

INCH-POUND

MIL-PRF-1/1605C  
 17 August 2004  
 SUPERSEDING  
 MIL-PRF-1/1605B  
 23 September 1974

PERFORMANCE SPECIFICATION SHEET

ELECTRON TUBE, TRAVELING WAVE  
 TYPE 8128

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

The requirements for acquiring the electron tube described herein shall consist of this document and the latest issue of MIL-PRF-1.

**DESCRIPTION:** Forward-wave amplifier, 2.9 to 3.1 GHz operation, 60 kw peak power output, pulsed, liquid cooled, external magnet field.

**ABSOLUTE RATINGS:** 1/

Parameter:	Ef	If (surge)	If	Epy	ib	Du	tp	tk	VSWR
Unit:	V	A	A	Kv	a	---	μs	sec	---
Maximum:	8.4	15	9	40	14	0.021	32	---	1.5:1
Minimum:	7.8	---	---	---	---	---	---	300	---

**ABSOLUTE RATINGS:** 1/

Parameter:	Waveguide pressurization	Coolant pressure, collector	Coolant temperature		Coolant flow rate, anode
			Inlet	Bushing	
Unit	psia	psia	°C	°C	GPM
Maximum:	55	75	65	150	---
Minimum:	14 2/	----	---	---	1.5 17/

**PHYSICAL CHARACTERISTICS:**

Dimensions:	See figure 1.	Connectors:	
Mounting position:	Any	Input:	Type N
Getter:	See figure 1.	Output:	See figure 1.
Magnetic field:	750 ± 50 Gauss 5/ 8/	Solenoid:	See figure 3.
		Weight:	33 pounds (14.97 kg) max

**TEST CONDITONS:**

Parameter:	Ef	pd	epy	Du	tp	tk	VSWR
Unit:	V	w	kv	---	μs	sec	---
Maximum:	8.0	600	37	0.021	32	---	1.1:1
Minimum:	---	500 7/	33 5/	---	29 6/	300	---

Frequency	
F	GHz
1	2.9
2	3.0
3	3.1

See footnotes at end of table I.

**GENERAL:**

Qualification - Not required.

Shelf life: 9/

MIL-PRF-1/1605C

TABLE I. Testing and inspection.

Requirement or test	MIL-STD-1311 Method	Notes	Conditions	Symbol	Limits		Unit
					Min	Max	
<u>First article testing</u>							
Phase shift	4278	<u>4/</u> <u>13/</u>	F = F2; epy = 33 to 36 kv <u>2/</u>	$\Delta\theta/\Delta\text{epy}$	---	30	deg/kv
Vibration	---	<u>11/</u>		---	---	---	---
Shock, specified pulse	1042	<u>12/</u>		---	---	---	---
<u>Conformance inspection, part 1</u>							
Pressurizing (rf window)	4003	---	P = 55 psia (min)	---	---	---	---
Heater current	1301	<u>9/</u>	Ef = 8 V	If	7.7	8.7	A
Power output	4250	---	F = F1, F2, and F3	Po	1,260	2,500	W
Static diode impedance	---	<u>5/</u>	epy as required	Z	2,550	3,150	Ohms
Forced cooling	1143	---		P	---	75	psia
<u>Conformance inspection, part 2</u>							
Electrode voltage (getter)	1261	---	I (getter) = 15 A	E (getter)	1.0	4.0	V
Direct-interelectrode capacitance	4266	---	Anode - cathode	C	---	30	pF
Coolant-pressure drop versus coolant flow (collector)	1155	---	Flow = 1.5 GPM	$\Delta P$	10	30	psi
Liquid cooling jacket leakage	4153	---	P = 30 psi	---	---	---	---
<u>Conformance inspection, part 3</u>							
Life test	---	<u>15/ 16/</u>	Group D	t	1,000	---	hrs
Life-test end points:	---						
Power output	4250	---	F = F1, F2, and F3	Po	1,160	2,500	W
Static diode impedance	---	<u>5/</u>	epy as required	Z	2,550	3,150	Ohms

1/ In addition to MIL-PRF-1 symbols, the following shall apply:

- P.....Pressure
- GPM.....Gallons per minute
- ppm.....Parts per million
- $\Delta\theta$ .....Change in phase

2/ The gas used in pressurization shall provide insulating properties which are the equivalent of oil-filtered and particle-filtered air dried to a dew point below -40°C. The oil trap shall be activated alumina, the filter shall be 20 to 30 micron size, and the desiccant shall be silica gel, or equivalent.

TABLE I. Testing and inspection.

- 3/ The VSWR presented to the tube under test (TUT) by the driver or load shall not exceed 1.5:1 over the frequency range of 2.7 to 2.9 GHz; 1.3:1 from 2.9 to 3.1 GHz; 1.5:1 from 3.1 to 3.4 GHz; and 2.0:1 from 3.4 to 3.5 GHz.
- 4/ First article inspection when required shall consist of performing all tests listed on this tube specification sheet and MIL-PRF-1.
- 5/ The recommended value for operation shall be stamped on the identification plate of the tube.
- 6/ The pulse characteristics shall be as follows:

trv:	0.1 (min)	1.5 (max) $\mu$ s
tfv:	0.1 (min)	5.0 (max) $\mu$ s

No spike or ripple shall exceed  $\pm 3$  percent of the smooth peak value of voltage or current. Inverse voltage shall not exceed 30 percent of the forward voltage.

- 7/ The level shall remain constant at all frequencies.
- 8/ The transverse or radial magnetic field shall not exceed 1 percent of the axial magnetic field.
- 9/ The tubes tested and acquired with this tube specification sheet shall be capable of shelf-life for a period of 12 months after date of shipment from the manufacturer's plant. Tubes placed in operation during this shelf-life period shall meet all requirements of this tube specification sheet.
- 10/ Unless otherwise specified, the acceptance level for all tests listed under conformance inspection, shall be based upon accept on zero (c = 0) sampling plan in accordance with MIL-PRF-1, table III.
- 11/ The tube shall be mounted with the cathode axis vertical and vibrated in a nonoperating condition as follows:

Exploratory: With a peak-to-peak amplitude and frequency range of:

- 5 to 15 Hz at .075  $\pm$  .012 inches.
- 16 to 25 Hz at .050  $\pm$  .008 inches.
- 26 to 33 Hz at .025  $\pm$  .004 inches.

Variable: As specified in the exploratory test except that the dwell time at each frequency with observed resonances shall be approximately 5 minutes.

Endurance: As specified in the variable test except that the dwell time shall be at least 2 hours duration.

The tube shall pass conformance inspection, part 1, upon completion of this test.

- 12/ The TUT shall be shocked three times in a direction along the cathode axis, the shock pulse shall be a half sine wave with a duration of 11 ms and an intensity of 50G. It shall also be mounted and shocked in the same manner for three times in the other mutually perpendicular axes, the shock pulse having a duration of 11 ms and an intensity of 25 G. The tube shall pass conformance inspection, part 1, upon completion of this test.
- 13/ The  $\Delta\theta/\Delta E_{py}$  value is computed from the difference between the phase shifts through the TUT at the two anode voltage extremes divided by the total voltage change.
- 14/ Revision letters are not used in this revision to identify changes with respect to the previous issue, due to the extensiveness of the changes.

MIL-PRF-1/1605C

TABLE I. Testing and inspection.

15/ Power input to the TUT during life test shall be cycled according to the following schedule:

High voltage on: 7.5 hours.

High voltage off: 0.5 hours.

The rf input frequency shall be varied from F1 to F2 to F3 and repeated in intervals of 100 hours.

16/ Life test required for first article testing only.

17/ Water shall be used with (1) specific resistivity maintained greater than 0.5 Meg $\Omega$ -cm (2) oxygen content maintained less than 0.5 ppm, and (3) a 3 to 4 micron filter.

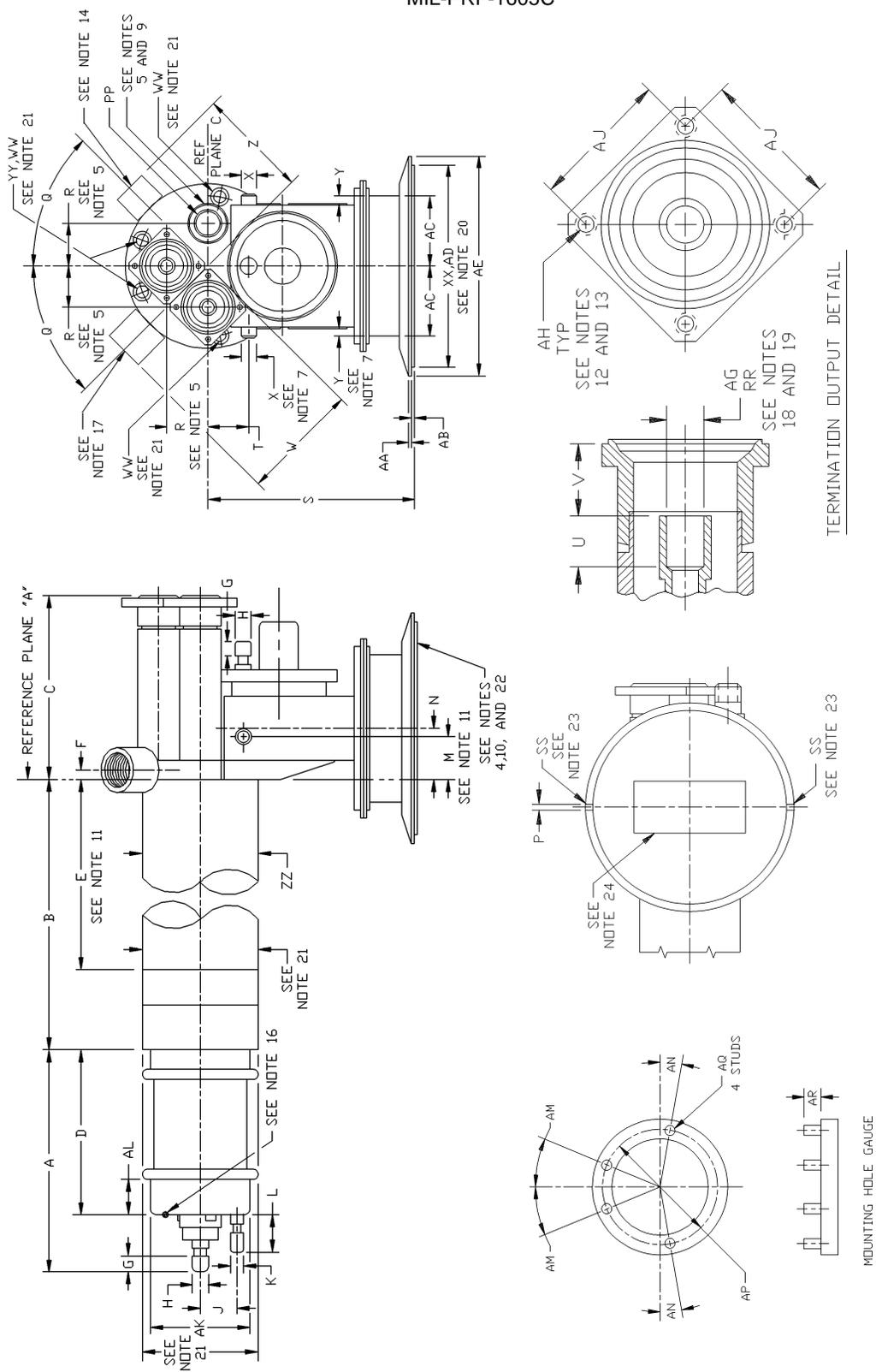


FIGURE 1. Outline drawing of electron tube type 8128.

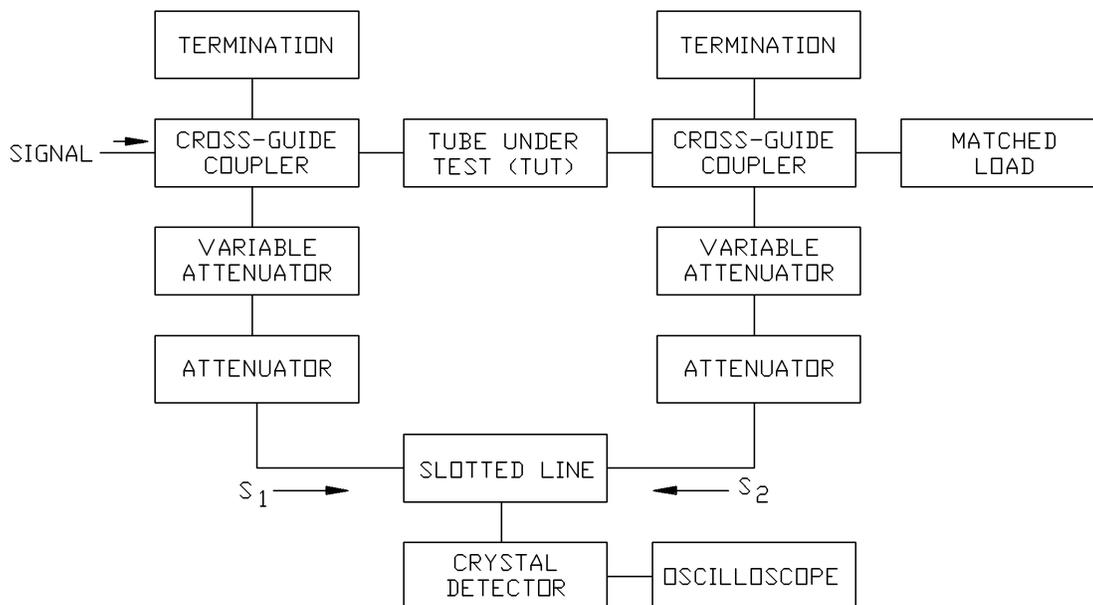
MIL-PRF-1/1605B

Ltr	Dimensions			
	Inches		Millimeters	
	Min	Max	Min	Max
Conformance inspection, part 1 25/				
A	4.867	5.241	123.62	133.12
B	18.615	18.950	472.82	481.33
C	---	4.455	---	113.16
N	1.200	1.240	30.48	31.50
P	.0595	.0655	1.51	1.66
S	4.960	5.040	125.98	128.02
V	.500	.520	12.70	13.21
Y	.187	---	4.75	---
AG	.308	.316	7.82	8.03
Conformance inspection, part 2				
D	3.632	3.882	92.25	98.60
G	.312	---	7.92	---
H	.367	.383	9.32	9.73
K	.306	.312	7.77	7.92
L	.855	.895	21.72	22.73
R	.950	1.050	24.13	26.67
U	.375	---	9.52	---
W	---	3.375	---	85.73
X	.370	.380	9.40	9.65
Z	---	3.125	---	79.38
AB	.084	.104	2.13	2.64
AD	5.031	5.051	127.79	128.30
AE	5.285	5.315	134.24	135.00
AJ	1.006	1.050	25.55	26.67
AK	2.342	2.372	59.49	60.25
AI	.780	---	19.81	---
Nominal dimensions				
E	17.125		435.00	
F	.235		5.97	
J	.850		21.60	
M	1.050		26.70	
Q	45°		45°	
T	1.000		25.40	
AA	.063		1.60	
AC	1.750		44.50	
AF	20°		20°	
AH	.190-32		4.83-32	
AM	22°30'		22°30'	
AN	10°		10°	
AP	3.410 DIA		86.61 DIA	
AQ	.255 DIA		6.48 DIA	
AR	.500		12.70	

NOTES:

- Reference plane "A" is defined as a plane passing along the face of the mounting surface as shown.
- Reference plane "B" is defined as a plane perpendicular to plane "A" passing through the axis of diameter "ZZ" at plane "A" and midway between the axes of holes "YY" at plane "A".
- Reference plane "C" is defined as a plane mutually perpendicular to planes "A" and "B" passing through the axis of diameter "ZZ" at reference plane "A".
- This flange shall mate with a modified M3922/61-002.
- This part shall mate with a type "N" plug.
- These dimensions apply to the axes of diameter "RR" and "PP".
- Terminal for ground adapter.
- This dimension refers to the axis of diameter "XX".
- rf input (type "N").
- rf output
- This section of the tube may be composed of numerous laminations, each containing a "V" notch.
- Pitch diameter shall accept a class 2 "GO" gauge only.
- Minor diameter shall be not greater than .166 inch (4.22 mm).
- This part shall be equivalent to AN-D10050-6.
- Getter bushing.
- Cathode temperature measurement point.
- This part shall be equivalent to AN-D10050-8.
- For termination.
- This part shall mate with an UG-45/U coupling flange.
- The axis of this diameter shall lie on reference plane "B" within .020 inch (0.51 mm).
- These diameters and mounting holes "WW" shall simultaneously accept a gauge 22.500 inch (571.50 mm) long with a 2.652 inch (67.36 mm) I. D. with pins as shown on "MOUNTING HOLE GAUGE."
- This surface shall be perpendicular to reference "A" within .020 inch (0.51 mm).
- A centerline created by these pins shall be parallel to reference plane "A" within .040 inch (1.02 mm) and pass through axis of diameter "XX" within .004 inch (0.102 mm).
- This surface shall be parallel to a centerline passing through pins "SS" within .025 inch (0.64 mm).
- This specification uses accept on zero defect sampling plan in accordance with MIL-PRF-1, table III.

FIGURE 1. Outline drawing of electron tube type 8128 - Continued.



Equipment required:

- |   |                      |
|---|----------------------|
| 2 - Cross-guide couplers (30-40 dB directivity) | 1 - Slotted line     |
| 2 - Waveguide-to-coaxial transitions            | 1 - Crystal detector |
| 2 - Terminations                                | 1 - Oscilloscope     |
| 2 - Coaxial attenuators                         | 1 - Matched load     |
| 2 - Variable attenuators                        |                      |

For the measurement of phase sensitivity to voltage change, a setup as shown above shall be used. Both arms 1 and 2 shall be well-matched to minimize reflections. At a fixed frequency and a fixed anode voltage level, the variable attenuators shall be adjusted to equalize the magnitude of signals  $S_1$  and  $S_2$ . (Oscilloscope comparison of the signal of  $S_1$  and  $S_2$  removed, and vice versa, will aid in this step.) The trace shown on the oscilloscope will be a pulse whose magnitude varies with the position of the probe carriage. The position of the minimum of the standing wave will be observed by a dip in the oscilloscope signal.

After the minimum position of the standing wave has been located, the operating point of the tube is changed by reducing the magnitude of the pulse voltage. The new minimum position shall then be located. The phase shift shall be determined from the difference of the standing wave minimum positions caused by the two voltage levels.

The pulse voltage shall be viewed on an oscilloscope to determine the two voltage levels of the measurement.

The phase sensitivity is determined by dividing the voltage change into the measured phase shift.

FIGURE 2. Phase shift variation.

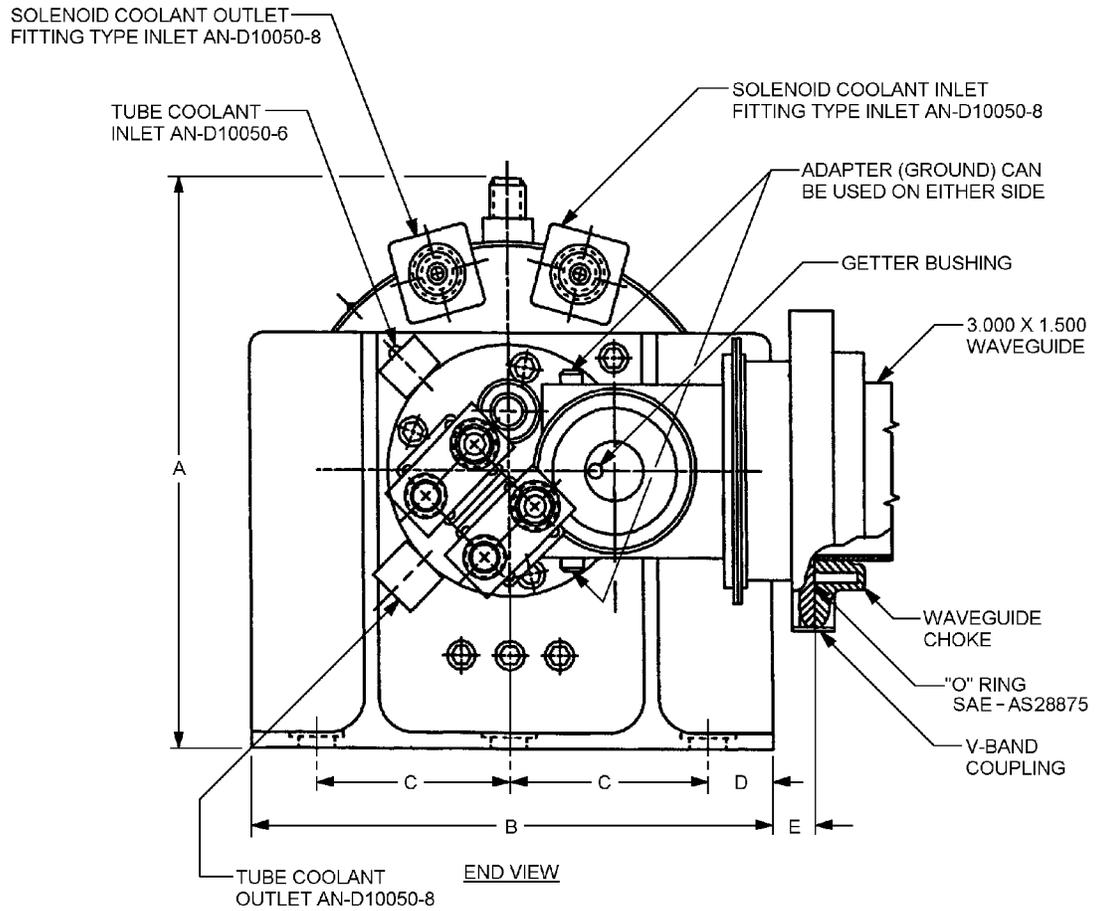


FIGURE 3. Installation drawing (for guidance only).

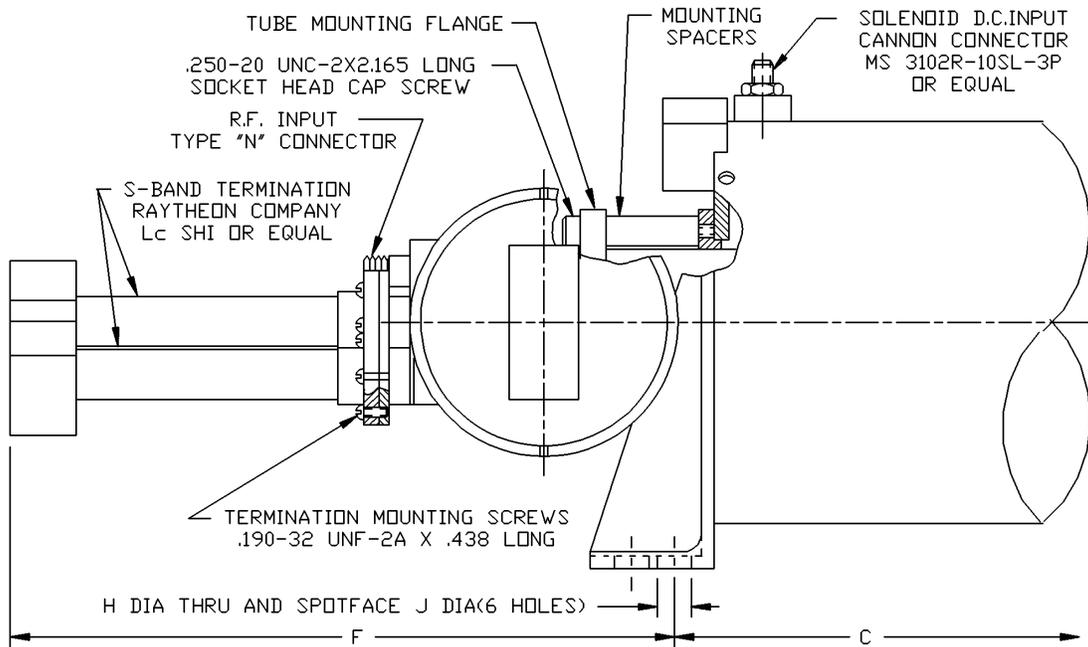


FIGURE 3. Installation drawing (for guidance only) - Continued.

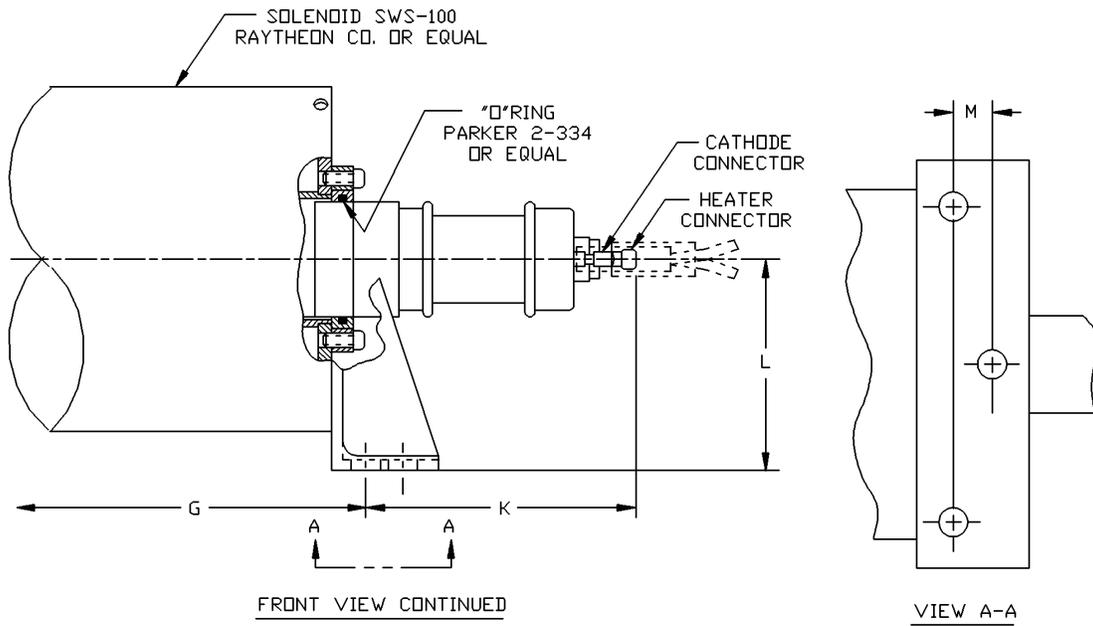
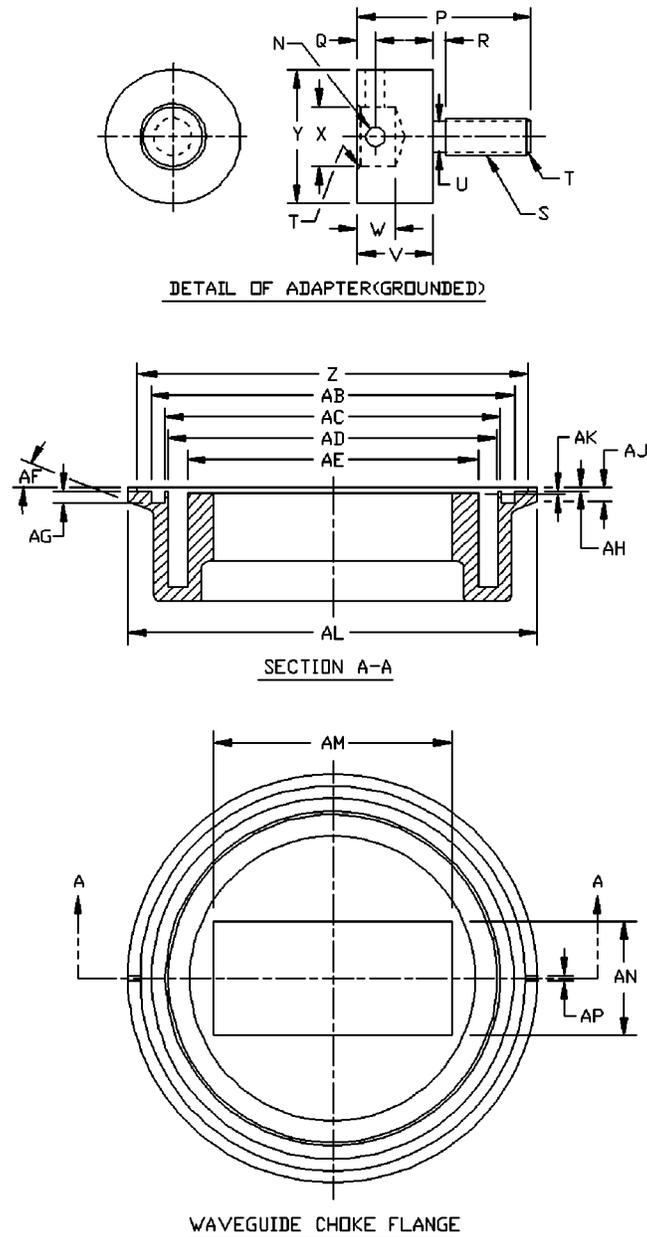


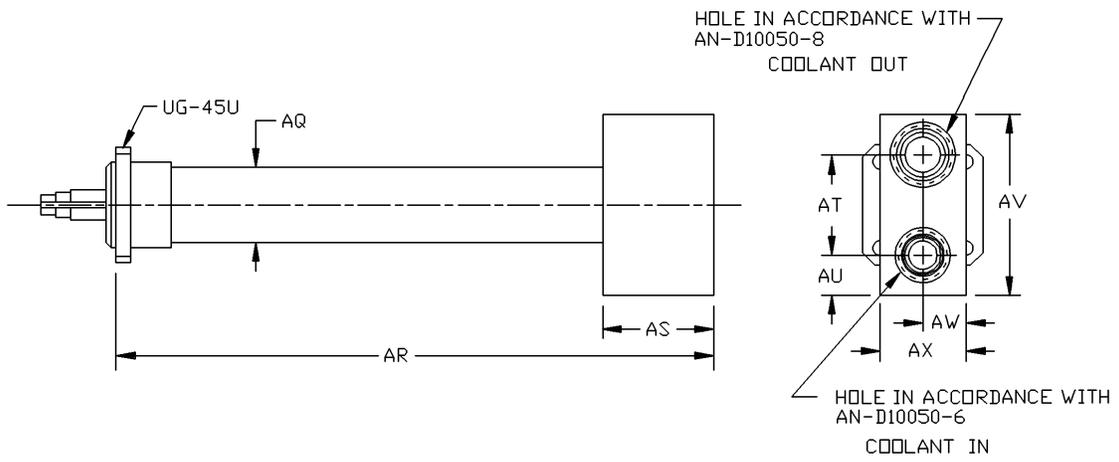
FIGURE 3. Installation drawing (for guidance only) - Continued.



NOTES:

1. Dimensions are in inches.
2. Metric equivalents (to the nearest 0.01 mm) are give for general information only and are based upon 1 inch = 25.4 mm.
3. Unless otherwise specified, tolerance is  $\pm .005$  (0.13 mm) for three place decimals, tolerance is  $\pm .02$  inch (0.51 mm) for two place decimals.

FIGURE 3. Installation drawing (for guidance only) - Continued.



**TERMINATION Lc SH 1**  
Flow = Water, 1 G.P.M.  
Pressure drop = 10 P.S.I.  
Pressure max = 115 P.S.I.A.

FIGURE 3. Installation drawing (for guidance only) - Continued.

MIL-PRF-1/1605C

Ltr	Dimensions			
	Inches		Millimeters	
	Min	Max	Min	Max
A	9.370	9.380	238.00	238.25
B	8.745	8.755	222.12	222.38
C	3.370	3.380	85.60	85.85
D	.995	1.005	25.27	25.53
E	.620	.630	15.75	16.00
F	12.680	12.690	322.07	322.23
G	16.870	16.880	428.50	428.75
H	.620 DIA	.630 DIA	15.75 DIA	16.00 DIA
J	.995 DIA	1.005 DIA	25.27 DIA	25.53 DIA
K	5.706	5.716	144.93	145.18
L	4.495	4.505	114.17	114.43
M	.745 TYP	.755 TYP	18.92 TYP	19.18 TYP
N	.138-32 UNC-2B		3.51-32UNC-2B	
P	1.094	1.156	27.79	29.36
Q	.115	.135	2.92	3.43
R	.035	.055	0.89	1.40
S	.250-28UNF-2A		6.35-25UNF-2A	
T	.030 x 45° CHAM		0.76 x 45° CHAM	
U	.190	.210	4.83	5.33
V	.468	.531	11.89	13.49
W	.219	.281	55.63	7.14
X	.385	.395	9.78	10.03
Y	.844	.906	21.44	23.01
Z	5.052	5.062	128.32	128.57
AB	4.684	4.688	118.97	119.07
AC	4.382	4.386	111.30	111.40
AD	4.260	4.270	108.20	108.46
AE	3.670	3.770	93.22	95.76
AF	19°30'	20°30'	19°30'	20°30'
AG	.113	.118	2.87	3.00
AH	.065	.070	1.65	1.78
AJ	.169	.173	4.29	4.39
AK	.045	.055	1.14	1.40
AL	5.307	5.317	134.80	135.05
AM	3.000	3.010	76.20	76.45
AN	1.495	1.505	37.97	38.23
AP	.066 TYP	.069 TYP	1.68 TYP	1.75 TYP
AQ	.870 DIA	.880 DIA	22.10 DIA	22.35 DIA
AR	7.0575	7.0675	179.260	179.514
AS	1.3075	1.3175	33.210	33.464
AT	1.120	1.130	28.45	28.70
AU	.495	.505	12.57	12.83
AV	2.120	2.130	53.85	54.10
AW	.495	.505	12.57	12.83
AX	.995	1.005	25.27	25.53

FIGURE 3. Installation drawing (for guidance only) - Continued.

MIL-PRF-1/1605C

NOTES

Referenced documents. In addition to MIL-PRF-1, this specification sheet sheet references MIL-STD-1311, MS3102, AN-D10050 and SAE-AS28775.

Changes from previous issue. The margins of this specification are marked with vertical lines to indicate where changes from the previous issue were made. 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 and relationship to the previous issue.

Custodians:  
Navy - EC  
DLA - CC

Preparing activity:  
DLA - CC

(Project 5960-3750)

Review activities:  
Navy - AS, CG, MC, OS, SH

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 [www.dodssp.daps.mil](http://www.dodssp.daps.mil).