed in accordance with RDT F 3-6, T-810.1 or T-810.2 as appropriate for the type of material involved.

Acceptance Criteria. Any indication with an amplitude equal to or greater than that produced by the reference standard is unacceptable.

5.1.6 Castings. When specified by a referencing standard, the following examinations apply:

(a) Radiographic Examination. Radiographic examination shall be performed in accordance with the requirements of RDT F 3-6, Article 2. C

Radiography shall be performed on a finished casting after heat treatment and machining, or on a casting after heat treatment prior to finish machining at the following limiting thicknesses:

(1) Within 20 percent of finished thickness for thicknesses less than 2 inches.

(2) Within 15 percent of finished thickness for thicknesses between 2 inches and 6 inches inclusive.

(3) Within 10 percent of finished thickness for thicknesses greater than 6 inches.

The thickness of the penetrameter used shall be based on the final thickness, except that where casting practices for pump and valves for flange sections require thickness to exceed the finish-machined thickness limits of (1), (2), and (3) above, radiography of the as-cast thickness is acceptable provided the acceptance reference radiographs of the next lesser thickness are met in those areas; e.g., if the section being radiographed exceeds 4 1/2 inches, ASTM E 186 reference radiographs shall be used. The penetrameter shall be based on the thickness of the section being radiographed.

Acceptance Criteria.

(1) For casting sections to 2 inches in thickness, the requirements of ASTM E 71 shall apply. Severity Level 2 shall govern for discontinuity Types A and B and Severity Level 1 for discontinuity Type C. Discontinuity Types D, E, F, or G, are unacceptable.

(2) For casting sections 2 to 4 1/2 inches in thickness, the requirements of ASTM E 186 shall apply. Severity Level 2 shall govern for Categories A and B, and Severity Level 1 for Category C. Discontinuity of Categories D and E are unacceptable.

(3) For casting sections 4 1/2 inches and over in thickness, the requirements of ASTM E 280 shall apply. Severity Level 2 shall govern for Categories A and B, and Severity Level 1 for Category C. Discontinuities of Categories D and E are unacceptable.

In addition to the above, the following indications are also unacceptable:

(1) Any indication which is larger than 50 percent of the thickness of the section in which it is located.

(2) In sections specifically designated as critical by the purchaser, sand spots and inclusions which exceed size and distribution of defects shown in Plate A1 of ASTM E 71.

(b) Ultrasonic Examination. For ferritic castings, ultrasonic examination shall be performed in accordance with the requirements of RDT F 3-6, T-524. C

Acceptance Criteria. The quality levels of ASME SA-609 shall apply for casting thickness indicated:

(1) Quality Level 1 for thicknesses up to 2 inches.

(2) Quality Level 3 for thicknesses 2 to 4 inches.

(3) Quality Level 4 for thicknesses greater than 4 inches.

In addition to the quality level requirements stated in (1), (2), and (3) above, the requirements in (4) through (8) below shall apply for both straight beam and angle beam examination.

(4) Areas giving indications exceeding the Amplitude Reference Line with any dimensions longer than those specified in the following tabulation are unacceptable:

TABLE 1
Unacceptable Indications

<u>Ultrasonic Examination Quality Level</u>	<u>Longest Dimension of Area (inches)</u>
1	1.5
2	2.0
3	2.5
4	3.0

(5) Quality Level 1 shall apply for the volume of castings within 1 inch of the surface regardless of the overall thickness.

(6) Discontinuities indicated to have a change in depth equal to or greater than one-half the wall thickness or 1 inch, whichever is less, are unacceptable.

(7) Two or more indications in the same plane with amplitudes exceeding the Amplitude Reference Line and separated by a distance less than the longest dimension of the larger of the adjacent indications are unacceptable if they cannot be encompassed within an area less than that of the quality level specified in (1).

(8) Two or more indications greater than permitted for Quality Level 1 for castings less than 2 inches in thickness, greater than permitted for Quality Level 2 for thickness 2 inches through 4 inches, and greater than permitted for Level 3 for thickness greater than 4 inches, separated by a distance less than the longest dimension of the largest of the adjacent indications are unacceptable, if they cannot be encompassed in an area less than that of the quality level requirements stated in (1), (2), and (3).

Notes:

1. The areas for the Ultrasonic Quality Levels in ASME SA-609 refer to the surface area on the casting over which a continuous indication exceeding the transfer-corrected distance-amplitude curve is maintained.
2. Areas are to be measured from dimensions of the movement of the search unit, using the center of the search unit as the reference point.
3. In certain castings, because of very long metal patch distances or curvature of the examination surfaces, the surface area over which a given discontinuity is detected may be considerably larger or smaller than the actual area of the discontinuity in the casting. In such cases, other criteria which incorporate a consideration of beam angles or beam spread must be used for realistic evaluation of the discontinuity.

(c) Magnetic Particle Examination. Magnetic particle examination shall be performed in accordance with RDT F 3-5, T-710. C

Acceptance Criteria.

(1) For materials less than 3/16 inch thick, the following indications are unacceptable:

- a. Any cracks.
- b. Linear indications
- c. Rounded indications with dimensions exceeding 1/32 inch. Rounded indications separated by 1/16 inch or less edge to edge shall be evaluated as a single indication.
- d. Rounded indications separated by less than the larger of 4T or 1/2 inch.
- e. Ten or more indications in any 6 square inches of surface with the major dimension of this area not to exceed 6 inches with the area taken in the most unfavorable location relative to the indications being evaluated.

(2) For materials 3/16 inch thick and greater, the following relevant indications are unacceptable (only indications with major dimensions greater than 1/16 inch are considered relevant):

- a. Indications with dimensions greater than 1/16 inch for material less than 5/8 inch thick.
- b. Linear indications with dimensions greater than 1/8 inch and rounded indications with dimensions greater than 3/16 inch for material 5/8 inch thick and greater.
- c. Four or more indications in a line separated by 1/16 inch or less edge to edge.
- d. Ten or more indications in any 6 square inches of surface with the major dimension of this area not to exceed 6 inches with the area taken in the most unfavorable location relative to the indication being evaluated.

(d) Liquid Penetrant Examination. Liquid penetrant examination shall be performed in accordance with RDT F 3-6, T-610.

C

Acceptance Criteria.

(1) For materials less than 3/16 inch thick, the following indications are unacceptable:

- a. Any cracks.
- b. Linear indications.
- c. Rounded indications with dimensions exceeding 1/32 inch. Rounded indications separated by 1/16 inch or less edge to edge shall be evaluated as a single indication.
- d. Rounded indications separated by less than the larger of 4T or 1/2 inch.
- e. Ten or more indications in any 6 square inches of surface with the major dimensions of this area not to exceed 6 inches with the area taken in the most unfavorable location relative to the indications being evaluated.

(2) For materials 3/16 inch thick and greater, the following relevant indications are unacceptable (only indications with major dimensions greater than 1/16 inch are considered relevant):

- a. Indications with dimensions greater than 1/16 inch for material less than 5/8 inch thick.
- b. Linear indications with dimensions greater than 1/8 inch and rounded indications greater than 3/16 inch for material 5/8 inch thick and greater.
- c. Four or more indications in a line separated by 1/16 inch less edge to edge.
- d. Ten or more indications in any 6 square inches of surface with the major dimension of this area not to exceed 6 inches with the area taken in the most unfavorable location relative to the indication being evaluated.

5.2 Welds and Weld-Clad Plate.

5.2.1 Conventional Weld Joint Types. When specified by the referencing standard, the following examinations apply:

(a) Radiographic Examination. Radiography shall be performed in accordance with RDT F 3-6, Article 2.

C

Acceptance Criteria. Unacceptable welds are those which have:

- penetration.
- (1) Any type of crack or zone of incomplete fusion or
- greater than:
- (2) Any other elongated indication which has a length
- (a) 1/4 inch for t up to 3/4 inch, inclusive;
- (b) 1/3t for t from 3/4 inch to 2 1/4 inch, inclusive;
- (c) 3/4 inch for t over 2 1/4 inch

where t is the thickness of the thinner portion of the weld;

- (3) Any group of indications in line that have an aggregate length greater than t in a length of 12t except where the distance between the successive indication exceeds 6L, where L is the longest indication in the group.

- (4) Porosity in excess of that shown as acceptable in Appendix VI, Section III of the Code.

(b) Magnetic Particle Examination. Magnetic particle examination shall be performed in accordance with RDT F 3-6, T-710.

Acceptance Criteria. The following relevant indications are unacceptable (only those indications with major dimensions greater than 1/64 inch are considered relevant for item (3)):

- (1) Any Cracks.
- (2) Any Linear indications.
- (3) Rounded indications with dimensions exceeding 10 percent of the nominal weld thickness or 1/8 inch, whichever is smaller. Rounded indications separated by 1/16 inch or less edge to edge shall be evaluated as a single indication.
- (4) Four or more rounded indications in a line separated by 1/16 inch or less edge to edge.
- (5) Six or more indications in any 6 square inches of surface with the major dimension of this area not to exceed 6 inches with the area taken in the most unfavorable location relative to the indications being evaluated.

(6) Aligned indications in which the average of the center to center distance between any one indication and the two adjacent indications in a straight line is less than 3/16 inch.

(c) Liquid Penetrant Examination. Liquid penetrant examination shall be performed in accordance with RDT F 3-6, T-610. C

Acceptance Criteria. The following relevant indications are unacceptable (only those indications with major dimensions greater than 1/64 inch are considered relevant for item (3)):

(1) Any cracks.

(2) Any linear indications.

(3) Rounded indications with dimensions exceeding 10 percent of the nominal weld thickness or 1/8 inch, whichever is smaller. Rounded indications separated by 1/16 inch or less edge to edge shall be evaluated as a single indication.

(4) Four or more rounded indications in a line separated by 1/16 inch or less edge to edge.

(5) Six or more indications in any 6 square inches of surface with the major dimension of this area not to exceed 6 inches with the area taken in the most unfavorable location relative to the indications being evaluated.

(6) Aligned indications in which the average of the center to center distance between any one indication and the two adjacent indications in a straight line is less than 3/16 inch.

5.2.2 Seal Welds. When specified by a referencing standard, the following examinations apply:

(a) Magnetic Particle Examination. Magnetic particle examination shall be performed on each layer of all seal welds in accordance with RDT F 3-6, Article 7. C

Acceptance Criteria. The following indications are unacceptable:

(1) Any cracks.

(2) Any linear indications.

(3) Rounded indications with dimensions exceeding 1/64 inch.

(4) Any rounded indications separated by 1/4 inch or less edge to edge.

(5) Five or more indications in any 6 square inches of surface with the major dimension of this area not to exceed 6 inches with the area taken in the most unfavorable location relative to the indications being evaluated.

(b) Liquid Penetrant Examination. Liquid penetrant examination shall be performed on each layer of all seal welds in accordance with RDT F 3-6, Article 6. C

Acceptance Criteria. The following relevant indications are unacceptable:

- (1) Any cracks.
- (2) Any linear indications.
- (3) Rounded indications with dimensions exceeding 1/64 inch.
- (4) Any rounded indications separated by 1/4 inch or less edge to edge.

(5) Five or more indications in any 6 square inches of surface with the major dimensions of this area not to exceed 6 inches with the area taken in the most unfavorable location relative to the indications being evaluated.

5.2.3 Weld-Clad Plate. When specified by a referencing standard, the following examinations apply:

(a) Liquid Penetrant Examination. Liquid penetrant examination shall be performed in accordance with RDT F 3-6, Article 6. C

Acceptance Criteria. The following are unacceptable (only those indications with major dimensions greater than 1/64 inch are considered relevant for item (3)):

- (1) Any cracks.
- (2) Any linear indications.
- (3) Rounded indications with dimensions exceeding 1/8 inch. Rounded indications separated by 1/16 inch or less edge to edge shall be evaluated as a single indication.
- (4) Four or more rounded indications in a line separated by 1/16 inch or less edge to edge.

(5) Six or more indications in any 6 square inches of surface with the major dimensions of this area not to exceed 6 inches with areas taken in the most unfavorable location relative to the indications being evaluated.

(6) Aligned indications in which the average of the center to center distance between any one indication and the two adjacent indications in a straight line is less than 3/16 inch.

(b) Ultrasonic Examination. Ultrasonic examination shall be performed in accordance with RDT F 3-6, T-540. C

Acceptance Criteria. Portions of cladding shown by ultrasonic examination to have any of the following discontinuities shall be unacceptable unless repaired in accordance with RDT F 6-10.

(1) Any lack of bond giving indications equal to or greater than the indication from the 1/2 inch diameter flat bottom hole.

(2) Any lack of bond giving indications equal to or greater than the indication from the 1/4 inch diameter flat bottom hole but less than the indication from the 1/2 inch diameter flat bottom hole, separated by less than 6 inches of acceptable cladding.

(3) Any lack of bond giving indications of any magnitude that are continuous during 1 inch of linear movement of the crystal.

6. HIGH NEUTRON FIELD APPLICATIONS

Ferritic materials intended for service in 10^{18} nvt, or greater (E_n of 1 Mev or above) shall meet the requirements of Sections 4, 7, 8, and 10.

7. STEEL MANUFACTURING PROCESS

The steel shall be made by the basic electric furnace process. The molten steel shall be vacuum treated prior to or during the pouring of the ingot in order to remove objectionable gases, particularly hydrogens.

8. PHOSPHORUS, SULFUR, AND COPPER LIMITATIONS

For ladle analysis, the phosphorus content shall be 0.012 percent maximum, the sulfur content shall be 0.015 percent maximum, and the copper content shall be 0.10 percent maximum. For check analysis, phosphorus and sulfur shall not exceed 0.015 and 0.018 percent respectively, and copper shall not exceed 0.10 percent.

9. COBALT CONTENT LIMITATIONS

The cobalt content as determined by check analysis performed on each heat of material shall be 0.10 percent maximum.

10. GRAIN SIZE

The McQuaid Ehn grain size of the material determined in accordance with ASTM E 122 shall be Number 5 or finer.

11. EXTRA LOW CARBON GRADES, AUSTENITIC STAINLESS STEEL

11.1 Carbon Content. The carbon content as determined by ladle and check analysis for the applicable type or grade of austenitic stainless steel covered by the referencing standard, shall be 0.030 percent maximum. In all other respects the requirements for the type or grade whose carbon content is to be limited shall apply as provided by the referencing standard.

11.2 Boiling Nitric Acid Test. The following applies where the boiling nitric acid test, Practice C, ASTM A 262 is specified by the purchaser:

Duplicate specimens shall be taken from the material on the same frequency basis required for check analysis in the referencing standard, unless another frequency is specified by the purchaser. Specimens shall be prepared as required, sensitized by heating to 1250°F with one hour hold at temperature, and water quenched. The average corrosion rate for each specimen shall not exceed 0.0020 inch per month for the full five periods. Corrosion rates shall be reported for each period, together with the average rate for five periods for both specimens.

12. WELDING MATERIALS QUALIFICATION REQUIREMENTS

When specified, the following tests shall be performed and results conform to requirements indicated.

12.1 Chemical Analysis. Chemical analyses of welding materials shall be performed as follows.

a. Analysis of each lot¹ of bare electrodes, rod, or wire for use in gas metal arc welding or gas tungsten arc welding shall be made from all-weld-metal deposits or from the material itself.

b. An analysis of each lot² of covered, flux-cored, or fabrication electrodes shall be made from all-weld-metal deposits.

¹ A lot of bare electrodes, rod, or wire is the quantity (in pounds) of a material of a given size made from a single melt of metal.

² A lot of covered, flux-cored or fabricated electrodes is the quantity (in pounds) of electrodes of a given size made from the same combination of melt of metal and dry blend of dry batch of flux or core materials.

c. An analysis of each lot¹ of bare wire or other form of filler metal to be used in conjunction with a flux shall be conducted on material from all-weld-metal deposits made using the lot¹ of filler metal and lot² of submerged arc flux to be used together in production welding.

d. One consumable insert of each size from each melt (heat) shall be analyzed. Analyses shall be made for all elements listed in Table 2 and any additional elements specified in the welding procedure or purchase order. Acceptance criteria shall be based on results for those elements specified in the welding procedure or purchase order. Results for other elements shall be for information only.

Table 2. Welding Material Chemical Analysis

Material	Elements
Carbon and Low Alloy Materials	C, Cr, Mo, Ni, Mn, Si, P, S, V, Cu
Chromium and Chromium-Nickel	C, Cr, Mo, Ni, Mn, Si, P, S, V,
Stainless Materials	Cb + Ta, Ti, Cu
Nickel and Nickel Alloy Materials	C, Cr, Mo, Ni, Mn, Si, S, Cb + Ta, Cu, Fe, Co

e. The results of the analyses for a, b, and c shall conform to the requirements of the applicable RDT material standard for the material type or classification.

f. Tests that have been performed by the user of the welding material in conformance with the requirements of NB-2410 and which meet the requirements of this section in all respects need not be repeated.

12.2 Mechanical Property Tests. Tensile and impact tests shall be made of welding materials used for welding P-number (see Section IX of the Code) 1, 3, 4, 5, 6, 7, 9, and 11 base materials in accordance with either 12.2.1 or 12.2.2 as specified in the referencing RDT standard.

¹ A lot of bare electrodes, rod, or wire is the quantity (in pounds) of a material of a given size made from a single melt of metal.

² A lot of submerged arc flux is defined as the quantity of flux produced from the same combination of raw materials under one production schedule.

12.2.1 General Test Requirements. The welding test coupon shall be made as follows using each process with which the weld material will be used in production welding.

a. Test coupons shall be of sufficient size and thickness such that the test specimens required herein can be removed.

b. The weld metal to be tested shall be deposited in such a manner as to subsequently eliminate the influence of the base material on the results of the tests.

c. The welding of the test coupon shall conform to the applicable (purchaser furnished) welding procedure specification for production welding relative to preheat and interpass temperatures. Coupons shall be tested in the as-welded condition, or, where indicated by the welding procedure specification, they shall be postweld heat treated to the specified temperature. The postweld heat treatment holding time shall be at least 80 percent of the maximum time to be applied to the weld metal in production application. The total time for postweld heat treatment of the test coupon may be applied in one heating cycle. The cooling rate from the postweld heat treatment temperature shall be of the same order as that applicable to the weld metal in the component.

d. Regardless of the welding process or welding material being tested, the tensile specimens, and the Cv test specimens where required, shall be located and prepared in accordance with the requirements of ASME SFA-5.1. Dropweight impact test specimens shall be located and prepared in accordance with 3.1.1.

e. One all-weld-metal tensile specimen shall be tested and shall meet the tensile strength requirements of the base material specification. Where base materials of different specifications are to be welded, the tensile strength results shall conform to either of the base material specifications.

f. Impact specimens of the weld metal shall conform to the requirements for the base metals they will be used with as specified in Basis of Purchase of the referencing RDT material standard (see 3.3.1).

12.2.2 Standard Test Requirements. When specified in the referencing RDT standard, tensile and impact tests shall be made in accordance with the following.

a. Testing to the requirements of this paragraph shall be limited to electrode classifications included in ASME SFA-5.1 or SFA-5.5.

b. The test assembly required by ASME SFA-5.1 or SFA-5.5, as applicable, shall be used for test coupon preparation except that it shall be increased in size to obtain the number of Cv specimens and the dropweight test specimens required by 3.1.1.

c. The welding of the test coupon shall conform to the requirements of the ASME specification for the classification of electrode being tested. Coupons shall be tested in the as-welded condition and also in the postweld heat treated condition. The postweld heat treatment temperatures shall be 1100°F minimum for weld metal A-numbers 1, 2, and 3; and 1250°F minimum for A-number 5. The maximum temperature shall not exceed 100°F above the minimum postweld heat treatment temperatures. The time at postweld heat treatment temperature shall be 8 hours. This qualifies postweld heat treatment of 10 hours or less. Where the postweld heat treatment of the production weld will exceed 10 hours, or where postweld heat treatment temperature is other than that required above this test is not applicable (see 12.2.1).

d. The tensile and Cv specimens shall be located and prepared in accordance with the requirements of ASME SFA-5.1 or SFA-5.5 as applicable. Dropweight impact test specimens, shall be located and oriented as specified in 3.1.1.

e. The all-weld-metal tensile specimen shall meet the tensile strength requirement of the ASME specification for the applicable electrode classification.

f. The requirements of 12.2.1.f shall apply to these (12.2.2) impact tests.

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RDT STANDARD

UNITED STATES ATOMIC ENERGY COMMISSION
DIVISION OF REACTOR RESEARCH AND DEVELOPMENT

RDT F 3-37T, Amendment 1
DATE July 1974
PAGE 1 OF 1

SPECIAL REQUIREMENTS FOR METAL PRODUCTS

AMENDMENT 1

This amendment forms a part of RDT F 3-37T
dated May 1974

1. Page 2: Add an asterisk to the title of Section 3, "Fabrication Toughness Test Requirements*", and add footnote:

*The requirements of 3.6, 3.7, and 3.8 shall also apply to tensile test specimens when so specified by a referencing RDT materials standard.

2. Page 15, 3.6: Change to read:

3.6 Test Coupons Heat Treatment for Ferritic Materials. Where ferritic steel materials will be subjected to heat treatment during fabrication or installation of a component, the materials used for the tensile and impact test specimens shall be heat treated in the same manner as the component. The purchaser will provide the materials manufacturer with the temperature and heating and cooling rate to be used. In the case of postweld heat treatment, the total time at temperature or temperatures for the test material shall be at least 80 percent of the total time at temperature or temperatures during actual postweld heat treatment of the material and the total time at temperature or temperatures for the test material may be performed in a single cycle.