

SPECIFICATION FOR CONSUMABLE INSERTS



SFA-5.30



(Identical with AWS Specification A5.30-79)

Scope:

This specification prescribes requirements for classification of consumable inserts.¹

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

1. Classification and Acceptance

1.1 Classification²

1.1.1 Consumable inserts are classified on the basis of their chemical composition as manufactured (see Tables 1, 2, 3, and 4).

1.1.2 Any consumable insert classified under one classification shall not be classified under any other classification of this specification.

1.2 Acceptance. At the option and expense of the purchaser, any or all of the test requirements of this specification may be used as a basis for acceptance of the products covered by this specification.

1.3 Chemical Composition Requirements. The chemical composition shall conform to the requirements of Tables 1, 2, 3, or 4 for the classification involved. The details of the test are specified in Section 3.

¹ For definition of "consumable insert," see AWS A3.0-76, Welding Terms and Definitions.

² For an explanation of the system of classification, see paragraph A2 in the Appendix.

2. Manufacture

2.1 Method of Manufacture. The consumable inserts may be made by any method that will yield a product conforming to the requirements of this specification.

2.2 Standard Shapes, Styles, and Sizes. Standard shapes, styles, and sizes shall be as listed below and shown in Fig. 1 and Tables 5, 6, 7, and 8.³

2.2.1 Class 1, inverted T-shaped cross section

2.2.1.1 Style A, coiled consumable insert

2.2.1.2 Style B, preformed rings, open lap joint

2.2.1.3 Style C, preformed rings, open butt joint

2.2.2 Class 2, J-shaped cross section

2.2.2.1 Style A, coiled consumable insert

2.2.2.2 Style B, preformed rings, open lap joint

2.2.2.3 Style C, preformed rings, open butt joint

2.2.3 Class 3, rectangular-shaped cross section

2.2.3.1 Style D, solid rings, $\frac{3}{16}$ in. (4.8 mm) rim width

2.2.3.2 Style E, solid rings, $\frac{1}{8}$ in. (3.2 mm) rim width

2.2.4 Class 4, Y-shaped cross section

³ Other sizes and shapes may be supplied upon agreement between supplier and purchaser. Chemical composition of other sizes and shapes shall conform to the pertinent classification requirements of this specification.

TABLE 1
CHEMICAL COMPOSITION PERCENT — MILD STEEL^a

	AWS Classification	C	Mn	P	S	Si	Al	Zr	Ti
Group A	INMs1	0.07	0.90 to 1.40	0.025	0.035	0.40 to 0.70	0.05 ^b to 0.15	0.02 ^b to 0.12	0.05 ^b to 0.15
	INMs2	0.06 to 0.15	0.90 to 1.40	0.025	0.035	0.45 to 0.70			
	INMs3	0.07 to 0.15	1.40 to 1.85	0.025	0.035	0.80 to 1.15			

NOTES:

a. Single values are maximum percentages, except where otherwise specified.

b. Al + Zr + Ti = 0.15 minimum.

TABLE 2
CHEMICAL COMPOSITION PERCENT — CHROMIUM MOLYBDENUM STEELS^a

	AWS Classification	C	Mn	P	S	Si	Al	Cr	Mo	Ni	Cu	Total Other
Group B	IN502	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	—	—	—
	IN515	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	0.50
	IN521	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	0.50

NOTE:

a. Single values are maximum percentages, except where otherwise specified.

TABLE 3
CHEMICAL COMPOSITION PERCENT — AUSTENITIC CHROMIUM NICKEL STEELS^a

	AWS Classification	C	Cr	Ni	Mo	Cb + Ta	Mn	Si	P	S	Cu
Group C	IN308 ^{b,d}	0.08	19.5 to 22.0	9.0 to 11.0			1.0 to 2.5	0.25 to 0.60	0.03	0.03	
	IN308L ^{b,d}	0.03	19.5 to 22.0	9.0 to 11.0			1.0 to 2.5	0.25 to 0.60	0.03	0.03	
	IN310	0.08 to 0.15	25.0 to 28.0	20.0 to 22.5			1.0 to 2.5	0.25 to 0.60	0.03	0.03	
	IN312 ^{b,d}	0.08 to 0.15	28.0 to 32.0	8.0 to 10.5			1.0 to 2.5	0.25 to 0.60	0.03	0.03	
	IN316	0.08	18.0 to 20.0	11.0 to 14.0	2.0 to 3.0		1.0 to 2.5	0.25 to 0.60	0.03	0.03	
	IN316L	0.03	18.0 to 20.0	11.0 to 14.0	2.0 to 3.0		1.0 to 2.5	0.25 to 0.60	0.03	0.03	
	IN348 ^{b,d}	0.08	19.0 to 21.5	9.0 to 11.0		10 × C min ^c to 1.0 max	1.0 to 2.5	0.25 to 0.60	0.03	0.03	

NOTES:

a. Single values shown are maximum percentages, except where otherwise specified.

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

c. Tantalum content shall not exceed 0.10 percent.

d. The cobalt content shall not exceed 0.10 percent.

TABLE 4
CHEMICAL COMPOSITION PERCENT — NICKEL ALLOY (INCLUDES COPPER-NICKEL)^{a,b}

	AWS Classifi- cation	C	Mn	Fe	S	P	Si	Cu	Ni + Co	Al	Ti	Cr	Cb + Ta	Other Elements, Total
Group E	IN60	0.15	4.00	2.50	0.015	0.020	1.25	Balance	62.0 to 69.0	1.25	1.5 to 3.0	...	...	0.50
	IN61	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	0.08	1.00	6.0 to 10.0	0.015	0.030	0.35	0.50	70.0 min ^c	...	...	14.0 to 17.0	1.5 to 3.0 ^d	0.50
	IN67	...	1.00	0.40 to 0.75	0.01	0.020	0.15	Balance	29.0 to 32.0	...	0.2 to 0.5	...	...	0.50
	IN6A	0.08	2.00 to 2.75	8.00	0.015	0.030	0.35	0.50	67.0 min ^c	...	2.5 to 3.5	14.0 to 17.0	...	0.50
	IN82	0.10	2.50 to 3.50	3.00	0.015	0.030	0.50	0.50	67.0 min ^c	...	0.75	18.0 to 22.0	2.0 to 3.0 ^d	0.50

NOTES:

- Analysis shall be made for the elements for which specific values are shown. If, however, the presence of other elements is indicated in the course of routine analysis, further analysis shall be made to determine that the total of these other elements is not present in excess of the limits specified for "Other elements, total."
- Single values shown are maximum percentages, except where otherwise specified.
- Cobalt shall not exceed 0.10 percent.
- Tantalum shall not exceed 0.30 percent.

2.2.4.1 Style A, coiled consumable insert

2.2.4.2 Style B, preformed rings, open lap joint

2.2.4.3 Style C, preformed rings, open butt joint

2.2.5 Class 5, rectangular-shaped cross section (contoured edges)

2.2.5.1 Style A, coiled consumable insert

2.2.5.2 Style B, preformed rings, open lap joint

2.2.5.3 Style C, preformed rings, open butt joint

2.3 Standard Packages. Consumable inserts shall be suitably packaged to insure against damage during shipment and storage under normal conditions. The weight of the package shall be agreed upon by the supplier and purchaser and shall not exceed 60 lbs (27 kg).

2.4 Marking

2.4.1 The outside of each unit package of consumable inserts shall be legibly marked to provide the following information:

2.4.1.1 Specification and classification number

2.4.1.2 Supplier's name and trade designation

2.4.1.3 Standard size and net weight

2.4.1.4 Lot, control, or heat number.⁴

2.4.2 Marking of any or all overpackaging of unit packages with items listed in 2.4.1 shall be optional with the manufacturer.

2.4.3 All packages shall carry the following caution label, as a minimum, prominently displayed in legible type:

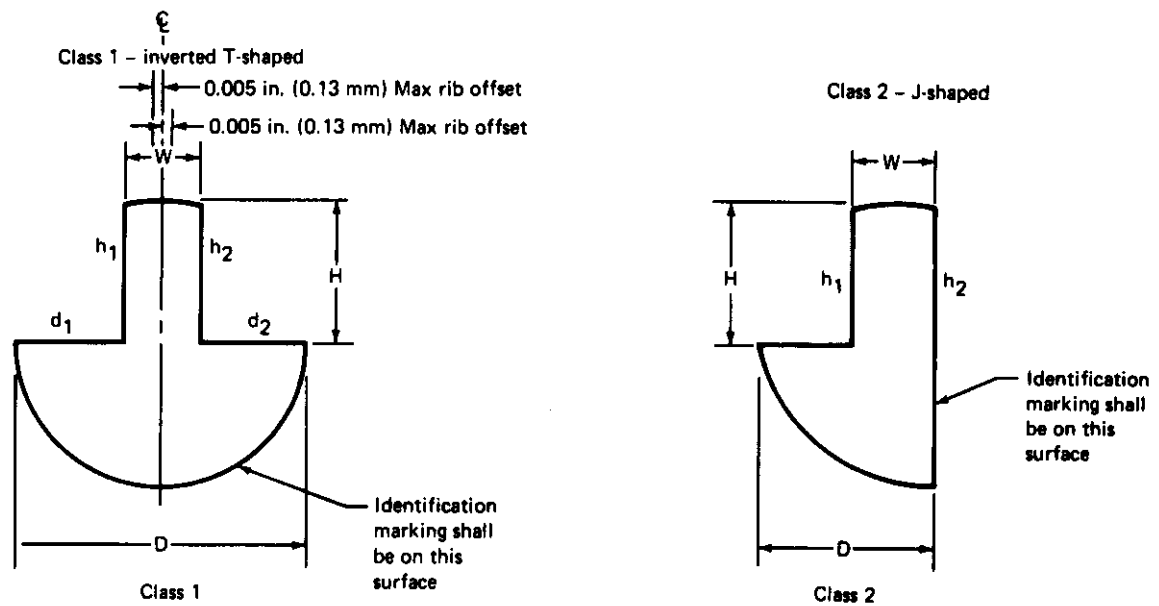
CAUTION

Welding may produce fumes and gases hazardous to health. Avoid breathing these fumes and gases. Use adequate ventilation.

See American National Standard Z49.1, Safety in Welding and Cutting, published by the American Welding Society.

2.5 Consumable Insert Identification. All consumable inserts shall be tagged or otherwise identified to provide the AWS classification number. The prefix letters IN in the insert classification number may be omitted.

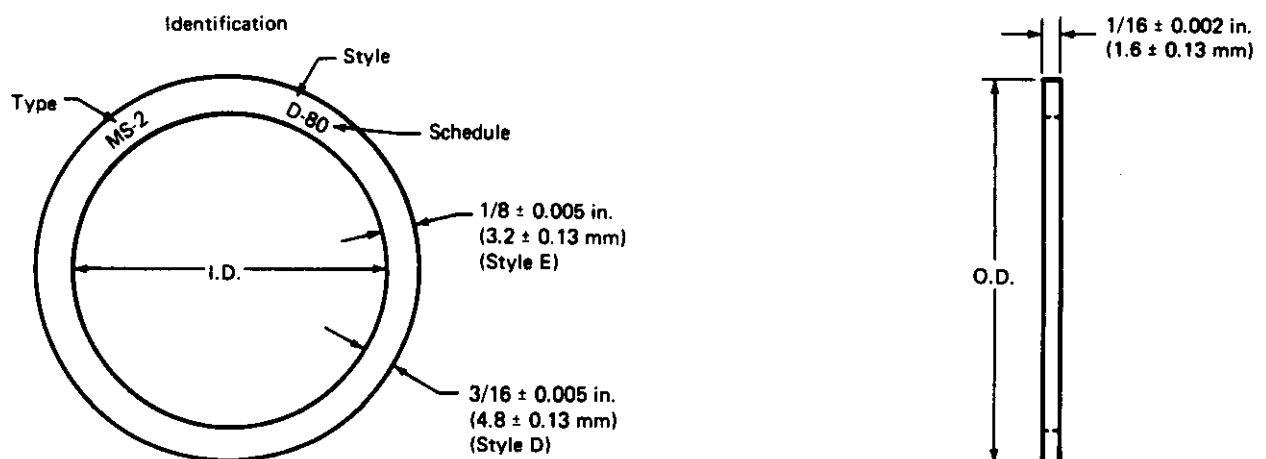
⁴For purposes of this specification, a lot shall be those consumable inserts having the same cross-sectional shape and produced from the same heat of metal. Heat is defined as that material obtained from the same melt of metal.



Notes:

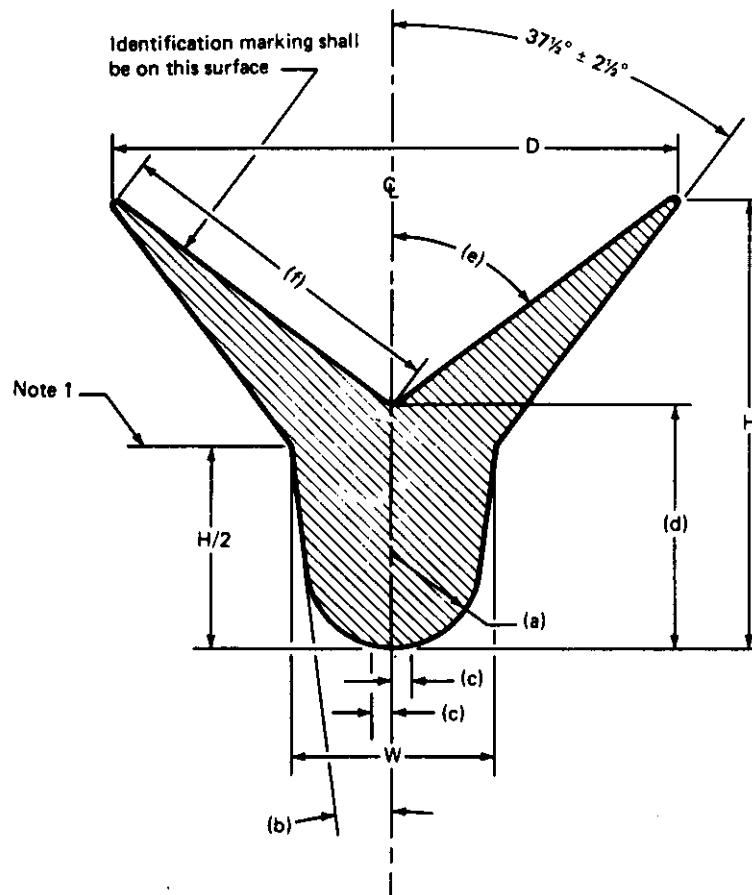
1. Lands (d_1 , d_2) on either side of the rib shall be on the same plane within 0.005 in. (0.13 mm).
2. Rib surfaces (h_1 , h_2) shall be parallel within 0.002 in. (0.05 mm) and square with lands (d_1 , d_2) within 0.005 in. (0.13 mm).
3. Dimensions and tolerances, see Table 8.

Class 1 and Class 2 inserts – Cross-sectional configuration



Class 3 – Solid ring inserts – Plan view and cross-sectional configurations

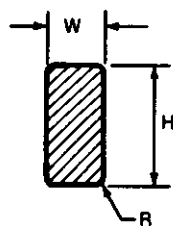
FIG. 1 STANDARD SIZES AND SHAPES OF CONSUMABLE INSERTS



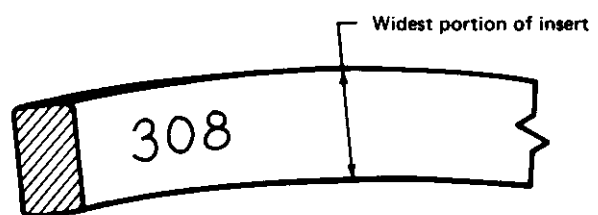
Notes:

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

FIG. 1 STANDARD SIZES AND SHAPES OF CONSUMABLE INSERTS (CONT'D)

TABLE 5
CLASSES 1, 2, AND 5, STYLE B — MINIMUM
OVERLAP

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

2.6 Rounding Off Procedures. For purposes of determining conformance with this specification, an observed or calculated value shall be rounded off to the nearest unit in the last right-hand place of figures used in expressing the limiting value for values in

accordance with the rounding-off method of ASTM E29, Recommended Practice for Indicating Which Places of Figures are to be Considered Significant in Specified Limiting Values.⁵

2.7 Certification. For all material furnished under this specification, the manufacturer certifies (by meeting the requirements of 2.4) that the material, or representative material, has passed the tests required for classification by this specification. When required by the purchaser, the manufacturer shall furnish a copy of the results of those tests.

3. Details of Test Chemical Analysis

3.1 An adequate sample of as-manufactured consumable insert material, sufficient for re-test if necessary, shall be acquired to perform the prescribed chemical analysis.

3.2 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 latest edition of the ASTM Methods for Chemical Analysis of Metals.

⁵ASTM Standards can be obtained from the American Society for Testing and Materials, 1916 Race Street, Philadelphia, PA 19103.

TABLE 6
CLASS 3, STYLE D INSERTS — DIMENSIONS

Pipe Dimensions					Ring Diameter ²			
Nominal Diameter		Schedule Number ¹	ID ²		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	56.4	1.85	47.0
2-1/2	64	10S	2.635	66.93	2.91	73.9	2.54	64.5
		40	2.469	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:

- Schedule number followed by "S" applies to Group C types.
- Class 3, style D insert rings are normally furnished to match nominal internal diameters of the pipe. Special ring sizes (non-stranded) shall be obtainable when specified by contract or purchase order. The dimensions of such rings are determined as follows:
Ring ID (inside diameter) = pipe ID - 0.094 in. (2.38 mm)
Ring OD (outside diameter) = ring ID + 0.375 in. (9.53 mm)
Where special applications demand, rings have 1/8 in. (3.2 mm) instead of the 3/16 in. (4.8 mm) dimension shown on Fig. 1, the narrower width (style E) shall be made available as shown in Table 8. To determine the required ID and OD dimensions for the narrower type, substitute 0.250 in. (6.35 mm) for 0.375 in. (9.53 mm) in the above equations.

TABLE 7
CLASS 3, STYLE E INSERTS — DIMENSIONS*

Pipe Dimensions					Ring Dimensions ²			
Nominal Diameter		Schedule Number ¹	ID ²		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	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	5S	2.709	68.81	2.87	72.9	2.62	66.5
3	76	5S	3.334	84.68	3.49	88.6	3.24	82.3
3-1/2	89	5S	3.834	97.38	3.99	101.3	3.74	95.0
4	102	5S	4.334	110.08	4.49	114.0	4.24	107.7

*See footnotes at end of Table 6.

PART C — SPECIFICATIONS FOR WELDING RODS,
ELECTRODES, AND FILLER METALS

SFA-5.30

TABLE 8
CLASSES 1, 2, 4, AND 5 INSERTS — CROSS-SECTIONAL DIMENSIONS AND TOLERANCES

Insert Size		Class One, ¹ Inverted T-Shaped				Class Two, ¹ J-Shaped				Class Four, ² Y-Shaped				Class Five, Rectangular-Shaped			
		Dimensions		Tolerances		Dimensions		Tolerances		Dimensions		Tolerances		Dimensions		Tolerances	
in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm
$\frac{1}{8}$	3.2	D	0.125	3.18	± 0.004	± 0.10	0.086	2.18	$+0.011$ -0.005	$+0.28$ -0.13	0.165	4.19	± 0.010	± 0.25	...	...	...
		W	0.047	1.19	$+0.002$ -0.012	$+0.05$ -0.30	0.047	1.19	$+0.002$ -0.012	$+0.05$ -0.30	0.078	1.98	± 0.010	± 0.25	0.0625	1.59	± 0.010
		H	0.055	1.40	$+0.012$ -0.002	$+0.30$ -0.05	0.055	1.40	$+0.012$ -0.002	$+0.30$ -0.05	0.140	3.56	± 0.010	± 0.25	0.125	3.18	± 0.010
		H/2	...	...	...	...	...	...	...	...	0.072	1.83	± 0.010	± 0.25	...	...	...
		R	...	...	...	...	...	...	...	...	...	...	...	0.0156	0.40	± 0.005	± 0.13
$\frac{5}{32}$	4.0	D	0.156	3.96	± 0.005	± 0.13	0.110	2.79	$+0.012$ -0.010	$+0.30$ -0.25	0.205	5.21	± 0.015	± 0.38	...	...	...
		W	0.063	1.60	$+0.003$ -0.014	$+0.08$ -0.36	0.063	1.60	$+0.003$ -0.014	$+0.08$ -0.36	0.093	2.36	± 0.015	± 0.38	0.125	3.18	± 0.015
		H	0.063	1.60	$+0.014$ -0.003	$+0.36$ -0.08	0.063	1.60	$+0.014$ -0.010	$+0.36$ -0.25	0.175	4.45	± 0.010	± 0.25	0.156	3.96	± 0.015
		H/2	...	...	...	...	...	...	...	...	0.093	2.36	± 0.010	± 0.25	...	...	...
		R	...	...	...	...	...	...	...	...	...	...	...	0.03125	0.794	± 0.005	± 0.13

NOTES:

1. The offset between the center of the rib (W) and center of the land (D) shall not exceed 0.005 in. (0.13 mm).
2. Additional dimensions and tolerances — class 4, Y-shaped inserts (See Fig. 1):

	$\frac{1}{8}$ in. size	$\frac{3}{32}$ in. size	$\frac{1}{4}$ in. size
(a) Radius of rib	0.044 $\pm$ 0.005	1.12 $\pm$ 0.13	4.0 mm size
(b) Angle between side of rib and center line	1° - 2°	0.050 $\pm$ 0.005	1.27 $\pm$ 0.13
(c) Rib offset	± 0.010	± 0.015	1° - 2°
(d) Height of rib along center line	0.100 $\pm$ 0.010	0.115 $\pm$ 0.010	± 0.38
(e) Angle between top surface of inclined arm and center line	50° $\pm$ 5°	50° $\pm$ 5°	2.92 $\pm$ 0.25
(f) Length of inclined arm	0.085 $\pm$ 0.010	0.125 $\pm$ 0.010	50° $\pm$ 5°
			3.18 $\pm$ 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.

Appendix: Guide to AWS Classification of Consumable Inserts

A1 Introduction

This guide is appended to the specification as a source of information; *it is not mandatory and does not form a part of the specification*. The purpose of this guide is to correlate the filler metal classification with 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 have, however, necessitated specific changes that more ably 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 solid products are classified on the basis of their chemical composition. However, their cross-sectional configurations are another consideration that must be selected and specified when ordering.

A3 Description of Process

A3.1 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 a confined space for welding or the necessity for maximum insurance against weld cracks, etc. They usually are used in pipe joints but are often used also in pressure vessel and structural applications. The classes of consumable inserts most commonly used are illustrated in Fig. 1. The various classes are normally available in the sizes listed in Tables 5 through 8.

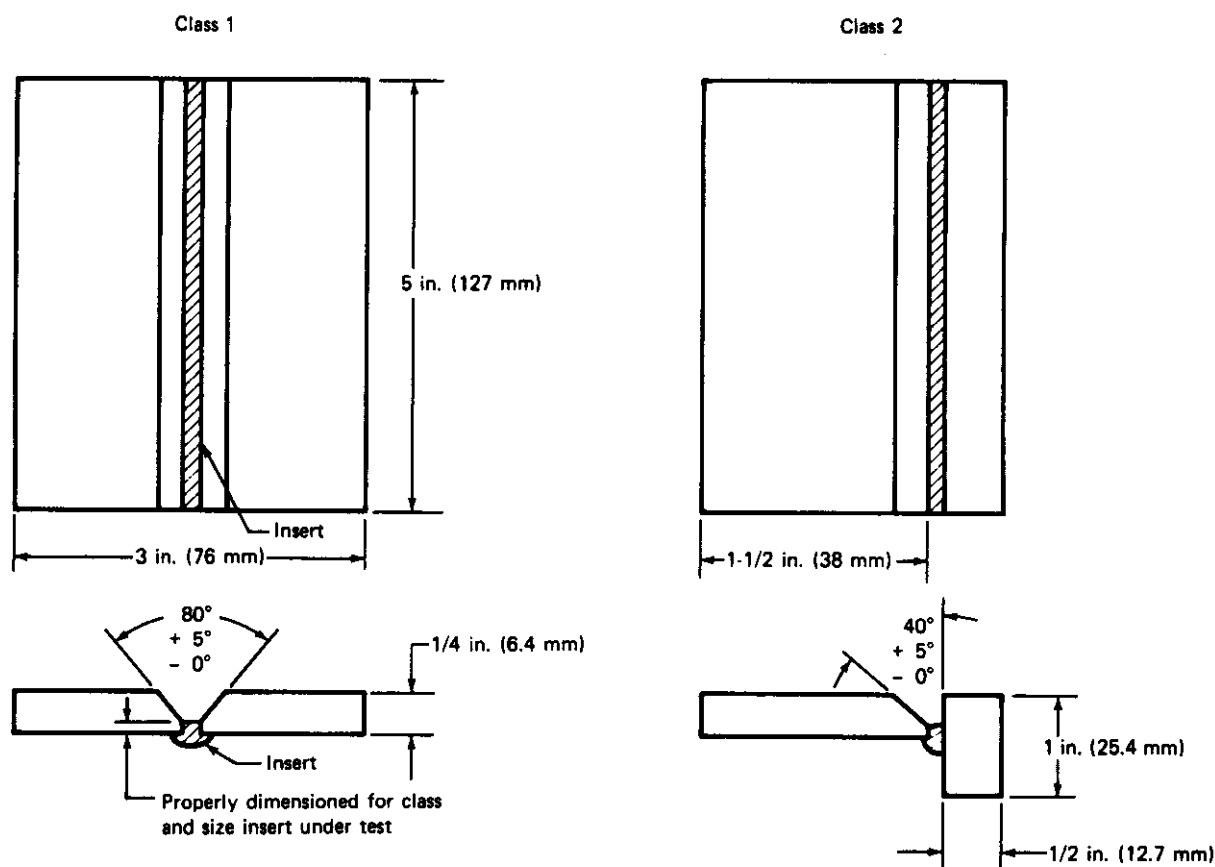
A3.2 Purging. To provide welded piping systems with the integrity required by existing codes, the weld joint must provide a full penetration joint with weld

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 GTAW process, either manual or automatic, is generally used to consume or fuse the consumable insert. This method is particularly adaptable to conditions encountered in pipe welding but 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 back side of the joint is inaccessible for welding. In order to obtain a suitably smooth, uniform back side weld surface without crevices or oxidation, a purge must 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 $\frac{3}{16}$ in. (4.8 mm) root thickness is obtained.

A3.3 Ferrite Content. For use of austenitic consumable inserts, the purchaser should specify in his purchase order the applicable limits for ferrite or the ferrite number he requires 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 shall be measured by means of a suitable instrument that has been calibrated in accordance with AWS A4.2-74, Standard Procedures for Calibrating Magnetic Instruments to Measure the Delta Ferrite Content of Austenitic Stainless Steel Weld Metal.

A3.4 Joint Configuration. It should be noted that the joint end preparation configuration must 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) shall not exceed $\frac{1}{16}$ in. (1.6 mm).



All dimensions, excluding angles, are in inches (millimeters).

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 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:
 - (1) The contour of the backside surface of fused insert.
 - (a) Reinforcement shall not exceed 3/32 in. (2.4 mm).
 - (b) Concavity shall not exceed 1/32 in. (0.8 mm).
 - (c) The contour shall have a uniform radius and shall blend smoothly into the base metal.
 - (2) The fused insert shall also be free of linear indications, as revealed by liquid penetrant inspection with non-water washable penetrant.

FIG. A1 FUSIBILITY TEST JOINT

A4 Ordering Information

When ordering inserts, the following items should be included:

- (1) Title, number, and date of this specification
- (2) Classifications, shape, and size, including pipe schedule
- (3) Required ferrite content or number (as applicable)

A5 Ventilation During Welding

A5.1 Three major factors in arc and gas welding that govern the amount of contamination to which welders or welding operators may be exposed to are:

A5.1.1 Dimensions of space in which welding is to be done (with special regard to height of ceiling).

A5.1.2 Number of welders or welding operators working in that space.

A5.1.3 Possible evolution of hazardous fumes, gases, or dusts, according to the metals and shielding gases involved.

A5.2 American National Standard Z49.1, Safety in Welding and Cutting, discusses the ventilation required during welding and should be referred to for details. Attention is particularly drawn to Section 8, Health Protection and Ventilation.

A6 Usability

A6.1 The control of chemical composition is generally sufficient to insure usability of these classifications. However, a fusibility test is sometimes specified. Figure A1 illustrates a typical fusibility test plate.

A6.2 A complete description of the characteristics of the consumable insert classifications covered by this specification is beyond the scope of this document. For further information, see AWS D10.4-79, Recommended Practices for Welding Austenitic Chromium-Nickel Stainless Steel Piping and Tubing, and AWS D10.11-79, Recommended Practices for Root Pass Welding and Gas Purging.