

INCH-POUND

MS9195B
w/AMENDMENT 1
17 May 2011
SUPERSEDING
MS9195B
16 February 2010

DETAIL SPECIFICATION SHEET

ELBOW, TUBE - SAE-AMS5646, BOSS, 45°

Inactive for new design after 2 April 1999.

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
SAE-AS4841.

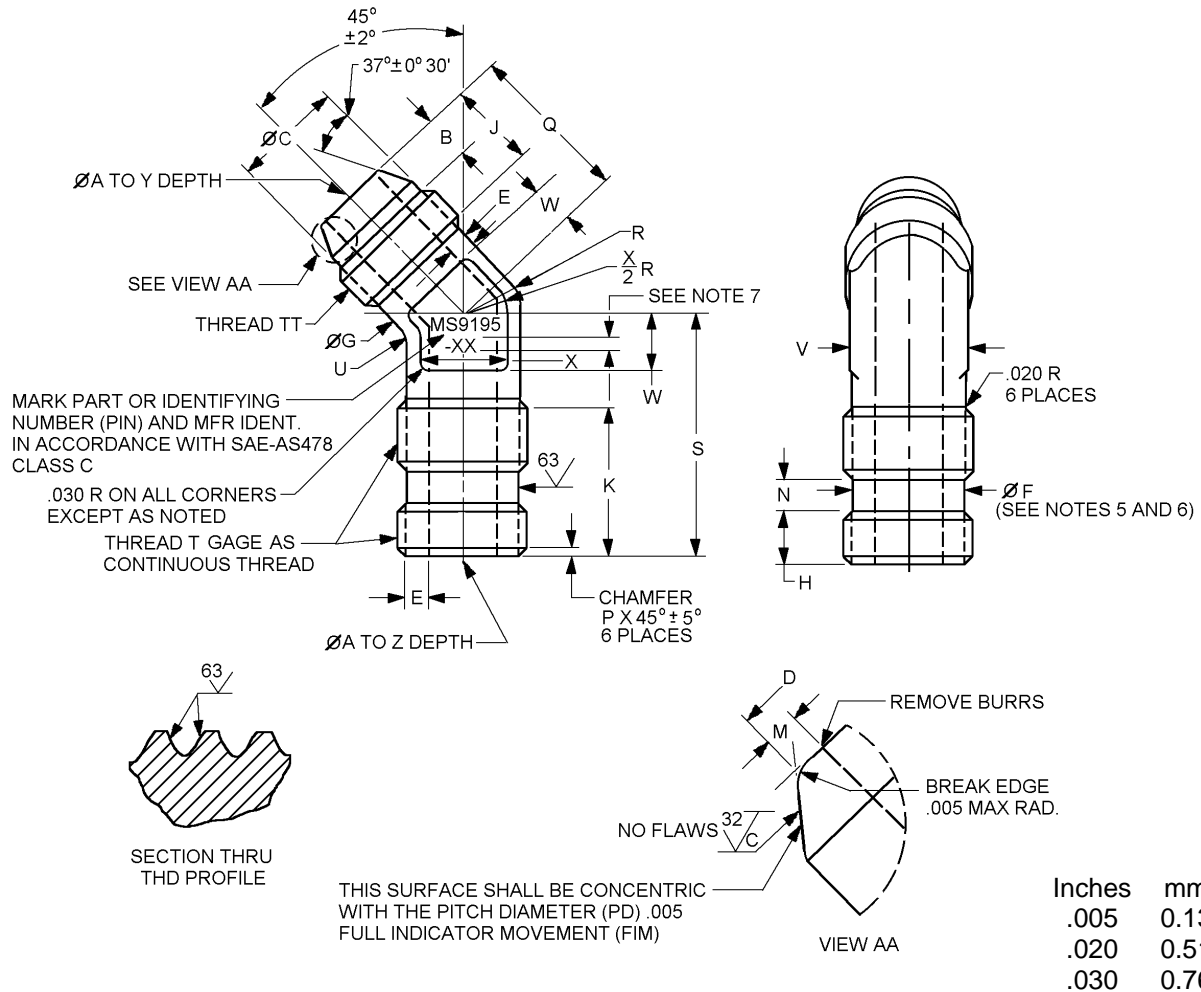


FIGURE 1. Elbow, tube, boss, 45°.

MS9195B
w/AMENDMENT 1

Dash number	Tube OD (reference) inches (mm)	A diameter inches (mm)	B inches (mm) +.015 (0.38) -.000	C diameter inches (mm) +.000 -.010 (0.25)
-02	.125 (3.18)	.058 (1.47) - .065 (1.65)	.144 (3.66)	.245 (6.22)
-03	.188 (4.78)	.121 (3.07) - .128 (3.25)	.144 (3.66)	.307 (7.80)
-04	.250 (6.35)	.168 (4.27) - .175 (4.45)	.160 (4.06)	.359 (9.12)
-05	.313 (7.95)	.230 (5.84) - .237 (6.02)	.160 (4.06)	.421 (10.69)
-06	.375 (9.53)	.293 (7.44) - .301 (7.65)	.165 (4.19)	.476 (12.09)
-07	.438 (11.13)	.355 (9.02) - .363 (9.22)	.165 (4.19)	.539 (13.69)
-08	.500 (12.70)	.387 (9.83) - .395 (10.03)	.229 (5.82)	.654 (16.61)
-09	.562 (14.27)	.434 (11.02) - .442 (11.23)	.229 (5.82)	.716 (18.19)
-10	.625 (15.88)	.480 (12.19) - .488 (12.40)	.255 (6.48)	.767 (19.48)
-11	.688 (17.48)	.542 (13.77) - .552 (14.02)	.304 (7.72)	.875 (22.23)
-12	.750 (19.05)	.604 (15.34) - .614 (15.60)	.304 (7.72)	.938 (23.83)
-14	.875 (22.23)	.729 (18.52) - .739 (18.77)	.304 (7.72)	1.062 (26.97)
-16	1.000 (25.40)	.839 (21.31) - .851 (21.62)	.312 (7.92)	1.188 (30.18)
-18	1.125 (28.58)	.948 (24.08) - .960 (24.38)	.312 (7.92)	1.375 (34.93)
-20	1.250 (31.75)	1.073 (27.25) - 1.086 (27.58)	.363 (9.22)	1.500 (38.10)
-24	1.500 (38.10)	1.307 (33.20) - 1.320 (33.53)	.374 (9.50)	1.750 (44.45)
-28	1.750 (44.45)	1.542 (39.17) - 1.557 (39.55)	.447 (11.35)	2.125 (53.98)
-32	2.000 (50.80)	1.776 (45.11) - 1.791 (45.49)	.457 (11.61)	2.375 (60.33)

FIGURE 1. Elbow, tube, boss, 45°- Continued.

MS9195B
w/AMENDMENT 1

Dash number	D diameter inches (mm) ±.003 (0.08)	E (see note 10) inches (mm)	F diameter inches (mm) +.002 (0.05) -.003 (0.08) (see notes 4 and 5)	G diameter inches (mm)	H inches (mm) ±.010 (0.25)
-02	.132 (3.35)	.040 (1.02)	.250 (6.35)	.240 (6.10)	.208 (5.28)
-03	.195 (4.95)	.050 (1.27)	.312 (7.92)	.300 (7.62)	.208 (5.28)
-04	.242 (6.15)	.050 (1.27)	.364 (9.25)	.350 (8.89)	.250 (6.35)
-05	.304 (7.72)	.050 (1.27)	.426 (10.82)	.415 (10.54)	.250 (6.35)
-06	.368 (9.35)	.050 (1.27)	.481 (12.22)	.470 (11.94)	.278 (7.06)
-07	.430 (10.92)	.060 (1.52)	.544 (13.82)	.535 (13.59)	.278 (7.06)
-08	.462 (11.73)	.080 (2.03)	.660 (16.76)	.650 (16.51)	.312 (7.92)
-09	.509 (12.93)	.090 (2.29)	.722 (18.34)	.710 (18.03)	.312 (7.92)
-10	.555 (14.10)	.090 (2.29)	.773 (19.63)	.765 (19.43)	.357 (9.07)
-11	.619 (15.72)	.100 (2.54)	.882 (22.40)	.870 (22.10)	.417 (10.59)
-12	.681 (17.30)	.100 (2.54)	.945 (24.00)	.935 (23.75)	.417 (10.59)
-14	.806 (20.47)	.100 (2.54)	1.070 (27.18)	1.055 (26.80)	.417 (10.59)
-16	.918 (23.32)	.120 (3.05)	1.195 (30.35)	1.185 (30.10)	.417 (10.59)
-18	1.027 (26.09)	.140 (3.56)	1.382 (35.10)	1.365 (34.67)	.417 (10.59)
-20	1.153 (29.29)	.150 (3.81)	1.507 (38.28)	1.495 (37.97)	.417 (10.59)
-24	1.387 (35.23)	.160 (4.06)	1.756 (44.60)	1.745 (44.32)	.417 (10.59)
-28	1.652 (41.96)	.210 (5.33)	2.131 (54.13)	2.120 (53.85)	.417 (10.59)
-32	1.886 (47.90)	.210 (5.33)	2.381 (60.48)	2.370 (60.20)	.417 (10.59)

FIGURE 1. Elbow, tube, boss, 45° - Continued.

MS9195B
w/AMENDMENT 1

Dash number	J inches (mm) ±.010 (0.25)	K inches (mm) ±.010 (0.25)	M min inches (mm)	N inches (mm) +.010 (0.25) -.000
-02	.317 (8.05)	.682 (17.32)	.030 (0.76)	.125 (3.18)
-03	.346 (8.79)	.682 (17.32)	.030 (0.76)	.131 (3.33)
-04	.398 (10.11)	.748 (19.00)	.030 (0.76)	.140 (3.56)
-05	.398 (10.11)	.748 (19.00)	.030 (0.76)	.140 (3.56)
-06	.398 (10.11)	.813 (20.65)	.030 (0.76)	.156 (3.96)
-07	.398 (10.11)	.813 (20.65)	.030 (0.76)	.172 (4.37)
-08	.489 (12.42)	.903 (22.94)	.030 (0.76)	.187 (4.75)
-09	.489 (12.42)	.903 (22.94)	.030 (0.76)	.203 (5.16)
-10	.585 (14.86)	1.018 (25.86)	.030 (0.76)	.219 (5.56)
-11	.663 (16.84)	1.122 (28.50)	.030 (0.76)	.234 (5.94)
-12	.663 (16.84)	1.122 (28.50)	.030 (0.76)	.234 (5.94)
-14	.710 (18.03)	1.122 (28.50)	.030 (0.76)	.234 (5.94)
-16	.720 (18.29)	1.122 (28.50)	.030 (0.76)	.234 (5.94)
-18	.767 (19.48)	1.122 (28.50)	.030 (0.76)	.234 (5.94)
-20	.767 (19.48)	1.122 (28.50)	.030 (0.76)	.234 (5.94)
-24	.889 (22.58)	1.122 (28.50)	.030 (0.76)	.234 (5.94)
-28	1.017 (25.83)	1.205 (30.61))	.044 (1.12)	.234 (5.94)
-32	1.142 (29.01)	1.320 (33.53)	.044 (1.12)	.234 (5.94)

FIGURE 1. Elbow, tube, boss, 45° - Continued.

MS9195B
w/AMENDMENT 1

Dash number	P inches (mm)	Q inches (mm) ±.010 (0.25)	R radius	S inches (mm) +.010 (0.25 mm)
-02	.020 (0.51) - .050 (1.27)	.608 (15.44)	.120 (3.05)	1.000 (25.40)
-03	.020 (0.51) - .050 (1.27)	.608 (15.44)	.150 (3.81)	1.000 (25.40)
-04	.030 (0.76) - .060 (1.52)	.717 (18.21)	.175 (4.45)	1.094 (27.79)
-05	.030 (0.76) - .060 (1.52)	.717 (18.21)	.207 (5.26)	1.094 (27.79)
-06	.040 (1.02) - .070 (1.78)	.779 (19.79)	.235 (5.97)	1.219 (30.96)
-07	.040 (1.02) - .070 (1.78)	.779 (19.79)	.267 (6.78)	1.219 (30.96)
-08	.040 (1.02) - .070 (1.78)	.945 (24.00)	.325 (8.26)	1.375 (34.93)
-09	.040 (1.02) - .070 (1.78)	.945 (24.00)	.355 (9.02)	1.375 (34.93)
-10	.050 (1.27) - .080 (2.03)	1.083 (27.51)	.382 (9.70)	1.531 (38.89)
-11	.050 (1.27) - .080 (2.03)	1.255 (31.88)	.435 (11.05)	1.734 (44.04)
-12	.050 (1.27) - .080 (2.03)	1.255 (31.88)	.467 (11.86)	1.734 (44.04)
-14	.050 (1.27) - .080 (2.03)	1.440 (36.58)	.527 (13.39)	1.734 (44.04)
-16	.050 (1.27) - .080 (2.03)	1.450 (36.83)	.592 (15.04)	1.734 (44.04)
-18	.050 (1.27) - .080 (2.03)	1.574 (39.98)	.682 (17.32)	1.750 (44.45)
-20	.050 (1.27) - .080 (2.03)	1.574 (39.98)	.750 (19.05)	1.750 (44.45)
-24	.050 (1.27) - .080 (2.03)	1.762 (44.75)	.872 (22.15)	1.750 (44.45)
-28	.050 (1.27) - .080 (2.03)	1.949 (49.50)	1.062 (26.97)	1.969 (50.01)
-32	.050 (1.27) - .080 (2.03)	2.199 (55.85)	1.188 (30.18)	2.203 (55.96)

Dash number	Thread T (see note 13)
-02	.3125 - 24UNF-3A
-03	.375 - 24UNF-3A
-04	.4375 - 20UNF-3A
-05	.500 - 20UNF-3A
-06	.5625 - 18UNF-3A
-07	.625 - 18UNF-3A
-08	.7500 - 16UNF-3A
-09	.8125 - 16UN-3A
-10	.8750 - 14UNF-3A
-11	1.000 - 12UNF-3A
-12	1.0625 - 12UN-3A
-14	1.1875 - 12UN-3A
-16	1.3125 - 12UN-3A
-18	1.500 - 12UNF-3A
-20	1.625 - 12UN-3A
-24	1.8750 - 12UN-3A
-28	2.2500 - 12UN-3A
-32	2.500 - 12UN-3A

FIGURE 1. Elbow, tube, boss, 45° - Continued.

MS9195B
w/AMENDMENT 1

Dash number	Thread TT (see note 13)					
	Size	Major Diameter inches (mm)		Pitch Diameter inches (mm)		Minor diameter max inches (mm)
-02	.3125 - 24UNS-3A	.3023 (7.678)	- .3095 (7.861)	.2797 (7.104)	- .2824 (7.173)	.2584 (6.563)
-03	.3750 - 24UNS-3A	.3648 (9.266)	- .3720 (9.449)	.3420 (8.687)	- .3449 (8.760)	.3209 (8.151)
-04	.4375 - 20UNS-3A	.4264 (10.831)	- .4345 (11.036)	.3989 (10.132)	- .4020 (10.211)	.3732 (9.479)
-05	.500 - 20UNS-3A	.4889 (12.418)	- .4970 (12.623)	.4613 (11.717)	- .4645 (11.798)	.4357 (11.067)
-06	.5625 - 18UNS-3A	.5508 (13.990)	- .5595 (14.211)	.5200 (13.208)	- .5234 (13.294)	.4913 (12.479)
-07	.6250 - 18UNS-3A	.6133 (15.578)	- .6220 (15.799)	.5824 (14.793)	- .5859 (14.881)	.5538 (14.067)
-08	.750 - 16UNS-3A	.7376 (18.735)	- .7470 (18.974)	.7026 (17.846)	- .7064 (17.942)	.6703 (17.026)
-09	.8125 - 16UNS-3A	.8001 (20.323)	- .8095 (20.561)	.7653 (19.44)	- .7689 (19.530)	.7328 (18.613)
-10	.875 - 14UNS-3A	.8617 (21.887)	- .8720 (22.149)	.8215 (20.866)	- .8256 (20.970)	.7844 (19.924)
-11	1.000 - 12UNS-3A	.9856 (25.034)	- .9970 (25.324)	.9385 (23.838)	- .9429 (23.950)	.8948 (22.728)
-12	1.0625 - 12UNS-3A	1.0481 (26.622)	- 1.0595 (26.911)	1.0012 (25.430)	- 1.0054 (25.537)	.9573 (24.315)
-14	1.1875 - 12UNS-3A	1.1731 (29.797)	- 1.1845 (30.086)	1.1261 (28.603)	- 1.1304 (28.712)	1.0823 (27.490)
-16	1.3125 - 12UNS-3A	1.2981 (32.972)	- 1.3095 (33.261)	1.2511 (31.778)	- 1.2554 (31.887)	1.2073 (30.665)
-18	1.500 - 12UNS-3A	1.4856 (37.734)	- 1.4970 (38.024)	1.4381 (36.528)	- 1.4429 (36.650)	1.3948 (35.428)
-20	1.625 - 12UNS-3A	1.6106 (40.909)	- 1.6220 (41.199)	1.5635 (39.713)	- 1.5679 (39.825)	1.5198 (38.603)
-24	1.875 - 12UNS-3A	1.8606 (47.259)	- 1.8720 (47.549)	1.8134 (46.060)	- 1.8179 (46.175)	1.7698 (44.953)
-28	2.250 - 12UNS-3A	2.2356 (56.784)	- 2.2470 (57.074)	2.1884 (55.585)	- 2.1929 (55.700)	2.1448 (54.478)
-32	2.500 - 12UNS-3A	2.4856 (63.134)	- 2.4970 (63.424)	2.4429 (62.050)	- 2.4383 (61.933)	2.3948 (60.828)

FIGURE 1. Elbow, tube, boss, 45° - Continued.

MS9195B
w/AMENDMENT 1

Dash number	U radius inches (mm)	V inches (mm)	W inches (mm)	X inches (mm)	Y inches (mm) ±.010 (0.25)
-02	.062 (1.57)	.250 (6.35)	.160 (4.06)	.200 (5.08)	.639 (16.23)
-03	.062 (1.57)	.312 (7.92)	.160 (4.06)	.220 (5.59)	.639 (16.23)
-04	.062 (1.57)	.375 (9.53)	.200 (5.08)	.270 (6.86)	.748 (19.00)
-05	.062 (1.57)	.438 (11.13)	.200 (5.08)	.330 (8.83)	.748 (19.00)
-06	.094 (2.39)	.500 (12.70)	.250 (6.35)	.330 (8.38)	.826 (20.98)
-07	.094 (2.39)	.562 (14.27)	.250 (6.35)	.330 (8.38)	.826 (20.98)
-08	.094 (2.39)	.688 (17.48)	.310 (7.87)	.430 (10.92)	1.023 (25.98)
-09	.094 (2.39)	.750 (19.05)	.310 (7.87)	.440 (11.18)	1.023 (25.98)
-10	.094 (2.39)	.812 (20.62)	.350 (8.89)	.500 (12.70)	1.177 (29.90)
-11	.094 (2.39)	.938 (23.83)	.420 (10.67)	.500 (12.70)	1.364 (34.65)
-12	.094 (2.39)	1.000 (25.40)	.420 (10.67)	.500 (12.70)	1.364 (34.65)
-14	.125 (3.18)	1.125 (28.58)	.420 (10.67)	.500 (12.70)	1.534 (38.96)
-16	.125 (3.18)	1.250 (31.75)	.420 (10.67)	.500 (12.70)	1.544 (39.22)
-18	.125 (3.18)	1.438 (36.53)	.450 (11.43)	.600 (15.24)	1.699 (43.15)
-20	.125 (3.18)	1.625 (41.28)	.450 (11.43)	.600 (15.24)	1.699 (43.15)
-24	.125 (3.18)	1.812 (46.02)	.450 (11.43)	.600 (15.24)	1.855 (47.12)
-28	.188 (4.78)	2.188 (55.58)	.500 (12.70)	.660 (16.76)	2.199 (55.85)
-32	.250 (6.35)	2.438 (61.93)	.500 (12.70)	.750 (19.05)	2.480 (62.99)

FIGURE 1. Elbow, tube, boss, 45° - Continued.

MS9195B
w/AMENDMENT 1

Dash number	Z inches (mm) ±.010 (0.25)	Approx weight lbs/ea (grams/ea)
-02	1.032 (26.21)	.024 (11)
-03	1.032 (26.21)	.033 (15)
-04	1.122 (28.50)	.047 (21)
-05	1.122 (28.50)	.059 (27)
-06	1.250 (31.75)	.074 (34)
-07	1.250 (31.75)	.085 (39)
-08	1.406 (35.71)	.163 (74)
-09	1.406 (35.71)	.187 (85)
-10	1.625 (41.28)	.238 (108)
-11	1.859 (47.22)	.356 (161)
-12	1.859 (47.22)	.385 (175)
-14	1.859 (47.22)	.467 (212)
-16	1.859 (47.22)	.549 (208)
-18	1.921 (48.79)	.778 (353)
-20	1.921 (48.79)	.871 (395)
-24	1.921 (48.79)	1.115 (506)
-28	2.188 (55.58)	1.912 (867)
-32	2.422 (61.52)	2.497 (1133)

NOTES:

1. Dimensions are in inches.
2. Metric equivalents are given for information only.
3. Unless otherwise specified tolerances for linear dimensions are ±.015 inch (0.38 mm) and angular dimensions are ±5°, all dimensions concentric within .010 inch (0.25 mm) FIM.
4. Unless otherwise specified machined surfaces to be 125μ inches (3.18μm) in accordance with ASME B46.1.
5. Diameter F shall be free of thread marks.
6. Diameter F shall be concentric with PD of thread within .0025 inch (0.064 mm) FIM.
7. Lettering height:
 - a. For -02 through -04 size: .020 - .040 inch (0.51 - 1.02 mm).
 - b. For -05 through -16 size: .040 - .060 inch (1.02 - 1.52 mm).
 - c. For -18 and larger: .090 - .150 inch (2.29 - 3.81 mm).
8. All diameters shall be concentric within .010 inch (0.25 mm) FIM unless otherwise specified.
9. Parting line mismatch .015 inch (0.38 mm) max.
10. E minimum wall thickness between forged surface and hole A.
11. Unless otherwise specified break sharp edges .003 - .015 inches (0.08 - 0.38 mm).
12. Dimensions are to sharp corners unless otherwise specified.
13. Threads shall be in accordance with FED-STD-H28/2.

FIGURE 1. Elbow, tube, boss, 45° - Continued.

MS9195B
w/AMENDMENT 1

REQUIREMENTS:

Dimensions and configurations: See figure 1.

Material: Steel, corrosion and heat-resistant in accordance with SAE-AMS5646.

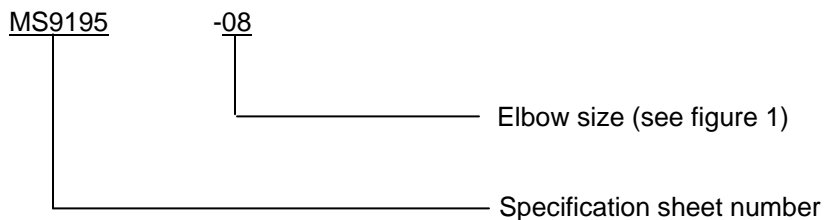
Max operating temperature: Oxidation resistance up to 1500°F (816°C).

Operating pressure: 1500 psi (10MPa).

Finish: Passivate in accordance with SAE-AMS2700, method 1.

All parts shall be fluorescent penetrant inspected in accordance with ASTM E1417.

PIN:



PIN Example:

MS9195-08 identifies a 45° elbow .500 inch (tube), CRES.

Do not use unassigned PIN's.

Intended usage: Jet engine, miscellaneous parts, oil, fuel, and de-icing kits.

Not to be used on hydraulic, oxygen or applications requiring pressures of 3000 psi (21 MPa).

Amendment notations. The margins of this specification are marked with vertical lines to indicate modifications generated by this amendment. This was done as a convenience only and the Government assumes no liability whatsoever for any inaccuracies in these notations. Bidders and contractors are cautioned to evaluate the requirements of this document based on the entire content irrespective of the marginal notations.

Referenced documents. In addition to SAE-AS4841, this document references the following:

FED-STD-H28/2
ASME B46.1
ASTM E1417
SAE-AMS2700
SAE-AMS5646
SAE-AS478

MS9195B
w/AMENDMENT 1

CONCLUDING MATERIAL

Custodians:

Navy - AS
DLA - CC

Preparing activity:

DLA - CC

(Project 4730-2011-042)

Review activity:

Navy - SA

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