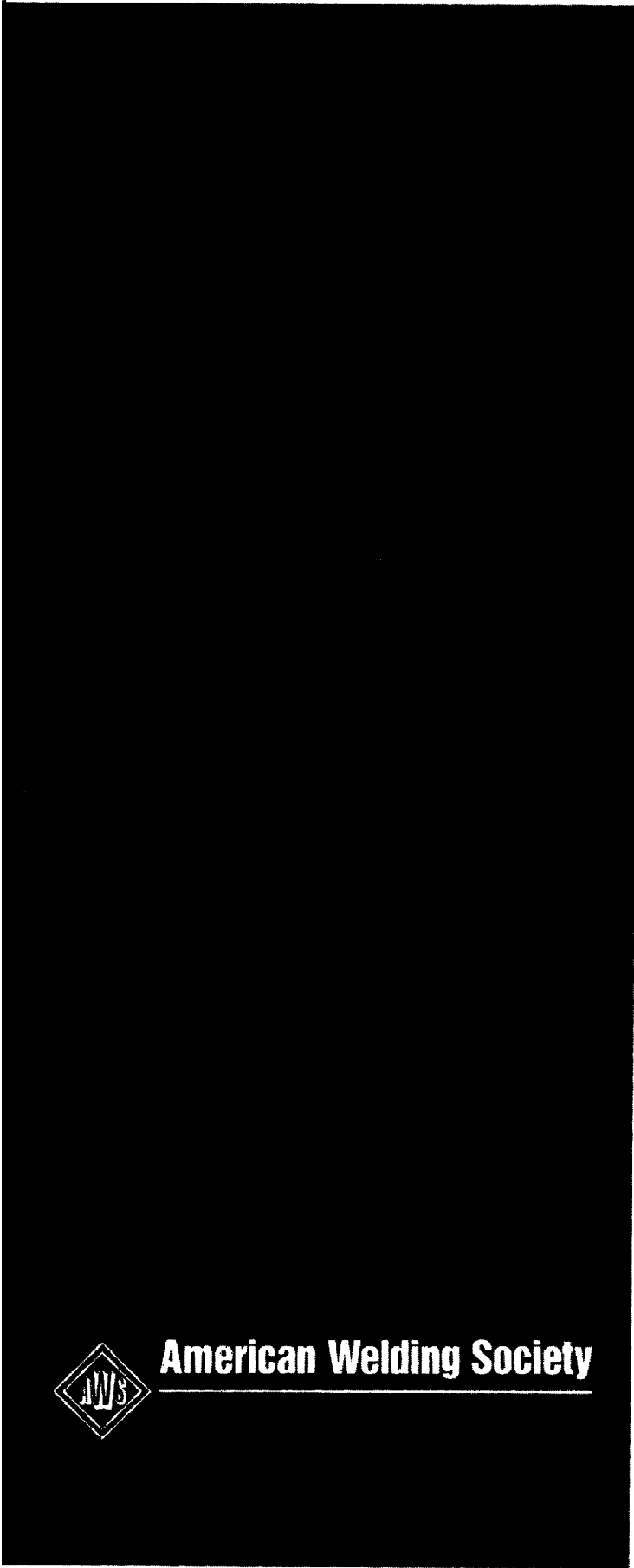


ANSI/AWS A5.30-97
An American National Standard



Specification for Consumable Inserts



American Welding Society

Key Words—Consumable inserts, gas tungsten arc welding, gas metal arc welding, steel inserts, stainless steel inserts, nickel alloy inserts, purging gases

ANSI/AWS A5.30-97
An American National Standard

Approved by
American National Standards Institute
August 11, 1997

Specification for Consumable Inserts

Supersedes AWS A5.30-79

Prepared by
AWS Committee on Filler Metals

Under the Direction of
AWS Technical Activities Committee

Approved by
AWS Board of Directors

Abstract

Five classes (cross-sectional design) of consumable inserts of various chemical compositions are described. Each class is subdivided into two or three styles (based on the shape of the insert). Topics include the chemical composition, general dimensional requirements, packaging, and application guidelines.



American Welding Society

550 N.W. LeJeune Road, Miami, Florida 33126

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Foreword

(This Foreword is not a part of ANSI/AWS A5.30-97, *Specification for Consumable Inserts*, but is included for information purposes only.)

This specification for consumable inserts, one of the latest of the currently available specifications, was first published in 1979. The specification was developed in response to the need for standardized compositions, styles, and profiles for inserts used in the assembly of piping for critical applications.

The current revision includes additional alloy compositions not covered by the original document.

Specific topics include composition, style, profiles, dimensional tolerances, packaging, and package marking. The Annex suggests general areas of application.

Comments and suggestions for the improvement of this standard are welcome. They should be sent to the Secretary, AWS Committee on Filler Metals, American Welding Society, 550 N.W. LeJeune Road, Miami, FL 33126.

Official interpretations of any of the technical requirements of this standard may be obtained by sending a request, in writing, to the Managing Director, Technical Services Division, American Welding Society. A formal reply will be issued after it has been reviewed by the appropriate personnel following established procedures.

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Specification for Consumable Inserts

1. Scope

This specification prescribes requirements for the classification of plain carbon and Cr-Mo stainless steels, nickel alloy, and copper-nickel alloy consumable inserts for use in conjunction with the gas tungsten arc welding. These inserts also may be used with any other welding process for which they are found suitable.¹ Included are packaging and testing requirements.

Part A General Requirements

2. Classification

2.1 The consumable inserts covered by this specification are classified according to chemical composition of the insert material as specified in Tables 1, 2, 3, and 4.

2.2 Consumable inserts classified under one classification shall not be classified under any other classification of this specification.

3. Acceptance

Acceptance of the consumable inserts shall be in accordance with the provisions of ANSI/AWS A5.01, *Filler Metal Procurement Guidelines*.²

1. For definition of "consumable insert," see ANSI/AWS A3.0, *Standard Welding Terms and Definitions*. AWS standards can be obtained from The American Welding Society, 550 N.W. LeJeune Road, Miami, FL 33126.

2. See Section A3, Acceptance (in the Annex), for further information concerning acceptance and testing of material shipped, and ANSI/AWS A5.01, *Filler Metal Procurement Guidelines*.

4. Certification

By affixing the AWS specification and classification designations to the packaging, or the classification to the product, the manufacturer certifies that the product meets the requirements of this specification.³

5. Units of Measure and Rounding-Off Procedure

5.1 U.S. Customary Units are the standard units of measure in this specification. The SI Units are given as equivalent values to the U.S. Customary Units. The standard sizes and dimensions in the two systems are not identical, and for this reason conversion from a standard size or dimension in one system will not always coincide with a standard size or dimension in the other. Suitable conversions, encompassing standard sizes of both, can be made, however, if appropriate tolerances are applied in each case.

5.2 For the purpose of determining conformance with this specification, an observed or calculated value shall be rounded to the "nearest unit" in the last right-hand place of figures used in expressing the limiting value in accordance with the rounding-off method given in ASTM E29, *Standard Practice for Using Significant Digits in Test Data to Determine Conformance with Specifications*.⁴

3. See Section A4, Certification (in the Annex), for further information concerning certification and the testing called for to meet this requirement.

4. ASTM standards can be obtained from ASTM, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959.

Table 1
Carbon Steel Compositions

Group	AWS Classification	UNS Number ^c	Weight Percent ^{a,b}							
			C	Mn	P	S	Si	Al	Zr	Ti
A	INMs1	K10726	0.07	0.90 to 1.40	0.025	0.035	0.40 to 0.70	0.05 ^d to 0.15	0.02 ^d to 0.12	0.05 ^d to 0.15
	INMs2	K01313	0.06 to 0.15	0.90 to 1.40	0.025	0.035	0.45 to 0.70	—	—	—
	INMs3	K11140	0.07 to 0.15	1.40 to 1.85	0.025	0.035	0.80 to 1.15	—	—	—

Notes:

- a. The consumable insert shall be analyzed for the specific elements for which values are shown in the table.
b. Single values shown are maximum.
c. SAE/ASTM Unified Numbering System for Metals and Alloys.
d. Al + Zr + Ti = 0.15 minimum.

Table 2
Chromium-Molybdenum Steel Compositions

Group	AWS Classification	UNS Number ^c	Weight Percent ^{a,b}											Other Elements, Total
			C	Mn	P	S	Si	Al	Cr	Mo	Ni	Cu	Fe	
B	IN502	S50280	0.10	0.40 to 0.75	0.025	0.025	0.25 to 0.50	0.15	4.5 to 6.0	0.45 to 0.65	0.6	0.25	Balance	—
	IN515	K20900	0.07 to 0.12	0.40 to 0.70	0.025	0.025	0.40 to 0.70	0.15	1.20 to 1.50	0.40 to 0.65	0.20	0.35	Balance	0.50
	IN521	K30960	0.07 to 0.12	0.40 to 0.70	0.025	0.025	0.40 to 0.70	0.15	2.30 to 2.70	0.90 to 1.20	0.20	0.35	Balance	0.50

Notes:

- a. The consumable insert shall be analyzed for the specific elements for which values are shown in this table. If the presence of other elements is indicated in the course of this work, the amount of those elements shall be determined to ensure that their total does not exceed the limit specified for "Other Elements, Total" in the last column of the table.
b. Single values shown are maximum.
c. SAE/ASTM Unified Numbering System for Metals and Alloys.

Table 3
Chromium-Nickel Stainless Steel Compositions

Group	AWS Classification	UNS Number ^c	Weight Percent ^{a,b}									
			C	Cr	Ni	Mo	Nb(Cb) + Ta	Mn	Si	P	S	Cu
C	IN308 ^d	S30880	0.08	19.5 to 22.0	9.0 to 11.0	0.75	—	1.0 to 2.5	0.30 to 0.65	0.03	0.03	0.75
	IN308L ^d	S30883	0.03	19.5 to 22.0	9.0 to 11.0	0.75	—	1.0 to 2.5	0.30 to 0.65	0.03	0.03	0.75
	IN309 ^d	S30980	0.12	23.0 to 25.0	12.0 to 14.0	0.75	—	1.0 to 2.5	0.30 to 0.65	0.03	0.03	0.75
	IN309L ^d	S30983	0.03	23.0 to 25.0	12.0 to 14.0	0.75	—	1.0 to 2.5	0.30 to 0.65	0.03	0.03	0.75
	IN310	S31080	0.08 to 0.15	25.0 to 28.0	20.0 to 22.5	0.75	—	1.0 to 2.5	0.30 to 0.65	0.03	0.03	0.75
	IN312 ^d	S31380	0.15	28.0 to 32.0	8.0 to 10.5	0.75	—	1.0 to 2.5	0.30 to 0.65	0.03	0.03	0.75
	IN316 ^d	S31680	0.08	18.0 to 20.0	11.0 to 14.0	2.0 to 3.0	—	1.0 to 2.5	0.30 to 0.65	0.03	0.03	0.75
	IN316L ^d	S31683	0.03	18.0 to 20.0	11.0 to 14.0	2.0 to 3.0	—	1.0 to 2.5	0.30 to 0.65	0.03	0.03	0.75
	IN348 ^d	S34780	0.08	19.0 to 21.5	9.0 to 11.0	0.75	10 × C min ^e to 1.0 max	1.0 to 2.5	0.30 to 0.65	0.03	0.03	0.75

Notes:

a. The consumable insert shall be analyzed for the specific elements for which values are shown in this table.

b. Single values shown are maximum.

c. SAE/ASTM Unified Numbering System for Metals and Alloys.

d. Delta ferrite may be specified upon agreement between supplier and purchaser.

e. Tantalum content shall not exceed 0.10 percent. (Nb is the same as Cb.)

Table 4
Copper-Nickel and Nickel Alloy Compositions

Group	AWS Classifi- cation	UNS Number ^c	Weight Percent ^{a,b}													Nb + Ta	Other Elements, Total
			C	Mn	Fe	S	P	Si	Cu	Ni + Co	Al	Ti	Cr	Mo			
E	IN52	N06052	0.04	1.0	7.0 to 11.0	0.015	0.02	0.50	0.30	Rem	1.10	1.0	28.0 to 31.5	0.50	0.10	0.50	
	IN60	N04060	0.15	4.00	2.50	0.015	0.020	1.25	Rem	62.0 to 69.0	1.25	1.5 to 3.0	—	—	—	0.50	
	IN61	N02061	0.15	1.00	1.00	0.015	0.030	0.75	0.25	93.0 min	1.50	2.0 to 3.5	—	—	—	0.50	
	IN62	N06062	0.08	1.00	6.0 to 10.0	0.015	0.030	0.35	0.50	70.0 min ^d	—	—	14.0 to 17.0	—	1.5 to 3.0 ^e	0.50	
	IN67	C71581	—	1.00	0.40 to 0.75	0.01	0.020	0.25	Rem	29.0 to 32.0	—	0.2 to 0.5	—	—	—	0.50 ^f	
	IN6A	N07092	0.08	2.0 to 2.7	8.00	0.015	0.030	0.35	0.50	67.0 min ^d	—	2.5 to 3.5	14.0 to 17.0	—	—	0.50	
	IN82	N06082	0.10	2.50 to 3.50	3.00	0.015	0.030	0.50	0.50	67.0 min ^d	—	0.75	18.0 to 22.0	—	2.0 to 3.0 ^e	0.50	

Notes:

- The consumable insert shall be analyzed for the specific elements for which values are shown in this table. If the presence of other elements is indicated in the course of this work, the amount of those elements shall be determined to ensure that their total does not exceed the limit specified for "Other Elements, Total" in the last column of the table.
- Single values shown are maximum, except where otherwise specified.
- SAE/ASTM Unified Numbering System for Metals and Alloys.
- Cobalt—0.12 maximum when specified.
- Tantalum—0.30 maximum when specified.
- Lead—0.02 maximum.

Part B

Tests, Procedures, and Requirements

6. Summary of Tests

Chemical analysis of the consumable insert material, or the stock from which it is made, is the only test required for classification of a product under this specification.

7. Retest

If the results of any test fail to meet the requirement, that test shall be repeated twice. The results of both retests shall meet the requirement. Samples for retest may be taken from the original test sample or from a new test sample. For chemical analysis, retest need be only for those specific elements that failed to meet the test requirement. If the results of one or both retests fail to meet the requirement, the material under test shall be considered as not meeting the requirements of this specification for that classification.

In the event that, during preparation or after completion of any test, it is clearly determined that prescribed or proper procedures were not followed in preparing the test specimen(s), or in conducting the tests, the test shall be considered invalid, without regard to whether the test was actually completed, or whether test results met, or failed to meet, the requirement. That test shall be repeated, following proper prescribed procedures. In this case, the requirement for doubling the number of test specimens does not apply.

8. Chemical Analysis

8.1 A sample of the consumable insert material or the stock from which it is made, sufficient for retest if necessary, shall be prepared for chemical analysis.

8.2 Chemical analysis may be made by any suitable method agreed upon by the supplier and the purchaser. In case of dispute, referee methods of analysis shall be according to the appropriate technique set forth in the following documents: ASTM A751, *Test Methods, Practices, and Terminology for Chemical Analysis of Steel Products*; for nickel alloys, ASTM E76, *Test Methods for Chemical Analysis of Nickel-Copper Alloys*, and ASTM E39, *Methods for Chemical Analysis of Nickel*; for stainless steels, ASTM E353, *Test Methods for Chemical Analysis of Stainless, Heat Resisting, Maraging and other Similar Chromium-Nickel-Iron Alloys*, and ASTM E354, *Test Methods for Chemical Analysis of High-Temperature Electrical, Magnetic, and Similar Iron, Nickel and Cobalt Alloys*, for elements not shown

in ASTM E353; for copper alloys, ASTM E62, *Test Methods for Chemical Analysis of Copper and Copper Alloys*, and E75, *Test Methods for Chemical Analysis of Copper-Nickel and Copper-Nickel-Zinc Alloys*.

8.3 The results of the chemical analysis shall meet the requirements of Table 1, 2, 3, or 4, for the classification of the consumable insert material under test.

Part C

Manufacture, Identification, and Packaging

9. Method of Manufacture

Consumable inserts classified according to this specification may be manufactured by any method that will produce consumable inserts that meet the requirements of this specification.

10. Standard Shapes, Styles, and Sizes

Standard shapes, styles, and sizes shall be as listed below and shown in Figure 1 and Tables 5, 6, 7, and 8.

10.1 Class 1, Inverted T-Shaped Cross-Section

10.1.1 Style A, Coiled Consumable Insert

10.1.2 Style B, Preformed Rings, Open Lap Joint

10.1.3 Style C, Preformed Rings, Open Butt Joint

10.2 Class 2, J-Shaped Cross-Section

10.2.1 Style A, Coiled Consumable Insert

10.2.2 Style B, Preformed Rings, Open Lap Joint

10.2.3 Style C, Preformed Rings, Open Butt Joint

10.3 Class 3, Rectangular-Shaped Cross-Section

10.3.1 Style D, Solid Rings, 3/16 in. (4.8 mm) rim width

10.3.2 Style E, Solid Rings, 1/8 in. (3.2 mm) rim width

10.4 Class 4, Y-Shaped Cross-Section

10.4.1 Style A, Coiled Consumable Insert

10.4.2 Style B, Preformed Rings, Open Lap Joint

10.4.3 Style C, Preformed Rings, Open Butt Joint

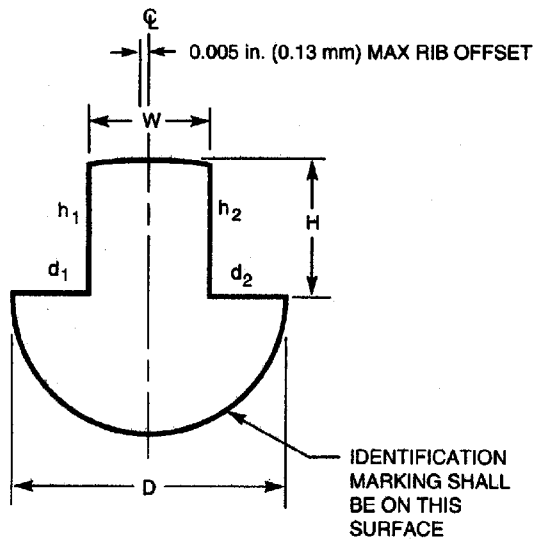
10.5 Class 5, Rectangular-Shaped Cross-Section (Contoured Edges)

10.5.1 Style A, Coiled Consumable Insert

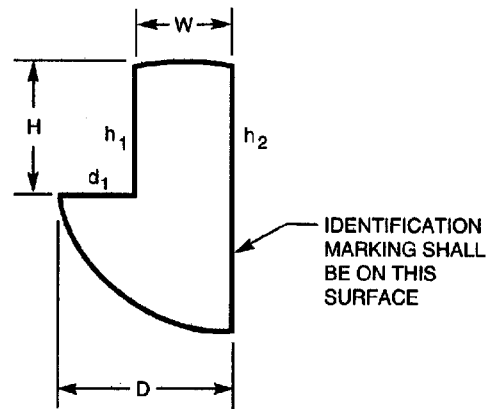
10.5.2 Style B, Preformed Rings, Open Lap Joint

10.5.3 Style C, Preformed Rings, Open Butt Joint

CLASS 1 - INVERTED T-SHAPED



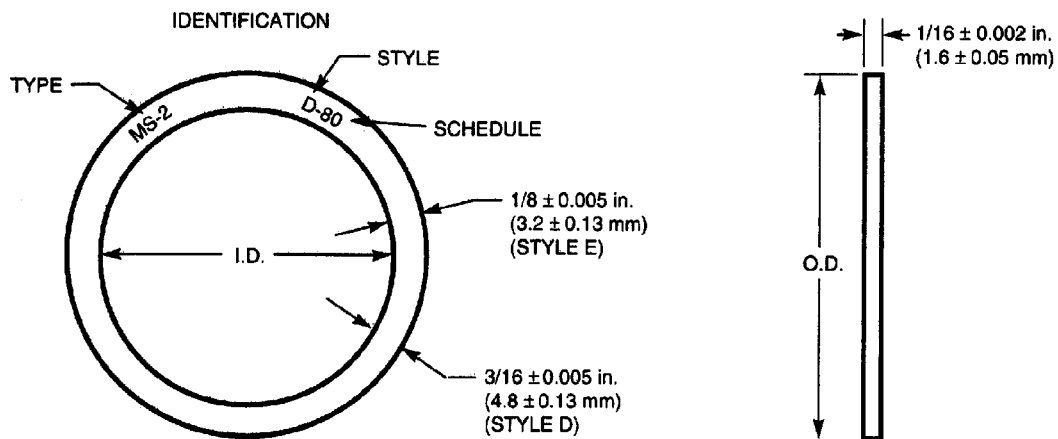
CLASS 2 - J-SHAPED



General Notes:

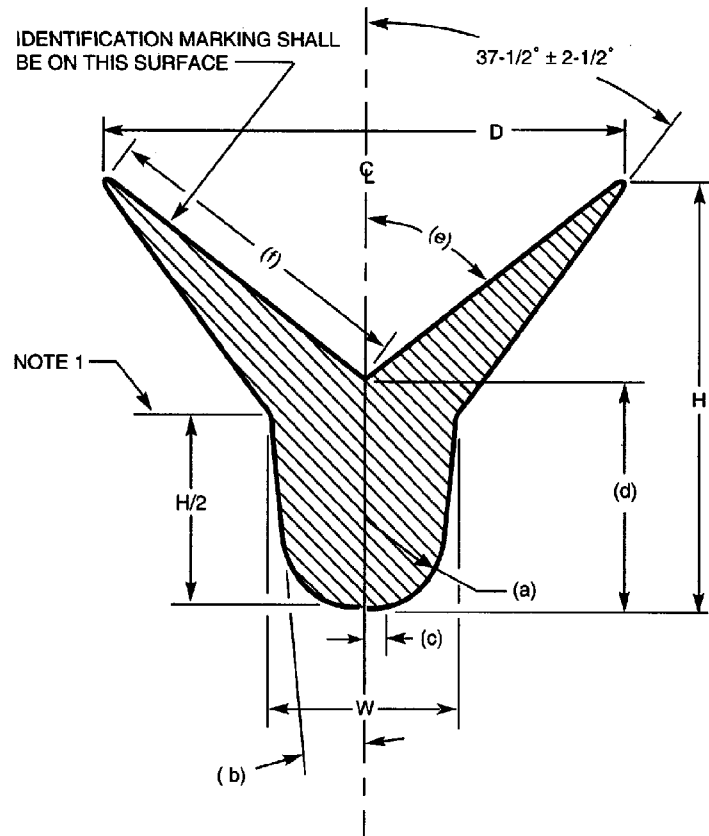
1. Lands (d_1 , d_2) on either side of the rib shall be on the same plane within 0.005 in. (0.13 mm).
2. Rib surfaces (h_1 , h_2) shall be parallel within 0.002 in. (0.05 mm) and square with lands (d_1 , d_2) within 0.005 in. (0.13 mm).
3. Dimensions and tolerances, see Table 8.

CLASS 1 AND 2 INSERTS — CROSS-SECTIONAL CONFIGURATION



CLASS 3 — SOLID RING INSERTS — PLAN VIEW AND CROSS-SECTIONAL CONFIGURATION

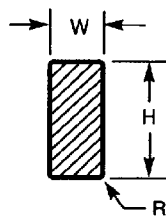
Figure 1 — Standard Sizes and Shapes of Consumable Inserts



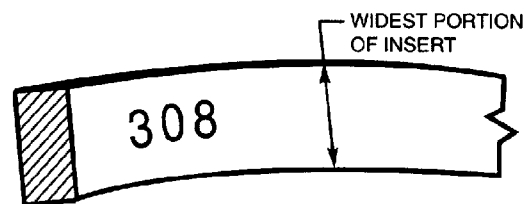
General Notes:

1. Reference diameter for correlating with pipe I.D.
2. Dimensions and tolerances, see Table 8.
3. When specified, rings 1-1/2 to 2 in. (38.1 to 50.8 mm) in diameter shall be formed of 5/32 in. (4.0 mm) material.

CLASS 4 INSERTS — CROSS-SECTIONAL CONFIGURATION



1/8 in. x 5/32 in. (3.2 mm x 4.0 mm)
WITH SLIGHT RADIUS ON EDGES



CLASS 5 INSERTS — CROSS-SECTIONAL CONFIGURATION

Figure 1 (Continued) — Standard Sizes and Shapes of Consumable Inserts

Table 5
Minimum Overlap for Class 1, 2, and 5
Style B Inserts

Nominal Pipe Sizes		Circumferential Overlap	
in.	mm	in.	mm
1	25.0	1/4	6.4
1-1/4	32.0	1/4	6.4
1-1/2	38.0	1/4	6.4
2	51.0	1/4	6.4
2-1/2	64.0	1/4	6.4
3	76.0	3/8	9.5
3-1/2	89.0	3/8	9.5
4	102.0	3/8	9.5
5	127.0	1/2	12.7
6	152.0	1/2	12.7
8	203.0	5/8	15.9
10	254.0	3/4	19.1
12	305.0	3/4	19.1
14	356.0	3/4	19.1

10.6 Other sizes and shapes may be supplied as agreed upon between supplier and purchaser. Chemical composition of other sizes and shapes shall conform to the pertinent classification requirements of this specification.

11. Finish and Uniformity

All consumable inserts shall have a smooth finish that is free from slivers, depressions, scratches, scale, seams, laps and foreign matter that would adversely affect the welding characteristics, or the properties of the weld metal.

12. Standard Package Forms

Inserts shall be packaged in accordance with the manufacturer's standard practice. Solid rings or coils may be packed on mandrels, in tubes, or in boxes.

13. Insert Identification

All consumable inserts shall be either tagged, steel stamped, or otherwise identified to provide the AWS classification number, and either lot, control, or heat number. The prefix letters "IN" may be omitted.

14. Packaging

14.1 Consumable inserts shall be suitably packaged to ensure against damage during shipment or storage under normal conditions.

14.2 Weights of the package shall be as agreed upon by the supplier and purchaser but shall not exceed 60 lb (27 kg).

15. Marking of Packages

15.1 The following product information shall be legibly marked so as to be visible from the outside of each unit package:

- (1) AWS specification and classification number (Year of issue may be excluded)
- (2) Supplier's name and trade designation
- (3) Standard size and net weight or number of pieces
- (4) Lot, control, or heat number⁵

15.2 Marking of any overpacking of unit packages with items listed in 15.1 shall be optional with the manufacturer.

15.3 All packages of welding materials, including individual unit packages enclosed within a larger package(s), shall carry, as a minimum, the following precautionary information prominently displayed in legible type:

WARNING:

- Protect yourself and others.
- Read and understand this label.
- FUMES and GASES can be hazardous to your health.
- ARC RAYS can injure eyes and burn skin.
- ELECTRIC SHOCK can kill.
- Before use read and understand the manufacturer's instructions, the Material Safety Data Sheets (MSDSs), and your employer's safety practices.
- Keep your head out of the fumes.
- Use enough ventilation, exhaust at the arc, or both, to keep fumes and gases away from your breathing zone and the general area.
- Wear correct eye, ear, and body protection.
- Do not touch live electrical parts.
- See American National Standard ANSI/ASC Z49.1, *Safety in Welding, Cutting, and Allied Processes*, published by the American Welding Society, 550 N.W. LeJeune Road, Miami, FL 33126; and *OSHA Safety and Health Standards*, 29 CFR 1910, available from the U.S. Government Printing Office, Washington, DC 20402.

DO NOT REMOVE THIS INFORMATION

⁵ For purposes of this specification, a *lot* shall be those consumable inserts having the same cross-sectional shape and produced from the same heat of metal. A *heat* is defined as that material obtained from the same melt of metal.

Table 6
Dimensions of Class 3, Style D Inserts

Pipe Dimensions					Ring Diameter ^a			
Nominal Diameter		Schedule Number ^b	Inside Diameter ^a		Ring OD for Nominal Pipe Diameter		Ring ID for Nominal Pipe Diameter	
in.	mm		in.	mm	in.	mm	in.	mm
2	51	10S	2.157	54.78	2.43	61.7	2.06	52.3
		40	2.067	52.50	2.34	59.4	1.97	50.0
		80	1.939	49.25	2.22	58.4	1.85	47.0
2-1/2	64	10S	2.635	66.93	2.91	73.9	2.54	64.5
		40	2.489	62.71	2.75	69.9	2.38	60.4
		80	2.323	59.00	2.60	66.0	2.23	56.6
3	76	10S	3.260	82.80	3.54	88.9	3.17	80.5
		40	3.068	77.93	3.35	85.1	2.98	75.7
		80	2.900	73.66	3.18	80.8	2.81	71.4
3-1/2	89	10S	3.760	95.50	4.04	102.6	3.67	93.2
		40	3.548	90.12	3.82	97.0	3.45	87.6
		80	3.364	85.45	3.64	92.5	3.27	83.1
4	102	10S	4.260	108.20	4.54	115.3	4.17	105.9
		40	4.026	102.26	4.30	109.2	3.93	99.8
		80	3.826	97.18	4.10	104.1	3.73	94.7
5	127	5S	5.345	135.76	5.62	142.7	5.25	133.4
		10S	5.295	134.49	5.57	141.5	5.20	132.1
		40	5.047	128.19	5.32	135.1	4.95	125.7
		80	4.813	122.25	5.09	129.3	4.72	119.9
6	152	5S	6.407	162.74	6.68	169.7	6.31	160.3
		10S	6.357	161.47	6.63	168.4	6.26	159.0
		40	6.065	154.05	6.34	161.0	5.97	151.6
		80	5.761	146.33	6.04	153.4	5.67	144.0
8	203	5S	8.407	213.54	8.68	220.4	8.31	211.1
		10S	8.329	211.56	8.61	218.7	8.24	209.3
		40	7.981	202.72	8.26	209.8	7.89	200.4
		80	7.625	193.68	7.90	200.7	7.53	191.3
10	254	5S	10.482	266.24	10.76	273.3	10.39	263.9
		10S	10.420	264.67	10.70	271.8	10.33	262.4
		40	10.020	254.51	10.30	261.6	9.93	252.2
		80S	9.750	247.65	10.03	254.8	9.66	245.4
		80	9.564	242.93	9.84	249.9	9.47	240.5
12	305	5S	12.420	315.47	12.70	322.6	12.33	313.2
		10S	12.390	314.71	12.67	321.8	12.30	312.4
		40S	12.000	304.80	12.28	311.9	11.91	302.5
		40	11.938	303.22	12.22	310.4	11.85	301.0
		80S	11.750	298.45	12.03	305.6	11.66	296.2
		80	11.376	288.95	11.65	295.9	11.28	286.5
14	356	10	13.500	342.90	13.78	350.0	13.41	340.6
		40	13.126	333.40	13.40	340.4	13.03	331.0
		80	12.500	317.50	12.78	324.6	12.41	315.2
16	406	10	15.500	393.70	15.78	400.8	15.41	391.4
		40	15.000	381.00	15.28	388.1	14.91	378.7
		80	14.314	363.58	14.59	370.6	14.22	361.2

Notes:

a. Class 3, Style D insert rings are normally furnished to match nominal internal diameter of the pipe as shown in Table 6. For Class 3 Style D insert rings required for use with specially I.D. machined pipe end joint preparation, the dimensions are determined as follows:

Ring ID = pipe ID minus 0.094 in. (2.38 mm)

Ring OD = ring ID + 0.375 in. (9.53 mm)

b. Schedule number followed by "S" applies to Group C Types.

Table 7
Dimensions of Class 3, Style E Inserts

Pipe Dimensions					Ring Diameter ^a			
Nominal Diameter		Schedule Number ^b	Inside Diameter ^a		Ring OD for Nominal Pipe Diameter		Ring ID for Nominal Pipe Diameter	
in.	mm		in.	mm	in.	mm	in.	mm
1/4	6.4	10S	0.410	10.41	0.57	14.5	0.32	8.1
		40	0.364	9.25	0.52	13.2	0.27	6.8
		80	0.302	7.67	0.46	11.7	0.21	5.3
3/8	9.5	10S	0.545	13.84	0.70	17.8	0.45	11.4
		40	0.493	12.52	0.65	16.5	0.40	10.1
		80	0.423	10.74	0.58	14.7	0.33	8.4
1/2	12.7	5S	0.710	18.03	0.87	22.1	0.62	15.7
		10S	0.674	17.12	0.83	21.1	0.58	14.7
		40	0.622	15.80	0.78	19.8	0.53	13.5
		80	0.546	13.87	0.70	17.8	0.45	11.4
3/4	19.1	5S	0.920	23.37	1.08	27.4	0.83	21.1
		10S	0.884	22.45	1.04	26.4	0.79	20.1
		40	0.824	20.93	0.98	24.9	0.73	18.5
		80	0.742	18.85	0.90	22.9	0.65	16.5
1	25.0	5S	1.185	30.10	1.34	34.0	1.09	27.7
		10S	1.097	27.86	1.25	31.8	1.00	25.4
		40	1.049	26.64	1.21	30.7	0.96	24.4
		80	0.957	24.31	1.11	28.2	0.86	21.8
1-1/4	32.0	5S	1.530	38.86	1.69	42.9	1.44	36.6
		10S	1.442	36.63	1.60	40.6	1.35	34.3
		40	1.380	35.05	1.54	39.1	1.29	32.8
		80	1.278	32.46	1.43	36.3	1.18	30.0
1-1/2	38.0	5S	1.770	44.96	1.93	49.0	1.68	42.7
		10S	1.682	42.72	1.84	46.7	1.59	40.4
		40	1.610	40.89	1.77	45.0	1.52	38.6
		80	1.500	38.10	1.65	41.9	1.41	35.8
2	51.0	5S	2.245	57.02	2.40	61.0	2.15	54.6
		10S	2.157	54.79	2.31	58.7	2.06	52.3
		40	2.067	52.50	2.22	56.4	1.97	50.0
		80	1.939	49.25	2.10	53.3	1.85	47.0
2-1/2	64.0	5S	2.709	68.81	2.87	72.9	2.62	66.5
3	76.0	5S	3.334	84.68	3.49	88.6	3.24	82.3
3-1/2	89.0	5S	3.834	97.38	3.99	101.3	3.74	95.0
4	102.0	5S	4.334	110.08	4.49	114.0	4.24	107.7

Notes:

a. Class 3, Style E insert rings are normally furnished to match nominal internal diameter of the pipe as shown in Table 7. For Class 3 Style E insert rings required for use with specially I.D. machined pipe end joint preparations, the dimensions are determined as follows:

Ring ID = pipe ID minus 0.094 in. (2.38 mm)

Ring OD = ring ID + 0.250 in. (6.35 mm)

b. Schedule number followed by "S" applies to Group C Types.

Table 8
Cross-Sectional Dimensions and Tolerances for Classes 1, 2, 4, and 5 Inserts

Insert Size	Legend (Figure 1)	Class One, ^a Inverted T-Shaped		Class Two, ^a J-Shaped		Class Four, ^b Y-Shaped		Class Five Rectangular-Shaped	
		in.	mm	in.	mm	in.	mm	in.	mm
3/64	1.2	D	—	—	—	—	—	—	—
		W	—	—	—	0.165	4.19	±0.25	±0.25
		H	—	—	—	0.044	1.12	+0.08	+0.08
		H/2	—	—	—	0.155	3.94	-0.05	-0.05
		R	—	—	—	0.078	1.97	+0.64	+0.64
1/8	3.2	D	0.125	±0.004	3.18	±0.10	0.086	±0.011	2.18
		W	0.047	+0.002	1.19	+0.05	0.047	+0.005	1.19
		H	0.055	+0.012	1.40	+0.30	0.055	+0.012	1.40
		H/2	—	—	—	-0.05	—	-0.002	—
		R	—	—	—	—	—	—	—
5/32	4.0	D	0.156	±0.005	3.96	±0.13	0.110	+0.012	2.79
		W	0.063	+0.003	1.60	+0.08	0.063	+0.003	1.60
		H	0.063	+0.014	1.60	+0.36	0.063	+0.014	1.60
		H/2	—	—	—	-0.08	—	-0.003	—
		R	—	—	—	—	—	—	—
5/32	4.0	D	0.156	±0.005	3.96	±0.13	0.110	+0.012	2.79
		W	0.063	+0.003	1.60	+0.08	0.063	+0.003	1.60
		H	0.063	+0.014	1.60	+0.36	0.063	+0.014	1.60
		H/2	—	—	—	-0.08	—	-0.003	—
		R	—	—	—	—	—	—	—

Notes:

a. The offset between the center of the rib (W) and the center of the land (D) shall not exceed 0.005 in. (0.13 mm).

b. Additional dimensions and tolerances—Class 4, Y-shaped inserts (see Figure 1):

	3/64 in. size (in.)	1.2 mm size (mm)	1/8 in. size (in.)	3.2 mm size (mm)	5/32 in. size (in.)	4.0 mm size (mm)
(a) Radius of rib	0.020 ± 0.003	0.5 ± 0.08	0.044 ± 0.005	1.12 ± 0.13	0.050 ± 0.005	1.27 ± 0.13
(b) Angle between side of rib and center of line	1° - 2°	1° - 2°	1° - 2°	1° - 2°	1° - 2°	1° - 2°
(c) Rib offset	±0.010	±0.25	±0.010	±0.25	±0.015	±0.38
(d) Height of rib along center line	0.093 ± 0.010	2.36 ± 0.25	0.100 ± 0.010	2.54 ± 0.25	0.115 ± 0.010	2.92 ± 0.25
(e) Angle between top surface of inclined arm and center line	50° ± 5°	50° ± 5°	50° ± 5°	50° ± 5°	50° ± 5°	50° ± 5°
(f) Length of inclined arm	0.085 ± 0.010	2.16 ± 0.25	0.085 ± 0.010	2.16 ± 0.25	0.125 ± 0.010	3.18 ± 0.25

From a practical inspection standpoint, the D, W, H, and H/2 dimensions have the most to do with the usability and weldability. The (a) through (f) dimensions are furnished to complete the description of the cross-sectional configuration.

Annex

Guide to AWS Specification for Consumable Inserts

(This Annex is not a part of ANSI/AWS A5.30-97, *Specification for Consumable Inserts*, but is included for information purposes only.)

A1. Introduction

The purpose of this guide is to correlate the filler metal classifications with their intended applications so that this specification may be used effectively.

A2. Classification System

A2.1 The classification system used in this specification follows, as closely as possible, the standard pattern used in other AWS filler metal specifications. The inherent nature of the products being classified has, however, necessitated specific changes that more precisely classify the product. As an example, consider IN308. The prefix "IN" designates a consumable insert. The numbers 308 designate the chemical composition.

A2.2 The consumable inserts are classified on the basis of their chemical composition. However, their cross-sectional configuration is another consideration that must be selected and specified when ordering.

A2.3 Request for Filler Metal Classification

A2.3.1 When a filler metal cannot be classified according to a standard classification, the manufacturer may request that a classification be established for that filler metal. The manufacturer may do this by following the procedure given here.

A2.3.2 A request to establish a new filler metal classification must be in writing, and it needs to provide sufficient detail to permit the Committee on Filler Metals or the Subcommittee to determine whether the new classification or the modification of an existing classification is more appropriate, and whether either is necessary to

satisfy the need. The request needs to state the variables and their limits, for such a classification or modification. The request should contain some indication of the time by which completion of the new classification or modification is needed.

A2.3.3 The request should be sent to the Secretary of the Committee on Filler Metals at AWS Headquarters. Upon receipt of the request, the Secretary will do the following:

- (1) Assign an identifying number to the request. This number will include the date the request was received.
- (2) Confirm receipt of the request and give the identification number to the person who made the request.
- (3) Send a copy of the request to the Chairman of the Committee on Filler Metals and the Chairman of the particular Subcommittee involved.
- (4) File the original request.
- (5) Add the request to the log of outstanding requests.

A2.3.4 All necessary action on each request will be completed as soon as possible. If more than 12 months lapse, the Secretary shall inform the requestor of the status of the request, with copies to the Chairpersons of the Committee and Subcommittee. Requests still outstanding after 18 months shall be considered not to have been answered in a "timely manner" and the Secretary shall report these to the Chair of the Committee on Filler Metals for action.

A2.3.5 The Secretary shall include a copy of the log of all requests pending and those completed during the preceding year with the agenda for each Committee on Filler Metals meeting. Any other publication of requests that have been completed will be at the option of the American Welding Society, as deemed appropriate.

A3. Acceptance

Acceptance of all welding materials classified under this specification is in accordance with ANSI/AWS A5.01, *Filler Metal Procurement Guidelines*, as the specification states. Any testing a purchaser requires of the supplier, for material shipped in accordance with this specification, shall be clearly stated in the purchase order, according to the provisions of ANSI/AWS A5.01. In the absence of any such statement in the purchase order, the supplier may ship the material with whatever testing is normally conducted on material of that classification, as specified in Schedule F, Table 1, of the ANSI/AWS A5.01. Testing in accordance with any other schedule in that Table must be specifically required by the purchase order. In such cases, acceptance of the material shipped will be in accordance with those requirements.

A4. Certification

The act of placing the AWS specification and classification designations on the packaging enclosing the product, or the classification on the product itself, constitutes the supplier's (manufacturer's) certification that the product meets all of the requirements of the specification.

The only testing requirement implicit in this certification is that the manufacturer has actually conducted the tests required by the specification on material that is representative of that being shipped and that that material met the requirements of the specification. Representative material, in this case, is consumable insert material from any production run of that classification. "Certification" is not to be construed to mean that tests of any kind were necessarily conducted on samples of the specific material shipped. Tests on such material may, or may not, have been conducted. The basis for the "certification" required by the specification is the classification test of "representative material" cited above, and the "Manufacturer's Quality Assurance Program" in ANSI/AWS A5.01.

A5. Ventilation During Welding

A5.1 Five major factors govern the quantity of fumes to which welders and welding operators are exposed during welding (see A9.3, *Fumes and Gases*). They are as follows:

- (1) Dimensions of the space in which welding is done (with special regard to the height of the ceiling)
- (2) Number of welders and welding operators working in that space
- (3) Rate of evolution of fumes, gases, or dust, according to the materials and processes involved

(4) The proximity of the welder or welding operator to the fumes, as these fumes issue from the welding zone, and to the gases and dust in the space in which they are working

(5) The ventilation provided to the space in which the welding is done

A5.2 American National Standard ANSI/ASC Z49.1, *Safety in Welding, Cutting, and Allied Processes* (published by the American Welding Society), discusses the ventilation that is required during welding and should be referred to for details. Attention is drawn particularly to the section entitled "Ventilation".

A6. Description of the Process

A6.1 General. Consumable inserts are used for root pass welding from one side where consistent, high quality welds are required with minimum repairs, or rejects, and where welding conditions may be less than optimum, such as confined space for welding or the necessity for maximum assurance against weld cracks, etc. Consumable inserts are most often used in pipe joints, and frequently used in pressure vessel and structural applications.

A6.2 Purging. To provide welded piping systems with the integrity required by some piping codes, the weld joint must be a full penetration joint with weld metal of consistently good quality. One method of obtaining this high level of quality is the use of preplaced consumable inserts in conjunction with a specific joint configuration together with a suitable protective gas back purge. The gas tungsten arc welding process, either manual or automatic, generally is used to consume or fuse the consumable insert. This method is particularly adaptable to conditions encountered in pipe welding, but also may be applied to flat plate type joints. The main consideration is that a full penetration butt weld is required when the accessibility is limited to one side or when the reverse side of the joints is inaccessible for welding. In order to obtain a suitably smooth, uniform under side weld surface without crevices or oxidation, a purge may be established using a suitable protective gas. Since the second and third passes in the joint may take the previously deposited consumable insert root pass above the oxidizing temperature of the base and filler metal, it may be necessary to maintain the purge until three layers or at least 3/16 in. (4.8 mm) root thickness is obtained.

A6.3 Ferrite Content. For austenitic stainless steel consumable inserts, the purchaser should specify in the purchase order the applicable limits of the Ferrite Number (FN) required in the consumable inserts. In general, the limits applied to the matching filler metal type being

used in the joint are recommended for the consumable insert. The ferrite should be measured on a weld metal pad by means of a suitable instrument that has been calibrated in accordance with ANSI/AWS A4.2, *Standard Procedures for Calibrating Magnetic Instruments to Measure the Delta Ferrite Content of Austenitic Stainless and Duplex Austenitic Ferritic Stainless Steel Weld Metal*. Alternately, the Ferrite Number can be estimated from the chemical composition of the insert using one of two constitution diagrams prepared through the efforts of the Welding Research Council. The earlier diagram, Figure A2, popularly known as the DeLong diagram or WRC-DeLong diagram, was first published in 1973. It covers a limited range of compositions and is reasonably accurate for normal austenitic stainless steel weld metals. More recently, this diagram has been replaced with the updated WRC-1992 diagram, Figure A3, which has a broader range of application and improved predicting accuracy, especially for nonconventional austenitic stainless steel weld metals.

A6.4 Joint Configuration. The joint end preparation configuration should be compatible with the shape of the consumable insert used in order to obtain consistent high quality, particularly under field welding conditions.

For all shape configurations, the butt gap in the insert (fitted, ready for tack welding) should not exceed 1/16 in. (1.6 mm).

A7. Ordering Information

When ordering inserts, the following information shall be included:

- (1) Title, number, and date of this specification
- (2) Classifications, shape, and size, including pipe schedule or pipe inside diameter
- (3) Required Ferrite Number

A8. Special Test

A8.1 Usability. The control of chemical composition is generally sufficient to ensure usability of these classifications. However, a fusibility test may be specified. Figure A1 illustrates a typical fusibility test joint in plate.

A8.2 Applications. A complete description of how to use consumable inserts is beyond the scope of this document. For further information, see ANSI/AWS D10.4, *Recommended Practices for Welding Austenitic Chromium-Nickel Stainless Steel Piping and Tubing*, and ANSI/AWS D10.11, *Recommended Practices for Root Pass Welding and Gas Purging*.

A9. General Safety Considerations

A9.1 Burn Protection. Molten metal, sparks, slag, and hot-work surfaces are produced by welding, cutting, and allied processes. These can cause burns if precautionary measures are not used. Workers should wear protective clothing made of fire-resistant material. Pant cuffs, open pockets, or other places on clothing that can catch and retain molten metal or sparks should not be worn. High-top shoes or leather leggings and fire-resistant gloves should be worn. Pant legs should be worn over the outside of high-top shoes. Helmets or hand shields that provide protection for the face, neck, and ears, and a head covering to protect the head should be used. In addition, appropriate eye protection should be used.

When welding overhead or in confined spaces, ear plugs to prevent weld spatter from entering the ear canal should be worn in combination with goggles or equivalent to give added eye protection. Clothing should be kept free of grease and oil. Combustible materials should not be carried in pockets. If any combustible substance has been spilled on clothing, a change to clean, fire resistant clothing should be made before working with open arcs or flame. Aprons, cape-sleeves, leggings, and shoulder covers with bibs designed for welding service should be used.

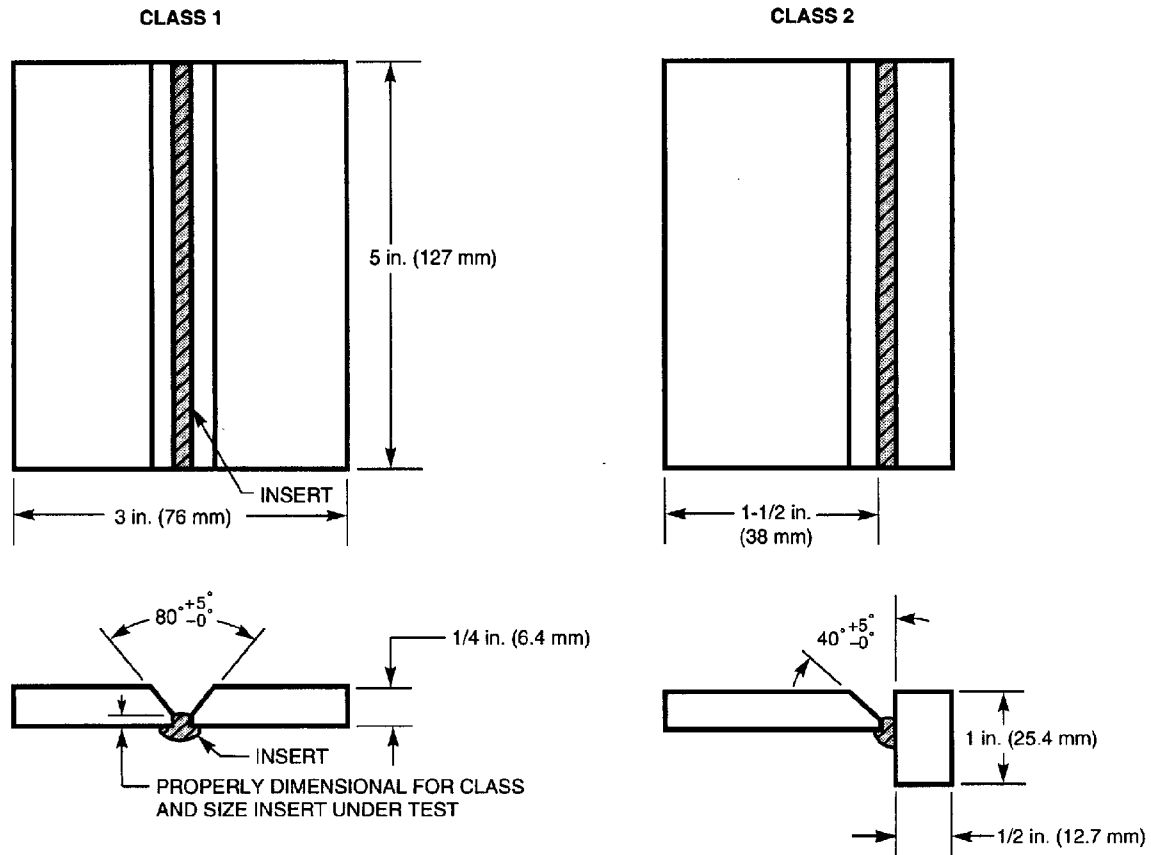
Where welding or cutting of unusually thick base metal is involved, sheet metal shields should be used for extra protection. Mechanization of highly hazardous processes or jobs should be considered. Other personnel in the work area should be protected by the use of noncombustible screens or by the use of appropriate protection as described in the previous paragraph.

Before leaving a work area, hot workpieces should be marked to alert other persons of this hazard. No attempt should be made to repair or disconnect electrical equipment when it is under load. Disconnection under load produces arcing of the contacts and may cause burns or shock, or both. (*Note: Burns can be caused by touching hot equipment such as electrode holders, tips, and nozzles. Therefore, insulated gloves should be worn when these items are handled, unless an adequate cooling period has been allowed before touching.*)

The following sources are for more detailed information on personal protection:

- (1) American National Standards Institute. ANSI/ASC Z41.1, *Safety-Toe Footwear*. New York: American National Standards Institute.⁶
- (2) ——. ANSI/ASC Z49.1, *Safety in Welding, Cutting, and Allied Processes*, Miami, FL: American Welding Society.

6. ANSI documents are available from the American National Standards Institute, 11 West 42 Street, New York, NY 10036.

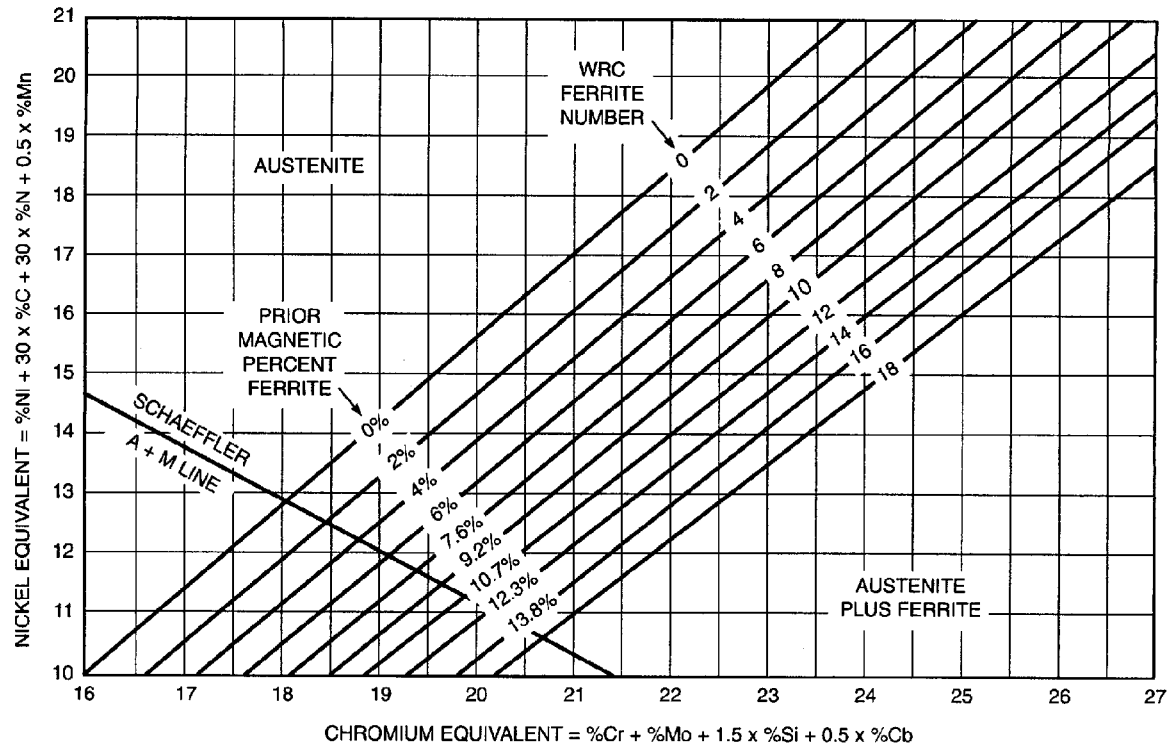


ALL DIMENSIONS, EXCLUDING ANGLES, ARE IN INCHES (MILLIMETERS)

General Notes:

1. Base plate shall be of composition similar to the insert.
2. One-half of joint shall be welded in flat position; the remainder, in the vertical position. All welding shall be done on the groove side.
3. Argon gas shall be used for purging and shielding electrode and back side of weld.
4. Standard techniques and procedures for fusing the insert shall be followed at all times.
5. Upon completion of fusion, the joint shall be visually examined for compliance with the following:
 - (a) The contour of the back side surface of fused insert.
 - (1) Reinforcement shall not exceed 3/32 in. (2.4 mm).
 - (2) Concavity shall not exceed 1/32 in. (0.8 mm).
 - (3) The contour shall have a uniform radius and shall blend smoothly into the base metal.
 - (b) The fused insert shall also be free of linear indications, as revealed by liquid penetrant inspection with non-water washable penetrant.

Figure A1 — Fusibility Test Joint



Calculate the nickel and chromium equivalents from the weld metal analysis. If nitrogen analysis of the weld metal is not available, assume 0.06% for GTA and covered electrode, or 0.08% for GMA weld metals. If the chemistry is accurate the diagram predicts the WRC Ferrite Number within plus or minus 3 in approximately 90% of the tests for the 308, 309, 316, and 317 families.

Figure A2 — DeLong (FN) Diagram for Stainless Steel Weld Metal

(3) —. ANSI/ASC Z87.1, *Practice For Occupational and Educational Eye and Face Protection*. New York: American National Standards Institute.

(4) Occupational Safety and Health Administration. *Code of Federal Regulations*, Title 29 Labor, Chapter XVII, Part 1910. Washington, DC: U.S. Government Printing Office.⁷

A9.2 Electrical Hazards. Electric shock can kill; however, it can be avoided. Live electrical parts should not be touched. The manufacturer's instructions and recommended safe practices should be read and understood. Faulty installation, improper grounding, and incorrect operation and maintenance of electrical equipment are all sources of danger.

All electrical equipment and the workpieces should be grounded. The workpiece lead is not a ground lead. It is

used only to complete the welding circuit. A separate connection is required to ground the workpiece. The workpiece should not be mistaken for a ground connection.

The correct cable size should be used, since sustained overloading will cause cable failure and result in possible electrical shock or fire hazard. All electrical connections should be tight, clean, and dry. Poor connections can overheat and even melt. Further, they can produce dangerous arcs and sparks. Water, grease, or dirt should not be allowed to accumulate on plugs, sockets, or electrical units. Moisture can conduct electricity.

To prevent shock, the work area, equipment, and clothing should be kept dry at all times. Welders should wear dry gloves and rubber-soled shoes, or stand on a dry board or insulated platform. Cables and connections should be kept in good condition. Improper or worn electrical connections may create conditions that could cause electrical shock or short circuits. Worn, damaged, or bare cables should not be used. Open-circuit voltage should be avoided. When several welders are working with arcs of different polarities, or when a number of alternating

7. OSHA documents are available from U.S. Government Printing Office, Washington, DC 20402.

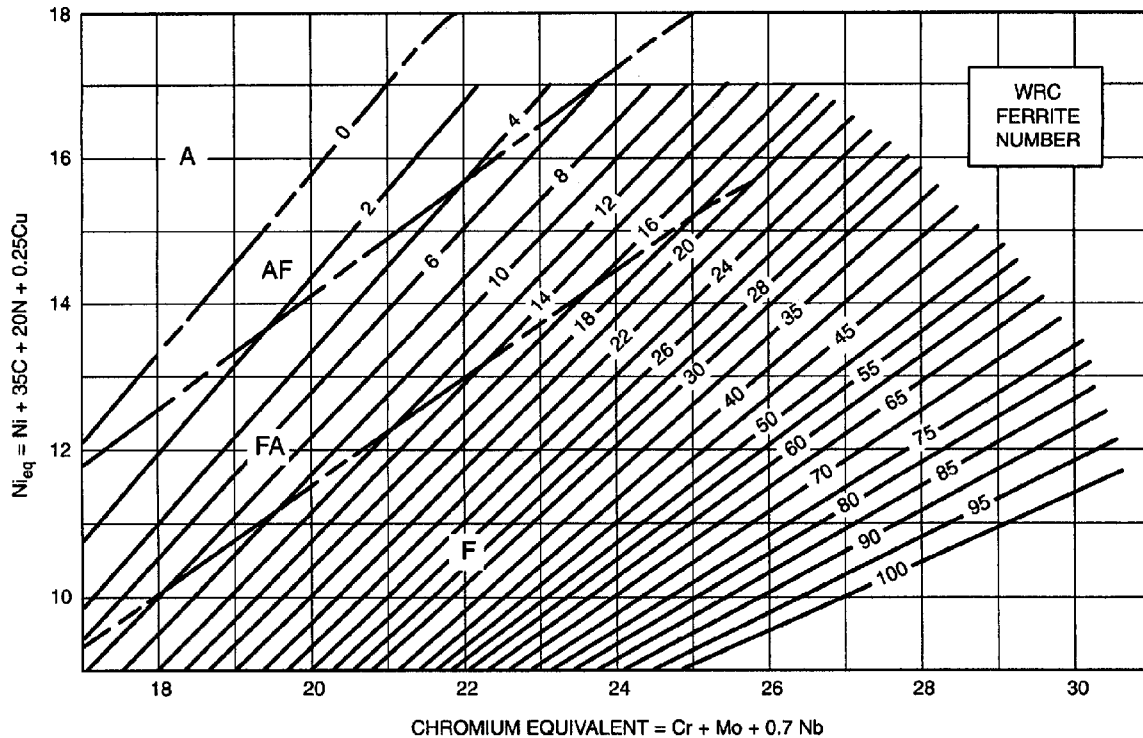


Figure A3 — WRC-1992 (FN) Diagram for Stainless Steel Weld Metal

current machines are being used, the open-circuit voltages can be additive. The added voltages increase the severity of the shock hazard.

In case of electric shock, the power should be turned off. If the rescuer must resort to pulling the victim from the live contact, nonconducting materials should be used. If the victim is not breathing, cardiopulmonary resuscitation (CPR) should be administered as soon as contact with the electrical source is broken. A physician should be called and CPR continued until breathing has been restored, or until a physician has arrived. Electrical burns are treated as thermal burns; that is, clean, cold (iced) compresses should be applied. Contamination should be avoided; the area should be covered with a clean, dry dressing; and the patient should be transported to medical assistance.

Recognized safety standards such as ANSI/ASC Z49.1, *Safety in Welding, Cutting, and Allied Processes*; and National Fire Protection Association (NFPA)⁸ No. 70, *National Electrical Code*, should be followed.

8. NFPA documents are available from the National Fire Protection Association, 1 Batterymarch Park, Quincy, MA 02269.

A9.3 Fumes and Gases. Many welding, cutting, and allied processes produce fumes and gases which may be harmful to health. Fumes are solid particles which originate from welding filler metals and fluxes, the base metal, and any coatings present on the base metal. Gases are produced during the welding process or may be produced by the effects of process radiation on the surrounding environment. Management personnel and welders alike should be aware of the effects of these fumes and gases. The amount and composition of these fumes and gases depend upon the composition of the filler metal and base metal, welding process, current level, arc length, and other factors.

The possible effects of overexposure range from irritation of eyes, skin, and respiratory system to more severe complications. Effects may occur immediately or at some later time. Fumes can cause symptoms such as nausea, headaches, dizziness, and metal fume fever. The possibility of more serious health effects exists when especially toxic materials are involved. In confined spaces, the shielding gases and fumes might displace breathing air and cause asphyxiation. One's head should always be kept out of the fumes. Sufficient ventilation, exhaust at

the arc, or both, should be used to keep fumes and gases from your breathing zone and the general area.

In some cases, natural air movement will provide enough ventilation. Where ventilation may be questionable, air sampling should be used to determine if corrective measures should be applied.

More detailed information on fumes and gases produced by the various welding processes may be found in the following:

(1) The permissible exposure limits required by OSHA can be found in *Code of Federal Regulations*, Title 29, Chapter XVII, Part 1910.

(2) The recommended threshold limit values for fumes and gases may be found in *Threshold Limit Values for Chemical Substances and Physical Agents in the Workroom Environment*, published by the American Conference of Governmental Industrial Hygienists (ACGIH)⁹.

(3) The results of an AWS-funded study are available in a report entitled, *Fumes and Gases in the Welding Environment*, available from the American Welding Society.

(4) Manufacturer's Material Safety Data Sheet for the product.

A9.4 Radiation. Welding, cutting, and allied operations may produce radiant energy (radiation) harmful to health. One should become acquainted with the effects of this radiant energy.

Radiant energy may be ionizing (such as x-rays), or nonionizing (such as ultraviolet, visible light, or infrared). Radiation can produce a variety of effects such as skin burns and eye damage, depending on the radiant energy's wavelength and intensity, if excessive exposure occurs.

A9.4.1 Ionizing Radiation. Ionizing radiation is produced by the electron beam welding process. It is ordinarily controlled within acceptance limits by use of suitable shielding enclosing the welding area.

A9.4.2 Nonionizing Radiation. The intensity and wavelengths of nonionizing radiant energy produced depend on many factors, such as the process, welding parameters, electrode and base-metal composition, fluxes, and any coating or plating on the base metal. Some processes, such as resistance welding and cold pressure welding, ordinarily produce negligible quantities of radiant energy. However, most arc welding and cutting processes (except submerged arc when used properly), laser beam welding and torch welding, cutting, brazing, or

soldering can produce quantities of nonionizing radiation such that precautionary measures are necessary.

Protection from possible harmful effects caused by nonionizing radiant energy from welding include the following measures:

(1) One should not look at welding arcs except through welding filter plates which meet the requirements of ANSI/ASC Z87.1, *Practice for Occupational and Educational Eye and Face Protection*, published by the American National Standards Institute. It should be noted that transparent welding curtains are not intended as welding filter plates, but rather are intended to protect passersby from incidental exposure.

(2) Exposed skin should be protected with adequate gloves and clothing as specified in ANSI/ASC Z49.1, *Safety in Welding, Cutting, and Allied Processes*, published by the American Welding Society.

(3) Reflections from welding arcs should be avoided, and all personnel should be protected from intense reflections. (*Note: Paints using pigments of substantially zinc oxide or titanium dioxide have a lower reflectance for ultraviolet radiation.*)

(4) Screens, curtains, or adequate distance from aisles, walkways, etc., should be used to avoid exposing passersby to welding operations.

(5) Safety glasses with UV-protective side shields have been shown to provide some beneficial protection from ultraviolet radiation produced by welding arcs.

A9.4.3 Ionizing radiation information sources include the following:

(1) AWS F2.1-78, *Recommended Safe Practices for Electron Beam Welding and Cutting*, available from the American Welding Society, Miami, FL.

(2) Manufacturer's product information literature.

A9.4.4 The following include nonionizing radiation information sources:

(1) American National Standards Institute. ANSI/ASC Z136.1, *Safe Use of Lasers*, New York, N.Y.: American National Standards Institute.

(2) ——. ANSI/ASC Z87.1, *Practice for Occupational and Educational Eye and Face Protection*. New York, N.Y.: American National Standards Institute.

(3) ——. ANSI/ASC Z49.1, *Safety in Welding, Cutting, and Allied Processes*. Published by the American Welding Society, Miami, FL.

(4) Hinrichs, J. F. Project Committee on radiation-summary report. *Welding Journal*, January 1978.

(5) Moss, C. E. "Optical radiation transmission levels through transparent welding curtains". *Welding Journal*, March 1979.

(6) Moss, C. E., and Murray, W. E. "Optical radiation levels produced in gas welding, torch brazing, and oxygen cutting". *Welding Journal*, September 1979.

9. ACGIH documents are available from American Conference of Governmental Industrial Hygienists, Kemper Woods Center, 1330 Kemper Meadow Drive, Cincinnati, OH 45240.

(7) Marshall, W. J., Sliney, D. H., *et al.* "Optical radiation levels produced by air-carbon arc cutting processes", *Welding Journal*, March 1980.

(8) National Technical Information Service. Nonionizing radiation protection special study No. 42-0053-77, *Evaluation of the Potential Hazards from Actinic Ultraviolet Radiation Generated by Electric Welding and*

Cutting Arcs. Springfield, Va.: National Technical Information Service, ADA-033768.

(9) ——. Nonionizing radiation protection special study No. 42-0312-77, *Evaluation of the Potential Retina Hazards from Optical Radiation Generated by Electrical Welding and Cutting Arcs*. Springfield, Va.: National Technical Information Service, ADA-043023.

AWS Filler Metal Specifications by Material and Welding Process

	OFW	SMAW	GTAW GMAW PAW	FCAW	SAW	ESW	EGW	Brazing
Carbon Steel	A5.2	A5.1	A5.18	A5.20	A5.17	A5.25	A5.26	A5.8, A5.31
Low-Alloy Steel	A5.2	A5.5	A5.28	A5.29	A5.23	A5.25	A5.26	A5.8, A5.31
Stainless Steel		A5.4	A5.9, A5.22	A5.22	A5.9	A5.9	A5.9	A5.8, A5.31
Cast Iron	A5.15	A5.15	A5.15	A5.15				A5.8, A5.31
Nickel Alloys		A5.11	A5.14		A5.14			A5.8, A5.31
Aluminum Alloys		A5.3	A5.10					A5.8, A5.31
Copper Alloys		A5.6	A5.7					A5.8, A5.31
Titanium Alloys			A5.16					A5.8, A5.31
Zirconium Alloys			A5.24					A5.8, A5.31
Magnesium Alloys			A5.19					A5.8, A5.31
Tungsten Electrodes			A5.12					
Brazing Alloys and Fluxes								A5.8, A5.31
Surfacing Alloys	A5.13, A5.21	A5.13, A5.21	A5.13, A5.21					
Consumable Inserts			A5.30					
Shielding Gases			A5.32	A5.32			A5.32	

AWS Filler Metal Specifications and Related Documents

AWS Designation	Title
FMC	Filler Metal Comparison Charts
UGFM	Users Guide for Filler Metals
A4.2	Standard Procedures for Calibrating Magnetic Instruments to Measure the Delta Ferrite Content of Austenitic and Duplex Austenitic-Ferritic Stainless Steel Weld Metal
A4.3	Standard Methods for Determination of the Diffusible Hydrogen Content of Martensitic, Bainitic, and Ferritic Steel Weld Metal Produced by Arc Welding
A5.01	Filler Metal Procurement Guidelines
A5.1	Specification for Carbon Steel Electrodes for Shielded Metal Arc Welding
A5.2	Specification for Carbon and Low-Alloy Steel Rods for Oxyfuel Gas Welding
A5.3	Specification for Aluminum and Aluminum Alloy Electrodes for Shielded Metal Arc Welding
A5.4	Specification for Stainless Steel Welding Electrodes for Shielded Metal Arc Welding
A5.5	Specification for Low-Alloy Steel Electrodes for Shielded Metal Arc Welding
A5.6	Specification for Covered Copper and Copper Alloy Arc Welding Electrodes
A5.7	Specification for Copper and Copper Alloy Bare Welding Rods and Electrodes
A5.8	Specification for Filler Metals for Brazing and Braze Welding
A5.9	Specification for Bare Stainless Steel Welding Electrodes and Rods
A5.10	Specification for Bare Aluminum and Aluminum Alloy Welding Electrodes and Rods
A5.11	Specification for Nickel and Nickel Alloy Welding Electrodes for Shielded Metal Arc Welding
A5.12	Specification for Tungsten and Tungsten Alloy Electrodes for Arc Welding and Cutting
A5.13	Specification for Solid Surfacing Welding Rods and Electrodes
A5.14	Specification for Nickel and Nickel Alloy Bare Welding Electrodes and Rods
A5.15	Specification for Welding Electrodes and Rods for Cast Iron
A5.16	Specification for Titanium and Titanium Alloy Welding Electrodes and Rods
A5.17	Specification for Carbon Steel Electrodes and Fluxes for Submerged Arc Welding
A5.18	Specification for Carbon Steel Electrodes and Rods for Gas Shielded Arc Welding
A5.19	Specification for Magnesium Alloy Welding Electrodes and Rods
A5.20	Specification for Carbon Steel Electrodes for Flux Cored Arc Welding
A5.21	Specification for Composite Surfacing Welding Rods and Electrodes
A5.22	Specification for Stainless Steel Electrodes for Flux Cored Arc Welding and Stainless Steel Flux Cored Rods for Gas Tungsten Arc Welding
A5.23	Specification for Low-Alloy Steel Electrodes and Fluxes for Submerged Arc Welding
A5.24	Specification for Zirconium and Zirconium Alloy Welding Electrodes and Rods
A5.25	Specification for Carbon and Low-Alloy Steel Electrodes and Fluxes for Electroslag
A5.26	Specification for Carbon and Low-Alloy Steel Electrodes for Electrode Gas Welding
A5.28	Specification for Low-Alloy Steel Electrodes and Rods for Gas Shielded Arc Welding
A5.29	Specification for Low-Alloy Steel Electrodes for Flux Cored Arc Welding
A5.30	Specification for Consumable Inserts
A5.31	Specification for Fluxes for Brazing and Braze Welding
A5.32	Specification for Welding Shielding Gases

For ordering information, contact the Order Department, American Welding Society, 550 N.W. LeJeune Road Miami, FL 33126. Phone: 1-800-334-9353.