

Specification for

Performance of environment-resistant terminal junction modules with removable crimp-type contacts

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Foreword

This British Standard has been prepared at the request of the aerospace industry to give details of environment-resistant terminal junction modules with removable crimp-type contacts suitable for use in aircraft and guided weapons.

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Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, pages 1 to 39 and a back cover.

This standard has been updated (see copyright date) and may have had amendments incorporated. This will be indicated in the amendment table on the inside front cover.

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1 Scope

This British Standard sets out the general requirements for the design, performance and testing of environment-resistant terminal junction modules having removable crimp-type contacts, together with their mounting frames. It does not specify dimensions. This standard should be supported by a detail specification, meeting the requirements of this standard, for each individual range of modules and frames. The detail specification should include dimensional details and control drawings.

A typical example of a detail specification is given in Appendix A.

2 References

Reference is made in this standard to the following standards publications:

BS 580, *Trichloroethylene*.

BS 1595, *isoPropyl alcohol*.

BS 2011, *Basic environmental testing procedures — Part 2.1Kb Test Kb. Salt mist*.

BS 3203, *Glossary of paper, stationery and allied terms*.

BS 6001, *Sampling procedures and tables for inspection by attributes*.

BS 3G 100, *General requirements for equipment for use in aircraft — Part 2: All equipment — Section 2: Magnetic influence — Section 3: Environmental conditions — Subsection 3.1: Vibration*.

BS 3G 178, *Crimped joints for aircraft electrical cables and wires*.

BS G 210, *PTFE insulated equipment wires (with silver plated copper conductors)*.

BS G 212, *General requirements for aircraft electrical cables*.

BS G 222, *Specification for efglas type electric cables (metric units)*.

3 Definitions

For the purposes of this British Standard, the following definitions apply.

3.1

terminal junction module

a device having multiple contacts interconnected to form one or more circuits. The module may be either “feed-back” or “feed-through” type. Modules are normally contained and mounted in a frame

3.2

feed-back module

a terminal junction module with two or more contacts bussed together, with the contact cavities on one face only

3.3

feed-through module

a terminal junction module with either bussed or unbussed contacts, the contact cavities being on two opposite sides. The contacts directly opposite each other are electrically common

3.4

terminal junction frame

a frame consisting of one or more parts used to contain and mount the terminal junction modules

3.4

bussed

electrically interconnected contacts within the module

4 Design requirements

4.1 Environmental conditions. The modules shall attain the performance requirements detailed in 4.2 and 4.3 when subjected to any one or any normal combination of the conditions described in 4.1.1 to 4.1.10.

4.1.1 Temperature range. The modules shall be capable of continuous operation within the temperature range -65°C to $+200^{\circ}\text{C}$. The upper temperature is the maximum internal hot-spot temperature resulting from any combination of electrical load and ambient temperature. Other standard temperature ranges within these values may be defined in the detail specification.

4.1.2 Altitude. The modules shall be suitable for operation at altitudes up to approximately 24 400 m (80 000 ft equivalent), or as specified in the detail specification.

4.1.3 Climatic conditions

4.1.3.1 Humidity, temperature and pressure. The humidity, temperature and pressure requirements shall be as stated in 5.7.12.1.

4.1.3.2 Tropical exposure. The tropical exposure requirements shall be as stated in 5.7.12.2.

4.1.4 Vibration. The modules and frames shall withstand the vibration requirements of 5.7.8.

4.1.5 Acceleration. The modules and frames shall withstand the acceleration requirements of 5.7.13.

4.1.6 Resistance to fluids. The materials and construction of the modules shall be such that they are resistant to the fluids listed in Appendix B when tested in accordance with 5.7.6.

4.1.7 Salt mist. The modules shall be suitable for use in a salt-laden atmosphere and shall withstand the conditions of **5.7.14**.

4.1.8 Compass safe distance. The modules and frames shall satisfy the requirements of **5.7.11**.

4.1.9 Flammability. The modules shall not constitute a fire hazard and shall withstand the conditions of **5.7.4**.

4.1.10 Interchangeability. Where terminal junction modules are made by different manufacturers to the same detail specification, the specification shall be sufficiently detailed to ensure interchangeability of any removable item.

4.2 Electrical performance

4.2.1 Working voltage. The working voltage of the wired modules, between contacts and between contacts and outer frame, under any normal combination of the environmental conditions given in **4.1**, shall be at least 350 V d.c. or a.c. peak.

4.2.2 Current rating. Two current ratings are specified, the continuous current rating relating to electrical load and ambient temperature, and the short term current rating relating to the evidence of damage by internal heating for a given size of cable.

4.2.2.1 Continuous current rating. Individual contacts when assembled in the module shall be capable of carrying continuously, under any normal combination of the environmental conditions given in **4.1**, the maximum continuous rated current of the largest appropriate size of cable at its maximum operating temperature. Table 1 shows contact size, conductor accommodation range and typical current ratings of the largest size of conductor that can be accommodated in the contact.

Table 1 — Typical continuous current ratings

Contact size (crimp barrel)	Conductor size accommodation range	Typical continuous current rating of largest size of conductor accommodated by contact
		A
22	22 to 26	8
20	20 to 24	12
16	16 to 20	20
12	12 to 14	37

The manufacturer shall declare any limitations on the contact current rating for each style and bussing arrangement of the module if the latter is not capable of carrying the typical maximum cable current simultaneously on all contacts.

4.2.2.2 Short term current rating. The manufacturer shall demonstrate and declare that the terminal junction modules are capable of carrying the short term current rating of the associated cables (see BS G 212), under the conditions specified in **5.1**. Table 2 gives typical values.

Table 2 — Typical short term current ratings

Nominal size of cable	Current for 0.35 s
	A
22	100
20	180
16	380
12	900

After being subjected to the above currents for not less than 0.35 s, the terminal junctions shall comply with the datum tests of this standard (see **5.5.2.1**).

4.2.3 Contact resistance. The modules shall satisfy the contact resistance requirements of **5.7.1**.

4.2.4 Insulation resistance and voltage proof. The modules shall satisfy the insulation resistance and voltage proof requirements of **5.7.2** and **5.7.7**.

4.3 Mechanical requirements

4.3.1 Dimensions. The terminal junction modules and their accessories shall comply with the requirements of the detail specification control drawings.

4.3.2 Contacts. Contacts shall be approved to the requirements of the relevant detail specification and Appendix C. When crimped with an approved tool, the resulting crimp shall comply with the requirements of BS 3G 178. Female contacts shall withstand the probe damage test described in Appendix C.

4.3.3 Contact insertion and extraction. The insertion and removal of a contact from a module shall be by an insertion/extraction tool as shown in the detail specification. The maximum insertion and removal forces shall not exceed the values given in Table 3, when tested in accordance with **5.7.3**.

Any such tools shall preferably be non-metallic, and shall not require lubrication. They shall meet the requirements of the detail specification, and the strength requirements of Appendix D.

4.3.4 Contact retention force. The contact retention system shall provide positive individual locking of each contact within the module. The contact shall be retained within the module when the relevant minimum contact retention force stated in Table 3 is applied to the wires and the axial movement of the contact shall not exceed the requirements of **5.7.3**.

Table 3 — Minimum contact retention, maximum insertion and removal forces

Contact size (crimp barrel)	Minimum contact retention force	Insertion force max.	Removal force max.
	N	N	N
22	50	22	22
20	90	44	44
16	110	66	44
12	130	66	66

4.8.5 Contact walk out. When tested as specified in 5.7.16, contacts shall not be dislodged from their normal position.

4.3.6 Wire accommodation. The modules shall be so sealed that, when subjected to the climatic tests required by this standard, there is no ingress of moisture. For this purpose, the outside of the insulation of the wire shall be of smooth finish, and within the dimensions shown in Table 4, or as specified in the detail specification.

Table 4 — Figures for diameter of wire insulation

Contact size (crimp barrel)	Diameter of wire insulation	
	Minimum	Maximum
	mm	mm
22	0.75	1.68
20	0.96	2.11
16	1.52	2.62
12	2.21	3.82

4.3.7 Wire support. The modules shall be so designed that a support to the cable, external to the grommet, can be provided.

4.3.8 Bonding. All seals shall be bonded such that the grommet shall comply with the requirements of 5.7.17.

NOTE Because of the limitation of the mechanical endurance of the grommet, these devices should only be used where the disconnection of any one contact is not frequent.

4.3.9 Marking. Each module and accessory shall be marked in accordance with this standard and the detail specification and, after conditioning tests, the marking shall remain legible.

4.3.9.1 Module identification. The module identification shall comprise the number of this British Standard, followed by a manufacturer's unique identification number, followed by a letter representing feed-back or feed-through type, followed by two numerals showing size of contact, followed by a letter showing the removable contact gender, followed by two numerals showing bussing arrangements and finally three numerals representing the variants. If of standard form, these last numerals may be omitted. An example of a typical module identification is shown in Appendix E.

4.3.9.2 Bussing and contact cavity identification. Each module shall have its bussing arrangement clearly identified, and a near continuous line shall enclose all those contact cavities connected to an individual bus. Individual contact cavities may be identified by means of letters, excluding I, O, Q, U and V, or by means of numerals.

NOTE The module should also preferably show the gender of the contact that is used within (i.e. male or female).

Full details of the method of identification shall be shown in the detail specification, and shall include the manufacturer's identification code and date code.

4.3.9.3 Frame identification. The frame identification shall comprise the number of this British Standard, followed by a manufacturer's unique identification number, followed by three letters representing a feed-back frame or a feed-through frame, followed by three numerals showing overall length of frame in millimetres and three numerals showing variants. The variants can be omitted if not required.

4.3.9.4 Position of module in frame. Frames shall be marked to indicate the position of the modules within the frame. The top edge of the frame may contain those numbers referring to size 12 modules, the bottom edge of the frame referring to sizes 22, 20 and 16 modules. Full details of the method of identification shall be shown in the detail specification and shall include the manufacturers identification code and date code. A typical example is shown in Appendix E.

4.3.10 Filler plugs. Where cavities are not used, contacts shall not be inserted, but suitable filler plugs shall be provided to seal the grommet and cavity. Such arrangements shall be described in the detail specification.

4.3.11 Probe damage. When tested in accordance with Appendix C of this standard, removable female contacts shall withstand the bending moment and depth of test probe insertion without evidence of visible damage, and shall meet the requirements of subsequent tests.

5 Type approval

5.1 Test conditions. Unless otherwise specified, the tests shall be carried out under normal atmospheric conditions, i.e.:

- a) temperature 15 °C to 35 °C;
- b) relative humidity not greater than 80 %;
- c) atmospheric pressure 96 kPa to 106 kPa (960 mbar to 1 060 mbar).

5.2 Recording of results. Where measurements are required, the precise figures obtained shall be recorded in the type test report.

5.3 Samples

5.3.1 Selection of specimens. For type approval of any manufacturer's range of terminal junction modules, two groups of samples, group A and group B, shall be subjected to type approval tests.

5.3.1.1 Group A. This shall consist of one assembled example of each type of terminal junction module for which approval is sought, in each contact size and bussing arrangement, together with the appropriate mounting frame(s). Additionally, one example shall be provided of every piece-part necessary to produce the assembly/assemblies, together with an example of each individual size/type of contact. The assemblies shall have been produced from piece-parts of the same batch as those supplied separately.

NOTE It is recognized that many piece-parts will be common to several assemblies. It is not intended that group A shall contain more than one specimen of a given piece-part.

5.3.1.2 Group B. This shall consist of 18 specimens assembled in a combination of mounting frames for which approval is sought. A specimen shall consist of terminal junction modules of either 2 four-way or 2 five-way bussed contact arrangements for each size of contact, mounted in frames.

5.3.2 Selection and crimping of contacts. All contacts used during type approval tests on modules shall have been released from a manufacturer holding type approval for them in accordance with 4.3.2.

5.3.3 Wiring of specimens. A proportion of the contacts in specimen groups 1B, 2B and 3B shall be wired with special leads ("measurement leads") intended to facilitate the accurate determination of contact resistance. Such leads shall be prepared in strict accordance with the requirements of Appendix F using the type and size of cable stated in Table 10.

The specimens shall be divided into four groups which, after the requisite contacts have been wired with the measurement leads, shall be wired as follows:

Group 1B
specimen
nos. 1, 4, 7,
10 and 13

All remaining contacts shall be wired with cable as near as possible to the largest diameter and gauge that can be accommodated, respectively, by the grommet seals and by the contact buckets.

Group 2B
specimen
nos. 2, 5, 8,
11 and 14

All remaining contacts shall be wired with cable as near as possible to the minimum diameter and wire gauge that can be accommodated, respectively, by the grommet seals and by the contact buckets.

Group 3B
specimen
nos. 3, 6, 9,
12 and 15

Approximately 25 % of the remaining contacts shall be unwired and their grommet apertures shall be sealed with filler plugs. The remaining contacts shall be wired as for group 2B.

Group 4B
specimen
nos. 16, 17
and 18

All contacts shall be wired with cable as near as possible to the largest diameter and gauge that can be accommodated by the grommet seals and by the contact buckets.

Appendix G summarizes the number of contacts to be wired with the measurement leads, maximum or minimum size cables or whose grommet apertures are to be fitted with filler plugs. The cables to be used are stated in Table 10 (Appendix F). The requirements of Appendix G and Table 10 shall be adhered to, strictly unless prior sanction is obtained from the Approval Authority¹⁾ for the use of different cables (but not different measurement leads). In such a case, care shall be exercised to ensure that the type(s) of cables selected have a smooth exterior finish. The type(s) shall be declared by the manufacturer of the terminal junction modules.

Not less than 500 mm of the appropriate type of cable shall be used for each contact. During "conditioning" tests, the test circuit connections to the measurement leads shall be made outside any chamber(s) used so as to avoid the risk that the characteristics of the leads might impair the environmental resistance of the modules.

¹⁾ The Approving Authority for civil aircraft applications is the Civil Aviation Authority, Airworthiness Division, and for military aircraft applications is the Procurement Executive, Ministry of Defence.

5.4 Drawings. The manufacturer shall prepare a Master Record Index which shall contain a complete list of drawings of every detail part which goes to make an assembly, as well as a list of drawings of assemblies. It shall also contain a list of all manufacturing processes used in the make up of assemblies.

5.5 Tests

5.5.1 Group A specimens. Each assembled example and each item of the set of piece-parts shall be examined visually for condition, workmanship, finish and, where applicable, marking.

Each item of the set of piece-parts shall be checked, by measurement and by such other means as may be appropriate, to verify that it conforms in every respect with the detail manufacturing drawings, and where applicable with the control drawings of the detail specification. The manufacturer shall declare the Master Record Index to which the items submitted for approval have been manufactured.

When available, an inspection record made at the time of production of the parts and certified by the manufacturer and by the relevant Inspection/Quality Assurance Authority, shall discharge this requirement.

5.5.2 Group B specimens. Two classes of test are provided for group B specimens.

5.5.2.1 Datum tests. These are designed to establish the basic electrical and mechanical characteristics of the modules, and are listed in Table 5.

Table 5 — Datum tests

Title	Test no.
Contact resistance	5.7.1
Insulation resistance	5.7.2
Voltage proof	5.7.7
Contact retention, insertion and removal forces	5.7.3

5.5.2.2 Type approval tests. These tests, listed in Table 6, are intended to establish that the modules possess the designed environmental characteristics. They are to be regarded as a “conditioning”, following which, where appropriate, the datum tests are repeated to verify that the specified electrical or mechanical characteristics have not been degraded.

Table 6 — Type approval tests

Title	Test no.
Flammability	5.7.4
Immersion, low air density	5.7.5
Resistance to fluids	5.7.6
Vibration	5.7.8
Thermal shock	5.7.9
Endurance at maximum temperature	5.7.10
Compass safe distance	5.7.11
Climatic conditions	5.7.12
Acceleration	5.7.13
Salt mist	5.7.14
Contact resistance stability	5.7.15
Contact walk out	5.7.16
Grommet bonding	5.7.17

5.6 Type approval test schedule. The group B specimens shall be numbered and tested in the order shown in Table 7.

Table 7 — Schedule of type approval

Test clause no.	Title	Specimen numbers																	
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
5.7.1	Contact resistance	1,7	1,7	1,7	1,9 ^a	1,9 ^a	1,9 ^a	1,6	1,6	1,6	1,6	1,6							
5.7.2	Insulation resistance	2,6 ^b	2,6 ^b	2,6 ^b	2,6 ^b	2,6 ^b	2,6 ^b	2,7	2,7	2,7	2,7	2,7	1,4 ^b	1,4 ^b	1,4 ^b	1,4 ^b			
5.7.3	Contact retention, insertion and removal forces	5	5	5	7	7	7	5	5	5	5	5	2	2	2	2	2	2	2
5.7.4	Flammability												5	5	6	6			
5.7.5	Immersion, low air density												3	3	3	3			
5.7.6	Resistance to fluids ^c							4a	4b	4c	4d	4e					1f	1g	1h
5.7.7	Voltage proof							3	3	3									
5.7.8	Vibration	4	4	4															
5.7.9	Thermal shock				4	4	4												
5.7.10	Endurance at maximum temperature				5	5	5												
5.7.11	Compass safe distance										3	3							
5.7.12	Climatic conditions	6	6	6															
5.7.13	Acceleration	3	3	3															
5.7.14	Salt mist				8	8	8												
5.7.15	Contact resistance stability				3	3	3												
5.7.16	Contact walk out																3	3	3
5.7.17	Grommet bonding														5	5			
NOTE The order of tests for a particular specimen is to be as indicated in the relevant column. For example, specimen no. 4 would be subjected to contact resistance, insulation resistance, contact resistance stability, thermal shock, endurance at maximum temperature, insulation resistance, contact retention, salt mist and contact resistance.																			
^a Requirement limits increased by 25 %.																			
^b Minimum insulation resistance shall be 100 MΩ.																			
^c Suffix letter denotes fluid (see Appendix B).																			

5.7 Test details

Test clause no.	Title	Description	Requirement												
5.7.1	Contact resistance	Modules shall be wired in accordance with 5.3.3 and Appendix F and Appendix G. Fully engage the contacts within the modules. On those contacts wired with measurements leads, pass the specified test current through the pairs of contacts via the screens of the measurement leads. With the minimum practicable delay, and using the inner conductors of the measurement leads, measure the potential difference across the individual pairs of contacts and hence derive the contact resistance. For feed-through modules the measurements are to be taken across contacts fitted in corresponding positions on opposing faces of the module. For feed-back modules the measurements are to be taken across contacts fitted in adjacent positions. The test current shall be 1 A derived from a source, the open-circuit voltage of which never exceeds 2.5 V, and shall flow in the same direction for all measurements. The method of measurement adopted shall enable the contact resistance to be determined with an error not exceeding 0.1 mΩ.	The contact resistance shall not exceed the following values: <table><tr><th>Contact bucket size</th><th>Resistance per pair of contacts</th></tr><tr><td></td><td>mΩ</td></tr><tr><td>22</td><td>10</td></tr><tr><td>20</td><td>7</td></tr><tr><td>16</td><td>5</td></tr><tr><td>12</td><td>2</td></tr></table>	Contact bucket size	Resistance per pair of contacts		mΩ	22	10	20	7	16	5	12	2
Contact bucket size	Resistance per pair of contacts														
	mΩ														
22	10														
20	7														
16	5														
12	2														
5.7.2	Insulation resistance	Mount the specimen normally. Measure the insulation resistance, using 500 ± 50 V d.c. applied for 1 min (or less, provided a stable reading is reached) successively between one set of bussed contacts and the other, connected to the mounting frame. The wire connected to the bus under test shall be separated from the remainder of the bunch.	The value shall be not less than 5 000 MΩ.												
5.7.3	Contact retention, insertion and removal forces	Cable securing devices are to be inoperative for this test. Remove and insert two widely spaced contacts using the appropriate tool. Measure the forces required for insertion and removal. Repeat the operation nine times but do not measure the forces. Slowly apply the specified force (see below) to the wires attached to the contacts under test. The force shall be applied along the axis of the contacts for 1 min. <table><tr><th>Contact size (crimp barrel)</th><th>Force</th></tr><tr><td></td><td>N</td></tr><tr><td>22</td><td>50^a</td></tr><tr><td>20</td><td>90</td></tr><tr><td>16</td><td>110</td></tr><tr><td>12</td><td>130</td></tr></table> ^a NOTE The cable breaking load may be below this retention force and may be replaced by a test gauge simulating the minimum retention features. Repeat this procedure on two other contacts applying the contact retention forces in the opposite sense by an approved means.	Contact size (crimp barrel)	Force		N	22	50 ^a	20	90	16	110	12	130	The insertion and removal forces shall not exceed those stated in Table 3. Movement of the contacts relative to the insert shall not exceed 0.38 mm at any time. Movement of the contacts relative to the insert shall not exceed 0.38 mm at any time.
Contact size (crimp barrel)	Force														
	N														
22	50 ^a														
20	90														
16	110														
12	130														

Test clause no.	Title	Description	Requirement
5.7.4	Flammability	The test shall be carried out on the smallest and largest terminal junction module for which approval is sought. The test is preferably performed in subdued light and the module shall be removed from its frame and have no wiring attached. The test apparatus shall be as described in Appendix H. Mount the specimen in the test chamber so that the plane of the wiring face is at an angle of 20° to 30° from the vertical. The wiring face is to be held towards, and approximately 150 mm away from the front face of the chamber. Adjust the burner to produce a 75 mm (approx.) high blue flame with a blue inner cone 20 mm to 25 mm high. A bare copper wire 0.7 ± 0.025 mm diameter, having a free length of not less than a 100 mm shall be inserted into the flame, the end of the wire being immediately above the tip of the inner cone. The burner shall be finally adjusted so that the wire starts to melt in a period of time between 4 s to 6 s. The flame shall be applied to the specimen such that the tip of the inner cone strikes the mid-point of the lowest edge for a period of 30 s. The flame shall be removed immediately at the end of the application time.	Under the test conditions, the specimen shall not emit visible smoke or toxic fumes in significant volume. Upon removal of the flame, any flame on the specimen shall extinguish within 15 s and no burning or flaming globules shall fall during or after application of the flame. Tiny globules that fall during the test shall not ignite the tissue paper at the bottom of the chamber.
5.7.5	Immersion, low air density	Separate individual cable leads as widely as practical, and do not seal the free ends of the cable. Immerse the devices in a container of water to which has been added a quantity of sodium chloride, 5 % by mass, to make the water conductive. Place the container in a suitable chamber with the free ends of the wire terminated inside the chamber but not immersed. Reduce the air pressure inside the chamber to that equivalent to an altitude of approximately 24 000 m or as stated in the detail specification, and maintain it at this figure for 30 min. Then return the chamber to normal atmospheric pressure. Repeat this test twice. At the end of the third cycle, and whilst the specimens are still submerged, subject devices to the procedure described in 5.7.2.	The value shall be not less than 100 MΩ.
5.7.6	Resistance to fluids	One specimen shall be tested with each fluid listed in Appendix B. The temperature of the fluid is to be as shown in column 1 of Appendix B or the maximum working temperature of the module if lower, as shown in the detail specification. NOTE Where necessary, a break of not more than three days is permitted at the end of any cycle. Subject the specimens to the following treatment: Immerse the specimens for a period of 15 min to 20 min. When grease is specified, liberal smearing over all exposed surfaces will suffice. Keep the specimens under normal conditions (as specified in 5.1) for a period of 15 h to 24 h.	On completion of the test, visually examine the items. There shall be no visible deterioration such as would impair performance. All markings shall be legible.

Test clause no.	Title	Description	Requirement
5.7.6 (Cont'd.)		Then subject the specimens to the temperature stated in column 2 of Appendix B or the maximum working temperature of the module if lower, as shown in the detail specification, for a period of 7 h to 7½ h. When the specimens have returned to normal conditions (as specified in 5.1) remove and replace two random contacts, in accordance with 5.7.3. This completes the first cycle. Repeat the above sequence for a further four cycles.	
5.7.7	<i>Voltage proof</i>	Place the mounted specimens in an altitude chamber, taking care to separate wire leads as widely as possible. Terminate the connections outside the chamber. Reduce the pressure within the chamber to the equivalent of an altitude of approximately 24 000 m or as stated in the detail specification. Maintain this condition for at least 2 h. At the end of this period, and whilst the condition still obtains, apply a test potential of 700 V d.c. or a.c. peak, for a period of 1 min between each contact and all other contacts connected together, and to the metal plate.	Leakage current shall not exceed 10 µA.
5.7.8	<i>Vibration</i>	Secure the fixed components to the vibration table by their normal mounting arrangements. Secure the wires from the specimens to the table at points not less than 200 mm from where they emerge from the components. Connect in series the measurement leads with which one pair of contacts in each bus is wired so as to form series chains of four contacts per module. Provide means for monitoring continuously the resistance of each chain, applying 1 A d.c. from an open circuit source not exceeding 2.5 V through the measurement lead screens connected in series, and by measuring the potential across the chain of contacts via the inner conductors connected in series. NOTE A recommended method of measurement is by the use of a storage oscilloscope connected to the inner conductors, the chains of four contacts per module for each of the three modules being connected so as to form a single series chain. In order to simplify detection the current flowing through the series screen circuit can be increased subject to the open circuit voltage not exceeding 2.5 V and the current not exceeding 5 A. If necessary, because of measurement difficulties, the requirement may be relaxed to read “the change in resistance of the chain shall not exceed 100 mΩ in 1 ms”. It is thought, however, that detection within 5 µs should be attainable.	
5.7.8.1	<i>Vibration endurance</i>	Sweep through a frequency range of 10 Hz to 500 Hz at a constant logarithmic sweep rate of not more than one tenth of an octave per second completing not less than 10 000 sweeps (i.e. 5 000 complete sweep cycles) at amplitudes corresponding to the curve in Appendix J. For engine mounted terminal junction modules and frames the frequency ranges shall be extended to 3 kHz. The test shall be arranged to give approximately equal duration in each direction of vibration.	

Test clause no.	Title	Description	Requirement
5.7.8.1 (Cont'd.)		Alternatively, subject the components to the tests described in BS 3G 100-2.3.1, applicable to category 3, equipment region A, frequency range 10 Hz to 1 000 Hz for a duration of 50 h using wide-band random motion. The test shall be arranged to give approximately equal duration in each direction of vibration. 60 % of the duration is to be under normal temperature. 10 % at approximately the declared minimum temperature and 30 % at approximately the declared maximum temperature. A stabilizing period of 2 h at the appropriate temperature is to elapse before vibration begins. Monitor contact resistance At the conclusion of the endurance tests, examine the items visually. The method adopted for testing at temperature extremes is to be to the satisfaction of the Approving Authority.	During the entire period, the change of resistance shall not exceed 100 mΩ for a period of more than 5 μs. There shall be no signs of loosening of parts or undue wear which would impair performance.
5.7.9	Thermal shock	Subject the specimens to 10 cycles of the following procedure: Place the specimens for not less than 2 h in a chamber maintained at the declared minimum temperature $\pm 5^{\circ}\text{C}$. Within a period not exceeding 2 min, transfer the specimens to a chamber maintained at the declared maximum temperature $\pm 5^{\circ}\text{C}$ where the specimens shall remain for not less than 2 h. At the conclusion of the 10th cycle allow the specimens to return to normal conditions. At the conclusion of the tests, examine the specimens visually.	There shall be no visible material deterioration.
5.7.10	Endurance at maximum temperature	Subject the devices to the declared maximum temperature $\pm 5^{\circ}\text{C}$ for a period of 1 000 h. At the end of this period and while the specimens are still at maximum temperature, measure the insulation resistance as in 5.7.2. Examine the specimens visually.	Values shall be not less than 100 MΩ. There shall be no visible material deterioration.