

INCH-POUND

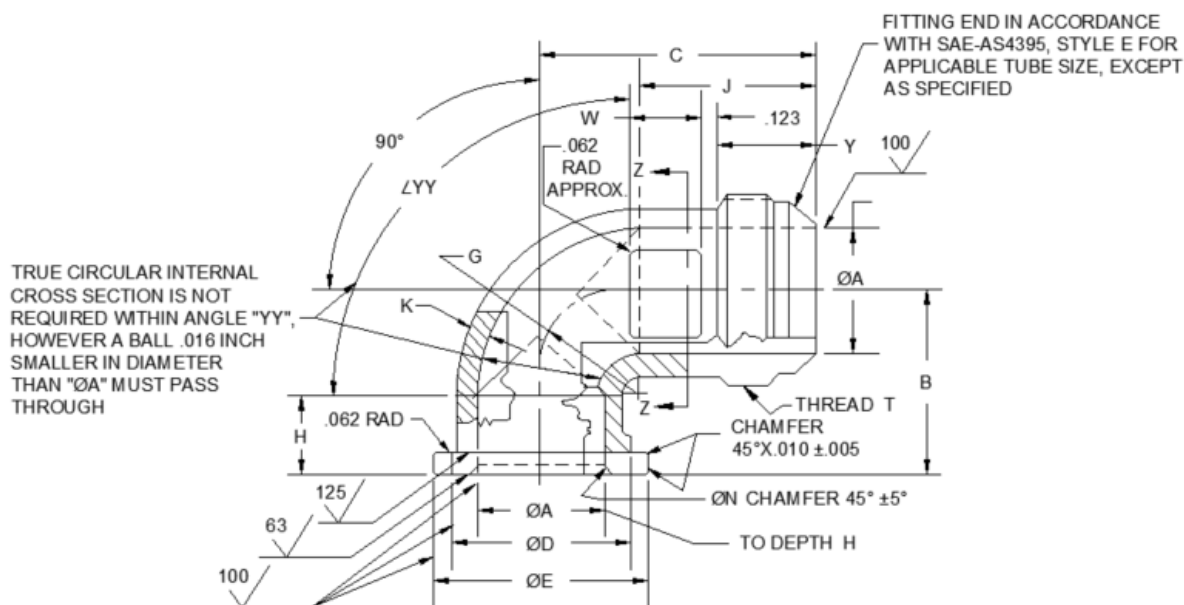
MS20762F
 2 March 2020
 SUPERSEDING
 MS20762E
 w/AMENDMENT 1
 6 August 2019

DETAIL SPECIFICATION SHEET

ELBOW, FLARED TUBE, FLANGED, SWIVEL, 90 DEGREE

This specification is approved for use by all Departments and Agencies of the Department of Defense.

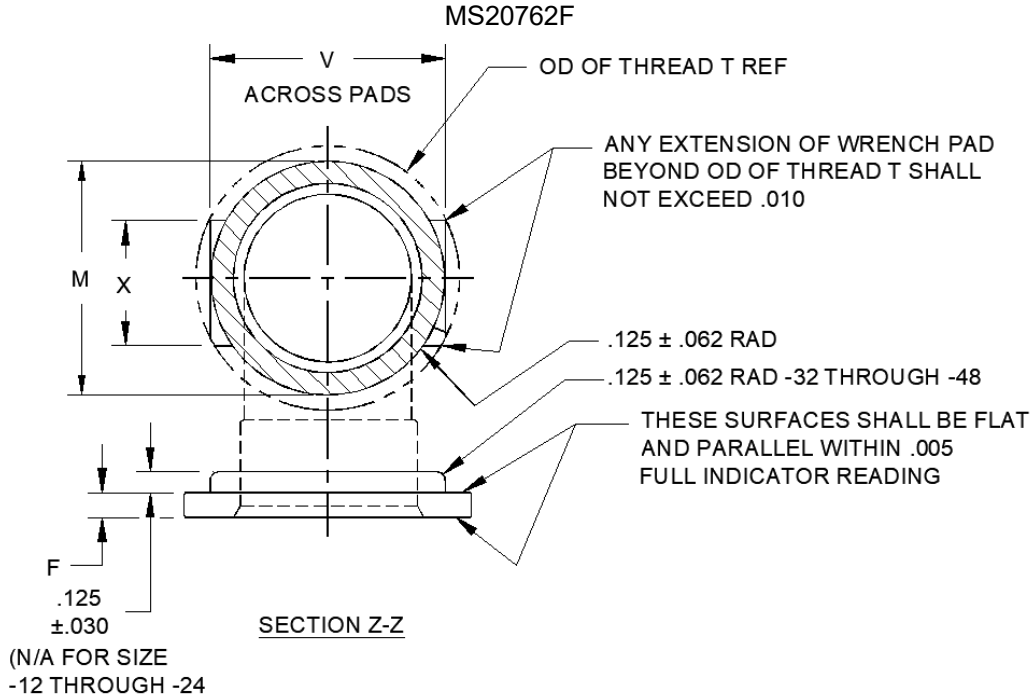
The requirements for acquiring the product described herein shall consist of this specification sheet and DLA Land and Maritime drawing 19002.



See notes at end of figure.

FIGURE 1. Elbow, flanged 90°.





Size	Tube OD	Thread T SAE-AS8879	A Dia. ± .003	B +.047 -.000	C +.047 -.000	D Dia. +.000 -.005	E Dia. +.000 -.005	F +.000 -.005	G Rad. Ref.	H +.047 -.000
-10 (See note 10)	.750	1.0625-12UNJF-3A	.609	1.156	1.938	.938	1.250	.156	.594	.562
-12					2.000		1.500			
-12-16										
-16	1.000	1.3125-12UNJF -3A	.844	1.281	2.125	1.188	1.500		.719	
-20	1.250	1.625-12UNJF -3A	1.078	1.500	2.375	1.500	1.844	.188	.875	.625
-20-24				1.562	2.562		2.125			
-24	1.500	1.875-12UNJF -3A	1.312	1.688	2.688	1.750	2.125		1.000	.650
-32	2.000	2.500-12UNJF -3A	1.781	2.042	3.375	2.375	2.750		1.312	.750
-40	2.500	3.000-12UNJF -3A	2.281	2.375	3.500	2.875	3.201		1.582	.812
-48	3.000	3.500-12UNJF -3A	2.781	2.625	3.675	3.375	3.701		1.812	

Size	J +.047 -.000	K Min	M Dia. ± .015	N Dia.	V ± .015	W Approx.	X Approx.	Y ± .015	Weight max		
									Al Alloy	Steel	Ti
-10 (See note 10)	1.344	.100	.922	.669	.891	.500	.562	.724	.12	.34	.20
-12		.125							.15	.42	.25
-12-16	1.406	.141	1.172	.904	1.156	.562	.625	.771	.18	.50	.30
-16		.156	1.484	1.138	1.438	.625	.750	.818	.32	.90	.53
-20	1.500	.172	1.734	1.372	1.710	.688	.938	1.193	.36	1.00	.60
-20-24	1.650	.203	2.309	1.841	2.250	.750	1.000	1.193	.45	1.26	.74
-24		.234	2.659	2.341	2.812	.875	1.000	1.193	.969	1.37	3.84
-32	2.062	.250	3.389	2.841	3.344	1.000	1.000	1.047	1.02	2.88	1.69
-40	1.938								1.37	3.84	2.26
-48	2.042								1.62	5.10	2.68

See notes at end of figure.

FIGURE 1. Elbow, flanged 90° - Continued.

MS20762F

Inches	mm	Inches	mm	Inches	mm	Inches	mm	Inches	mm	Inches	mm	Inches	mm	Inches	mm
0.003	0.08	0.176	4.47	0.420	10.67	0.771	19.58	1.130	28.70	1.562	39.67	2.062	52.37	2.812	71.42
0.005	0.13	0.180	4.57	0.450	11.43	0.812	20.62	1.156	29.36	1.582	40.18	2.125	53.98	2.841	72.16
0.010	0.25	0.188	4.78	0.500	12.70	0.818	20.78	1.172	29.77	1.620	41.15	2.250	57.15	2.875	73.03
0.015	0.38	0.200	5.08	0.530	13.46	0.844	21.44	1.188	30.18	1.644	41.76	2.260	57.40	2.880	73.15
0.016	0.41	0.203	5.16	0.562	14.27	0.875	22.23	1.193	30.30	1.650	41.91	2.281	57.94	3.000	76.20
0.030	0.76	0.221	5.61	0.594	15.09	0.891	22.63	1.250	31.75	1.688	42.88	2.309	58.65	3.201	81.31
0.047	1.19	0.234	5.94	0.600	15.24	0.900	22.86	1.260	32.00	1.690	42.93	2.341	59.46	3.344	84.94
0.062	1.57	0.250	6.35	0.609	15.47	0.904	22.96	1.281	32.54	1.710	43.43	2.375	60.33	3.375	85.73
0.100	2.54	0.300	7.62	0.625	15.88	0.922	23.42	1.312	33.32	1.734	44.04	2.500	63.50	3.389	86.08
0.120	3.05	0.320	8.13	0.650	16.51	0.938	23.83	1.344	34.14	1.750	44.45	2.562	65.07	3.500	89.90
0.125	3.18	0.322	8.18	0.669	16.99	0.943	23.95	1.370	34.80	1.781	45.24	2.625	66.68	3.675	93.35
0.141	3.58	0.333	8.46	0.688	17.48	0.969	24.61	1.372	34.85	1.812	46.02	2.659	67.54	3.701	94.01
0.150	3.81	0.340	8.64	0.719	18.26	1.000	25.40	1.406	35.71	1.841	46.76	2.680	68.07	3.840	97.54
0.156	3.96	0.344	8.74	0.724	18.39	1.020	25.91	1.438	36.53	1.938	49.23	2.688	68.28		
0.164	4.17	0.360	9.14	0.740	18.80	1.047	26.59	1.484	37.69	2.000	50.80	2.750	69.85		
0.172	4.37	0.362	9.19	0.750	19.05	1.078	27.38	1.500	38.10	2.042	51.87	2.781	70.64		

NOTES:

1. Dimensions are in inches.
2. Metric equivalents are given for information only.
3. Internal flow passage around bend shall be smooth and free from projections.
4. Unless otherwise specified tolerances shall be ± 0.005 inches (0.13 mm) and angles $\pm 5^\circ$.
5. Unless otherwise specified surface roughness shall not exceed 100 μ -inches (2.54 μ m) Ra in accordance with ASME B46.1. Angular tool marks up to 63 μ -inches (1.6 μ m) Ra will be allowed.
6. For steel castings surface roughness shall not exceed 125 μ -inches. Level of acceptance shall be in accordance with ASTM A997 level III, samples as specified in DLA Land and Maritime drawing 19002. Angular tool marks up to 63 μ -inches (1.6 μ m) Ra will be allowed.
7. Diameters A, D, and E shall be concentric with each other within .010 inch (0.25mm) full indicator movement.
8. Reduction by forging draft angle of 7° is permissible.
9. Dimensioning and tolerancing are in accordance with ASME Y14.5.
10. The -10 parts shall be forged elbows only. The K dimension of .100 inches is applicable only to the bend section of the 90° elbow, only at the end of the straight drilling process. The drilled wall thickness shall be .125 inches.
11. Proof pressure testing is not applicable to the -10 due to the thinner wall thickness.

FIGURE 1. Elbow, flanged 90° - Continued.

REQUIREMENTS:

Design and construction: See table I.

Additional testing and marking requirements shall be in accordance with DLA Land and Maritime drawing 19002.

For nominal use on fuel and oil systems.

Sizes -40 and -48 are not to be used unless approved by the program office.

Except where specified, materials shall be in accordance with SAE-AS4875 or optional material: aluminum alloy casting in accordance with ASTM B108/B108M.

Surfaces. All machined surfaces shall be finished to 250 μ in Ra (.00635mm), unless otherwise specified.

MS20762F

Fitting surface shall be free of all burrs and slivers.

Material designators and dash numbers for tube sizes see table I.

Preferred method of steel casting is investment casting. Cast elbows may include machine stock to finish the geometry as required.

Performance requirements shall be in accordance with DLA Land and Maritime drawing 19002.

Porosity test. Finished elbows shall not leak when subjected to 100 psi (700 kPa) air pressure and submerged in water for 3 minutes.

Proof pressure testing. When specified by the PIN designator "P" elbows shall be proof pressure tested in accordance with DLA Land and Maritime drawing 19002. Proof pressure testing is not applicable to the -10 due to the thinner wall thickness.

TABLE I. Material designators and dash numbers for tube sizes. 1/

Steel (Blank) <u>2/</u>	Aluminum "D" Alloy 2014/2024 <u>3/ 4/</u>	Aluminum "W" Alloy 7075 <u>5/</u>	CRES 304 <u>6/</u>	CRES 316 <u>6/</u>	CRES 321 <u>6/</u>	Titanium <u>7/</u>
-10	-D10	-W10	-J10	-K10	-R10	-T10
-12	-D12	-W12	-J12	-K12	-R12	-T12
-12-16	-D12-16	-W12-16	-J12-16	-K12-16	-R12-16	-T12-16
-16	-D16	-W16	-J16	-K16	-R16	-T16
-20	-D20	-W20	-J20	-K20	-R20	-T20
-20-24	-D20-24	-W20-24	-J20-24	-K20-24	-R20-24	-T20-24
-24	-D24	-W24	-J24	-K24	-R24	-T24
-32	-D32	-W32	-J32	-K32	-R32	-T32
-40	-D40	-W40	-J40	-K40	-R40	-T40
-48	-D48	-W48	-J48	-K48	-R48	-T48

- 1/ Material designators are in accordance with SAE-AS4875 the procurement specification.
- 2/ Steel parts that are casted the casting alloy shall be ASTM A732/A732M Grade 6N.
- 3/ Aluminum alloys 2014/2024 code D are inactive for new design, use aluminum alloy 7075 code W aluminum for new design.
- 4/ Aluminum parts that are casted the casting alloy shall be A356 T6 in accordance with SAE-AMS4260 or F357 T6 in accordance with SAE-AMS4289.
- 5/ Aluminum parts that are forged the forging material shall be 7075-T73 in accordance with SAE-AMS-QQ-A-367 or SAE-AMS4141.
- 6/ Corrosion resistant steel (CRES) for 304, 316 and 321. Casting material for alloy 304 shall be in accordance with ASTM A351/A351M Grade CF8 and for alloy 316 shall be ASTM A351/A351M Grade CF8M.
- 7/ Titanium shall not be used in oxygen systems.

Finish. Finishes shall be as specified in table II. All plating's shall be capable of meeting a minimum of 96 hours salt spray test in accordance with ASTM B117. The fittings shall show no evidence of red

MS20762F

corrosion after 96 hours of salt spray. Fluid passages, other openings and internal threads shall not be subject to the plating thickness requirement and may have bare areas provided they are protected with a light film of oil.

TABLE II. Elbow finish code.

Finish code	Material	Plating finish
Blank	Steel	Cadmium plating in accordance with SAE-AMS-C-81562, type II, class 2 or SAE-AMS-QQ-P-416, type II, class 2, dye black. <u>1/ 5/ 8/</u>
	Aluminum <u>2/</u>	Anodize in accordance with MIL-A-8625, type II.
	CRES	No additional finish. Passivation in accordance with SAE-AMS2700, method 1, type 6 or 7.
	Titanium <u>3/</u>	Fluoride phosphate in accordance with SAE-AMS2486.
A	Steel	Zinc-Aluminum in accordance with ASTM F1136/F1136M, grade 3, NC.
D	Aluminum <u>2/</u>	Anodize in accordance with MIL-A-8625, type II, class 2. Chemical conversion coating in accordance with NAVAIR trivalent chromium pretreatment (TCP) in accordance with MIL-DTL-5541 type II, Class 1A. TCP applied after anodizing.
DA	Aluminum <u>2/</u>	TCP chemical conversion coating in accordance with NAVAIR TCP in accordance with MIL-DTL-5541 type II, Class 1A.
G	Steel	Zinc plating with colorless passivate in accordance with ASTM B633, type V, Fe/Zn 8.
H	Steel	Zinc phosphate finish in accordance MIL-DTL-16232 type Z, class 4.
J	Steel	Zinc plating in accordance with ASTM B633; type II or III, Fe/Zn 8, or ASTM B695, type II, class 8. <u>4/ 5/</u>
R	Steel	Zinc plating in accordance with ASTM B633; type VI, Fe/Zn 8 <u>4/</u>
T	Titanium <u>3/ 9/</u>	Anodized in accordance with SAE-AMS2488, type 2.
V	Steel	Zinc-nickel in accordance with SAE-AMS2417, type 2, grade B. <u>6/</u>
W	Aluminum alloy 7075-T73 or T7352 <u>7/</u> in accordance with SAE-AS4875	Anodize in accordance with MIL-A-8625, type II, class 2, dye brown.
WC	Aluminum alloy 7075-T73 or T7352 <u>7/</u> in accordance with SAE-AS4875	Anodize in accordance with MIL-A-8625, type II, class 2, dye brown. TCP chemical conversion coating in accordance with, MIL-DTL-5541, type II, class 1A. TCP applied after anodizing.
WD	Aluminum alloy 7075-T73 or T7352 <u>7/</u> in accordance with SAE-AS4875	TCP chemical conversion coating in accordance with, MIL-DTL-5541, type II, class 1A. Paint brown after applying the TCP
Z	Steel	Zinc may be any zinc plating's from PIN codes H, J, R, V. <u>4/ 5/</u>
ZN	Steel	Zinc may be any zinc plating from PIN codes H, J, R, V with a colored chromate coating <u>4/ 5/</u>

1/ Embrittlement test need not be run.

2/ Aluminum alloys 2014 and 2024 shall be dyed light blue.

3/ A pretreatment, a modification of the fluoride treatment, or a post treatment shall be applied so the final color of the fittings shall be similar to SAE-AMS-STD-595 colors 36076 through 36293.

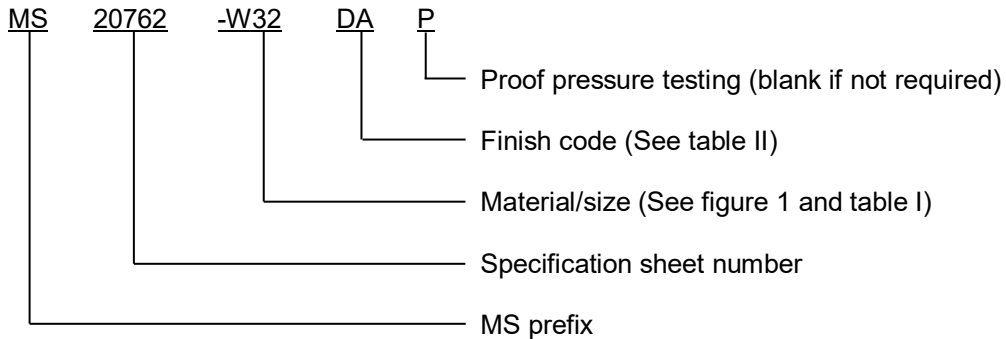
4/ Not for use in aircraft. Requires approval from the Program Office for all applications. Zinc-plated materials should be avoided in hydraulic systems with water-glycol fluids. Reference ASTM MNL37 - Fuels and Lubricants Handbook.

5/ These finishes have a chromate conversion coating or chromic acid rinse which includes hexavalent chromium and are not recommended. The use of coatings depositing hexavalent chromium for Army vehicles is prohibited unless otherwise explicitly stated in the contract as a requirement.

MS20762F

- 6/ The zinc-nickel alloy plate shall contain 12% to 16% nickel. The coating thickness shall be 315μ inches (8μm) minimum coating thickness.
- 7/ Unless otherwise specified aluminum alloy 7075 shall be dyed brown.
- 8/ Cadmium shall not be used in oxygen or potable water systems. Cadmium is prohibited from use in NAVSEA-owned shipboard systems in accordance with the requirements of T9070-AL-DPC-020/077-2, unless otherwise approved by NAVSEA. The use of cadmium plating for Army vehicles is prohibited unless otherwise explicitly stated in the contract as a requirement.
- 9/ Titanium shall not be used in oxygen or potable water systems.

Part or Identifying Number (PIN): The PIN consists of prefix "MS", the specification sheet number, a dash, a letter/number for material/size and a finish code. Unassigned PIN's shall not be used.

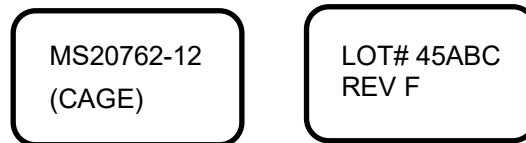


PIN example: MS20762-D32DAP indicates a 2-inch 7075 aluminum elbow with chemical conversion coating in accordance with MIL-DTL-5541 type II, class 3, and proof pressure tested.

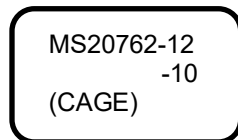
NOTE: The -12 size elbows will replace the -10 size elbows, however the -10 size elbows will not replace the -12 size elbows.

Marking. The complete PIN shall be permanently marked on one wrench surface or casted on the elbow along with the CAGE or trademark of the foundry. The other wrench flat shall be marked with the Manufactures name, CAGE code, or trademark, and revision letter. The part shall also be marked with the manufacturer's lot number on either wrench flat.

Marking examples:



-12 size parts may be dual marked as shown.



Guidance on use of alternative parts with less hazardous or nonhazardous materials. This specification provides for a number of alternative plating materials via the PIN. Users should select the PIN with the least hazardous material that meets the form, fit and function requirements of their application.

MS20762F

Cadmium is prohibited from use in NAVSEA-owned shipboard systems in accordance with the requirements of T9070-AL-DPC-020/077-2, unless otherwise approved by NAVSEA.

The use of cadmium plating or coatings depositing hexavalent chromium for Army vehicles is prohibited unless otherwise explicitly stated in the contract as a requirement.

For new designs PIN codes Blank, J, Z, and ZN are not to be supplied to Army and Marine ground forces.

Class I and II ozone depleting substances (ODS) shall not be used in MS20762 or any referenced procedures.

Referenced documents shall be of the issue in effect on date of invitations for bid.

Supersession data: Aluminum alloys 2014 and 2024 "D" designator is inactive for new design. For new design use aluminum alloy 7075 "W" designator.

Changes from previous issue. Marginal notations are not used in this revision to identify changes with respect to the previous issue, due to the extent of the changes.

Referenced documents. In addition to DLA Land and Maritime drawing 19002, this document references the following:

MIL-A-8625	SAE-AMS-STD-595/36081	SAE-AMS-QQ-P-416
MIL-DTL-5541	SAE-AMS-STD-595/36099	SAE-AMS-QQ-A-367
MIL-DTL-16232	SAE-AMS-STD-595/36118	SAE-AMS2417
ASME B46.1	SAE-AMS-STD-595/36134	SAE-AMS2486
ASME Y14.5	SAE-AMS-STD-595/36152	SAE-AMS2488
ASTM A351/A351M	SAE-AMS-STD-595/36170	SAE-AMS2700
ASTM A732/A732M	SAE-AMS-STD-595/36173	SAE-AMS4134
ASTM B108/B108M	SAE-AMS-STD-595/36176	SAE-AMS4141
ASTM B117	SAE-AMS-STD-595/36231	SAE-AMS4260
ASTM B633	SAE-AMS-STD-595/36251	SAE-AMS4289
ASTM B695	SAE-AMS-STD-595/36270	SAE-AS4395
ASTM F1136/F1136M	SAE-AMS-STD-595/36280	SAE-AS4875
ASTM MNL37	SAE-AMS-STD-595/36293	SAE-AS8879
SAE-AMS-STD-595/36076	SAE-AMS-C-81562	T9070-AL-DPC-020/077-2

MS20762F

CONCLUDING MATERIAL

Custodians:

Army - AV
Navy - AS
Air Force - 71
DLA - CC

Preparing activity:

DLA - CC

(Project 4730-2020-013)

Review activities:

Army - AR, MI
Navy - SA
Air Force - 11

NOTE: The activities listed above were interested in this document as of the date of this document. Since organization and responsibilities can change, you should verify the currency of the information above using the ASSIST Online database at <https://assist.dla.mil>.