

WW-U-531F

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 13 February 1968

## FEDERAL SPECIFICATION

UNIONS, PIPE, STEEL OR MALLEABLE IRON: THREADED  
 CONNECTION, 150 LB, 250 LB AND 300 LB WSP

This specification was approved by the Assistant Administrator, Office of Federal Supply and Services, General Services Administration, for use of all Federal agencies.

## 1. SCOPE AND CLASSIFICATION

1.1 Scope. This specification covers pipe unions with threaded connections, for 150 psig (pounds per square inch gauge) WSP (working steam pressure), 250 psig WSP, and 300 psig WSP unions joining standard weight and extra heavy pipe.

1.2 Classification.

1.2.1 Union designation. Unions covered by this specification shall be designated in the following form, (see 6.2 and 6.4).

Definitive Federal Specification Part Number	WWU531	XX	X	X
Federal specification code number	_____	_____	_____	_____
Type, class, and size code number (see 1.2.1.1)	_____	_____	_____	_____
Type thread code letter (1.2.1.2)	_____	_____	_____	_____
End style code letter (1.2.1.3)	_____	_____	_____	_____

FSC 4730

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WW-U-531F

1.2.1.1 Type, class, and size. The type, class, and size of the union are identified by two numerical symbols which indicate its application characteristics, (see Table I).

TABLE I. Type, Class, and size code number 1/

CODE NUMBER						
CLASS 1		CLASS 2		CLASS 3		NOMINAL
TYPE		TYPE		TYPE		PIPE
A	B	A	B	A	B	SIZE (INCHES)
00	70	21	33	45	57	1/8
01	11	22	34	46	58	1/4
02	12	23	35	47	59	3/8
03	13	24	36	48	60	1/2
04	14	25	37	49	61	3/4
05	15	26	38	50	62	1
06	16	27	39	51	63	1-1/4
07	17	28	40	52	64	1-1/2
08	18	29	41	53	65	2
09	19	30	42	54	66	2-1/2
10	20	31	43	55	67	3
69	71	32	44	56	68	4

1/ Types and classes have the following meaning:

- Type A - Uncoated malleable iron or steel unions with copper brass or bronze seats.  
 Type B - Zinc coated malleable iron and carbon steel unions with copper, brass, or bronze seats.  
 Class 1 - 150 psig WSP; 300 psig WOG (cold, nonshock)  
 Class 2 - 250 psig WSP; 500 psig WOG (cold, nonshock)  
 Class 3 - 300 psig WSP; 600 psig WOG (cold, nonshock)

1.2.1.2 Type of pipe thread. The type of pipe thread is designated by a single letter, (see Table II).

TABLE II. Type of pipe thread code letter

CODE LETTER	TYPE OF THREAD
T	NPT (American Standard taper pipe thread)
F	NPTF (Dryseal USA Standard taper pipe thread)

1.2.1.3 End style. The end style of the union is identified by a single letter (see Table III).

TABLE III. Union end style

CODE LETTER	END STYLE
A	Polygonal, round, or rounded with lugs.
B	Polygonal.
C	Rounded without lugs.
D	Rounded with lugs.

## 2. APPLICABLE DOCUMENTS.

2.1 The following documents, of issue in effect on date of invitation for bids or request for proposal, form a part of this specification to the extent specified herein:

### Federal Standard:

- Fed. Std. No. 123 - Marking for Shipment (Civil Agencies).
- Fed. Std. No. H28 - Screw-Thread Standards for Federal Services.

(Activities outside the Federal Government may obtain copies of Federal Specifications, Standards, and Handbooks as outlined under General Information in the Index of Federal Specifications and Standards and at the prices indicates in the Index. The index, which includes cumulative monthly supplements issued, is for sale on a subscription basis by the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402.)

(Single copies of this specification and other Federal Specifications required by activities outside the Federal Government for bidding purposes are available without charge from Business Services Centers at the General Services Administration Regional Offices in Boston, New York, Washington, DC, Atlanta, Chicago, Kansas City, MO, Fort Worth, Denver, San Francisco, Los Angeles, and Seattle, WA.)

(Federal Government activities may obtain copies of Federal Specification, Standards, and Handbooks and the Index of Federal Specifications and Standards from established distribution points in their agencies.)

### Military Specification:

- MIL-V-3 - Valves, Fittings and Flanges (Except for Systems Indicated Herein), Packaging of.
- MIL-P-116 - Method of Preservation

WW-U-531F

Military Standards:

- MIL-STD-105 - Sampling Procedures and Tables for Inspection by Attributes.
- MIL-STD-109 - Quality Assurance Terms and Definitions.
- MIL-STD-129 - Marking for Shipment and Storage.
- MIL-STD-794 - Parts and Equipment, Procedures for Packaging of.

(Copies of Military Specifications and Standards required by suppliers in connection with specific procurement functions should be obtained from the procuring activity or as directed by the contracting officer.)

2.2 Other publications. The following documents form a part of this specification to the extent specified herein. Unless otherwise indicated, the issue in effect on date of invitation for bids or request for proposal shall apply.

American National Standards Institute, Inc. (ANSI):

- B2.1 - Pipe Threads (Except Dryseal).
- B2.2 - Dryseal Pipe Threads.
- B16.39 - Malleable Iron Threaded Pipe Unions, Class 150, 250, and 300.

(Application for copies should be addressed to the American National Standards Institute, 1430 Broadway, New York, NY 10018.)

American Society for Testing and Materials (ASTM) Standards:

- A153 - Zinc Coating (Hot Dip) on Iron and Steel Hardware.
- A197 - Specification for Cupola Malleable Iron.
- A576 - Special Quality Hot-Rolled Carbon Steel Bars, Specification for.
- A675 - Special Quality Hot-Rolled Carbon Steel Bars Subject to Mechanical Property Requirements.
- B633 - Electrodeposited Coating of Zinc on Iron and Steel.
- D3951 - Standard for Commercial Packaging.

(Application for copies should be addressed to the American Society for Testing and Materials, 1916 Race Street, Philadelphia, PA 19103.)

National Motor Freight Traffic Association, Inc. Agent:

National Motor Freight Classification.

(Application for copies should be addressed to the National Motor Freight Traffic Association, Inc., Traffic Department, 1616 P Street, N.W., Washington, DC 20036.)

Uniform Classification Committee, Agent:

Uniform Freight Classification.

(Application for copies should be addressed to the Uniform Classification Committee, Tariff Publishing Officer, Room 1106, 222 South Riverside Plaza, Chicago, IL 60606.)

### 3. REQUIREMENTS

3.1 Material. Unions shall be malleable iron conforming to the minimum requirements of ASTM A197 or carbon steel conforming to ASTM A576 and ASTM A675. The manufacturer may use any composition of brass, bronze, or copper for the seat, which shall be suitable for the purpose intended. Recycled and recovered raw materials should be used to the maximum extent possible in lieu of virgin raw materials as long as these materials do not jeopardize the intended use and fully comply with all contract requirements. Materials used shall be free from defects which would adversely affect the performance or maintainability of individual components or the overall assembly. Material not specified herein shall be of the same quality used for the intended purpose in commercial practice. None of the above shall be interpreted to mean that the use of used or rebuilt products will be allowed.

3.2 Design. The unions shall consist of a male part, female part, and attaching nut, which shall conform to the requirements of ANSI B16.39. A brass, bronze, or copper ring shall be forced securely into the female portion of the union so as to become a permanent part and to form a bearing for the male portion. The seat of the male portion may be brass, malleable iron, or steel. Figure 1 indicates location of seat, but not the method of attachment. Unions with brass seat shall be furnished either with ball or ball-to-cone joints. The male or female part of the 1/8-inch unions made from bar stock may be solid brass or bronze, and shall meet the tensile strength requirements of Table IV.

TABLE IV. Tensile Strength of Unions

IRON PIPE		ULTIMATE LOAD, lb f		IRON PIPE		ULTIMATE LOAD, lb f	
SIZE	CLASS 1 & 2	CLASS 3	SIZE	CLASS 1 & 2	CLASS 3	CLASS 1 & 2	CLASS 3
1/8	2,500	4,000	1-1/4	21,300	23,000		
1/4	3,800	6,000	1-1/2	25,800	28,000		
3/8	5,300	8,000	2	30,000	40,000		
1/2	7,700	10,000	2-1/2	35,000	55,000		
3/4	10,600	14,000	3	40,000	75,000		
1	15,500	18,000	4	50,000	110,000		

3.2.1 Mating surfaces. All surfaces subjected to pressure when the union is tightened shall be finished smooth and true. Each union shall be machined or ground to insure proper seating.

3.2.2 Threaded ends. All union ends shall have either NPT threads conforming to FED STD H28 and ANSI B2.1 or NPTF threads conforming to FED STD H28 and ANSI B2.2, as specified (see 6.2 and 6.4), except in either case the minimum full thread length shall be as specified in Table V. Size 1/8-inch unions when made from bar stock may have straight pipe threads.

3.2.3 Dimensions. Unions shall conform to the applicable dimensions shown in Figure 1 and Table V for the class and size specified by the part number (see 1.2 and 6.2).

WW-U-531F

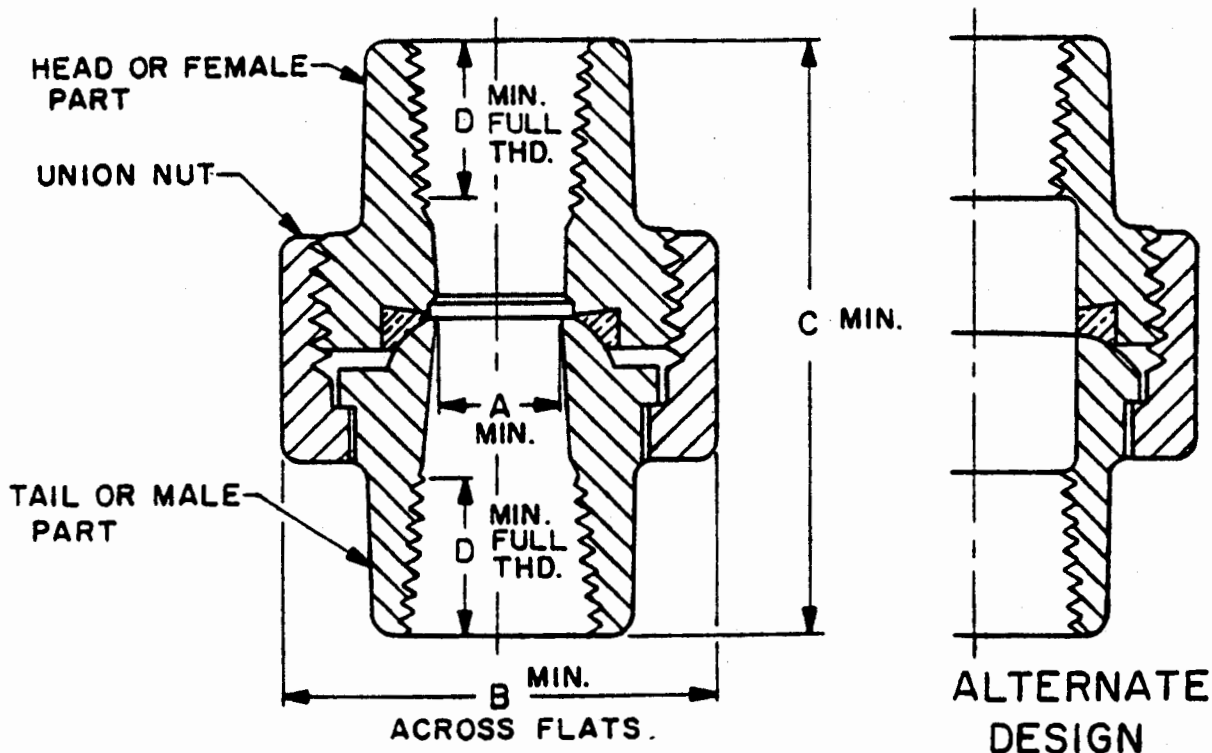
TABLE V. Unions, dimensions, (inches), classes 1, 2 and 3

Pipe size	Class 1					Class 2				
	A min.	B <u>1</u> / min.	C min.	D <u>2</u> / min.	E <u>3</u> / min.	A min.	B <u>1</u> / min.	C min.	D <u>2</u> / min.	E <u>3</u> / min.
1/8	.21	.93	1.26	.30	6	.21	.93	1.26	.30	6
1/4	.36	1.10	1.44	.32	8	.30	1.11	1.55	.43	8
3/8	.52	1.26	1.61	.36	8	.42	1.26	1.71	.47	8
1/2	.61	1.45	1.72	.43	8	.54	1.45	1.81	.57	8
3/4	.80	1.71	1.94	.50	8	.74	1.71	2.07	.64	8
1	1.00	2.07	2.06	.58	8	.95	2.07	2.31	.75	8
1-1/4	1.31	2.50	2.26	.67	8	1.27	2.57	2.62	.84	8
1-1/2	1.55	2.82	2.41	.70	8	1.50	2.89	2.78	.87	8
2	2.03	3.41	2.75	.75	8	1.93	3.48	3.13	1.00	8
2-1/2	2.38	4.12	3.22	.92	8	2.32	4.15	3.52	1.17	8
3	3.00	4.75	3.50	.98	8	2.90	4.96	3.84	1.23	8
4	4.03	6.00	3.85	1.08	8	3.82	6.47	4.39	1.33	8

Pipe size	Class 3				
	A Min.	B <u>1</u> / Min.	C Min.	D <u>2</u> / Min.	E <u>3</u> / Min.
1/8	0.21	0.93	1.26	0.30	6
1/4	0.30	1.33	1.55	0.43	8
3/8	0.42	1.50	1.71	0.47	8
1/2	0.54	1.76	1.81	0.57	8
3/4	0.74	2.15	2.12	0.64	8
1	0.95	2.48	2.31	0.75	8
1-1/4	1.27	3.02	2.66	0.84	8
1-1/2	1.50	3.28	2.85	0.87	8
2	1.93	3.96	3.23	1.00	8
2-1/2	2.32	4.72	3.33	1.17	8
3	2.90	5.37	4.09	1.23	8
4	3.82	7.00	4.47	1.33	8

1/ Minimum across flats.2/ Minimum full thread.3/ Minimum number of sides on nut.

FIGURE 1. Unions, Classes 1, 2, and 3



3.2.4 Union ends. Union ends shall be polygonal, round or rounded with lugs, unless one of these end designs is particularly specified (see 1.2 and 6.2).

### 3.3 Types.

3.3.1 Type A. Type A unions shall be uncoated.

3.3.2 Type B. Type B unions shall be zinc-coated by either the hot dip or electrodeposited method, inside and out.

3.3.2.1 Electrodeposited coating. When electrodeposited zinc coating is used, the plating shall be in accordance with ASTM specification B633, Type II, SC4. The plating shall be done after machining and threading.

3.3.2.2 Hot dip. When hot dip process is used, the coating shall be in accordance with class A of ASTM A153 and shall be applied prior to all threading and machining.

3.4 Tensile strength. The minimum tensile strength of unions when assembled and tested in accordance with 4.6.2 shall be as shown in Table IV.

3.5 Air pressure. Unions shall pass the test specified in 4.6.1 without evidence of air leakage.

WW-U-531F

3.6 Hydrostatic strength. Unions shall withstand without rupture or leakage at the joints, an internal hydrostatic pressure of five times the cold nonshock pressure rating when tested as specified in 4.6.4.

3.7 Marking for identification. The name or trademark of the manufacturer shall be permanently marked on the outside of each union.

3.8 Workmanship. The unions shall be free from blowholes, porosity, cracks, seams, sand, scale, and rust. Swivel nuts shall rotate freely. The union shall assemble freely without binding.

#### 4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection. Unless otherwise specified in the contract, the contractor is responsible for the performance of all inspection requirements herein. Except as otherwise specified in the contract, the contractor may use his own or any other facilities suitable for the performance of the inspection requirements specified herein, unless disapproved by the Government. The Government reserves the right to perform any of the inspections set forth in the specification where such inspections are deemed necessary to assure supplies and services conform to prescribed requirements.

4.1.1 Inspection of materials and components. In accordance with 4.1, the contractor is responsible for insuring that materials and components used were manufactured, examined, and tested to the extent specified, in accordance with the requirements of referenced subsidiary specifications and standards. The terms and definitions of MIL-STD-109 shall apply.

4.2 Classification of inspections. The inspection requirements specified herein are classified as follows:

(a) Quality conformance inspection (see 4.2.1).

4.2.1 Quality conformance inspection. Quality conformance inspection shall be performed on the sample unions selected in accordance with 4.4. This inspection shall include the examination of 4.5 and the tests of 4.6.

4.3 Inspection lot. All units of the same type, style, size, and composition offered to the Government at one time shall be considered a lot for purposes of inspection.

4.4 Sampling for examination. A random sample of unions shall be selected from each lot offered to the Government in accordance with MIL-STD-105 at inspection level S-3. The Acceptable Quality Level (AQL) shall be 1.0 percent defective for major defects and 4.0 percent defective for minor defects.

4.5 Examination. Each unit selected in accordance with 4.4 shall be examined to verify compliance with the requirements of this specification. Examination shall be conducted as specified in Table VI.



TABLE VI. Classification of defects

CATEGORIES	DEFECTS	REFERENCE PARAGRAPH
<b>MAJOR:</b>		
101	Type, class, size and dimensions not as specified.	1.2 and 3.2.3
102	Surfaces subject to pressure not smooth	3.2.1
103	Threads not as specified.	3.2.2
104	Zinc coating missing, when applicable.	3.3.2
105	Blowholes, porosity, cracks, seams, sand, scale, and rust present.	3.8
106	Swivel does not turn freely.	3.8
107	Union parts do not go together without binding	3.8
<b>MINOR:</b>		
201	Marking not as specified.	3.7

#### 4.6 Tests.

4.6.1 Air pressure test. Unless otherwise specified (see 6.2), each union selected in accordance with 4.4 shall be tested under water or light oil by the application of air pressure as specified in Table VII, for a period of ten (10) seconds. No leakage shall occur. As an alternative to the air under water or light oil test, automatic testing machines may be used (see 3.5). An AQL of 2.5 percent defective shall apply.

TABLE VII. Air Pressure

CLASS OF UNION	AIR PRESSURE APPLIED (psig)
1 and 2	40
3	60

4.6.2 Tension test. Unless otherwise specified (see 6.2), each union selected in accordance with 4.4, shall be subjected to tension loading to verify conformance with 3.4. Suitable threaded rods shall be screwed into union ends. The test assembly shall then be secured in a tensile testing machine equipped with spherically seated adapters to minimize cramping and aid in axial loading. The test rods should be as long as can be conveniently accommodated in the tensile testing machine. An AQL of 2.5 percent defective shall apply.

4.6.3 Zinc coating. Unless otherwise specified (see 6.2), each union selected in accordance with 4.4 shall be tested in accordance with ASTM A153 to determine conformance to 3.3.2.

WW-U-531F

4.6.4 Hydrostatic pressure test. Unless otherwise specified (see 6.2), each union selected in accordance with 4.4 shall be subjected to a hydrostatic pressure of five times the cold nonshock pressure rating for a period of 1 minute without signs of damage or leakage. The test medium shall be water (see 3.6).

4.7 Preparation for delivery inspection. Preservation, packaging, packing, and marking requirements of the unions shall be inspected to determine conformance with the applicable requirements of Section 5 of the Specification.

## 5. PACKAGING

5.1 Preservation shall be Level A, C or Commercial/Industrial as specified (see 6.2).

5.1.1 Level A. The unions shall be preserved and packaged in accordance with the applicable Level-A requirements of MIL-V-3 and MIL-P-116.

5.1.2 Level C. The unions shall be preserved and packaged in accordance with the applicable Level-C requirements of MIL-V-3 and MIL-P-116.

5.1.3 Commercial/Industrial. The commercial preservation of the union shall be in accordance with the requirements of ASTM D 3951.

5.2 Packing. Packing shall be level A, B, C or commercial/industrial as specified (see 6.2).

5.2.1 Level A. The packaged unions shall be packed in containers as specified in MIL-STD-794 for Level A protection.

5.2.2 Level B. The packaged unions shall be packed in containers as specified MIL-STD-794 for Level B protection.

5.2.3 Level C. The packaged unions shall be packed in containers as specified in MIL-STD-794 for Level C protection.

5.2.4 Commercial/Industrial. The packaged union shall be packed in accordance with the requirements of ASTM D 3951.

## 5.3 Marking.

5.3.1 Levels A, B and C. In addition to any special or other identification marking required by the contract (see 6.2) each unit pack, intermediate and exterior container and unitized load shall be marked in accordance with MIL-STD-129.

5.3.2 Commercial. Commercial/industrial marking shall be in accordance with the requirements of ASTM D 3951.

## 6. NOTES

6.1 Intended use. Unions covered by this specification are intended for standard weight and extra heavy pipe and are used on oil, fuel, gas, air, water and steam lines. Pressure-temperature ratings for unions covered by this specification are shown in 6.3.

6.2 Ordering data. Purchasers should select the preferred options permitted herein and include the following information in procurement documents.

- (a) Title, number and date of this specification.
- (b) Definitive Federal Specification part number required (see 1.2, 3.2.2, 3.2.3, 3.2.4, and 6.4).
- (c) When air pressure, tension, zinc coating, and hydrostatic test is not required (see 4.6.1, 4.6.2, 4.6.3, and 4.6.4).
- (d) Level of preservation and packaging and level of packing required (see 5.1 and 5.2).
- (e) Marking required (see 5.3).

6.3 Pressure-temperature rating. The pressure-temperature ratings, which are applicable to the unions covered by this specification, are shown in TABLE VIII.

TABLE VIII. Union pressure-temperature ratings

TEMPERATURE DEGREE F	PRESSURE (psig) <sup>1/</sup> <sup>2/</sup>		
	CLASS 1	CLASS 2	CLASS 3
-20 to 150	300	500	600
200	265	455	550
250	225	405	505
300	185	360	460
350	150	315	415
400	110	270	370
450	75	225	325
500	-	180	280
550	-	130	230

<sup>1/</sup> Nonshock condition

<sup>2/</sup> Unions with copper or copper alloy seats are not intended for use where temperature exceeds 450 degrees F.

6.4 Definitive Federal specification part number. The Federal specification part number is a definitive part number which corresponds to the type, class, and size of unions covered by this specification and defines the requirements of the options presented under this specification. The Federal specification code number, the class, type and size code number, the type of pipe thread code letter, and the end style code letter are combined to form the definitive Federal specification part number.

MILITARY CUSTODIANS:

Army - ME  
Navy - YD  
Air Force - 82

REVIEW ACTIVITY:

DLA - CS

USER ACTIVITIES:

Army - CE, AR  
Navy - MC, CG

CIVIL AGENCY COORDINATING ACTIVITIES:

GSA - FSS, PCD  
HEW - FEC  
INTERIOR - BPA  
NASA - JFK

PREPARING ACTIVITY:

Navy - YD

AGENT ACTIVITY:

DLA - CS  
Project No. 4730-0395