REVISIONS

SYMBOL	DESCRIPTION	DATE	APPROVAL
—	Original Release	15-Aug-1995	ELB

SHEET REVISION STATUS

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

ORIGINATOR: Ron Hardesty	DATE 8/2/95	**FSC: 5905**
APPROVED: S. E. Archer-Davies/Unisys	8/3/95	Procurement Specification for Precision Trimming Potentiometer - Vishay 1285G
CODE 311 APPROVAL: M. J. Sampson/GSFC	8/14/95	
CODE 311 SUPERVISORY APPROVAL: G. P. Kramer/GSFC	8/15/95	
ADDITIONAL APPROVAL: J. M. Lohr/GSFC	8/15/95	**S-311-P-798**

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

CAGE CODE: 25306

1. SCOPE

1.1 Scope. This specification establishes device performance, screening and qualification requirements for Vishay 1285G style precision trimming potentiometers for use in space flight hardware by the GSFC/XDS project.

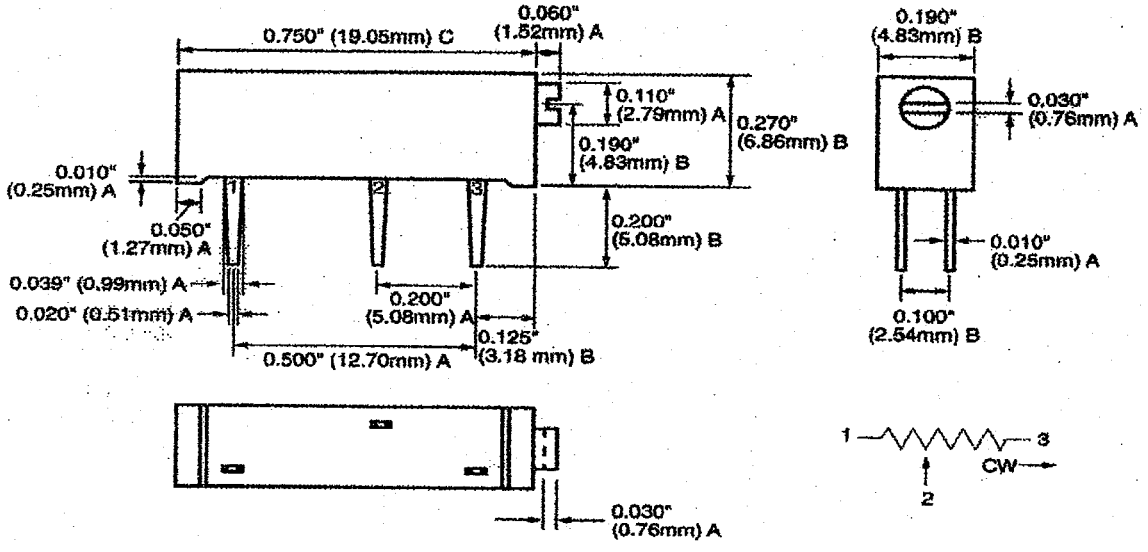
1.2 Part number. The part number shall be defined as follows:

G311P798	-500
Goddard Designator (see 1.3)	Resistance (see 1.4 and 1.4.1)

1.3 Goddard designator. The designator denotes resistors as specified in figure 1 and paragraph 1.5.

1.4 Standard resistance values: The resistance values covered by this specification are: 10Ω, 20Ω, 50Ω, 100Ω, 200Ω, 500Ω, 1kΩ, 2kΩ, 5kΩ, 10kΩ and 20kΩ. The nominal resistance, expressed in ohms, is identified by three characters in the dash numbers. The first two represent significant figures, and the third indicates the number of following zeros.

Figure 1 Resistor outline and schematic



1.4.1 Resistance tolerance. The resistance tolerance is 5%.

1.5 Absolute maximum ratings. Stresses above the absolute maximum temperature, voltage and power rating may cause permanent damage to the device. Extended operation at the maximum levels may degrade performance and affect reliability. The part ratings are listed below.

Power: .75 watts @ +25°C
Operation and storage temperature: -55°C to 125°C
Torque: 5 oz. maximum
Maximum cycle: 1000 turns
Temperature coefficient of resistance: +5ppm/°C (-55°C to +25°C)
(Ref. to +25°C) -5ppm/°C(+25°C to +125°C)
Working voltage: 300V

2. APPLICABLE DOCUMENTS

2.1 Government specification and standards. The following documents form a part of this drawing to the extent specified herein.

SPECIFICATION

MIL-I-45208	Inspection Systems Requirements
MIL-R-39035	Resistor, Variable, Non-Wire-Wound (Adjustment Type, Lead Screw Actuated), Established Reliability, General Specification for.

STANDARDS

MIL-STD-202	Test Methods for Electronic and Electrical Component Parts
MIL-STD-1276	Leads, Weldable, for Electronic Component Parts

OTHER PUBLICATIONS

ASTM E595	Total Mass Loss and Collected Volatile Condensable Materials from Outgassing in a Vacuum Environment, Standard Test Method for

2.2 Order of precedence. In the event of a conflict between this drawing and the applicable documents cited herein, this document shall take precedence.

3. REQUIREMENTS

3.1 Qualification. Resistors furnished under this specification shall be product which has been granted qualification approval by NASA/GSFC. Qualification approval shall be based on the following:

3.1.1 Design and source approval. Prior to qualification, the manufacturer's facility shall be subjected to a survey at the option of GSFC by the Office of Flight Assurance, GSFC. Compliance with MIL-I-45208 is required. In addition, the history and detailed engineering of the specific resistor network design will be reviewed, as well as the documented manufacturing and quality control procedures. Only those source (s) approved in the design and source phase shall be eligible for qualification or award of contract under this specification. Source approval and design approval do not constitute part qualification or an equivalent thereof. The place, date and time of any customer source inspection shall be submitted to the procuring activity, a minimum of 14 working days in advance.

3.1.2 Requalification. Requalification shall be imposed following any change in design, manufacture, materials or quality control procedures as reviewed and approved during qualification. Requalification shall be required if it is demonstrated that any stipulation initially presented in the manufacturer's certification no longer applies. Inspection discrepancies which are not suitably explained by failure analysis, or by other means, shall also be considered a basis for disqualification by GSFC.

3.2 General. The devices procured to this specification shall be fully compliant with the requirements specified herein.

3.3 Electrical performance specifications. Unless otherwise specified herein, the electrical performance characteristics are as specified in screening and qualification testing and shall apply over the specified operating ambient temperature range (See 1.5).

3.3.1 Electrical test requirements. The electrical test requirements shall be as specified in MIL-R-39035 and herein. The electrical tests and conditions for qualification and QCI testing.

3.3.2 Performance requirements. The devices procured to this specification shall be within the following performance parameters. See table I.

3.4 Materials.

3.4.1 Materials. Materials shall be as specified herein. However, when a definite material is not specified, a material shall be used which will enable the resistors to meet the performance requirement of this specification. Acceptance or approval of any constituent material shall not be construed as a guaranty of the acceptance of finished product.

3.4.1.1 Lubricants or grease. Any type of lubricant or grease used in these potentiometer shall be in accordance with 3.4.2 herein.

Table I. -Performance requirements.

Test	Typical resistance range(in Ω)	All Styles
Setting stability	10, 20, 50, 100, 500, 1k, 2k, 5k, 10k, and 20k.	± 0.1%
Setability	10, 20, 50, 100, 500, 1k, 2k, 5k, 10k, and 20k.	± 0.05%

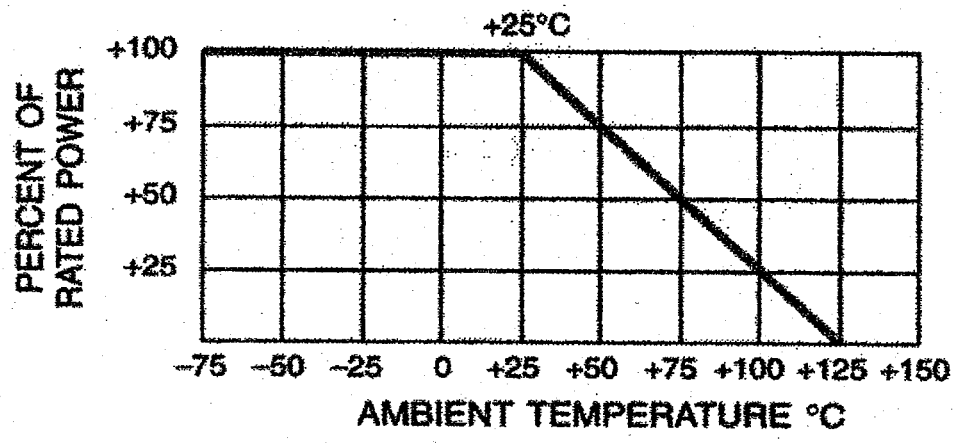
3.4.2 Thermal outgassing. When resistors are tested, as specified in 4.6.25, materials must meet outgassing requirements of 1.0% total mass loss (TML) maximum and 0.1% collected volatile condensable materials (CVCM) maximum. Materials listed in NASA Reference Publication 1124 that meet these requirements do not require further testing.

3.4.3 Design and construction. The part construction and package shall be in accordance with Figure 1. The resistive element shall consist of an etched metal foil and be enclosed in a sealed, molded package.

3.4.4 Terminations. The leads shall be solderable and weldable as defined by types C32 or C52 of MIL-STD-1276 (tin/lead plated or hot solder dip).

3.5 Power rating. Power rating is based on continuous full load operation, not exceeding the maximum working voltage, at a rated ambient temperature of +25°C. For higher temperatures, derating shall be in accordance with Figure 2.

Figure 2. Derating.



3.6 Voltage rating. Resistors shall have a rated direct current (DC) continuous working voltage, or an approximate sine wave root-mean- square (rms) continuous working voltage at commercial line frequency and waveform, corresponding to the power rating as determined from the following formula:

$$E = \sqrt{PR}$$

Where:

E = rated DC or rms continuous working voltage
P = power rating (see 3.5)
R = nominal resistance

3.7 Pre-Cap Visual Inspection. Each device shall be inspected, at low and high power magnification, as specified in 4.5, prior to final packaging.

3.8 Conditioning. When resistors are tested, as specified in 4.6.1, the change in total resistance shall not exceed 2% and no mechanical damage shall be noted.

3.9 Contact resistance variation. When resistors are tested, as specified in 4.6.2, the contact resistance variation shall not exceed ± 3% or 20Ω whichever is greater.

3.10 Total resistance. When resistors are tested, as specified in 4.6.3, the total direct current (dc) resistance shall not deviate from the specified nominal resistance by more than 5%

3.11 Visual and mechanical examination. When resistors are tested, as specified in 4.6.4, the finished parts shall be inspected for compliance with the dimensions specified herein. All parts shall be inspected for workmanship defects that compromise the quality or reliability of the part.

3.12 End resistance. When resistors are tested, as specified in 4.6.5, the end resistance shall not exceed 2% of nominal resistance value.

3.13 Actual effective electrical travel. When resistors are tested, as specified in 4.6.6, the lead screw shall travel 26 ± 2 turns between each end resistance points.

3.14 Dielectric withstanding voltage (atmospheric pressure). When resistors are tested, as specified in 4.6.7, there shall be no evidence of breakdown or damage following the test. The leakage current shall not exceed 1mA.

3.15 Insulation resistance. When resistors are tested, as specified in 4.6.8, the IR shall be greater than 1000 MΩ.

3.16 Torque. When resistors are tested, as specified in 4.6.9, the torque shall not exceed 5 oz.

3.17 Thermal shock. When resistors are tested, as specified in 4.6.10, the total resistance shall not change by greater than 1%. The setting stability shall not change by more than 0.1%.

3.18 Solderability. When resistors are tested, as specified in 4.6.11.1, acceptance shall be based on the criteria in paragraph 4.6.1 of test method 208 of MIL-STD-202.

3.19 Resistance-temperature characteristics. When resistors are tested, as specified in 4.6.12, the resistance temperature characteristic shall meet the stated requirements.

3.20 Moisture resistance. When resistors are tested, as specified in 4.6.13, the resistance shall not exceed 1% of the total resistance, insulation resistance shall be 100 MΩ minimum, and there shall be no evidence of mechanical damage.

3.21 Rotational life. When resistors are tested, as specified in 4.6.14, the change in total resistance shall not exceed 1%.

3.22 Terminal strength. When resistors are tested, as specified in 4.6.15, there shall be no evidence of breaking or loosening of the terminals from the resistor, or chipping of coating, or evidence of mechanical damage.

3.23 Resistance to soldering heat. When resistors are tested, as specified in 4.6.16, the change in total resistance shall not exceed 1%, and there shall be no evidence of mechanical damage.

3.24 High temperature exposure. When resistors are tested, as specified in 4.6.17, the change in resistance shall not exceed 1% of the total. The setting stability shall not change more than 0.5%. The DWV limit shall meet the minimum value in 3.14 above. Insulation resistance shall be a minimum of 1000 MΩ, and there shall be no evidence of mechanical damage.

3.25 Integrity of shaft. When resistors are tested, as specified in 4.6.18, there shall be no evidence of damage to the shaft.

3.26 Shock (specified pulse). When resistors are tested, as specified in 4.6.19, the change in total resistance shall not exceed 1%. The change in setting stability shall not exceed 0.5% and there shall be no electrical discontinuity or evidence of mechanical damage.

3.27 Vibration, high frequency. When the resistors are tested as specified in 4.6.20, there shall be no electrical discontinuity, and the resistors shall not exceed 0.5% of the setting stability. The total resistance shall not exceed 1%. There shall be no evidence of mechanical damage.

3.28 Low temperature operation. When resistors are tested as specified in 4.6.21, the change in total resistance shall not exceed 1%. The change in setting stability shall not exceed 0.5%, and there shall be no evidence of mechanical damage.

3.29 Setability. When resistors are tested, as specified in 4.6.22, the setability shall meet the requirements in table I.

3.30 Setting stability. When resistors are tested, as specified in 4.6.23, the change shall not exceed the requirements in table I.

3.31 Life. When resistors are tested, as specified in 4.6.24, the change in total resistance at any time during the test shall not exceed 2%.

3.32 Marking. Marking shall be in accordance with MIL-R-39035, except that the part identification number (PIN) shall be in accordance with 1.2 above. Part marking should also include manufacturer's name or logo and the lot date code.

3.33 Certificate of compliance. A certificate of compliance shall be submitted by the manufacturer. The certificate of compliance shall state that the manufacturer's product meets the requirements specified herein.

3.34 Workmanship. Workmanship shall be in accordance with MIL-R-39035.

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection. Unless otherwise specified in the purchase order, the manufacturer is responsible for performing all inspection requirements as specified herein using their own facilities or an outside laboratory acceptable to the procuring activity. Upon receipt of product, the procuring activity reserves the right to perform any of the inspections set forth in this specification.

4.2 Classification of inspection. Inspection requirements specified herein are classified as follows:
a. Qualification Inspection (see 4.3).
b. Quality Conformance Inspection (see 4.4).

4.3 Qualification. Qualification shall consist of the tests in Table II.

4.3.1 Part qualification. The individual potentiometer shall be a product which has passed the qualification inspection specified herein.

4.3.2 Test routine. Sample units shall be subjected to the qualification inspection specified herein and in the order shown. All samples units will be subjected to the inspections herein.

4.3.3 Inspection report. Qualification test data and the qualification test samples shall be submitted to the following activity:

NASA/GSFC
Greenbelt, MD 20771
Attn: QPLD Administrator
Code 311

4.3.4 Failures. Failures will not be tolerated and shall be cause for refusal to grant qualification.

4.4 Qualification Conformance Inspection (QCI). QCI shall be performed in accordance with Group A (Table III) and Group B (Table IV) herein. A percent defective of 10% or greater for Group A shall be cause for rejection of the lot. No failures are allowed for Group B testing.

4.5 Pre-Cap Visual Inspection. Each device shall be inspected before final packaging at low and high power magnification for the following defects. The Low power magnification shall be 30X. The high power magnification shall be defined by resistance value as described below.

Low Power:

- Internal workmanship defects.
- Cracks in the termination pad area that exceed 25% of the circumference of the weld area.

High Power:

- (30X for 10 to 200 ohms, 60X for 500 to 10 kohms, 100X for 20kohms): Voiding and thinning greater than 50% of the normal metal width.
- Bridging greater than 10% of the normal metal width.
- Grid line separation greater than 10% of the normal separation width between grid lines.
- Any lifting or blistering.
- Scratches greater than 10% of the normal metal width.
- Foreign matter large enough to bridge active grid lines or three or more particles of any size.
- Cracked foil in the main array exceeding 50% of the normal metal width.

4.6 Methods of Inspection

4.6.1 Conditioning (see 3.8). Conditioning shall be in accordance with MIL-R-39035.

4.6.2 Contact resistance variation (see 3.9). Contact resistance variation shall be tested in accordance with MIL-R-39035.

4.6.3 Total resistance (see 3.10). Total Resistance shall be tested in accordance with MIL-R-39035.

4.6.4 Visual and mechanical inspection (see 3.11). Dimensions shall be measured on three samples.

4.6.5 End resistance (see 3.12). The maximum resistance shall be measured in accordance with 4.6.3 above.

4.6.6 Actual effective electrical travel (see 3.13). The actual effective electrical travel shall be measured in accordance with MIL-R-39035.

4.6.7 Dielectric withstanding voltage (atmospheric pressure) (see 3.14). DWV shall be tested in accordance with MIL-R-39035.

4.6.8 Insulation resistance (see 3.15). IR shall be tested in accordance with MIL-R-39035.

Table II.- Qualification inspection

Test or Examination	Sample Size	Requirement paragraph herein	Test method paragraph herein
Subgroup 1 Group A inspection testing	100%	See table III	
Subgroup 2 Group B inspection testing	See table III	See table IV	
Subgroup 3			
Resistance-temperature characteristic	13	3.19	4.6.12
Moisture resistance	13	3.20	4.6.13
Contact resistance variation	13	3.9	4.6.2
Subgroup 4			
Rotational life	13	3.21	4.6.14
Contact resistance variation	13	3.9	4.6.2
Terminal strength	13	3.22	4.6.15
Subgroup 5			
Resistance to soldering heat	13	3.23	4.6.16
High temperature exposure	13	3.24	4.6.17
Contact resistance variation	13	3.9	4.6.2
Integrity of shaft	13	3.25	4.6.18
Subgroup 6			
Low temperature operation	13	3.28	4.6.21
Shock	13	3.26	4.6.19
Setability	13	3.29	4.6.22
Vibration	13	3.27	4.6.20
Setting stability	13	3.30	4.6.23
Subgroup 7			
Life	22	3.31	4.6.24

Table III.-Group A inspection.

Examination or test	Sample size	Requirement paragraph herein	Test method paragraph herein
Pre-cap visual inspection	100%	3.7	4.5
Conditioning		3.8	4.6.1
Contact resistance variation		3.9	4.6.2
Total resistance		3.10	4.6.3
Visual and mechanical inspection		3.11	4.6.4

Table IV-Group B inspection.

Examination or test	Sample size	Requirement paragraph herein	Method paragraph herein
End resistance	13 pieces	3.12	4.6.5
Actual effective electrical travel		3.13	4.6.6
Dielectric withstanding voltage		3.14	4.6.7
Insulation resistance		3.15	4.6.8
Torque		3.16	4.6.9
Thermal shock		3.17	4.6.10
Solderability	5	3.18.1	4.6.11.1
Lead dissolve	see 4.6.11.2	3.18.2	4.6.11.2

4.6.9 Torque (see 3.16). Torque shall be tested in accordance with MIL-R-39035.

4.6.10 Thermal shock (see 3.17). The potentiometers shall be tested in accordance with MIL-STD-202, method 107, condition B, except the low temperature shall be -55°C and the measurements shall be made for setting stability and total resistance as specified in 4.6.23 and 4.6.3 respectively herein before and after cycling.

4.6.11 Lead tests.

4.6.11.1 Solderability (see 3.18). Solderability shall be tested in accordance with MIL-STD-202, method 208.

4.6.11.2 Lead dissolve. The sample size to be used for this test shall be 5 pieces for lots of 20 pieces or more and 2 pieces for smaller lots. Samples may be selected following pre-cap visual inspection. The leads of the samples shall be dissolved from the nichrome foil using acid. The bond pad area on the foil shall then be inspected at 100X for cracks that are 25% of the circumference of the weld area or series of cracks exceeding this size. Inspection shall be accomplished using backlight illumination. No rejects are allowed.

4.6.12 Resistance-temperature characteristic (see 3.19). Potentiometers shall be tested in accordance with Method 304 of MIL-STD-202 except as modified herein.

a. Qualification testing. The first series of standard test temperature shall be 25°C, 0°C, -15°C, and -55°C; the second series shall be 25°C, 50°C, 75°C, 105°C, and 125°C.

b. QCI: The series of standard test temperatures shall be limited to +25°C, -55°C, +25°C, +125°C.

4.6.13 Moisture resistance (see 3.20). Moisture resistance shall be tested in accordance with MIL-R-39035.

4.6.14 Rotational life (see 3.21). Rotational life shall be tested in accordance with MIL-R-39035.

4.6.15 Terminal strength (see 3.22). Terminal strength shall be tested in accordance with MIL-R-39035 (both push and pull), with two pounds of force. The pull force shall be applied to each lead individually.

4.6.16 Resistance to soldering heat (see 3.23). Potentiometers shall be tested in accordance with MIL-R-39035.

4.6.17 High temperature exposure (see 3.24). Potentiometers shall be tested in accordance with MIL-R-39035, except for the ambient temperature shall not exceed +125°C.

4.6.18. Integrity of shaft (see 3.25). Potentiometers shall be tested in accordance with MIL-R-39035.

4.6.19 Shock (specified pulse) (see 3.26). Potentiometers shall be tested in accordance with MIL-R-39035 and the measurements shall be made for setting stability and total resistance as specified in 4.6.23 and 4.6.3 respectively herein before and after testing.

4.6.20 Vibration (see 3.27). Potentiometers shall be vibrated in accordance with MIL-R-39035 and the measurements shall be made for setting stability and total resistance as specified in 4.6.23 and 4.6.3 respectively herein before and after testing.

4.6.21 Low temperature operation (see 3.28). Potentiometers shall be tested in accordance with MIL-R-39035.

4.6.22 Setability (see 3.29). The resistor wiper shall be set at approximately 30%, 50%, and 75% of mechanical rotation. A dc voltage of up to 2.5V shall be applied across the end terminals , and the wiper shall then be adjusted smoothly without abrupt voltage change at each test point. The setability error shall be within the limits specified.

4.6.23 Setting stability (see 3.30). The contact arm shall be set at approximately 40% of the actual effective electrical travel. An adequate dc test potential shall be applied between the end terminals. The voltage between the end terminals, and the voltage between one end terminal and the contact arm, shall be measured an applied to the following formula:

Setting stability in percent: $\frac{E1 \times 100}{E2}$

Where:

E1= Voltage across one end terminal and the contact arm terminal.
E2= Voltage across the end terminals.

The difference between the initial measurements made before the environment test and the measurement made after the test indicates the setting stability in percent.

4.6.24 Life (see 3.31). Potentiometers shall be tested in accordance with MIL-R-39035 for 2000 hours at +25°C.

4.6.25 Thermal outgassing (see 3.3.2). Resistors shall be tested in accordance with ASTM E595.

5. PACKAGING

5.1 Packaging requirements. The requirements shall be in accordance with MIL-R-39035 and paragraphs 5.1.1 through 5.1.3 below.

5.1.1 Unit package identification and marking. The unit package shall be marked with the following:
a. NASA/GSFC H4 identification number (CAGE code) 25306.
b. Resistor part number per 1.2.
c. Manufacturer's name and H4 identification number (CAGE code).
d. Part lot date code.
e. Quantity in container
f. Purchase order number.

5.1.2 Shipping container. The shipping container shall be legibly marked with the following information.
a. Purchase order number.
b. Device part number.
c. Manufacturer's name and H4 identification number.

5.1.3 Deliverable data package. The data package for each shipment shall include the following:
a. Cover sheet with traceability information.
b. Certificate of conformance.
c. Copies of actual processing and screening travelers including number of device failures.
d. Waivers, if any.
e. Parts and materials list identifying part number, manufacturer, lot date code, and expiration date where applicable.

6. NOTES

6.1 Qualification Provisions. With respect to product requiring qualification, awards will be made only for product which have been tested and approved by GSFC before the time for opening of bids. The attention of the suppliers is called to this requirement: Manufacturers should arrange to have qualification tests made on product which they propose to offer to GSFC to become eligible for awards of contracts or orders for product covered by this specification. The manufacturer shall bear the cost of qualification inspection to this specification. Information pertaining to qualification, of product may be obtained from the activity whose address is listed in 4.3.3.

6.2 Notice. When GSFC drawings, specifications, or other data are sent for any purpose other than in connection with a definitely related GSFC procurement operation, the United States government thereby incurs no responsibility nor any obligation whatsoever. The fact that GSFC may have formulated, furnished, or in any way supplied said drawings, specifications or other data is not to be regarded by implication or otherwise as in any manner licensing the holder or any persons or corporations or conveying any rights or permission to manufacture, use, or sell any patented invention that may be in any way related thereto.

6.3 Qualifying activity. The identification and contact address of the qualifying activity shall be as follows:
Custodian
Goddard Space Flight Center
Greenbelt, Maryland 20771