IEC/PAS 61076-3-111

Edition 1.0
2002-06

Connectors for electronic equipment –

Part 3-111:
Detail specification for 8-way, shielded and unshielded, free and fixed connectors, for industrial environments for frequencies up to 250 MHz

PUBLICLY AVAILABLE SPECIFICATION

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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CONNECTORS FOR ELECTRONIC EQUIPMENT –

Part 3-111: Detail specification for 8-way, shielded and unshielded, free and fixed connectors, for industrial environments for frequencies up to 250 MHz

FOREWORD

A PAS is a technical specification not fulfilling the requirements for a standard, but made available to the public.

IEC-PAS 61076-3-111 has been processed by subcommittee 48B: Connectors, of IEC technical committee 48: Electromechanical components and mechanical structures for electronic equipment.

The text of this PAS is based on the following document:	This PAS was approved for publication by the P-members of the committee concerned as indicated in the following document:
Draft PAS	**Report on voting**
48B/1174/PAS	48B/1219A/RVD

Following publication of this PAS, the technical committee or subcommittee concerned will investigate the possibility of transforming the PAS into an International Standard.

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The Siemon Company
76 Westbury Park Road
Watertown, CT 06795 USA

Annexes A, B and C form an integral part of this document.

CONNECTORS FOR ELECTRONIC EQUIPMENT –

Part 3-111: Detail specification for 8-way, shielded and unshielded, free and fixed connectors, for industrial environments for frequencies up to 250 MHz

1 Scope

This part of IEC 61076-3 covers an 8-way shielded industrial environment connector system of 4, 6 or 8 contacts consisting of a range of free and fixed connectors. The connectors cover a variety of different mounting configurations and termination types with a common mating configuration.

Fixed connectors are provided with terminations suitable for solder, insulation displacement, screw terminal, crimp, insulation piercing termination and printed-board mounting.

Free connectors are provided for crimp, insulation piercing and insulation displacement terminations to cable assemblies with tinsel, stranded or solid wire conductors. At the present time, free connectors may only be available with a limited range of terminations and variants.

1.1 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this part of IEC 61076-3. At the time of publication, the editions indicated were valid. All normative documents are subject to revision, and parties to agreements based on this part of IEC 61076 are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

IEC 60050(581): 1978, *International Electrotechnical Vocabulary (IEV) – Chapter 581: Electro-mechanical components for electronic equipment*

IEC 60603-7, *Connectors for frequencies below 3 MHz for use with printed boards – Part 7: Detail specification for connectors, 8-way, including fixed and free connectors with common mating features, with assessed quality*

IEC 60068-1: 1988, *Environmental testing – Part 1: General and guidance*

IEC 60326-3: 1991, *Printed boards – Part 3: Design and use of printed boards*

IEC 60352-2: 1990, *Solderless connections – Part 2: Solderless crimped connections – General requirements, test methods and practical guidance*

IEC 60352-3: 1993, *Solderless connections – Part 3: Solderless accessible insulation displacement connections – General requirements, test methods and practical guidance*

IEC 60352-4: 1994, *Solderless connections – Part 4: Solderless non-accessible insulation displacement connections – General requirements, test methods and practical guidance*

IEC 60410: 1973, *Sampling plans and procedures for inspection by attributes*

IEC 60512-2: 1985, *Electromechanical components for electronic equipment, basic testing procedures and measuring methods – Part 2: General examination, electrical continuity and contact resistance tests, insulation tests and voltage stress tests*

IEC 60512-3: 1976, *Electromechanical components for electronic equipment; basic testing procedures and measuring methods – Part 3: Current-carrying capacity tests*

IEC 60512-4: 1976, *Electromechanical components for electronic equipment; basic testing procedures and measuring methods – Part 4: Dynamic stress tests*

IEC 60512-5: 1992, *Electromechanical components for electronic equipment; basic testing procedures and measuring methods – Part 5: Impact tests (free components), static load tests (fixed components), endurance tests and overload tests*

IEC 60512-6: 1984, *Electromechanical components for electronic equipment; basic testing procedures and measuring methods – Part 6: Climatic tests and soldering tests*

IEC 60512-7: 1988, *Electromechanical components for electronic equipment; basic testing procedures and measuring methods – Part 7: Mechanical operating tests and sealing tests*

IEC 60512-8: 1993, *Electromechanical components for electronic equipment; basic testing procedures and measuring methods – Part 8: Connector tests (mechanical) and mechanical tests on contacts and terminations*

IEC 60529: 1989, *Degrees of protection provided by enclosures*

IEC 60603-1: 1991, *Connectors for frequencies below 3 MHz for use with printed boards – Part 1: Generic specification – General requirements and guide for the preparation of detail specifications, with assessed quality*
Amendment 1 (1992)

IEC 60664-1: 1992, *Insulation coordination for equipment within low-voltage systems – Part 1: Principles, requirements and tests*

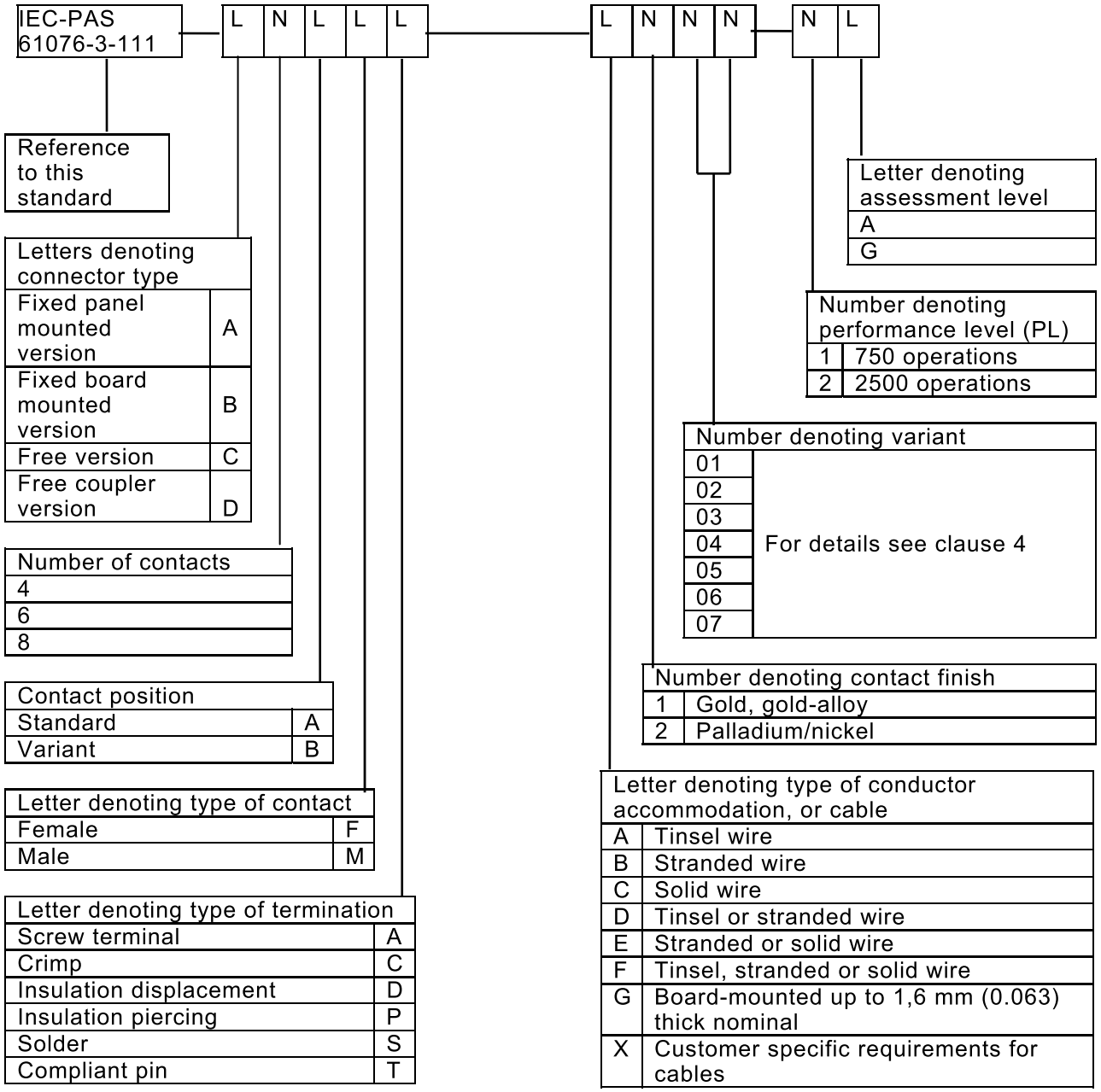
IEC 60807-1: 1991, *Rectangular connectors for frequencies below 3 MHz – Part 1: Generic specification – General requirements and guide for the preparation of detail specifications for connectors with assessed quality*

ITU-T K20: 1984, *Resistibility of telecommunication switching equipment to overvoltages and overcurrents*

ISO 1302, *Technical drawings – Method of indicating surface texture*

2 IEC type designation

Connectors, connector bodies and connectors with pre-inserted contacts according to this standard shall be designated by the following system:



NOTE "L" stands for letter
"N" stands for number

Example:

IEC PAS 61076-3-111 B8AFS-G101-2G: Fixed shielded connector, board mounted, unkeyed having 8 female contacts in standard contact positions, gold plated to be soldered into a printed board having a thickness of 1,6 mm nominal variant 01, meeting performance level 2, assessment level G.

2.1 Terminology

For definitions of terms used, refer to IEC 60050(581).

3 Common Features

The industrial connectors referenced in this specification are composed of RJ45 style fixed and free connectors housed in unique, industrial rated interfaces. The mating information and contact requirements of the RJ45 portion of these industrial connectors shall be compliant with the appropriate IEC 60603-7-X Series (-1,2,3,4,5,6).

4 Industrial RJ45 Variants

4.1 General

Dimensions are given in millimetres, with inch equivalents. The original dimensions are in inches. Drawings are shown in third angle projection. The shape of connectors may deviate from those shapes given in the following figures as long as the specified dimensions are not influenced.

4.1.1 Contact arrangement of all connector types

Table 1

Number of contacts	Contact position designation	Contact position							
		1	2	3	4	5	6	7	8
4	A			x	x	x	x		
6	A		x	x	x	x	x	x	
8	A	x	x	x	x	x	x	x	x

4.1.2 Terminations

Free connectors are intended to be terminated to cordage or cable to provide connector cord and cable assemblies. The connector type designation provides basic terminations concerning the type of conductor (tinsel, stranded, solid) to which the conductor may be applied, and the type of connection used (solder, insulation displacement, etc.). Specific details concerning wire gauge size, type and thickness of conductor insulation, size and shape of cordage or cable jacket, etc., are not intended to be part of this specification. Cable shield construction and method of cable shield termination are not intended to be part of this specification. These shall be as agreed between purchaser and supplier. Minor variations in a free connector's interior details to accommodate differing wire gauge sizes, outer jackets,etc., do not require the generation of new free connector variants.

4.2 Industrial RJ45 Variant 01

4.2.1 Industrial RJ45 Variant 01, Fixed Connector

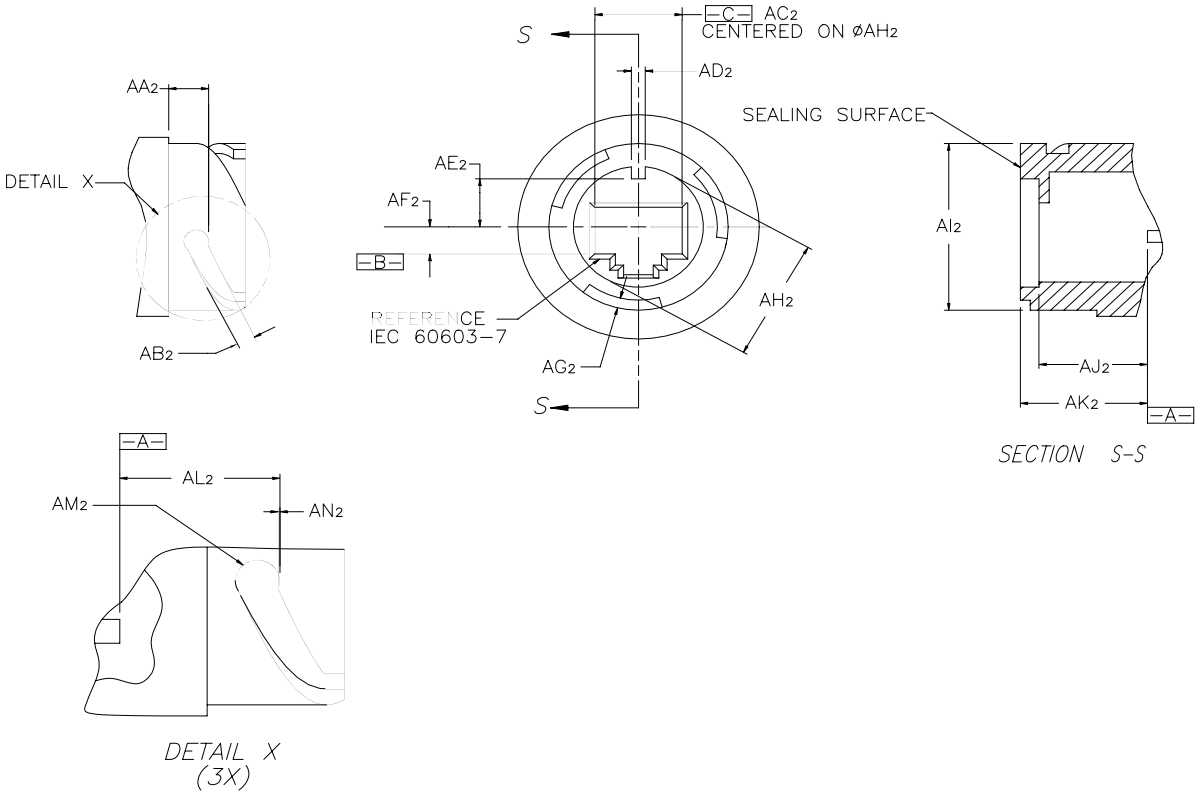


Table 2

Letter	Maximum		Minimum		Nominal (ref)	
	mm	in	Mm	in	mm	in
AA_2	-	-	5,46	,215	-	-
AB_2	3,55	,140	2,75	,108	3,15	,124
AC_2	12,03	,474	11,78	,464	11,91	,469
AD_2	1,65	,065	1,40	,055	1,52	,060
AE_2	7,1	,280	6,7	,263	6,91	,272
AF_2	4,14	,163	3,88	,153	4,01	,158
AG_2	1,57	,062	1,35	,053	1,47	,058
AH_2	17,6	,693	17,3	,681	17,45	,687
AI_2	24,60	,970	24,45	,963	24,56	,967
AJ_2	10,69	,421	-	-	-	-
AK_2	13,58	,535	13,33	,525	13,46	,530
AL_2	8,50	,335	8,25	,325	8,38	,330
AM_2	3,15	,124	2,75	,108	2,95	,116
AN_2	,304	,012	,152	,006	,229	,009

4.2.2 Industrial RJ45 Variant 01, Free Connector

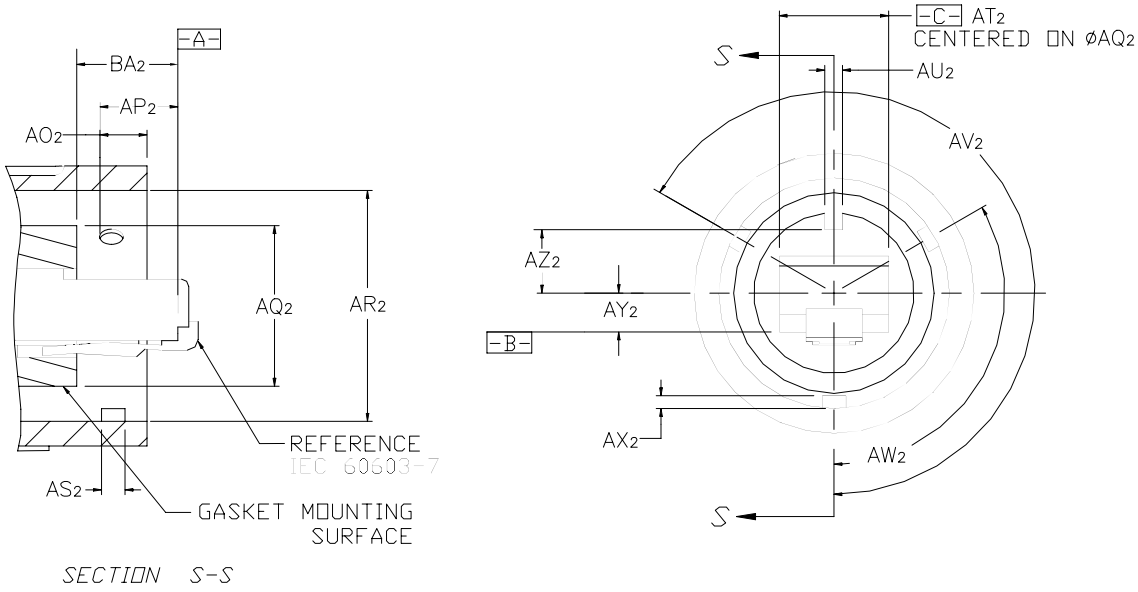


Table 3

Letter	Maximum		Minimum		Nominal (ref)	
	mm	in	mm	in	mm	in
AO_2	3,56	,140	-	-	-	-
AP_2	8,1	,319	7,85	,309	7,98	,314
AQ_2	17,1	,673	16,8	,661	16,94	,667
AR_2	25,0	,984	24,8	,974	24,87	,979
AS_2	2,59	,102	2,49	,098	2,54	,100
AT_2	11,78	,464	11,58	,456	11,68	,460
AU_2	2,25	,089	1,75	,069	2,01	,079
AV_2	241^{o}	-	239^{o}	-	-	-
AW_2	121^{o}	-	119^{o}	-	-	-
AX_2	1,30	,051	1,04	,041	1,17	,046
AY_2	4,14	,163	3,89	,153	4,01	,158
AZ_2	6,60	,260	6,35	,250	6,48	,255
BA_2	-	-	10,69	,401	-	-

4.3 Industrial RJ45 Variant 02

4.3.1 Industrial RJ45 Variant 02, Fixed Connector

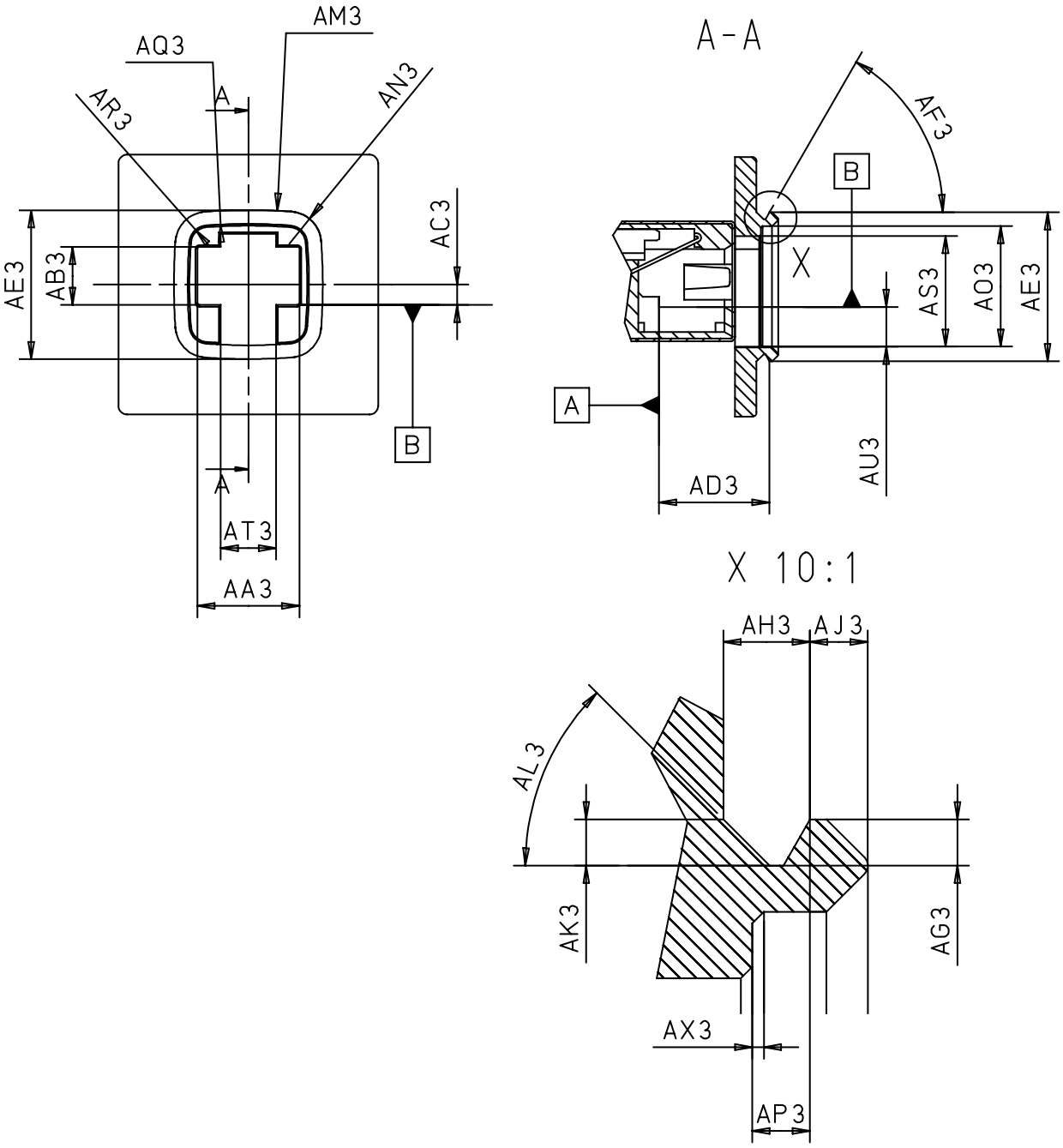


Table 4

Letter	Maximum		Minimum		Nominal (ref)	
	mm	in	mm	in	mm	In
AA_3	11,85	0,467	11,79	0,464	11,82	0,465
AB_3	6,77	0,267	6,71	0,264	6,74	0,265
AC_3	2,4	0,094	2,3	0,091	2,35	0,093
AD_3	13,2	0,52	12,8	0,504	13	0,512
AE_3	17,2	0,677	17,1	0,673	17,15	0,675
AF_3					60°	
AG_3	0,85	0,033	0,75	0,03	0,8	0,031
AH_3	1,55	0,061	1,45	0,057	1,5	0,059
AJ_3	1,1	0,043	0,9	0,035	1	0,039
AK_3	0,8	0,031	0,6	0,024	0,7	0,028
AL_3					45°	
AM_3					R 68,8	R 2,709
AN_3					R 3,8	R 0,15
AO_3	14,05	0,553	13,95	0,549	14	0,551
AP_3	1,05	0,041	0,95	0,037	1	0,039
AQ_3					R 67,2	R 2,646
AR_3					R 2,2	R 0,087
AS_3	13,05	0,514	12,65	0,498	12,85	0,506
AT_3	6,5	0,256	6,3	0,248	6,4	0,252
AU3	4,65	0,183	4,55	0,179	4,6	0,181

4.3.2 Industrial RJ45 Variant 02, Plug Connector

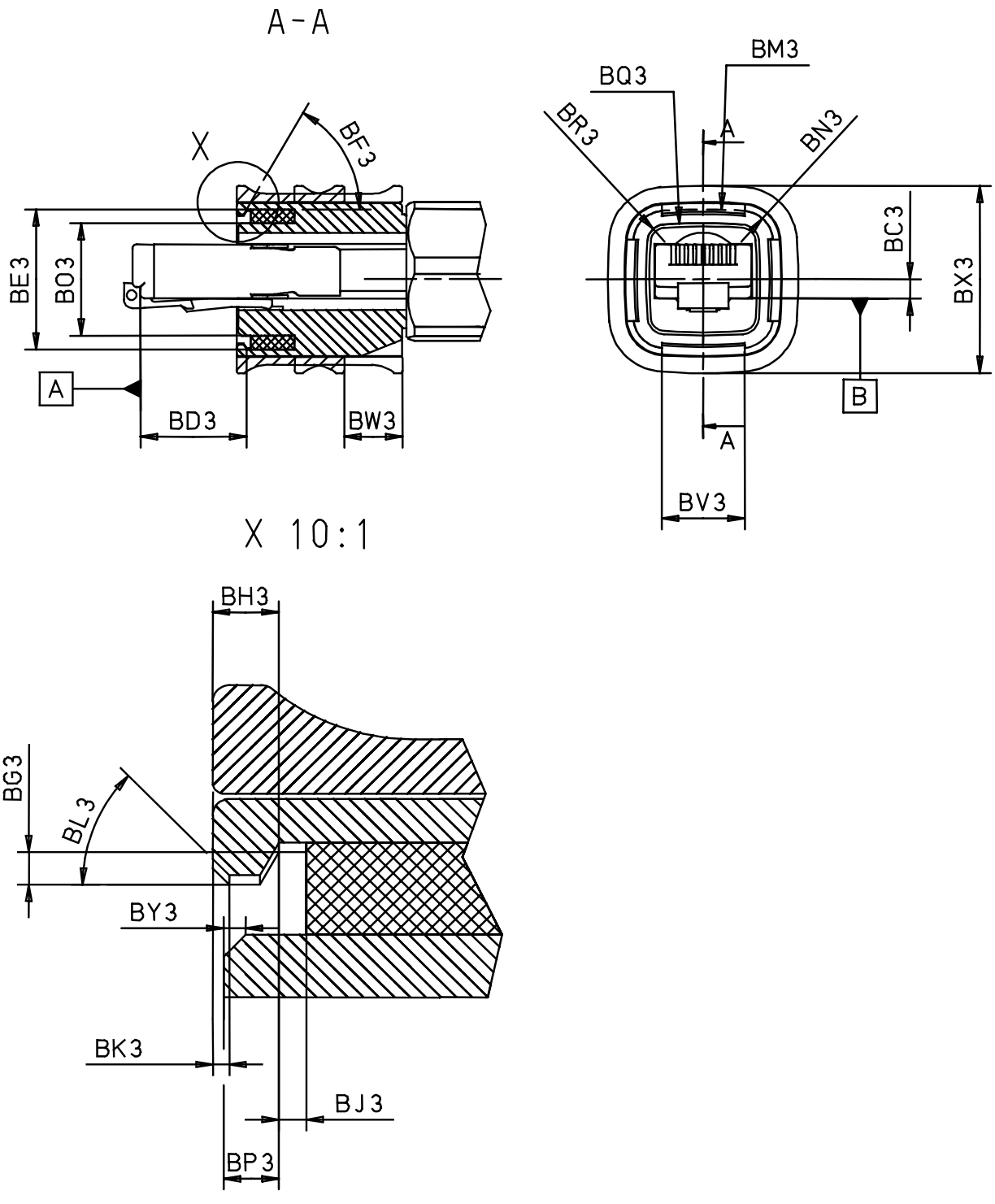


Table 5

Letter	Maximum		Minimum		Nominal (ref)	
	mm	In	mm	in	mm	In
BC_3	2,3	0,091	2,2	0,087	2,25	0,089
BD_3	12,8	0,504	11,4	0,449	12,6	0,496
BE_3	17,3	0,681	17,2	0,677	17,25	0,679
BF_3					60°	
BG_3	0,7	0,028	0,6	0,024	0,65	0,026
BH_3	1,3	0,051	1,1	0,043	1,2	0,047
BJ_3	0,6	0,024	0,4	0,016	0,5	0,02
BK_3	0,5	0,02	0,3	0,012	0,4	0,016
BL_3					45°	
BM_3					R 68,8	R 2,709
BN_3					R 3,8	R 0,15
BO_3	13,95	0,549	13,85	0,545	13,9	0,547
BP_3	1	0,039	0,9	0,035	0,95	0,037
BQ_3					R 67,15	R 2,644
BR_3					R 2,15	R 0,085
BV_3					10	0,394
BW_3					7	0,276
BX_3	23	0,906				

4.4 Industrial RJ45 Variant 03

4.4.1 Industrial RJ45 Variant 03, Fixed Connector Side

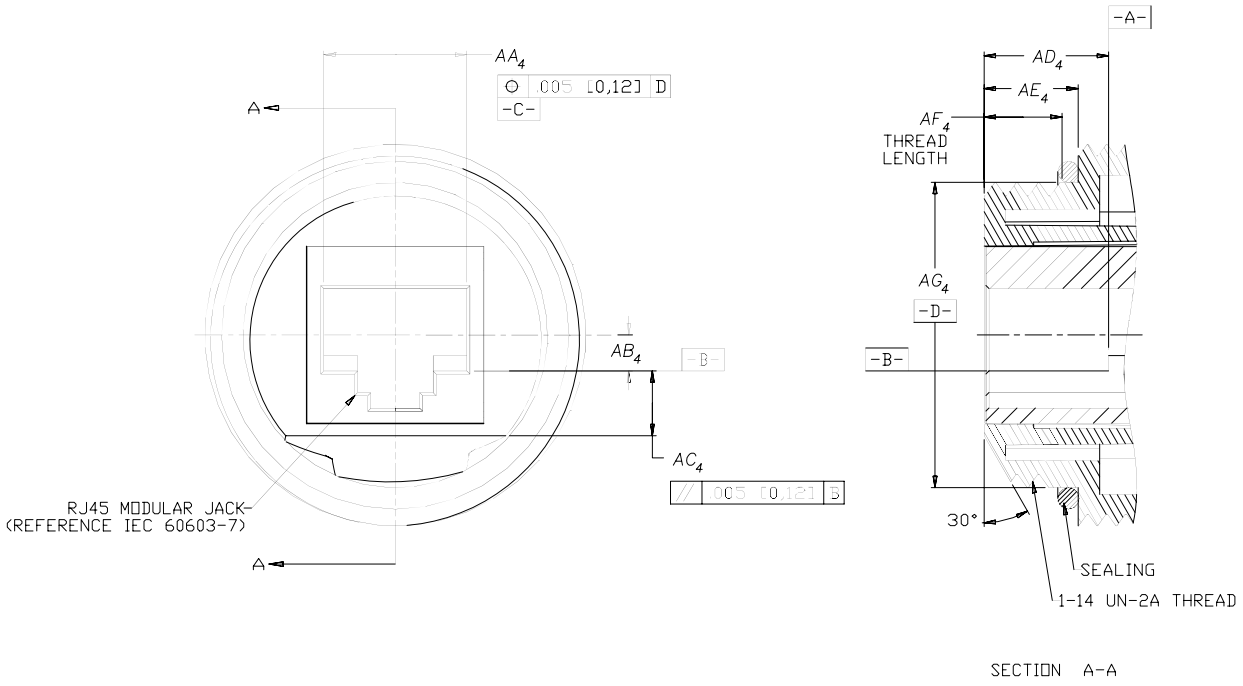


Table 6

Letter	Maximum		Minimum		Nominal (ref)	
	mm	in	mm	in	mm	in
AA_4	12,04	0,474	11,79	0,464	11,91	0,469
AB_4	3,12	0,123	2,87	0,113	3,00	0,118
AC_4	5,51	0,217	5,26	0,207	5,38	0,212
AD_4	12,07	0,475				
AE_4	7,98	0,314	7,72	0,304	7,85	0,309
AF_4	6,63	0,261	6,38	0,251	6,50	0,256
AG_4	25,40	1,000				

4.4.2 Industrial RJ45 Variant 03, Free Connector

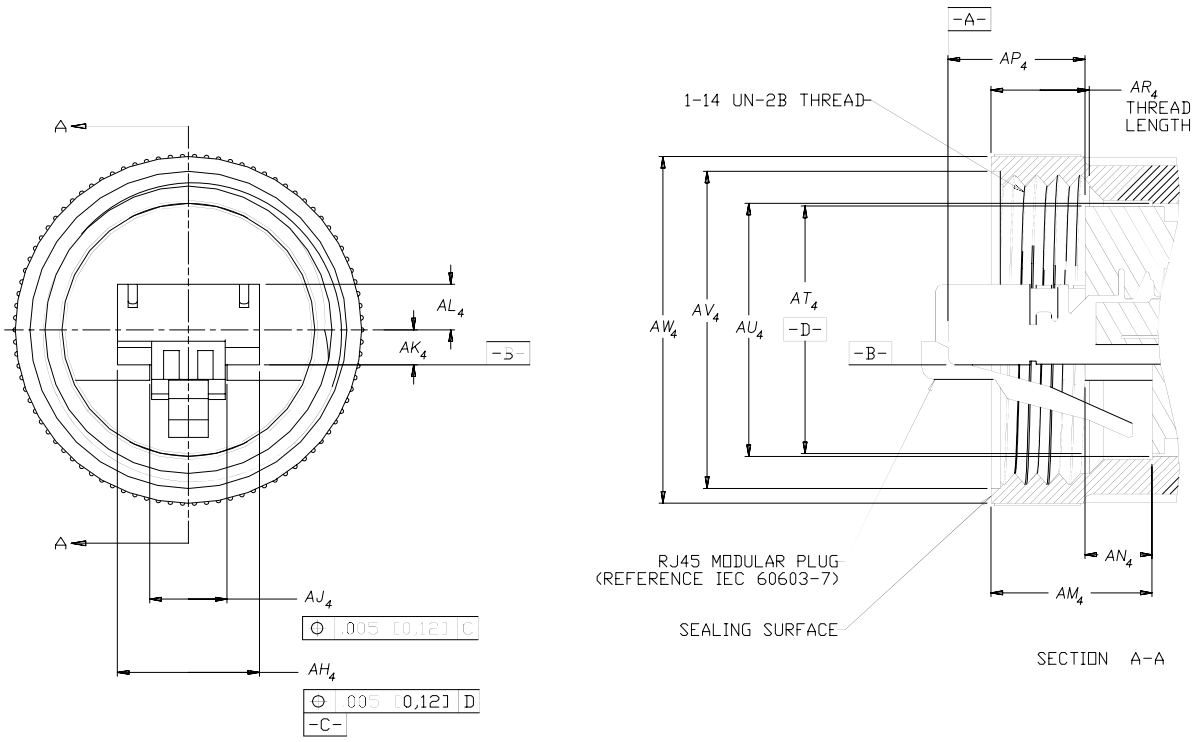


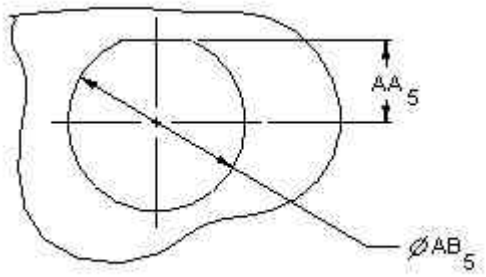
Table 7

Letter	Maximum		Minimum		Nominal (ref)	
	mm	in	mm	in	mm	in
AH_4	11,79	0,464	11,58	0,456	11,68	0,460
AJ_4	6,48	0,255	6,22	0,245	6,35	0,250
AK_4	3,00	0,118	2,74	0,108	2,87	0,113
AL_4	3,86	0,152	3,61	0,142	3,73	0,147
AM_4	13,36	0,526	13,11	0,516	13,23	0,521
AN_4	5,64	0,222	5,38	0,212	5,51	0,217
AP_4			11,25	0,443		
AR_4	8,20	0,323	7,95	0,313	8,08	0,318
AT_4	20,45	0,805	20,19	0,795	20,32	0,800
AU_4	20,90	0,823	20,65	0,813	20,78	0,818
AV_4	26,16	1,030	25,91	1,020	26,04	1,025
AW_4	28,58	1,125	28,32	1,115	28,45	1,120

5 Mounting Information for Variants 01-03

Hole sizes and tolerances in accordance with IEC 60326-3.

5.1 Mounting Information for Variant 01, Fixed Connector



Figure

Letter	Nominal	
	mm	in
AA_5	12.32	.485
AB_5	26.92	1.060

5.2 Mounting Information for Variant 02, Fixed Connector

5.3 Mounting Information for Variant 03, Fixed Connector

Letter	Maximum		Minimum	
	mm	in	mm	in

6 Gauges

6.1 Fixed connectors, RJ 45 Interface

Refer to IEC 60603-7-1.

7 Characteristics

7.1 Climatic category: 40/085/21

The lowest and highest temperatures and the duration of the damp heat, steady state test should be selected from the preferred values stated in 2.2 of IEC 61076-1. The connectors are classified into climatic categories in accordance with the general rules given in IEC 60068-1. The following preferred temperature range and severity of the damp heat steady state test have been selected to comply with IEC 61156.

Table 8 – Climatic categories – selected values

Climatic Category	Lower Temperature °C	Upper Temperature °C	Damp heat Steady state (days)
40/85/21	–40 °C	70 °C	21

7.2 Electrical

7.2.1 Creepage and clearance distances

The permissible operating voltages depend on the application and on the applicable or specified safety requirements.

Insulation co-ordination is not required for this connector; therefore, the creepage and clearance distances in IEC 60664-1 are reduced and covered by overall performance requirements.

Therefore, the creepage and clearance distances are given as operating characteristics of mated connectors.

In practice, reductions in creepage or clearance distances may occur due to the conductive pattern of the printed board or the wiring used, and shall duly be taken into account.

Table 9

Type	Minimum distance between contacts and chassis				Minimum distance between adjacent contacts			
	Creepage		Clearance		Creepage		Clearance	
	mm	in	mm	in	mm	in	mm	in
A, B, C	1,40	0,055	0,51	0,020	0,36	0,014	0,36	0,014

7.2.2 Voltage proof

Conditions: IEC 60512-2, Test 4a
Standard atmospheric conditions.
Mated connectors.
All variants: 1000 V d.c. or a.c. peak, contact-to-contact.
1500 V d.c. or a.c. peak, contact to test panel.

7.2.3 Current-carrying capacity

Conditions: IEC 60512-3, Test 5b.
Standard atmospheric conditions.
All contacts.

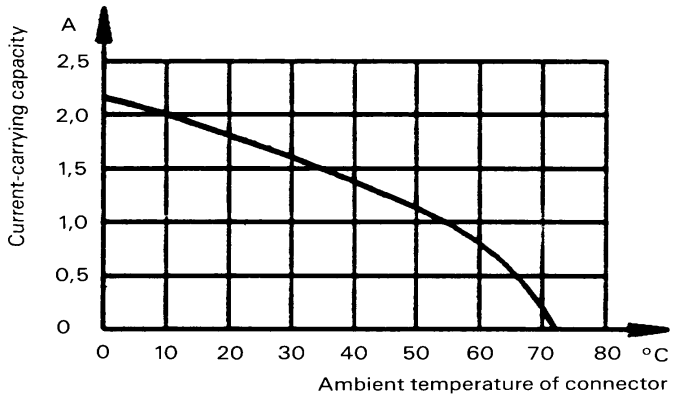


Figure 24 – Connector derating curve

7.2.4 Initial contact resistance

Conditions: IEC 60512-2, Test 2a.
Standard atmospheric conditions.
Mated connectors.
Connection points: as specified in figure 25.
All types: 20 mΩ max.

7.2.5 Initial insulation resistance

Conditions: IEC 60512-2, Test 3a.
Method A.
Standard atmospheric conditions.
Mated connectors.
Test voltage: 100 V d.c.
All types: 500 MΩ min.

7.3 Mechanical

7.3.1 Mechanical operation

Conditions: IEC 60512-5, Test 9a.
Speed: 10 mm/s (0,4 in/s) max.
Rest: 5 s min. (unmated).
PL 1: 750 operations.
PL 2: 2500 operations.

7.3.2 Effectiveness of connector coupling devices

Conditions: IEC 60512-8, Test 15f.
All types: 50 N (11 lbf) for 60 s ± 5 s.

8 Test schedule

8.1 General

This test schedule shows all tests and the order in which they shall be carried out, as well as the requirements to be met.

An "X" in the column "Requirements" of the following tables indicates that the test or conditioning shall be applied.

Unless otherwise specified, mated sets of connectors shall be tested. Care shall be taken to keep a particular combination of connectors together during the complete test sequence, that is, when unmating is necessary for a certain test, the same connectors shall be mated for the subsequent tests.

Hereinafter, a mated set of connectors is called a "specimen".

For the measurement of contact resistance, the points of connection shall be as shown in figure 25.
See clause 4 of IEC 61076-1.
The detail specification shall state the test sequence (in accordance with this standard), and the number of specimens for each test sequence (not less than four mated pairs).
Individual variants may be submitted to type tests for approval of those particular variants.
It is permissible to limit the number of variants tested to a selection representative of the whole range for which approval is required (which may be less than the range covered by the detail specification), but each feature and characteristic shall be proved.
The connectors shall have been processed in a careful and workmanlike manner, in accordance with good current practice.

8.2 Test Procedures and Measuring Methods

The test methods specified and given in the relevant standards are the preferred methods but not necessarily the only ones that can be used. In case of dispute, however, the specified method shall be used as the reference method.
Unless otherwise specified, all tests shall be carried out under standard atmospheric conditions for testing as specified in IEC 60068-1.
Where approval procedures are involved and alternative methods are employed it is the responsibility of the manufacturer to satisfy the authority granting approval that any alternative methods which he may use give results equivalent to those obtained by the methods specified.

8.3 Preconditioning

Before the tests are made, the connectors shall be preconditioned under standard atmospheric conditions for testing as specified in IEC 60068-1 for a period of 24 hours unless otherwise specified by the detail specification.

8.4 Wiring and Mounting of Specimens

8.4.1 Wiring

Wiring of these connectors shall take into account wire diameter of the cables defined in IEC 61156 parts 2, 3 and 4 as applicable. Where wiring and/or shielding of test specimens is required, the detail specification shall contain information suitable to comply with the selected methods of test.

8.4.2 Mounting

When mounting is required in a test, unless otherwise specified, the connectors shall be rigidly mounted on a metal plate or to specified accessories, whichever is applicable, using the specified connection methods, fixing devices and panel cut-outs as laid down in the detail specification.

8.5 Test Schedules

The test parameters required by the detail specification shall not be less than those listed in 4.5.2. Unless otherwise specified in the relevant detail specification, the requirements included in the following tables should be viewed as target values. The detail specification shall specify the actual requirements to be fulfilled. Where a detail specification includes additional characteristics that require testing and/or specific test sequences, the appropriate existing or new test (in the form of an annex to the detail specification) shall be in the appropriate place in the test table.

8.6 Arrangement for contact resistance test:

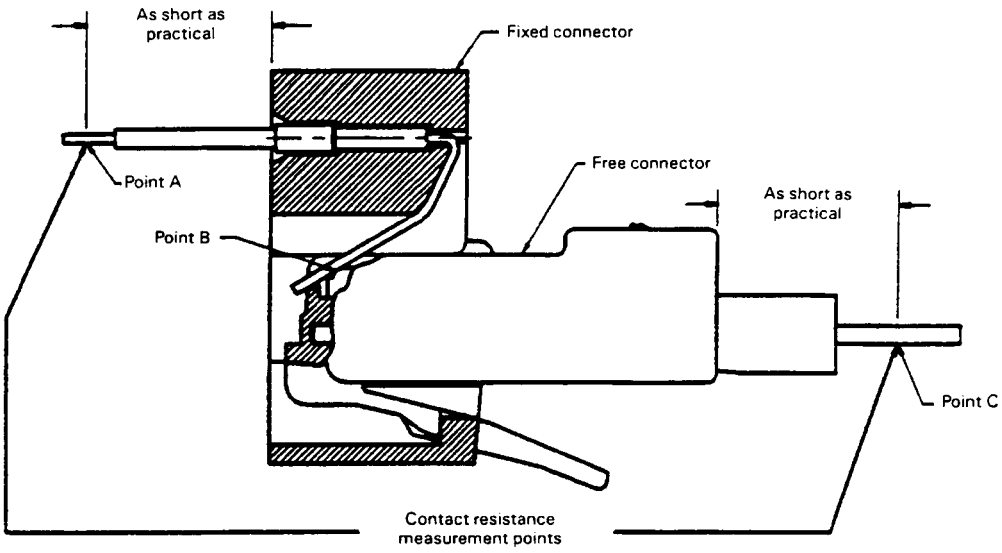


Figure 10

Test procedure

a) Determine the bulk resistance of the fixed connector between points A and B of figure 10 by calculation or by measurement.

b) Determine the bulk resistance of the free connector between points B and C of figure 10 by calculation or by measurement.

c) Measure the total mated connector resistance between points A and C, following the requirements and procedures of IEC 60512-2, Test 2a.

d) Calculate the contact resistance by subtracting the sum of the bulk resistance of the fixed and free connectors from the total mated connector resistance.

Contact resistance = $R_{AC} - (R_{ABI} + R_{BCI})$

where: I indicates initial value.

8.7 Arrangement for dynamic stress tests (test phase AP2)

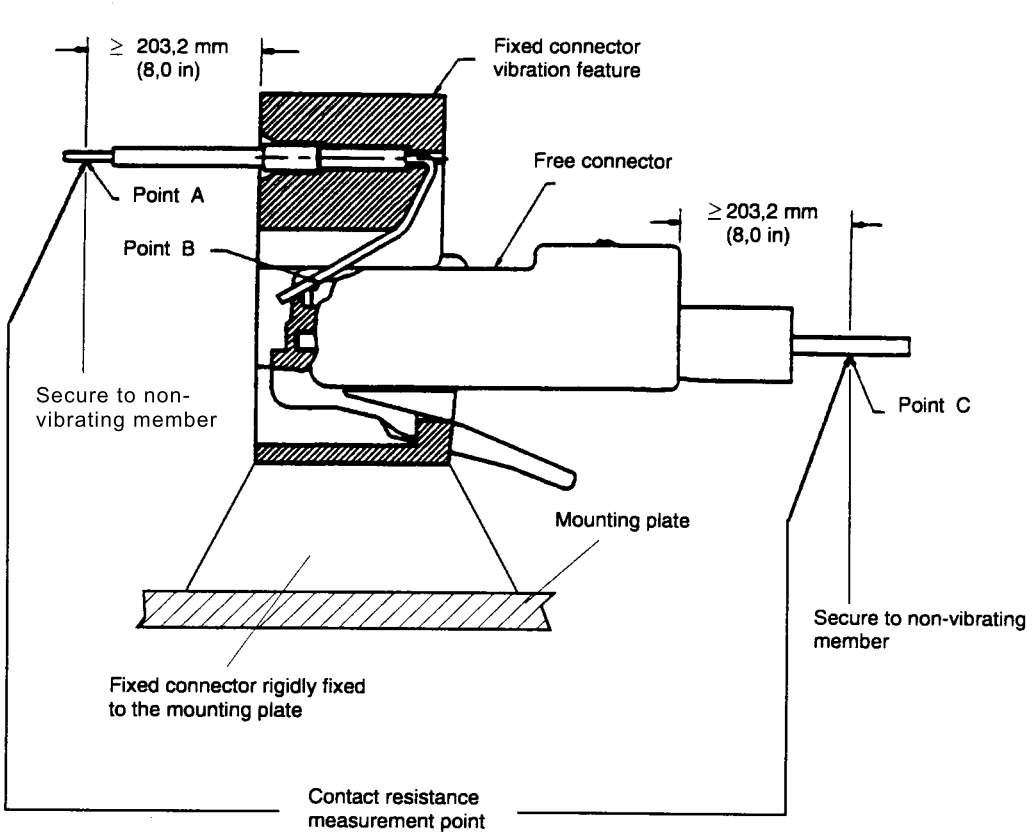


Figure 11

8.7.1 Basic (Minimum) Test Schedule

Not applicable.

8.7.2 Full Test Schedule

The detail specification shall call for the following tests and shall specify the characteristics to be examined and the requirements to be fulfilled.
For a complete test sequence, 52 specimens are needed (5 groups of 10 and 1 group of 2. The group of 2 shall be for transmission testing, group EP).

8.7.2.1 Test group P preliminary

All specimens shall be subjected to the following tests. All the test group specimens shall be subjected to the preliminary group P tests in the following sequence.
The specimens shall then be divided into the appropriate number of groups. All connectors in each group shall undergo the following tests as described in the detail specification and in the sequence given, unless the detail specification requires alteration of the sequence of tests or adds new tests to verify additional connector characteristics (see 4.5).

The test parameters required shall not be less than those listed in 7.5.2. Unless otherwise specified, the requirements included in the following tables should be viewed as target values.

The following tests specify the characteristics to be checked and the requirements to be fulfilled.

Table 10 – Test group P

Test phase	Test			Measurement to be performed		
	Title	IEC 60512 Test No.	Severity or condition of test	Title	IEC 60512 Test No.	Requirements
P 1	General examination	1		Visual examination	1a	There shall be no defects that would impair normal operation
				Examination of dimensions and mass	1b	The dimensions shall comply with those specified in the detail spec.
P 2	Polarization					
P 3	Contact resistance		Connection points as in figure XX All contacts/specimens	Millivolt level method or contact resistance – specified test current method	2a or 2b	Contact resistance = 20 mΩ maximum
P 4			100 V d.c.	Insulation resistance	3a	500 MΩ minimum
P 5			Contact/contact Method A Mated C	Voltage proof	4a	1000 V d.c
			All contacts to test panel Method A Mated C			1500 V d.c..

Table 11 – Test group AP

Test phase	Test			Measurement to be performed		
	Title	IEC 60512 Test No.	Severity or condition of test	Title	IEC 60512 Test No.	Requirements
AP 1	Insertion and withdrawal forces	13b	Connector locking device depressed			Insertion force 20 N max Withdrawal force 20 N max
AP 2	Effectiveness of connector coupling device	15f	Rate of load application 44,5 N/s (10 lbf/s) max.			50 N for 60 s ± 5 s
AP 3	Rapid change of temperature	11d (60068-2-14 test Nb)	–40 °C to 70 °C Mated connectors 25 cycles ι = 30 min Recovery time 2 h			
AP 4			Test voltage 100 V ± 15 V d.c. Method A Mated connectors	Insulation resistance	3a	500 MΩ min.
AP 5			Connection points as in figure 10 All Contacts/Specimens	Contact resistance	2a	20 mΩ max change from initial
AP 6			Contact/contact: Method A Mated connectors	Voltage proof	4a	1000 V d.c. or a.c. peak
			All contacts to test panel: Method A Mated connectors			1500 V d.c. or a.c. peak
AP 7			Unmated connectors	Visual examin-ation	1a	There shall be no defects that would impair normal operation
AP 8	Cyclic damp heat	11c (60068-2-38)	21 cycles low temperature 25 °C high temperature 65 °C cold subcycle –10 °C humidity 93 % Half of the samples in mated state Half of the samples in unmated state			
AP 9			Connection points as in figure 10 All Contacts/Specimens	Contact resistance	2a	20 mΩ max change from initial
AP 10	Insertion and withdrawal forces	13b	Connector locking device depressed			Insertion force 20 N max Withdrawal force 20 N max.
AP 11	Effectiveness of connector coupling device	15f	Rate of load application 44,5 N/s (10 lbf/s) max.			50 N for 60 s ± 5 s
AP 12			Unmated connectors	Visual examin-ation	1a	There shall be not defects that would impair normal operation
AP 13	Solderability		As Applicable			
AP 14	Resistance to soldering heat		As Applicable			
AP 15			See Note Contact/contact: Method A Mated connectors	Voltage proof	4a	1000 V d.c. or a.c. peak
			All contacts to test panel: Method A Mated connectors			1500 V d.c. or a.c. peak

NOTE Do not perform step AP 15 if solderability and resistance to soldering heat were not performed.

Table 12 – Test Group BP

Test phase	Test			Measurement to be performed		
	Title	IEC 60512 Test No.	Severity or condition of test	Title	IEC 60512 Test No.	Requirements
BP 1	Immersion	60529	1m, 30 minutes		14.2.7	no leakage on contacts
BP 2	Locking device mechanical operations		2 N operations – see mechanical operations			See annex B
BP 3	Mechanical operations	9a	N/2 operations – see mechanical operations. Speed 10 mm/s (0,4 in/s). Rest 5 s (when unmated). Locking device inoperative			(N) = 750
BP 3	Flowing mixed gas corrosion	11-7	4 days Half of the samples in mated state Half of the samples in unmated state		11-7	
BP 4			Connection points as in figure 10 All contacts/specimen	Contact resistance	2a	20 mΩ delta
BP 5	Mechanical operations	9a	N/2 operations see mechanical operations. Speed 10 mm/s (0,4 in/s). Rest 5 s (when unmated). Locking device inoperative			
BP 6	Immersion	60529	1m, 30 minutes		14.2.7	no leakage on contacts
BP 7			Connection points as in figure 10 All contacts/specimen	Contact resistance	2a	20 mΩ max. change from initial
BP 8			100 V ± 15 V d.c. Method A Mated connectors	Insulation resistance	3a	500 MΩ min.
BP 9			Contact/contact: Method A Mated connectors	Voltage proof	4a	1000 V d.c. or a.c. peak
			All contacts to test panel: Method A Mated connectors			1500 V d.c. or a.c. peak
BP 10				Visual examination	1a	There shall be no defects that would impair normal operation

Table 13 - Test group CP

Test phase	Test			Measurement to be performed		
	Title	IEC 60512 Test No.	Severity or condition of test	Title	IEC 60512 Test No.	Requirements
CP 1	Mechanical	Clause 5	Both, free and fixed connector		Annex M	Passing Go / No Go test
CP 2	Gauging Conntinuity	Annex A	All signal contacts and screen / specimens	Contact Disturbance	2e	5 μs maximum
CP 3	Immersion	60529	1m, 30 minutes		14.2.7	no leakage on contacts
CP 4	Vibration	11c	10-500 MHz,10g's, 0.3 mm p-p displacement	Contact disturbance	2e	10 microseconds maximum
CP 5			Test voltage 100 V d.c. Method A Mated connectors	Insulation resistance	3a	500 MΩ minimum
CP 6	Immersion	60529	1m, 30 minutes		14.2.7	no leakage on contacts
CP 7			Measurement points as in figure XX All contacts/specimens	Contact resistance	2a	20 mΩ max change from initial
CP 8			Unmated connectors	Visual examination	1a	There shall be no defects that would impair normal operation

Table 14– Test Group DP

Test phase	Test			Measurement to be performed		
	Title	IEC 60512 Test No.	Severity or condition of test	Title	IEC 60512 Test No.	Requirements
DP 1	Electrical load and temperature	9b	5 connectors 500 h 85°C Recovery period 2 h			.5A 5 connectors no current 5 connectors
DP 2			Test voltage 100 V d.c. Method A Mated connectors	Insulation resistance	3a	500 MΩ min.
DP 3			Contact/contact: Method A Mated connectors	Voltage proof	4a	1000 V d.c. or a.c. peak
			All contacts to test panel: Method A Mated connectors			1500 V d.c. or a.c. peak
DP 4			Unmated connectors	Visual examination	1a	There shall be no defects that would impair normal operation
DP 5			Connection points as in figure 10 All contacts/specimens	Contact resistance	1a	20 mΩ max. change from initial

Table 15 – Test Group EP

Test phase	Test			Measurement to be performed		
	Title	IEC 60512 Test No.	Severity or condition of test	Title	IEC 60512 Test No.	Requirements
EP1				Insertion loss	Annex E	60603-7-2 See notes 4,6,7
EP 2			All pairs, both directions, (pair to pair)	NEXT loss	25-1; Annex F	60603-7-2 See notes 1,6,7
EP 3			All pairs, both directions	Return loss	Annex G	60603-7-2 See notes 2,6,7
EP 4			All pairs, both directions, (pair to pair)	FEXT loss	Annex H	60603-7-2 See note 3,6,7
EP 5				Longitudinal conversion loss (balance)	Annex J	60603-7-2 See note 5,6,7
EP 6				Transfer impedance	Annex I	Not applicable
EP 7				Coupling attenuation	Annex K	60603-7-2 See notes 6,7
EP 8	Input to Output resistance		Measurement points as in figure 10 All signal contacts and shield / specimens	Millivolt level method	2a	60603-7-2
EP 9	Resistance unbalance		Measurement points as in figure 10 All signal contacts specimens	Millivolt level method	2a	60603-7-2

NOTE 1 NEXT loss at frequencies that correspond to calculated values of greater then 80 dB shall revert to a minimum requirement of 80 dB.

NOTE 2 Return loss at frequencies that correspond to calculated values of greater then 30 dB shall revert to a minimum requirement of 30 dB.

NOTE 3 FEXT loss at frequencies that correspond to calculated values of greater then 65 dB shall revert to a minimum requirement of 60 dB.

NOTE 4 Attenuation at frequencies that correspond to calculated values of less than 0,1 dB shall revert to a requirement of 0,1 dB maximum.

NOTE 5 Balance at frequencies that correspond to calculated values of greater then 40 dB shall revert to a minimum requirement of 40 dB.

NOTE 6 All transmission results shall report worst case overall for the corresponding pair or pair combination after testing all the samples.

NOTE 7 All measurements to be performed on mated connectors.

Table 16 – Test Group FP

Test phase	Test			Measurement to be performed		
	Title	IEC 60512 Test No.	Severity or condition of test	Title	IEC 60512 Test No.	Requirements
FP 1	Surge test	ITU-T K.20	Contact/contact Unexposed environments Mated connectors tests 1, 2 and 3			Test 1, 2 – Withstand per ITU-T K.20, clause 7, criterion A Test 3 – No fire hazard per ITU-T K.20, clause 7, criterion B
FP 2			100 V ± 15 V d.c. Method A Mated connectors	Insulation resistance	3a	500 MΩ min
FP 3			Unmated connectors	Visual examination	1a	There shall be no defects that would impair normal operation

Annex A
(normative)

Gauging requirements

A.1 Fixed connectors

The go gauge specified in 5.1 shall be capable of being inserted and removed with a force of 8,9 N (2,0 lbf) max.

The no-go gauges specified in 5.1 shall not be capable of entering the fixed connector more than 1,78 mm (0,070 in) with an 8,9 N (2,0 lbf) insertion force.

A.2 Free connectors

The connector shall be capable of insertion and latching into the go gauge specified in 5.2 with a 20 N (4,5 lbf) or less insertion force with the latch bar depressed.

After insertion and latching, the connector shall be capable of removal, with the latch depressed, with a removal force of 20 N (4,5 lbf) or less applied at an advantageous angle.

The free connectors shall not be capable of entering the no-go gauges specified in 5.2 more than 1,78 mm (0,070 in) with an 8,9 N (2,0 lbf) insertion force.

Annex B
(normative)

Locking device mechanical operation – Test procedure and requirements

B.1 Object

The object of this mechanical endurance test is to assess the operational limits of the locking device on free connectors.

B.2 Preparation of the specimens

The specimens shall be prepared and mounted so that the locking device is readily accessible for application of the test. No other movement of the free connector shall be allowed.

B.3 Test method

The specimens shall be subjected to mechanical operational endurance tests of the number of cycles, as specified in table 27, group B, test BP2.1.

The speed of the operation of the applied force to the locking device shall not exceed 20 cycles per minute.

The specimen shall be operated in the normal manner, and the locking device shall be depressed until it contacts the body of the free connector.

Mechanical aids which simulate normal operations may be used, provided that they do not introduce abnormal stresses.

B.4 Final measurements

After the specified number of operations, the specimens shall show no visual indication of fatigue or stress cracking of the locking device.

Annex C
(normative)

Gauging continuity procedure

C.1 Object

The object of this test is to check whether in worst case conditions of the fixed connector the electrical continuity is guaranteed.

C.2 Preparation of the specimens

A gauge according to figure C.1 should be applied to test the fixed connector specimen.

C.3 Test method

Apply to the test specimen and to the gauge a circuit according to figure C.2. For each individual contact of the free connector, the test has to be repeated.

The gauge shall be fully inserted and then be moved upwards until it stops against the plastic wall of the free connector.

During this movement a forwards force of 20 N minimum shall be applied as indicated by the arrow in figure C.3.

C.4 Final measurements

The fixed connector specimen will meet the requirements if no discontinuity or maximum 5 µs discontinuity is monitored for each individual contact.

Table C.1

Letter	Maximum		Minimum	
	mm	in	mm	in
A_1	11,59	0,4563	11,57	0,4555
C_1	0,8	0,031	0,6	0,024
D_1	4,12	0,1622	4,10	0,1614
E_1			15,0	0,591
F_1	2,80	0,1102	2,78	0,1094
H_1	0,47	0,0185	0,45	0,0177
J_1	0,69	0,0272	0,59	0,0232
L_1	6,76	0,2661	6,70	0,2637
M_1	6,23	0,2452	6,21	0,2444
N_1	5,90	0,2322	5,88	0,2314
P_1	4,7	0,185	4,3	0,1693
R_1	1,6	0,063	1,4	0,055
S_1	1,46	0,0574	1,44	0,0567
T_1	0,1	0,004		
X_1	0,6	0,024	0,4	0,016
Y_1			5,0	0,197

Letter	Maximum	Minimum
K_1	10°0’	9°0’

Gauging continuity process
Gauge shall be made according to the following (see figure C.1): Material: tool steel, hardened √ : Surface roughness, according to ISO 468 Ra: 0,25 μm max. (10 μin max.)

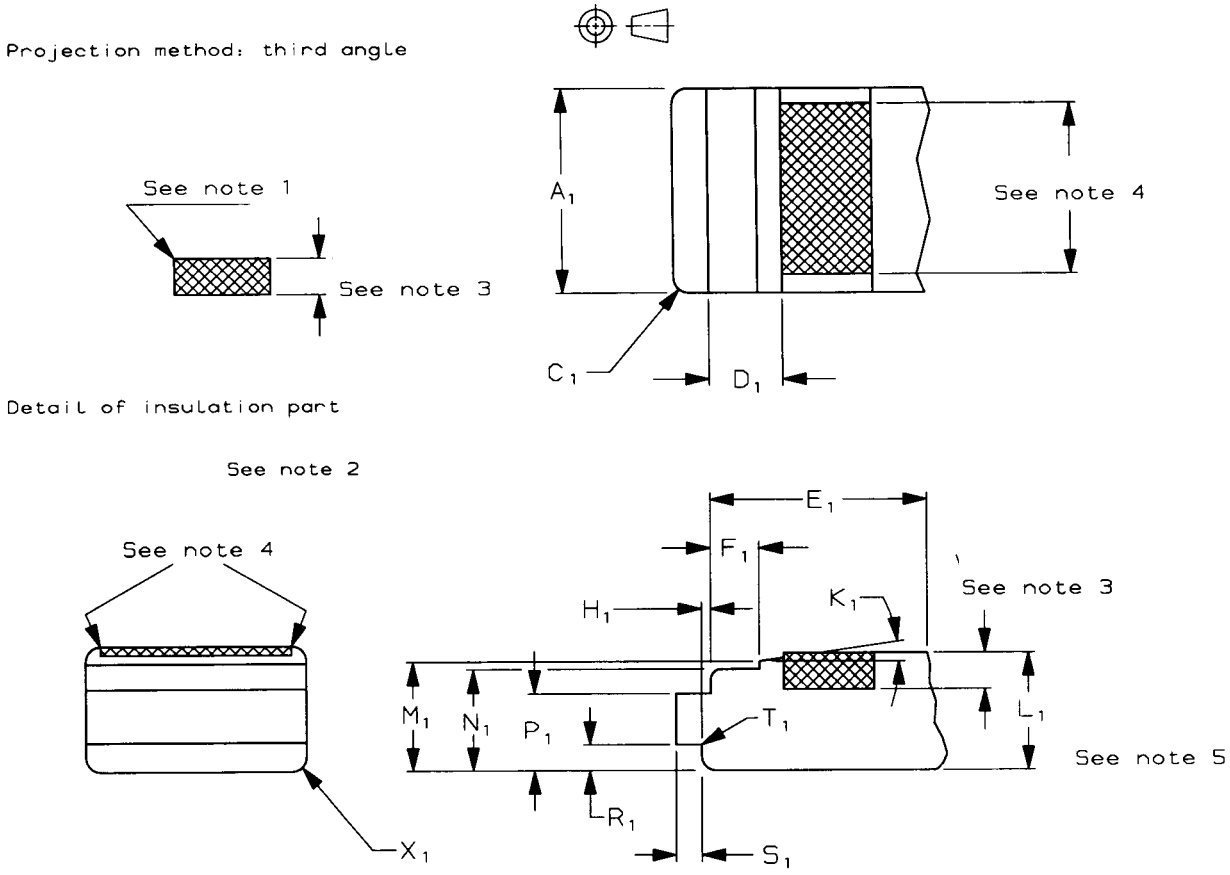


Figure C.1 – Gauge

NOTES

1 Sharp edge.

2 Insulation part made from 20 % glass-filled PBT.

3 Final assembled height: $6{,}71\ ^{+0{,}03}_{-0{,}01}$

4 Edge of insulation part may not extend beyond radius of steel part.

5 Dimension to edge of insulation part

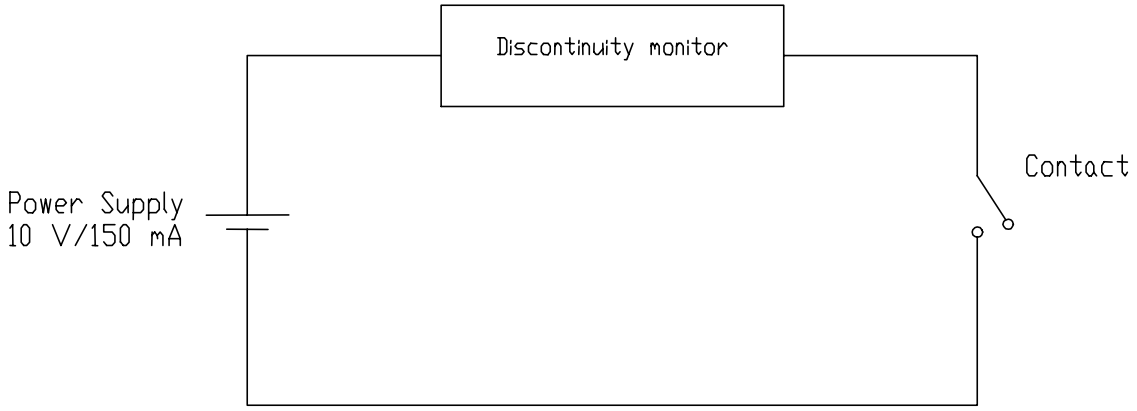


Figure C.2 – Discontinuity test circuit

The equipment used for discontinuity monitoring shall have sufficient sensitivity to detect the specified value in test phase P1.

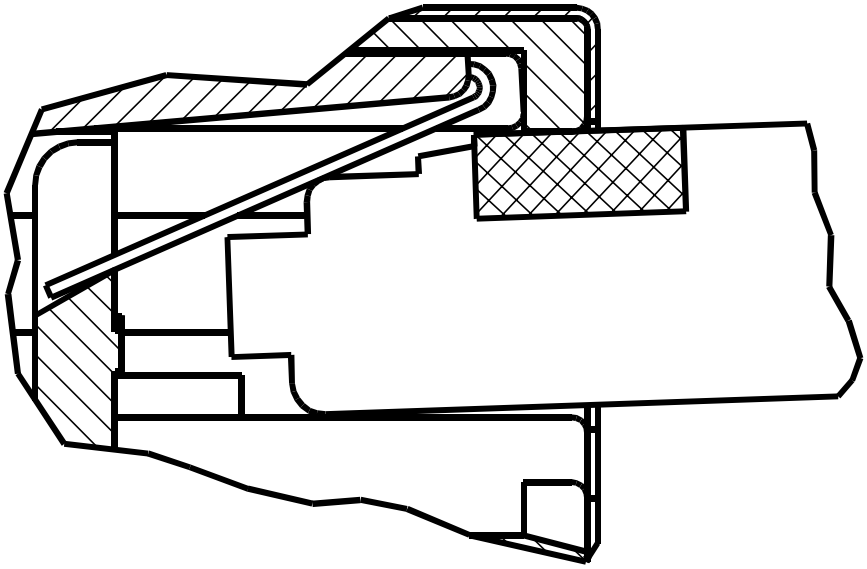


Figure C.3 – Gauge insertion

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