

REVISIONS			
SYMBOL	DESCRIPTION	DATE	APPROVAL
-	RELEASED	3/16/92	<i>[Signature]</i>

SHEET REVISION STATUS

SH	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
REV	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
SH	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
REV	--																			

ORIGINATOR T.J. Perry/Paramax	DATE 3/6/92	FSC: 5935 Connectors, Electrical, Rectangular, Polarized Shell, EMI Shielding (Size 3) For Space Flight Use, Detail Specification For
APPROVED S.E. Archer-Davies/Paramax	3/6/92	
CODE 311 APPROVAL S.A. Naus/GSFC	3/9/92	
CODE 311 SUPERVISORY APVL G.P. Kramer, Jr./GSFC	3/16/92	
ADDITIONAL APPROVAL		S-311-P-718/6

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
 GODDARD SPACE FLIGHT CENTER
 GREENBELT, MARYLAND 20771

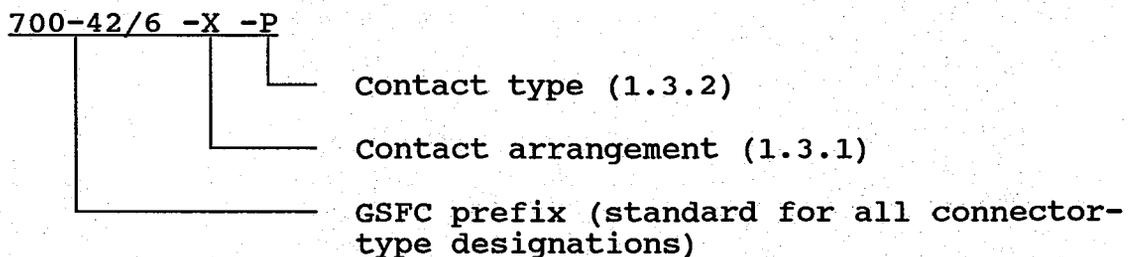
CAGE CODE: 25306 PAGE 1 OF 21

1. SCOPE

1.1 Specification for connectors. This specification covers the detail provisions for rectangular, polarized shell, electrical connectors, capable of continuous operation in a space environment within a temperature range from -65°C to +125°C. Connectors use rear-insertion and rear-release crimp-type contacts, supplied separately. Detail specification GSFC S-311-P-718/2 covers the contacts for the electrical connectors. The connectors shall be designed to be used with the appropriate EMI backshells furnished under GSFC S-311-P-718/4.

1.2 GSFC general specification. Unless otherwise noted, all connector provisions and requirements of GSFC general specification S-311-P-718 apply to this specification.

1.3 Connector-type designations. Connectors shall be of the following type designations, and shall be ordered by their type designations only.



1.3.1 Contact arrangement. Select the contact arrangement from Figure 1.

1.3.2 Contact type. Select the contact type: P for pin; S for socket (Note: Plug-type connectors are available with socket-type contacts only while receptacles are equipped with pin-type contacts). (See Figure 2.)

2. APPLICABLE DOCUMENTS (1.2)

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

2.1 Specifications.

2.1.1 Federals.

QQ-A-200/8 Aluminum Alloy Bar, Rod, Shapes and Tube, Extruded, 6061 and 6062

QQ-A-250/11 Aluminum Alloy 6061, Plate and Sheet

QQ-C-533 Copper, Beryllium Alloy Strip (Copper Alloy Numbers 170 and 172)

ZZ-R-765 Rubber, Silicone, Low and High-Temperature and Tear Resistant

2.1.2 Military.

MIL-C-26074 Coatings, Electroless Nickel, Requirements for

MIL-C-17 Cables, Radio Frequency; Coaxial, Dual Coaxial, Twin Conductor, and Twin Lead

MIL-W-16878 Wire, Electrical, Insulated, High Temperature

MIL-C-22520 Crimping Tools, Contact, Electric, Hand, General Specification for

MIL-T-22910 Tool, Crimping, Hand, for Crimp Style Electric Terminal and Shield Ferrule

MIL-I-43553 Ink, Marking, Epoxy Base

MIL-G-45204 Gold Plating, Electrodeposited

MIL-C-81511 Connectors, Electrical, Circular, High Density, Quick Disconnect, Environmental Resisting and Accessories, General Specification for

MIL-C-14550 Copper Plating (Electrodeposited)

2.1.3 NASA/GSFC.

GSFC S-311-P-718 Connectors, Electrical, Rectangular (Power and Coaxial Contacts) (Including EMI Shielding) for Space Flight Use, General Specification for

GSFC S-311-P-718/2 Contacts, Power and Coaxial, Removable, (Sizes 1, 2 and 3) for Electrical Connectors

GSFC S-311-P-718/4 Backshell Kits, Connector, Rectangular, EMI Shielding, Strain Relief (Sizes 1, 2, and 3) for Space Flight Use, Detail Specification for

2.2 Standards.

MS3187	Plug, End Seal, for MIL-C-26482, MIL-C-5015, MIL-C-81703 and MIL-C-93723, Electrical Connectors
MS3197	Gage Pin, for Socket Engagement Test
DOD-STD-100	Engineering Drawing Practices

2.3 Order of precedence. The order of precedence delineated in the general specification shall apply.

3. REQUIREMENTS (1.2)

3.1 Materials, design, and construction. Connectors shall be of the materials, design, construction, and physical dimensions as specified herein (Figures 1 and 2). They shall be constructed to accommodate removable crimp-type power and coaxial contacts conforming to specification GSFC S-311-P-718/2. (Reference: Finishes not specified, which are known to sublime in a hard vacuum, such as cadmium, shall not be used.) Connectors shall be designed to be mated when the distance between the plug and receptacle is achieved as indicated in Figure 2A and Figure 2B.

3.1.1 Material weight loss (vacuum). Connector materials used shall be such that in no case will outgassing limits of 3.2.3 be exceeded when tested in accordance with GSFC S-311-P-718.

3.1.2 Insert material. Inserts shall be made of Epiall 1908 or Epiall 1914. The inserts shall meet the material weight loss requirement of 3.1.1.

3.1.3 Contact designation. Contact locations (numerals) shall appear on the front and rear faces of inserts to identify the contacts (Figure 1). The socket identification shall correspond to the mating-pin contact identification.

3.1.4 Shell design. The shell shall be designed to positively retain the insert and be so constructed that the insert cannot be removed without the use of tools. Shells shall be scoop-proof and shall be chamfered at the mating surfaces. The connector shall be so designed that a single shell configuration pair will accommodate either contact arrangement (Figure 1). Flange location shall be as indicated in Figure 2.

3.1.4.1 Shell polarization. Polarization shall be accomplished by a shaped-shell design. Polarization shall be accomplished before engagement of the contacts.

C

3.1.4.2 Shell material and finish. The shells shall be made of aluminum alloy in accordance with QQ-A-200/8, 6061-T6511, or

QQ-A-250/11, 6061-T651. The connector's shell surface shall be nickel plated per MIL-C-26074, Class 4, Grade B. A blue painted alignment stripe and alignment line shall be located per Figures 2A and 2B. The paint shall be per MIL-I-43553, Type I. The paint shall meet the weight loss requirements of 3.1.1.

3.1.4.3 Shell spring fingers. Spring fingers shall be designed to make electrical contact with the mating shell without interfering with proper engagement. The fingers shall be positively retained about the shell periphery per Figure 2A. Spring fingers shall be made from beryllium copper alloy in accordance with QQ-C-533. Finger plating shall be gold plated per MIL-G-45204, Type II, Class II, Grade C, over Type I, Class 1, Grade A over copper flash per MIL-C-14550 .00001 - .00010" thick.

3.1.5 Connector mating/demating tooling The supplier shall design and/or recommend the required tooling necessary for connector mating/demating.

3.1.6 Contact retention clips. Contact retention clips shall be heat treated to a hardness of 65,000 psi. The clip material shall be beryllium copper.

3.1.7 Interfacial seal. All pin contact inserts shall have a resilient interface seal bonded to the front face, with individual pin barriers. The pin barrier projections shall seal in their respective lead-in chamfers of the hard face socket insert. The resilient interfacial seal shall provide individual contact seals in the mated condition to ensure circuit isolation between each contact and contact to shell. The interfacial seal shall meet the material weight loss requirement of 3.1.1.

3.1.8 Wire sealing member (rear grommet). A wire sealing member shall be provided on the rear of both the plug and receptacle and it shall not be removable from the connector. It shall be designed to provide sealing to meet the environmental requirements of this specification when using wire of outer diameters within the range shown below. When wires of smaller diameter are specified, (e.g., for qualification) the use of shrink-fit tubing is permitted, as required. The grommet shall meet the material weight loss requirement of 3.1.1. The grommet shall be of a triple-gland design.

Contact Cavity	Wire Size	Finished Wire Outside Dimensions (in.)	
		Min.	Max.
16	16-18-20(1)	0.064	- 0.095
20	20-22-24(1)	0.050	- 0.072
22	22-24-26(1)	0.045	- 0.064
RG-393/U	RG-393/U(2)	0.380	- 0.400

- (1) MIL-W-16878, type EE
- (2) MIL-C-17/127

3.1.9 Sealing plugs. The same sealing plugs shall be capable of being used in both connector plugs and receptacles. The sealing plug identification shall be as follows:

MS3187-16	For size 16 grommet cavity
MS3187A20	For size 20 grommet cavity
MIL-C-81511/15-22	For size 22 grommet cavity
882-214-004 *	For RG-393/U grommet cavity

*G&H Technology, Inc. FSCM 99447

3.1.10 Angular connect and disconnect capability. The connector pairs, when suitably mounted with one connector half on a floating, spring supported plate, must be capable of engagement or separation without binding, degradation or jamming and without exceeding acceptable force limits when the two connector mounting surfaces are engaged or separated at angles of up to +10° combined with a +0.12 in. misalignment.

3.1.11 Connector weight. The maximum weight of each connector half (including a full complement of contacts) minus the backshells, shall be in accordance with Figures 1A and 1B.

3.2 Performance. (1.2)

3.2.1 Dielectric withstanding voltage. The applicable dielectric withstanding voltage shall be in accordance with Table I.

Table I. Dielectric withstanding voltage.

	ac V (rms) 60 Hz	
	Sea Level	70,000 ft.
Size 16, 20 or 22 contact-to-contact and contact-to-shell	1000	350
Coaxial outer contact-to-shell; coaxial outer contact-to-nearest Size 8 or 16 contact	1000	350
Coaxial outer contact-to-coaxial center contact	1000	350

3.2.2 Contact retention (in insert). The applicable axial load shall be in accordance with Table II.

Table II. Contact Retention.

Contact Type	Force in lb (min.)
Size 16	25
Size 20	15
Size 22	10
Coaxial (RG-393/U)	20

3.2.3 Vacuum effects (material outgassing). The material outgassing limits of the insert, interfacial seal and grommet individually shall not exceed 1.0 percent in total weight loss and 0.1 percent in volatile-condensable material.

3.2.4 Contact resistance. The contact resistance shall not exceed the limits of Table III.

Table III. Voltage drop.

Contact Wire Size	Wire Size	Test Current (Amperes)	Voltage Drop (mV max)	Voltage Drop (mV max) After Durability
Size 16-1/16		13	49	59
Size 20-1/20		7.5	55	66
Size 22-1/22		5.0	73	88

3.2.5 Insert retention (in Shell). The applicable load shall be 60 lb per square in. (psi).

3.2.6 Connector mating and demating forces. The connectors shall not exceed the forces listed in Table IV.

Table IV. Connector mating and demating forces

Contact Arrangement	Force in lb (max)	
	Mating	Demating
No. 1	50	50
No. 2	50	50

3.2.7 Contact engagement and separation. Contacts shall conform to the forces in Table V. Test pins shall be in accordance with MS3197, except as noted.

Table V. Contact engaging and separating forces.

	Engag- ing	Separat- ing	Test Pin	
	Max.	Min.	Min.	Max.
Size 16	20.0	2.0	MS3197-16X1	MS3197-16Y1
Size 20	18.0	0.75	MS3197-20X1	MS3197-20Y1
Size 22	12.0	0.75	MS3197-22X1	MS3197-22Y1
Coax. (RG-393/U) (Center contact)	11.0	1.0	0.0630	0.0660
Coax. (RG-393/U) (Center contact)	48.0	3.0	0.4333	0.4356

3.2.8 Moisture resistance. Connectors shall meet the dielectric withstanding voltage, when tested as specified in 4.1.2, and the applicable insulation resistance as follows:

- a. After step 6(c), the insulation resistance shall be 1 megohm, min.

- b. After 24 hours, (g), the insulation resistance shall be 1,000 megohms.

4. QUALITY ASSURANCE PROVISIONS (1.2)

4.1 Quantity of samples for qualification. The quantity of connector samples for each connector type designation desired for qualification shall be two, minimum, together with their counterpart connectors and equipped with appropriate EMI shielding backshells per GSFC S-311-P-718/4. The connectors shall have their full complement of contacts. The connector type designation shall be specified.

4.1.1 Connector wiring. The power contacts shall be wired using wire per specification MIL-W-16878, (Type E) or (Type EE) as follows: Note: The percentages listed are only approximate; however, all contact cavities shall be filled.

- | | | |
|----|-----------------------------------|------------|
| a) | Size 20-1 | AWG 20-50% |
| | 20-1 | AWG 24-50% |
| | 22-1 | AWG 22-50% |
| | 22-1 | AWG 26-50% |
| b) | Size 16-1 | AWG 16-50% |
| | 16-1 | AWG 20-50% |
| c) | Coax. (RG-393/U) - RG-393/U*-100% | |

* MIL-C-17

4.1.2 Moisture resistance. Mated connectors shall be subjected to the moisture-resistance test as specified in the general specification (1.2), except when modified in 3.2.8.

- a. After completion of the sixth step of the final cycle and after removal of surface moisture from the insulator, the insulation resistance shall be measured while observing the limit of 3.2.8(a).
- b. The sea-level dielectric-withstanding-voltage test shall be sustained with 600 V ac (rms) 60 Hz applied.
- c. After the 24-hour conditioning period, the insulation resistance shall again be measured while observing the limit of 3.2.8(b).

4.2 Final inspection. Connectors final inspection shall consist of these examinations, inspections and tests:

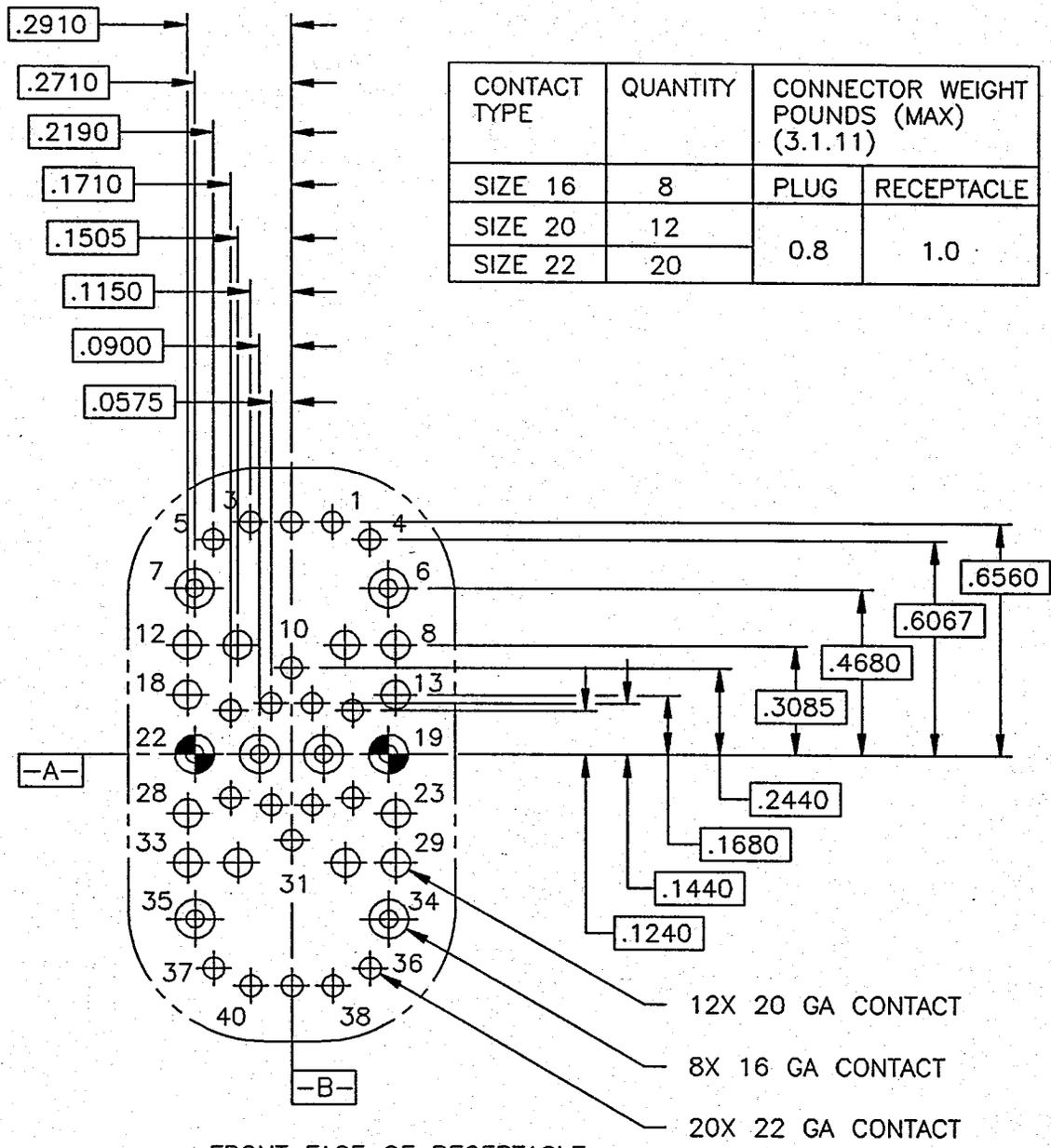
- a. Each connector shall be 100 percent inspected per the workmanship provisions of the general specification, GSFC S-311-P-718.
- b. Each connector shall be checked for:
 1. Critical Dimensions (per applicable figure)
 2. Weight (3.1.11)
 3. Mating and Demating Test (3.2.6)
 4. Contact Retention Test - all contacts (3.2.2)
 5. Electricals
 - a. DWV (3.2.1)
 - b. IR (3.6.1 - General Specification)

5. PREPARATION FOR DELIVERY (1.2)

6. NOTES (1.2)

Custodian:

Code 311.2
Goddard Space Flight Center
Greenbelt, MD 20771



FRONT FACE OF RECEPTACLE
(PIN POWER CONTACTS)

NOTE: UNLESS OTHERWISE SPECIFIED

1. INTERPRET PER DOD-STD-100.
2. DIMENSIONS AND IMPLIED 90° ANGLES ARE BASIC.
3. THE CENTER LINES OF CAVITIES INDICATED \oplus ARE LOCATED ON DATUM PLANE $\boxed{-A-}$.
4. THE CAVITIES INDICATED \ominus ARE LOCATED SYMMETRICALLY ABOUT DATUM PLANE $\boxed{-B-}$.
5. DIMENSIONS ARE SYMMETRICAL ABOUT $\boxed{-A-}$ AND $\boxed{-B-}$.

FIGURE 1A - CONTACT ARRANGEMENT-1

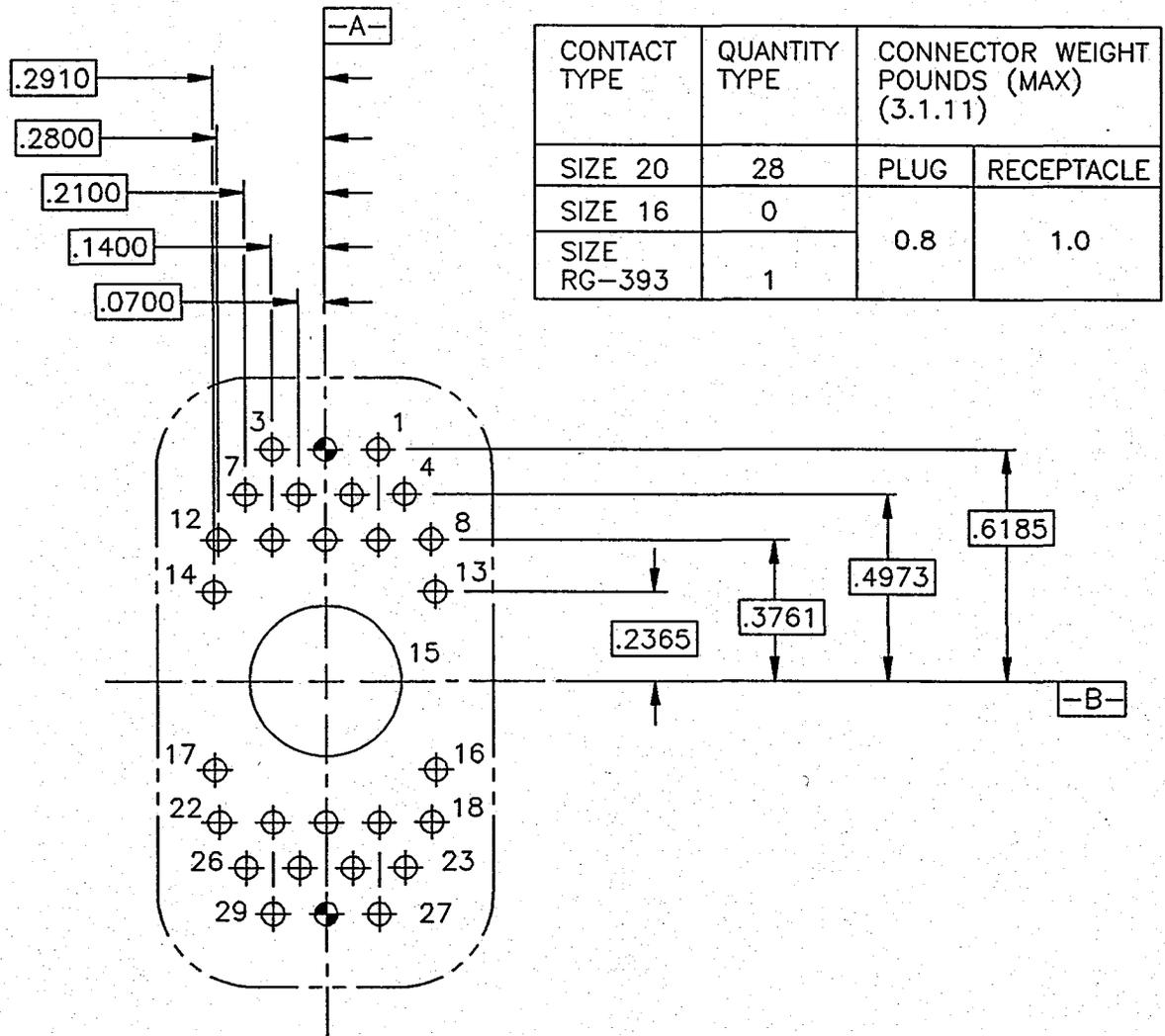
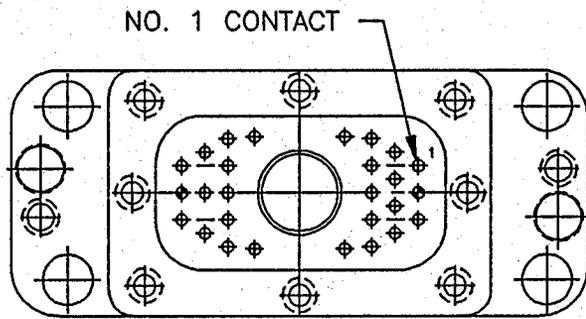


FIGURE 1B - CONTACT ARRANGEMENT-2



VIEW A
FOR -2

CONTACT ARRANGEMENT
-1 SHOWN
SEE VIEW A FOR -2
CONTACT ARRANGEMENT

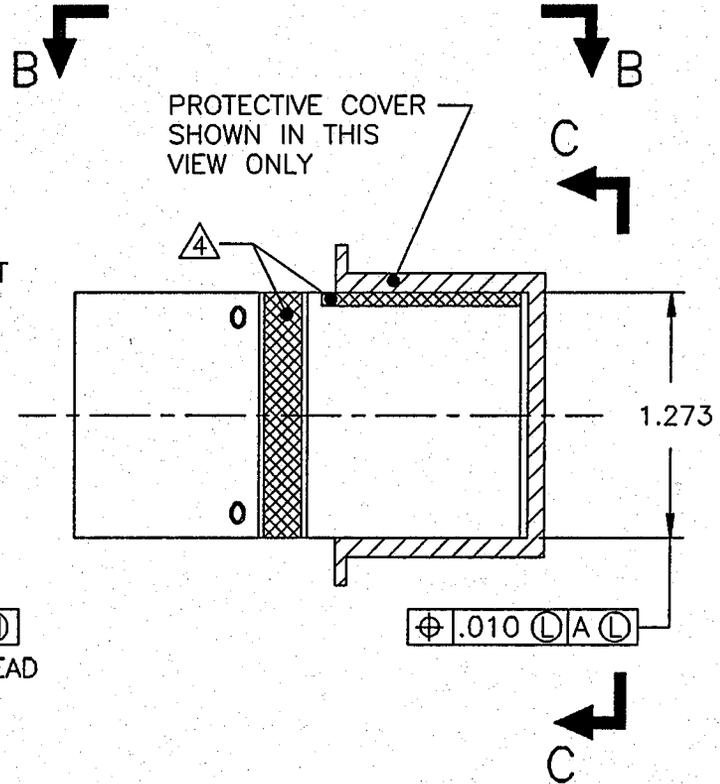
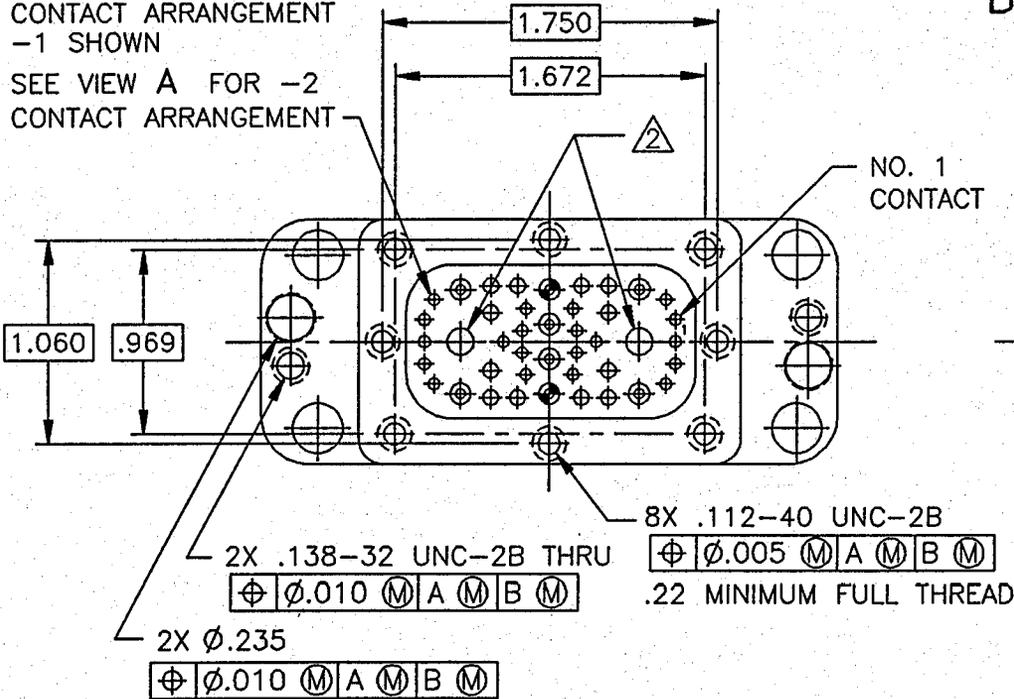
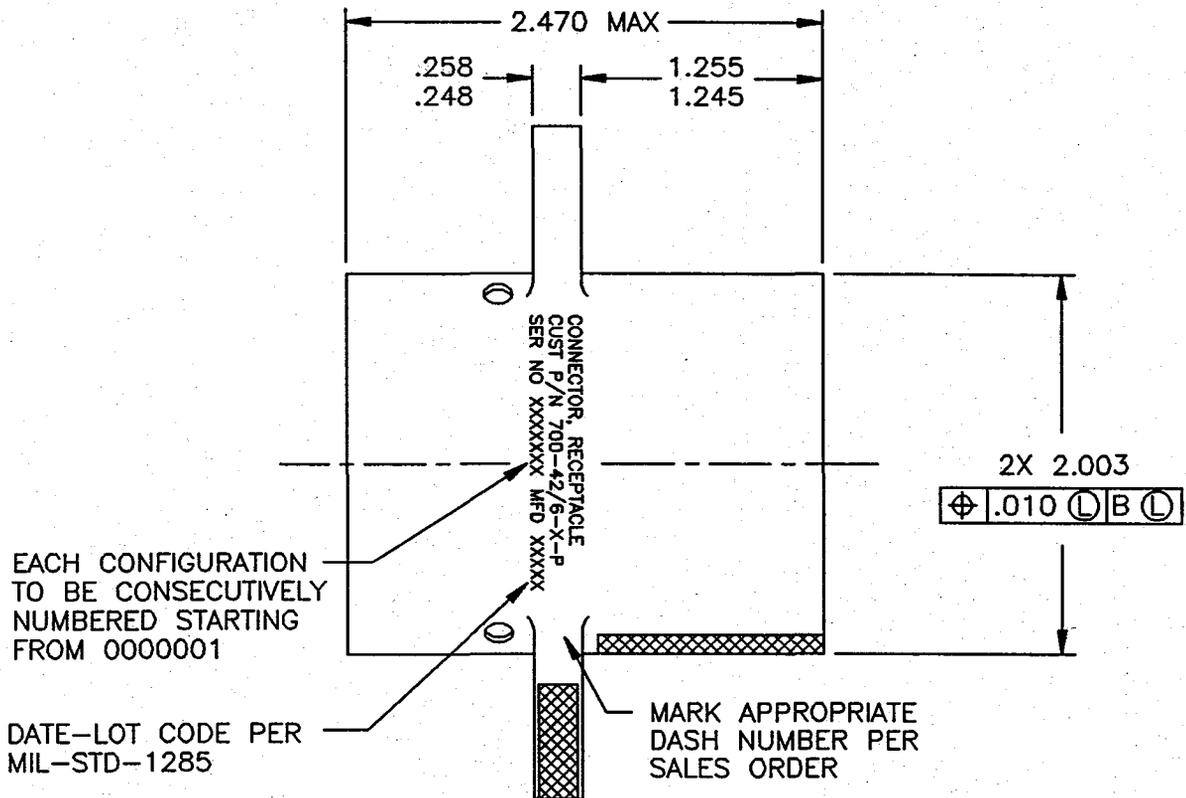
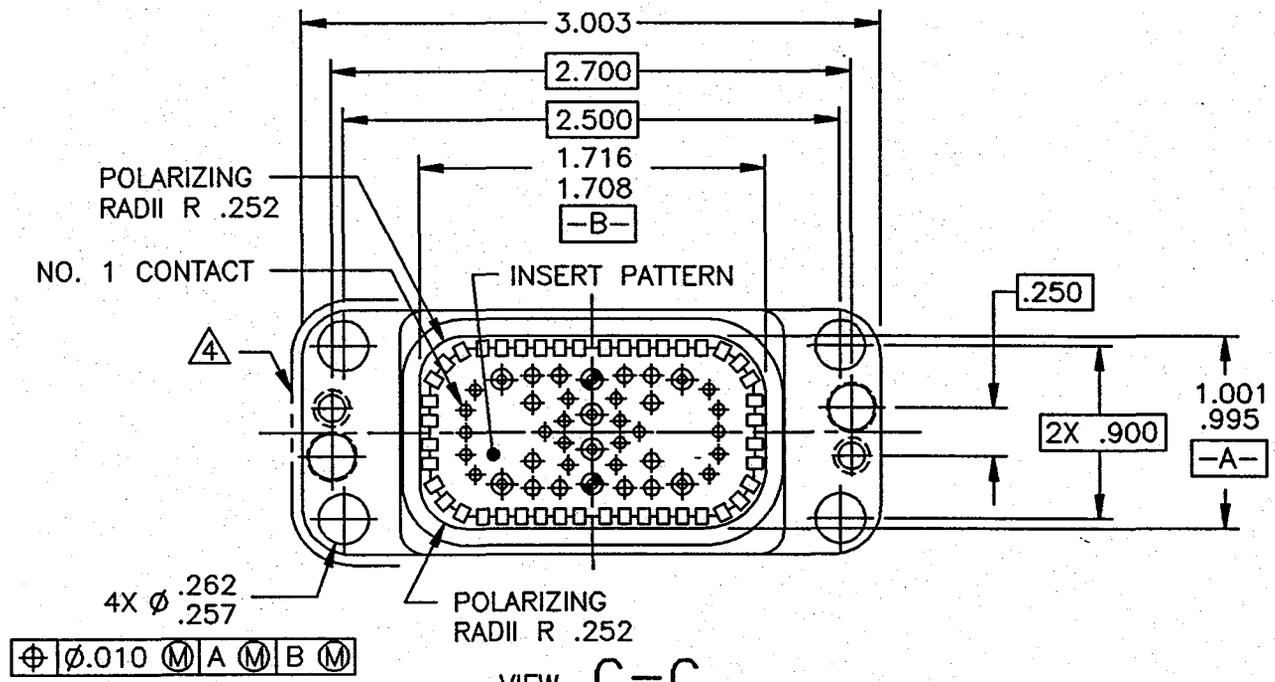


FIGURE 2A - CONNECTOR CONFIGURATION, RECEPTACLE, ELECTRICAL, RECTANGULAR
(PAGE 1 OF 4)



VIEW B-B

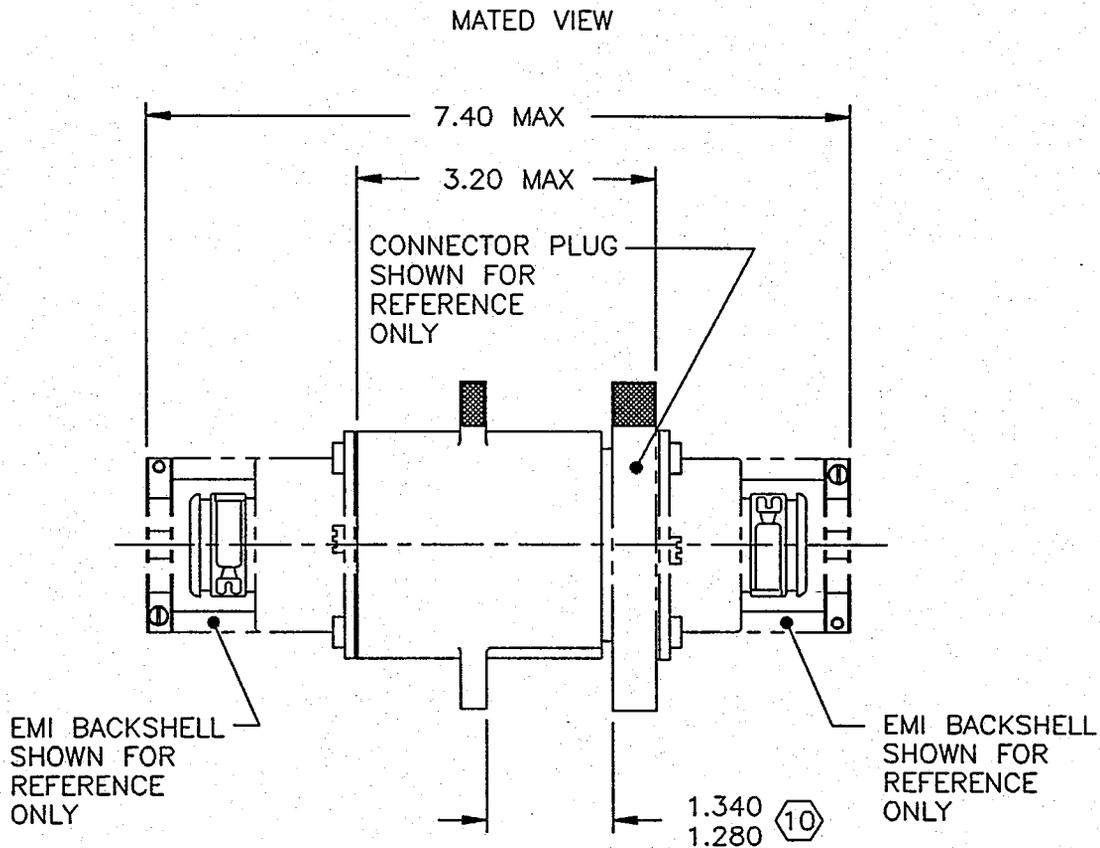


VIEW C-C

FIGURE 2A - CONNECTOR CONFIGURATION, RECEPTACLE, ELECTRICAL, RECTANGULAR (CONTD)
(PAGE 2 OF 4)

CONTACT SIZE (GA)	WIRE OR CABLE SIZE	CONTACT PIN P/N G&H P/N (NASA P/N)	COLOR CODE (2 BANDS)	SEALING PLUG P/N	CRIMP TOOL NO.	POSITIONER LOCATOR OR DIE NO.	REMOVAL TOOL NO. G&H P/N	INSERTION TOOL NO. G&H P/N	PUSH TOOL NO. G&H P/N	CONNECTOR SEPARATING TOOL NO. G&H P/N	CONNECTOR MATING TOOL NO. G&H P/N
22	22-24-26	882-606-001 (GPP25)	BLUE/ WHITE	MIL-C-81511/ 15-22	612118 	615507 	998-377-001	998-377-006	998-299-COTO	882-50-001 (2 REQ'D)	882-60-001 (2 REQ'D)
20	20-22-24	882-606-002 (GPP24)	GREEN/ WHITE	MS3187A20	M22520/1 -01	M22520/1 -02	998-377-002	998-377-005	998-300-COTO		
16	16-18-20	882-606-003 (GPP22)	BLUE/ YELLOW	MS3187-16	M22520/1 -01	M22520/1 -02	998-377-003	998-377-004	882-93-001		
	22-24-26	882-606-004 (GPP23)	BLUE/ RED		M22520/1 -01	M22520/7 -04					
RG-393/U	RG-393/U	882-117-001 (GCS14)	---	SP393 (882-214-001)	M22910/7 -1	BUCHANAN 613802 	882-95-003	---	882-78-001		
CONTACT PATTERN IDENTIFICATION NUMBER			CONTACT SIZE								
-1		-2									
1 THRU 5, 10, 14 THRU 17, 24 THRU 27, 31, 36 THRU 40		---	22								
8, 9, 11, 12, 13, 18, 23, 28, 29, 30, 32, 33		1 THRU 14, 16 THRU 29	20								
6, 7, 19 THRU 22, 34, 35		---	16								
---		15	RG-393/U								

FIGURE 2A -- CONNECTOR CONFIGURATION, RECEPTACLE, ELECTRICAL,
RECTANGULAR (CONTD)
(PAGE 3 OF 4)



NOTES: UNLESS OTHERWISE SPECIFIED

1. INTERPRET PER DOD-STD-100.

② G&H TECHNOLOGY, CAGE CODE 99447.

③ ASTRO TOOL CO., CAGE CODE 58164 (FORMERLY BUCHANAN CRIMP TOOL PRODUCTS).

④ BLUE COLOR BANDS ARE FOR VISUAL ALIGNMENT PRIOR TO MATING.

5. CONNECTOR IS DESIGNED TO FUNCTION WITH EMI BACKSHELL KIT, GSFC S-311-P-718/4.

6. TOLERANCES: .XX = $\pm .03$
.XXX = $\pm .010$

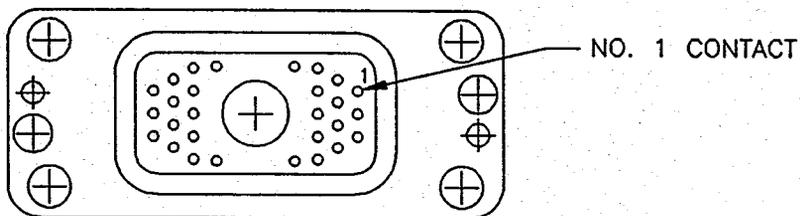
⑦ HOLES SHOWN ARE NON-FUNCTIONAL. (2 PLACES)

8. PART MATES WITH PLUG GSFC 700-42/6-X-S.

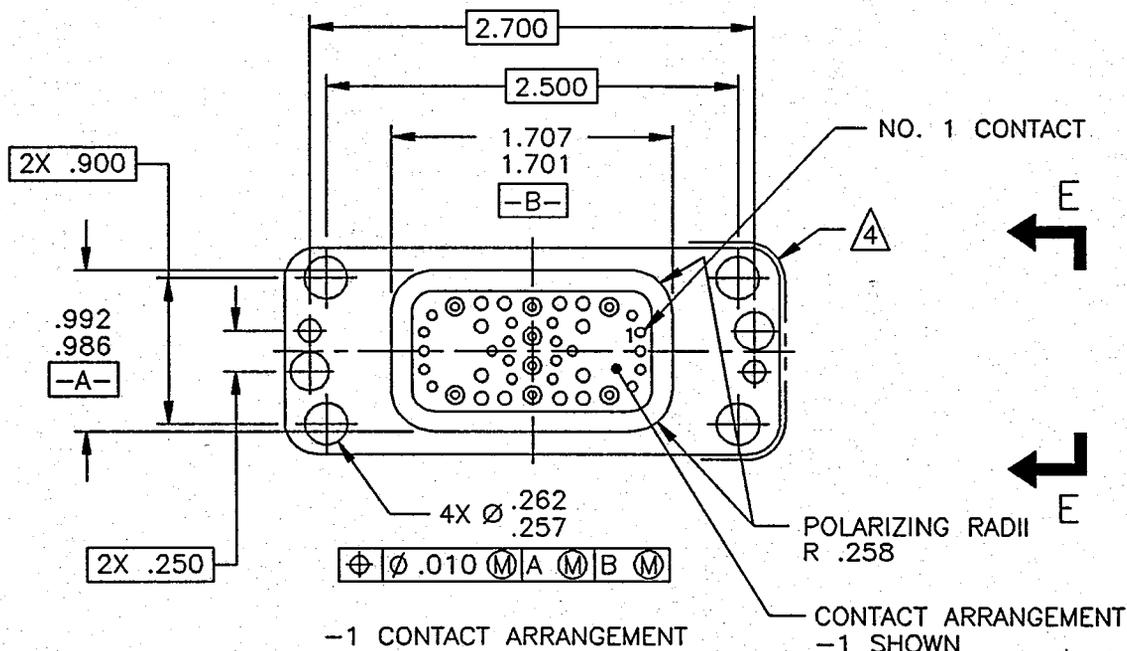
9. COAX CONTACT IS FOR RG 393.

⑩ CONNECTOR IS MATED WHEN DISTANCE NOTED BETWEEN FLANGES IS ACHIEVED.

FIGURE 2A - CONNECTOR CONFIGURATION, RECEPTACLE, ELECTRICAL,
RECTANGULAR (CONTD)
(PAGE 4 OF 4)



VIEW D
-2 CONTACT ARRANGEMENT



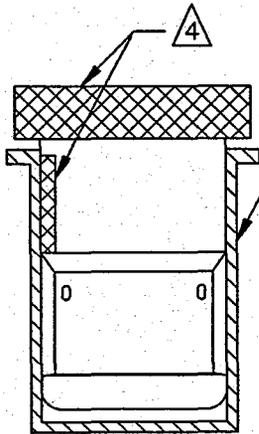
NOTES: UNLESS OTHERWISE SPECIFIED

1. INTERPRET PER DOD-STD-100.
- ② G&H TECHNOLOGY, CAGE CODE 99447.
- ③ ASTRO TOOL CO., CAGE CODE 58164 (FORMLY BUCHANAN CRIMP TOOL PRODUCTS).
- ④ BLUE COLOR BANDS ARE FOR VISUAL ALIGNMENT PRIOR TO MATING.
5. CONNECTOR IS DESIGNED TO FUNCTION WITH EMI BACKSHELL KIT, GSFC S-311-P-718/4.
6. TOLERANCES: .XX = $\pm .03$
.XXX = $\pm .010$
- ⑦ HOLES SHOWN ARE NON-FUNCTIONAL (2 PLACES).
8. PART MATES WITH RECEPTACLE GSFC 700-42/6-X-P.
9. COAX CONTACT IS FOR RG 393.
10. FOR DRY LUBRICANT LOCATIONS, SEE FIGURE 2B (PAGE 3 OF 5)

FIGURE 2B - CONNECTOR CONFIGURATION, PLUG, ELECTRICAL, RECTANGULAR
(PAGE 1 OF 5)

F ↓ ↓ F

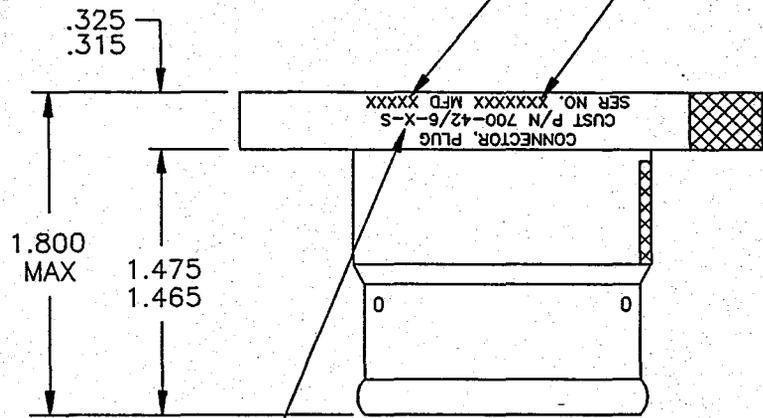
PROTECTIVE COVER
SHOWN ONLY IN THIS VIEW



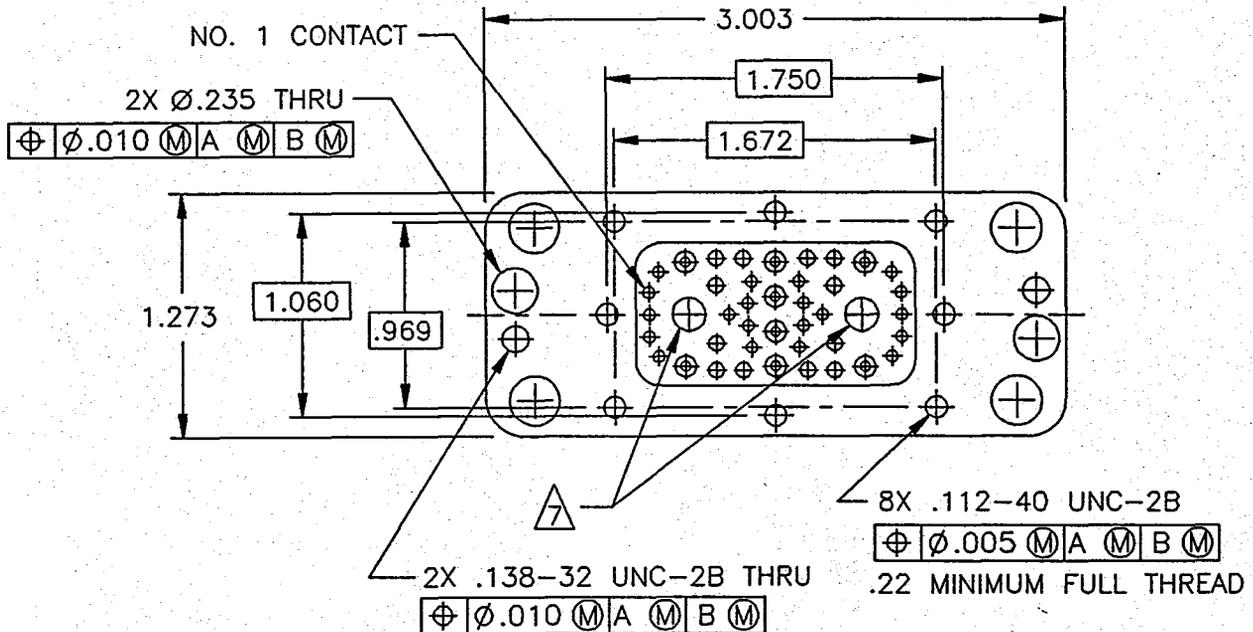
VIEW E-E
ROTATED 90° CCW

EACH CONFIGURATION TO BE
CONSECUTIVELY NUMBERED
STARTING FROM 0000001.

DATE-LOT CODE
PER MIL-STD-1285.



MARK APPROPRIATE
DASH NO. PER
SALES ORDER

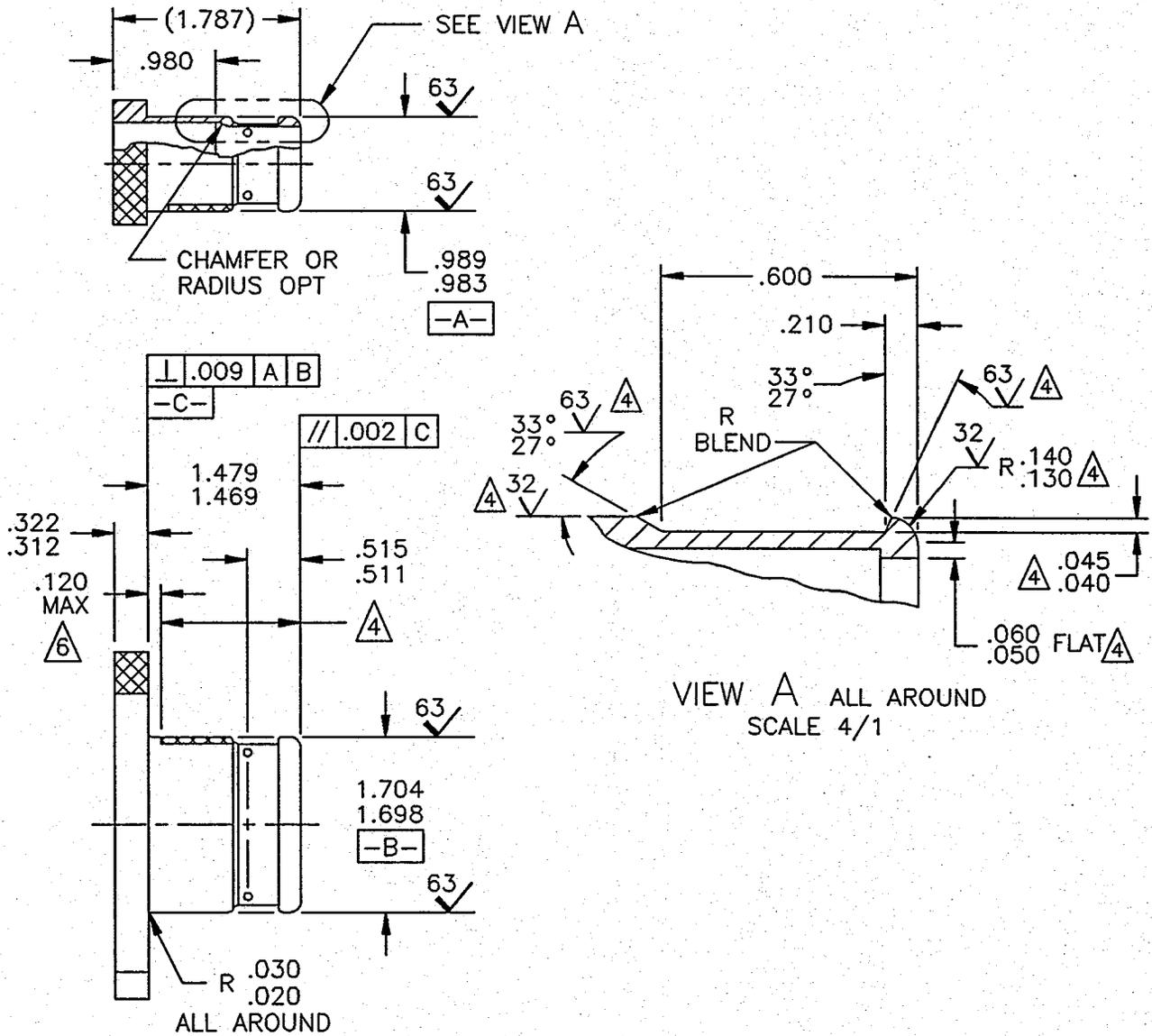


-1 CONTACT ARRANGEMENT

VIEW F-F
ROTATED 90°

FIGURE 2B - CONNECTOR CONFIGURATION, PLUG, ELECTRICAL, RECTANGULAR (CONTD)
(PAGE 2 OF 5)

DRY LUBRICANT DEFINITION



NOTES: UNLESS OTHERWISE SPECIFIED

1. INTERPRET PER DOD-STD-100.

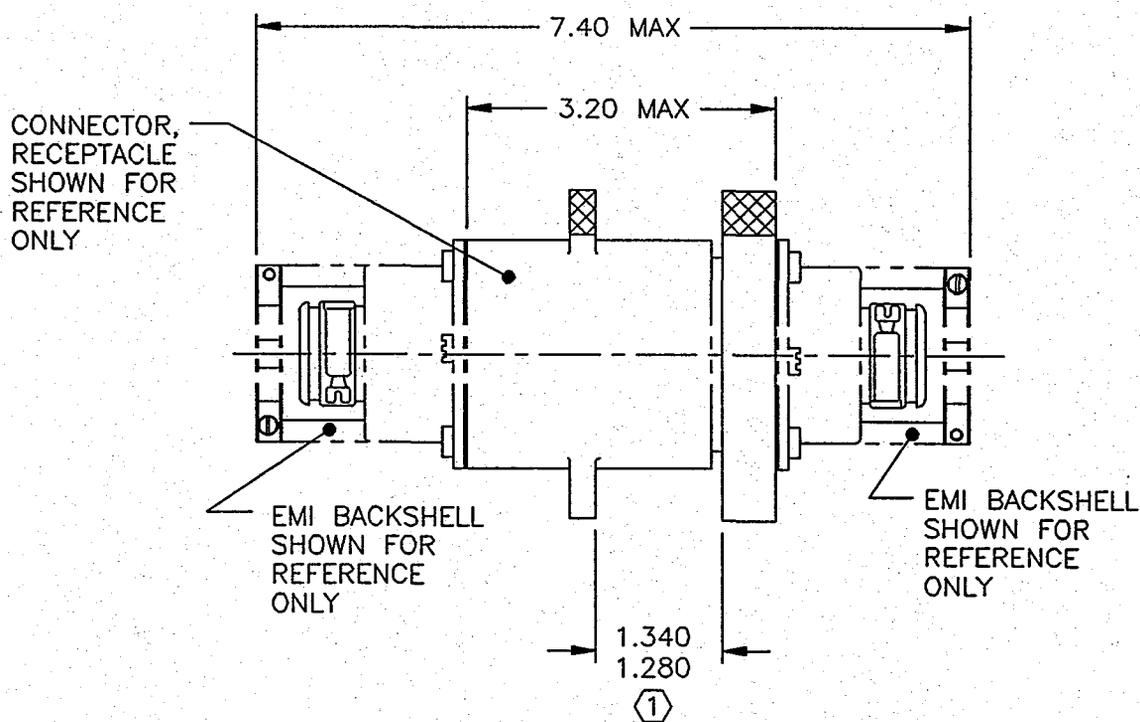
2. ELECTROLESS NICKEL PLATE PER MIL-C-26074, CLASS 4 EXCEPT THICKNESS TO BE .00176 - .0018 BUILDUP PER SURFACE.

3. NO SOLID FILM LUBRICANT PERMITTED ON SURFACES NOTED.

4. APPLY SOLID FILM LUBRICANT .0002-.0004 BUILDUP PER SURFACE PER G&H SPEC 999-143 TYPE I, CL 1, TO EXTERIOR SURFACE ALONG DIMENSION NOTED EXCEPT CURE 16 HOURS MINIMUM AT 250F - 260F.

FIGURE 2B - CONNECTOR CONFIGURATION, PLUG, ELECTRICAL, RECTANGULAR (CONTD)
(PAGE 3 OF 5)

MATED VIEW



① CONNECTOR IS MATED WHEN DISTANCE NOTED BETWEEN FLANGES IS ACHIEVED

FIGURE 2B - CONNECTOR CONFIGURATION, PLUG, ELECTRICAL, RECTANGULAR (CONTD)
(PAGE 4 OF 5)

CONTACT SIZE (GA)	WIRE OR CABLE SIZE	CONTACT SOCKET P/N G&H P/N (NASA P/N)	COLOR CODE (2 BANDS)	SEALING PLUG P/N	CRIMP TOOL NO.	POSITIONER LOCATOR OR DIE NO.	REMOVAL TOOL NO. G&H P/N	INSERTION TOOL NO. G&H P/N	PUSH TOOL NO. G&H P/N	CONNECTOR SEPARATING TOOL NO. G&H P/N	CONNECTOR MATING TOOL NO. G&H P/N
22	22-24-26	882-508-001 (GPS25)	BLUE/WHITE	MIL-C-81511/15-22	612118 △	615507 △	998-377-001	998-377-006	998-299-COTO		
20	20-22-24	882-508-002 (GPS24)	GREEN/WHITE	MS3187A20	M22520/1-01	M22520/1-02	998-377-002	998-377-005	998-300-COTO		
16	16-18-20	882-508-003 (GPS22)	BLUE/YELLOW	MS3187-16	M22520/1-01	M22520/1-02	998-377-003	998-377-004	882-93-001	882-50-001 (2 REQ'D)	882-60-001 (2 REQ'D)
	22-24-26	882-508-004 (GPS23)	BLUE/RED								
RG-393/U	RG-393/U	882-217-001 (GCP14)	---	SP393 (882-214-001)	M22910/7-1	BUCHANAN 613802 △	882-95-003	---	882-78-001		

CONTACT PATTERN IDENTIFICATION		CONTACT SIZE (GA)
-1	-2	
1 THRU 5, 10, 14 THRU 17, 24 THRU 27, 31, 36 THRU 40	---	22
8, 9, 11, 12, 13, 18, 23, 28, 29, 30, 32, 33	1 THRU 14, 16 THRU 29	20
6, 7, 19 THRU 22, 34, 35	---	16
---	15	RG-393/U

FIGURE 2B - CONNECTOR CONFIGURATION, PLUG, ELECTRICAL, RECTANGULAR (CONTD)
(PAGE 5 OF 5)