BRITISH STANDARD

BS EN 60603-9:1998
IEC 60603-9: 1990

Connectors for frequencies below 3 MHz for use with printed boards —

Part 9: Two-part connectors for printed boards, backpanels and cable connectors, basic grid of 2,54 mm (0,1 in)

The European Standard EN 60603-9:1998 has the status of a British Standard

ICS 31.220.10

National foreword

This British Standard is the English language version of EN 60603-9:1998. It is identical with IEC 60603-9:1990.

The UK participation in its preparation was entrusted by Technical Committee EPL/48, Electromechanical components for electronic equipment, to Subcommittee EPL/48/2, Connectors for electronic equipment, which has the responsibility to:

— aid enquirers to understand the text;

— present to the responsible international/European committee any enquiries on the interpretation, or proposals for change, and keep the UK interests informed;

— monitor related international and European developments and promulgate them in the UK.

A list of organizations represented on this subcommittee can be obtained on request to its secretary.

From 1 January 1997, all IEC publications have the number 60000 added to the old number. For instance, IEC 27-1 has been renumbered as IEC 60027-1. For a period of time during the change over from one numbering system to the other, publications may contain identifiers from both systems.

Cross-references

Attention is drawn to the fact that CEN and CENELEC Standards normally include an annex which lists normative references to international publications with their corresponding European publications. The British Standards which implement these international or European publications may be found in the BSI Standards Catalogue under the section entitled "International Standards Correspondence Index", or by using the "Find" facility of the BSI Standards Electronic Catalogue.

A British Standard does not purport to include all the necessary provisions of a contract. Users of British Standards are responsible for their correct application.

Compliance with a British Standard does not of itself confer immunity from legal obligations.

Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, the EN title page, pages 2 to 68 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.

Amendments issued since publication

Amd. No.	Date	Comments

This British Standard, having been prepared under the direction of the Electrotechnical Sector Board, was published under the authority of the Standards Board and comes into effect on 15 May 1998

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Contents

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EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 60603-9

February 1998

ICS 31.220.10

Descriptors: Electronic components, electric connectors, printed-circuit cards, connector plugs, designation, dimensions, assembling, couplings, tests

English version

Connectors for frequencies below 3 MHz for use with printed boards
Part 9: Two-part connectors for printed boards, backpanels and cable connectors, basic grid of 2,54 mm (0,1 in)

(IEC 60603-9:1990)

Connecteurs pour fréquences inférieures à 3MHz pour utilisation avec cartes imprimées
Partie 9: Connecteurs pour cartes imprimées enfichables, connexions fond de panier et connecteurs de câble, pour grille de base de 2,54 mm (0,1 in)
(CEI 60603-9:1990)

Stekverbinder für gedruckte Schaltungen für Frequenzen unter 3MHz
Teil 9: Indirekte Steckverbinder für gedruckte Schaltungen, Rückplatten und Kabelanschluß
Rastermaß 2,54 mm (0,1 in)
(IEC 60603-9:1990)

This European Standard was approved by CENELEC on 1998-01-01. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CENELEC member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CENELEC member into its own language and notified to the Central Secretariat has the same status as the official versions.

CENELEC members are the national electrotechnical committees of Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and United Kingdom.

CENELEC

European Committee for Electrotechnical Standardization
Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

Central Secretariat: rue de Stassart 35, B-1050 Brussels

Ref. No. EN 60603-9:1998 E

Foreword

The text of the International Standard IEC 60603-9:1990, prepared by SC 48B, Connectors, of IEC TC 48, Electromechanical components and mechanical structures for electronic equipment, was submitted to the formal vote and was approved by CENELEC as EN 60603-9 on 1998-01-01 without any modification.

The following dates were fixed:

- latest date by which the EN has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 1998-12-01
- latest date by which the national standards conflicting with the EN have to be withdrawn (dow) 1998-12-01

Annexes designated "normative" are part of the body of the standard.

In this standard, Annex ZA is normative.

Annex ZA has been added by CENELEC.

Endorsement notice

The text of the International Standard IEC 60603-9:1990 was approved by CENELEC as a European Standard without any modification.

Contents

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1 Scope

This standard covers a group of related two-part connectors for printed boards and cable connectors associated with printed backpanels. The group covers high-density connectors having up to 96 miniature contacts for low-voltage applications, hereinafter called “signal contacts”, connectors having up to 6 high current contacts, hereinafter called “power contacts”, combined with up to 42 signal contacts and a range of 4, 10, 20 and 64 way female cable connectors and associated male parts for making connection to the backpanel or to the printed board (see Figure 1 and Figure 2, pages 6 and 7).

The board-mounted connectors with female contacts are provided with terminations suitable for printed boards in accordance with IEC Publication 326 and using a grid of 2,54 mm (0,100 in) as laid down in IEC Publication 97.

A first range of fixed connectors with male signal contacts is assembled on the backpanel by signal contacts and moulded housings. These male signal contacts have compliant press-in sections (optional additional soldering) suitable for use in backpanels with a grid of 2,54 mm (0,100 in) according to IEC Publication 97. (The press-in technique is under consideration.)

The individual male contacts are suitable for additional wrapping (see Figure 1).

A second range of independent male connectors with solder terminals for printed back-panel mounting is included (see Figure 2).

First-to-make contact facilities can be provided on the connection between the printed board and the backpanel.

The two-row cable connectors are intended to connect round cables having up to 64 cores of 0,25 mm (0,010 in) or 0,5 mm (0,020 in) diameter conductors. Connections are made with the insulation displacement technique (under consideration for specification). Furthermore, male connectors for printed board mounting to mate with these cable connectors are included (see Figure 2).

This standard shall be used in conjunction with IEC Publications 50(581), 97, 194, 326, 352-1, 512, 603-1 and 603-2.

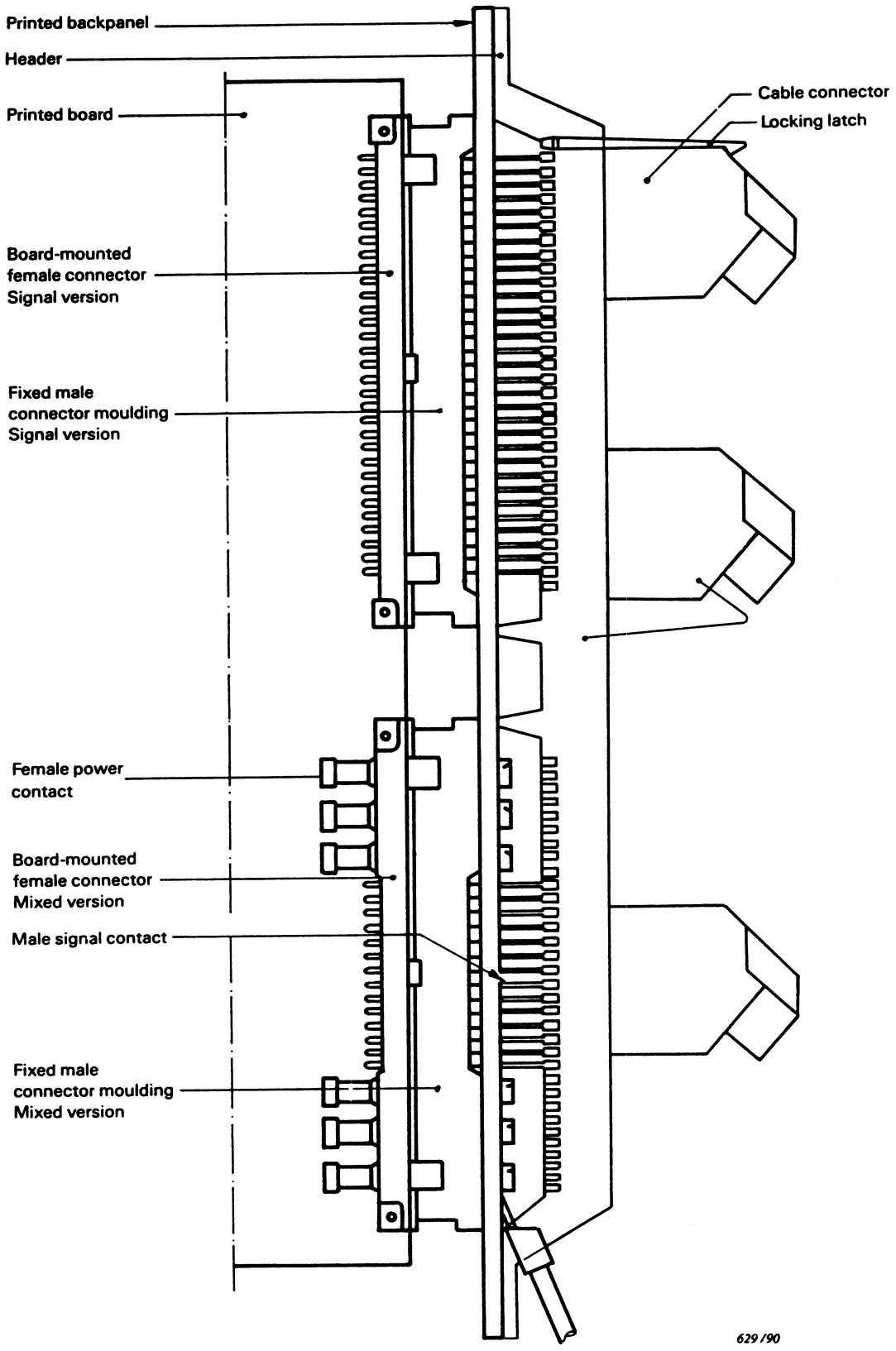


Figure 1 — General view of the connection system; male connectors, range 1 (press-in technique)

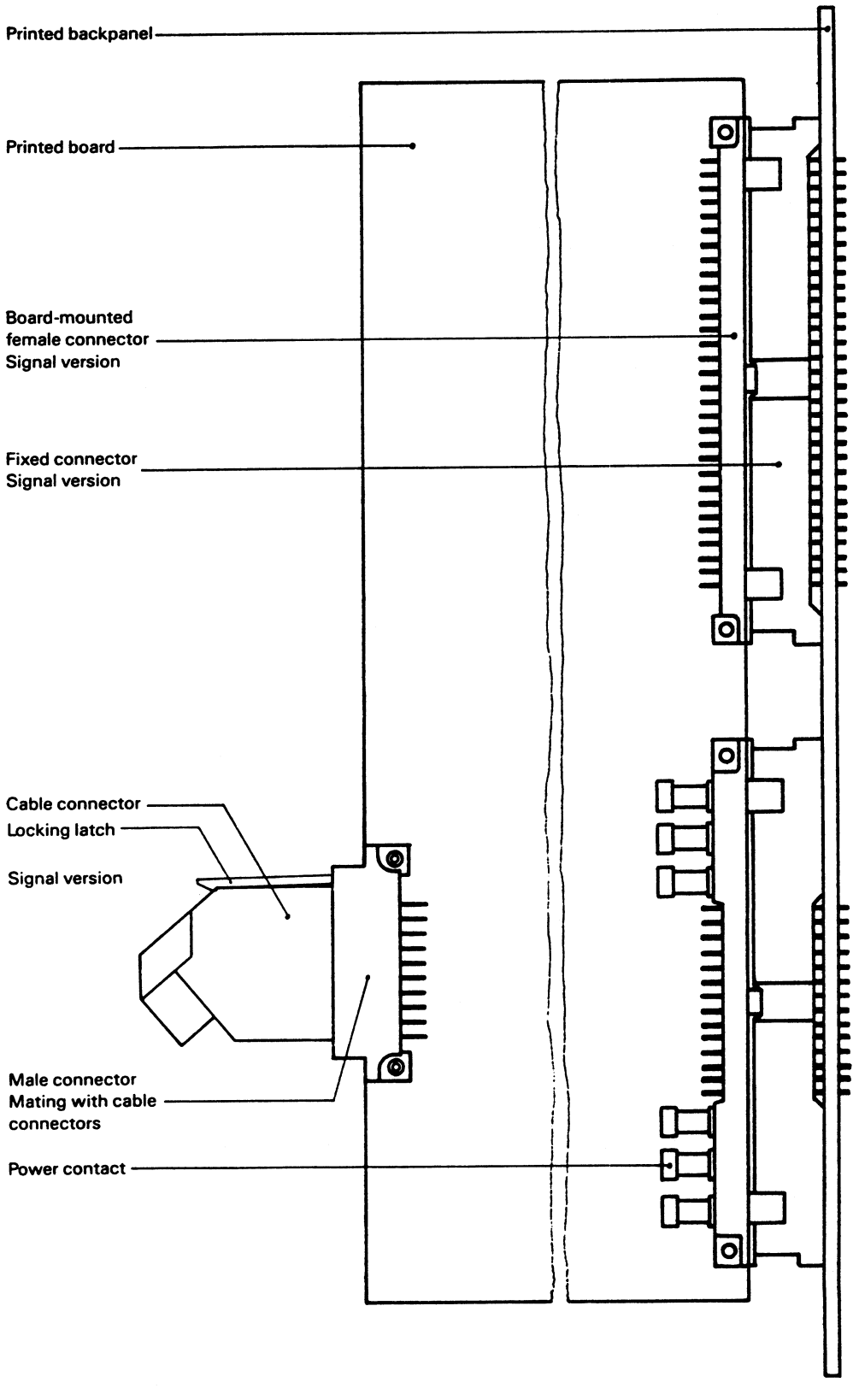
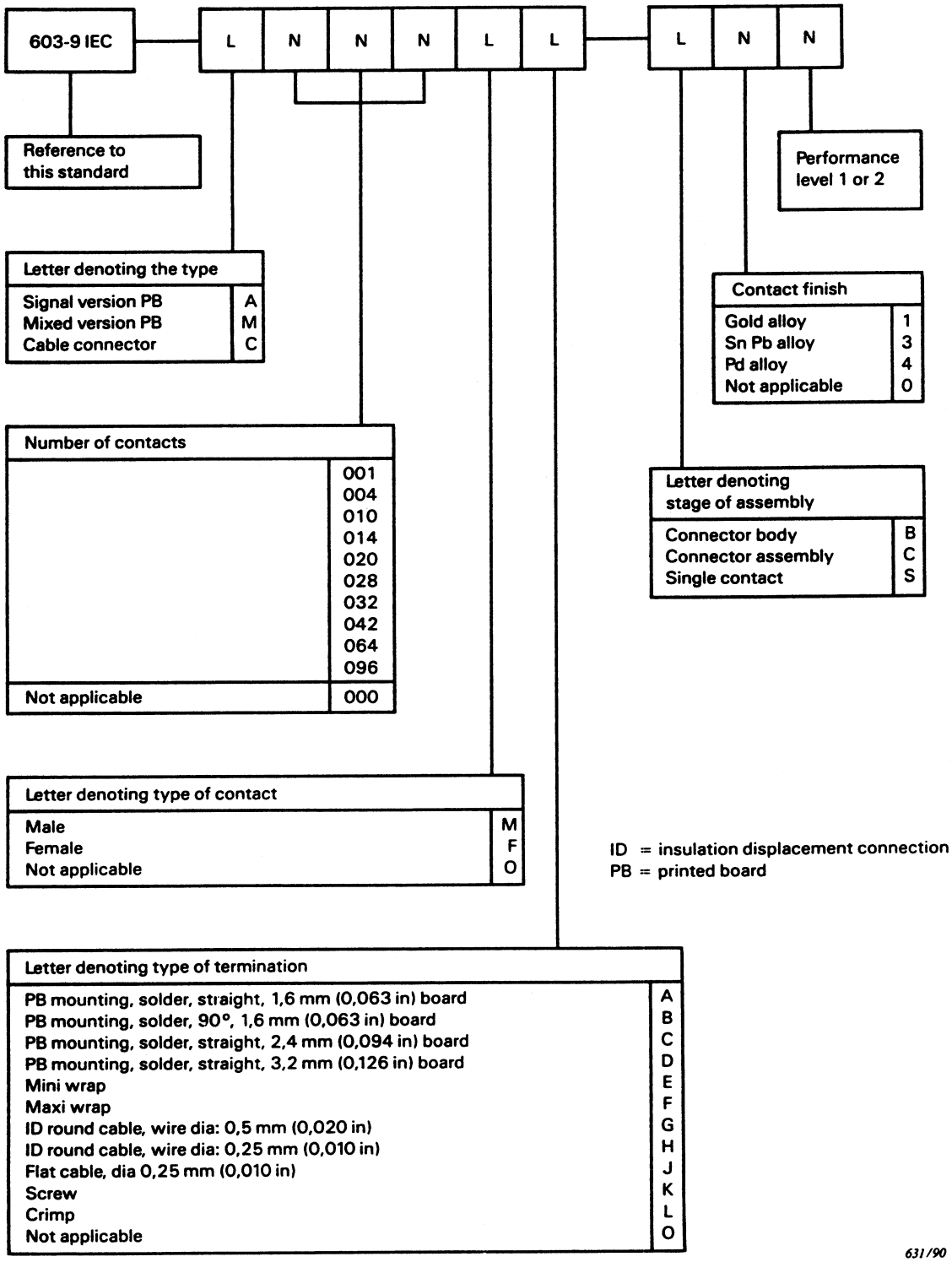


Figure 2 — General view of the connection system; male connectors, range 2 (soldered)

2 IEC type designation

Connectors, connector bodies and contacts according to this standard shall be designated by the following system:



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

Example: Connector type A having 96 female contacts gold finished with solder terminations bent 90° for 1,6 mm (0,063 in) nominal thickness boards, performance level 1:603-9 IEC-A096 FB-C1-1.

NOTE In Clause **4**, type designations show an "X". This means that the feature is variable.

3 Common features

3.1 Mounting dimensions

3.1.1 *Reference system*

A line in the mounting plane of the fixed connector and passing through the nominal position of the centres of row "b" male contacts is used as datum line, Figure 3 and Figure 4, pages 10 and 11. The dimensions in Sub-clauses **3.1.2** and **3.1.3** are defined with respect to this datum.

3.1.2 *Fixed connector*

a) General

For the basic concept of the fixed connector, the male signal contacts have compliant centre-sections for insertion into a backpanel of thickness 3,2 mm (0,126 in). There is the option of using the solderless press-in technique or soldering the contact to the backpanel. The choice depends upon the backpanel hole dimensions and finish, and upon the preference of the user. The male power contacts are inserted in the male contact housing and fixed to the backpanel by screws which also secure appropriate termination devices. The moulded housing has no fixing holes but is retained by an interference fit on the male signal contacts.

Additionally, an independent male connector with straight solder terminations for back-panels 2,4 mm (0,094 in) thick is included.

b) Position of the contacts and terminations

The distances between centres of the contacts are 2,54 mm (0,100 in) or multiples thereof in the X and Y axes. The terminations of the press-in contacts shall be located so as to permit automatic wiring techniques.

3.1.3 *Printed board assembly*

The following positions are shown in Figure 3 (connector system range 1) and Figure 4 (connector system range 2) and described in Table 1

— positions of the board-mounted female connectors;

— positions of the mounting holes of the board-mounted female connectors, see also Figure 30 and Figure 31, pages 44 & 45;

— position of the printed board;

— position of the grid of the printed board.

The terminations of the signal contacts of the board-mounted connectors shall fit into holes of printed boards according to IEC Publication 326 and shall be located on a grid of 2,54 mm (0,100 in) according to IEC Publication 97.

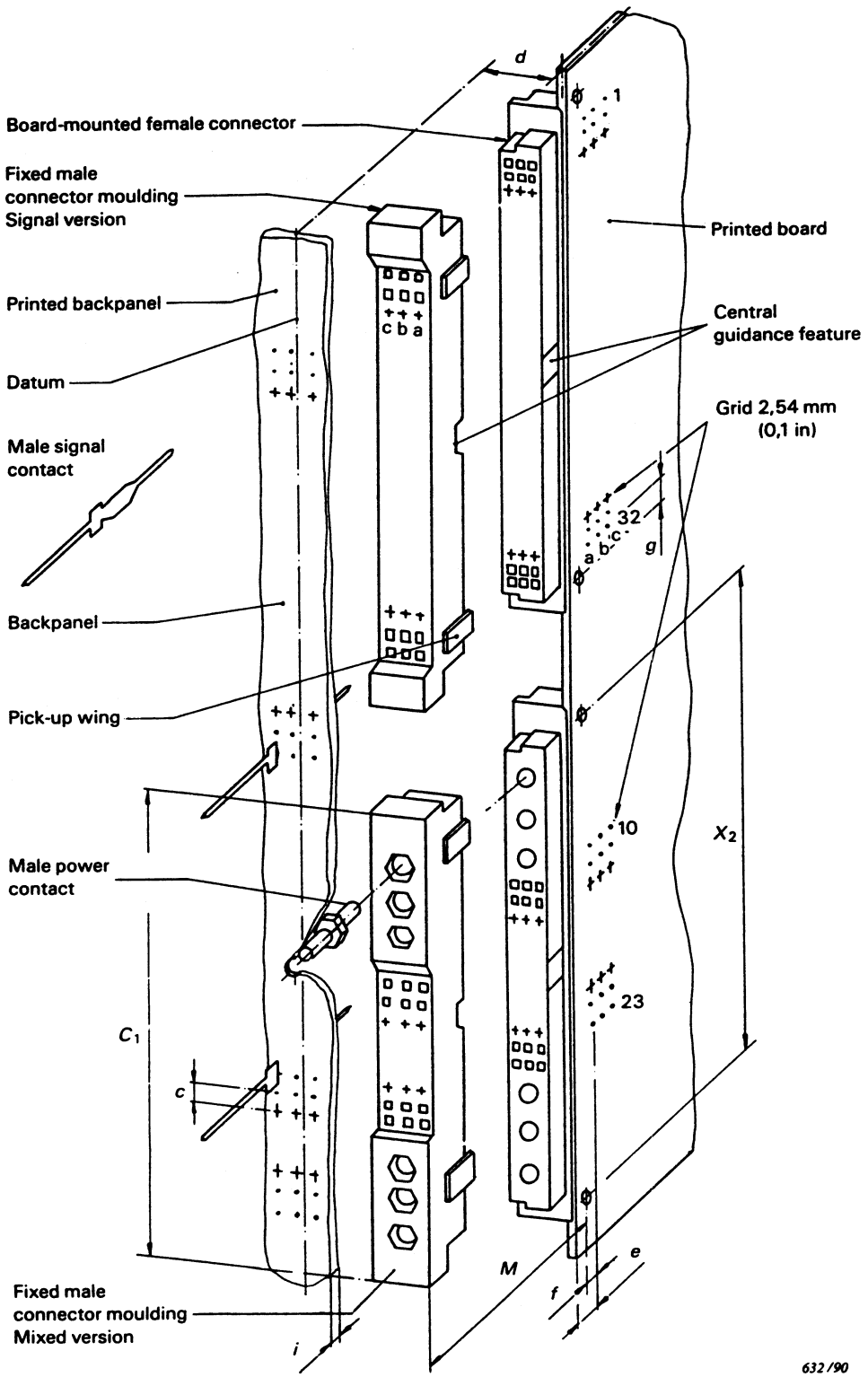


Figure 3 — Isometric view and basic dimensions for connector system, range 1

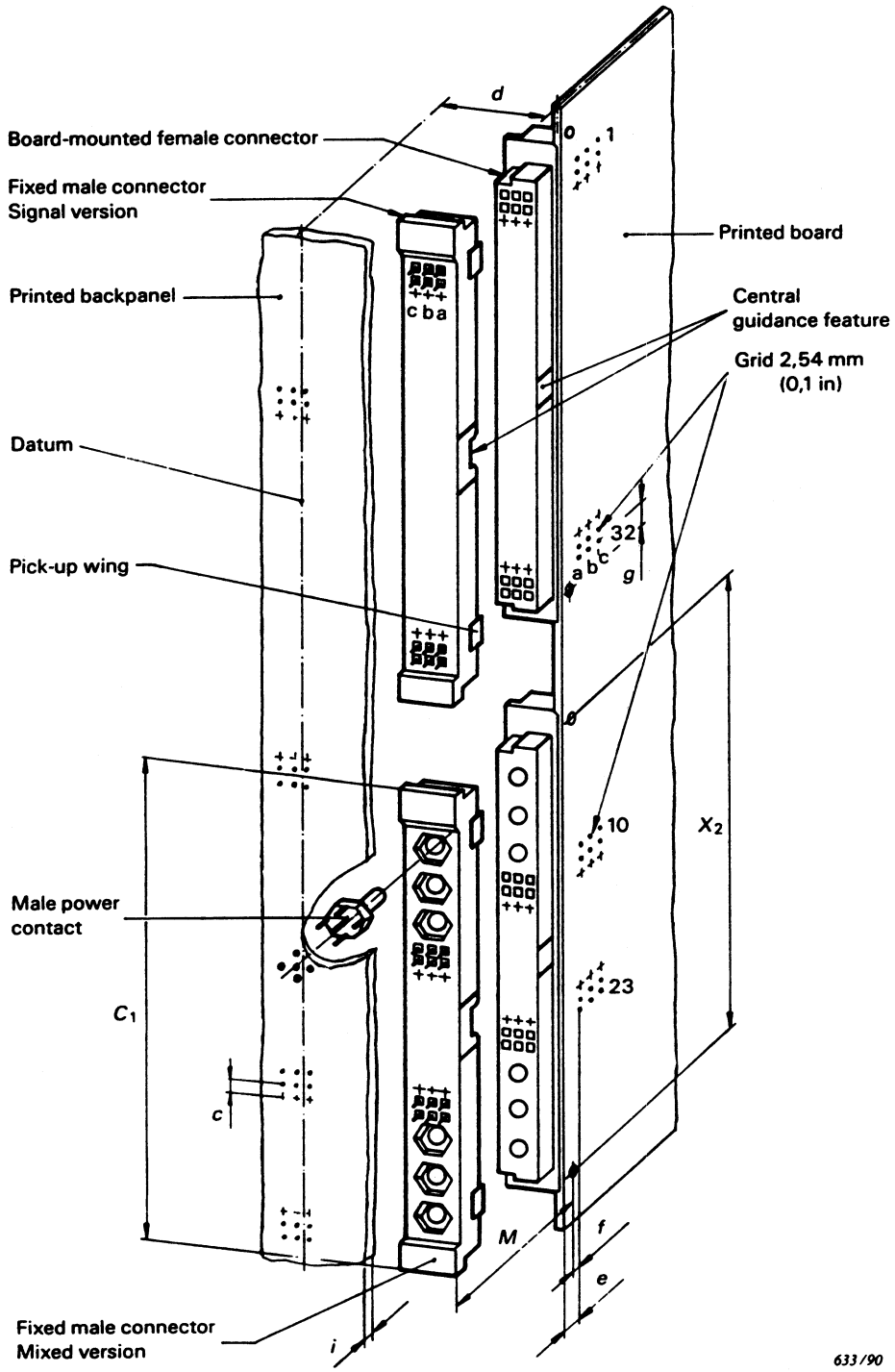


Figure 4 — Isometric view and basic dimensions for connector system, range 2

3.1.4 ***Isometric views and values*** (see Figure 3 and Figure 4, pages *10* and *11*)

Table 1

Reference letter	Dimensions		Description
	mm	in	
C_1	94	3,701	Maximum overall length of the fixed connector
M	17,46 14,96	0,687 0,589	Range of 2,5 mm (0,098 in) in which reliable contact is ensured NOTE See Sub-clause **3.2** for mating information
X_1 [a]	—	—	—
X_2	88,90	3,500	Distance between the two mounting holes of the board-mounted connector NOTE The mounting holes are also located on the grid of 2,54 mm (0,100 in) according to IEC Publication 97
a [a]	—	—	—
b [a]	—	—	—
c	2,54	0,100	Grid dimension of the terminations of the fixed connector
d	5,08	0,200	Distance between datum line and centreline of a 1,6 mm printed board
e	5,08	0,200	Distance between the edge of the printed board and the first row of component holes for the board-mounted connector
f	2,54	0,100	Distance between the mounting holes and the first row of component holes for the board-mounted connector
g	5,08	0,200	Distance between a mounting hole and the component hole for the termination No. 1 or No. 32 of the board-mounted connector
h [a]	—	—	—
i	3,20	0,126	Thickness of backpanel for the fixed connector

[a] No mechanical fixing holes — letter only for reference with other standardized connector families.

3.2 Mating information

3.2.1 ***Plug-in direction***

The engagement depth of both male and female mouldings is such that the specified contact resistance is ensured within the range M = 14,96 mm to 17,46 mm (0,589 in to 0,687 in), first-to-make/last-to-break contact facilities included (see Figure 5).

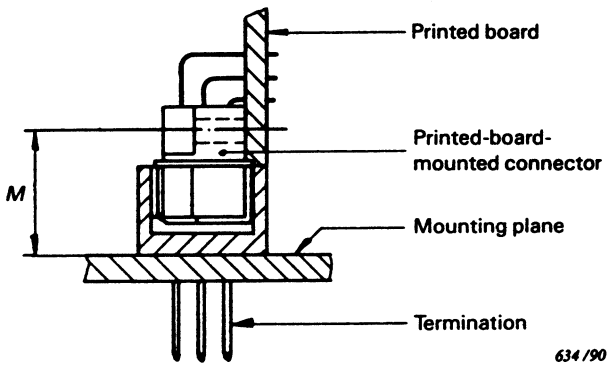
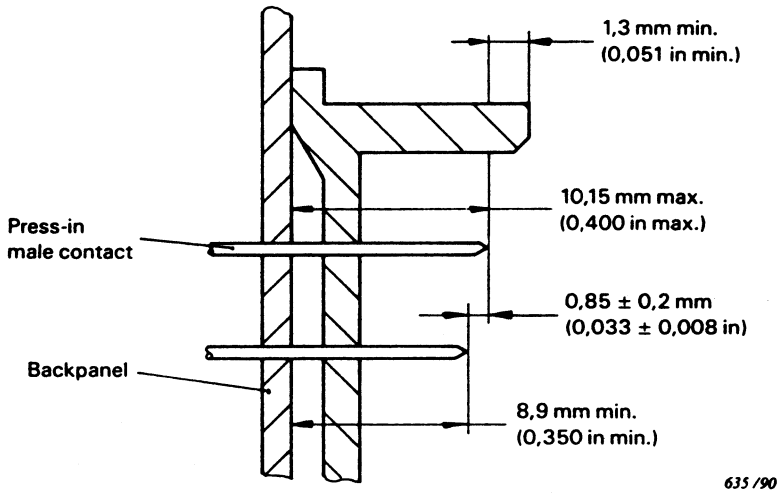


Figure 5

The design also ensures adequate protection of the tips of the first-to-make/last-to-break contacts. These contacts are provided solely by inserting the appropriate male signal contacts further through the backpanel as shown in Figure 6 such that the tips of these contacts are a nominal 0,85 mm (0,033 in) in advance of the tips of the remaining contacts.

NOTE To ensure the first-to-make/last-to-break contact function, it is recommended that the electrical signal of the first-to-make/last-to-break contacts be applied in parallel to protruding contacts at both ends of each equipped contact row.



NOTE If the male connector is assembled by the user it is his responsibility to guarantee the dimensions indicated in Figure 6.

Figure 6

3.2.2 *Perpendicular to plug-in direction*

The design of the board-mounted and the fixed connectors is such that a displacement of at least 2 mm (0,079 in) in the transverse direction of the connectors and 1 mm (0,039 in) in the longitudinal direction of the connectors can be accommodated, provided that the printed board has freedom to move (see Figure 7).

NOTE With two connector assemblies mounted rigidly in line on a backpanel and on a plug-in unit, a position tolerance of 0,1 mm (0,004 in) diameter on the termination holes of the boards will ensure the correct alignment and mating of the connectors without the need to use assembly jigs.

The central guidance is provided to reduce the total tolerance field in the case of in-line mounting such that, in practice, a proper entering of the contacts into the female cavity is ensured in the case of maximum board inclination and backpanel bow. The pick-up wings, extending the chamfer of the long walls of the male moulding, assist in the final alignment of female connectors fitted to bowed printed boards (see Figure 7).

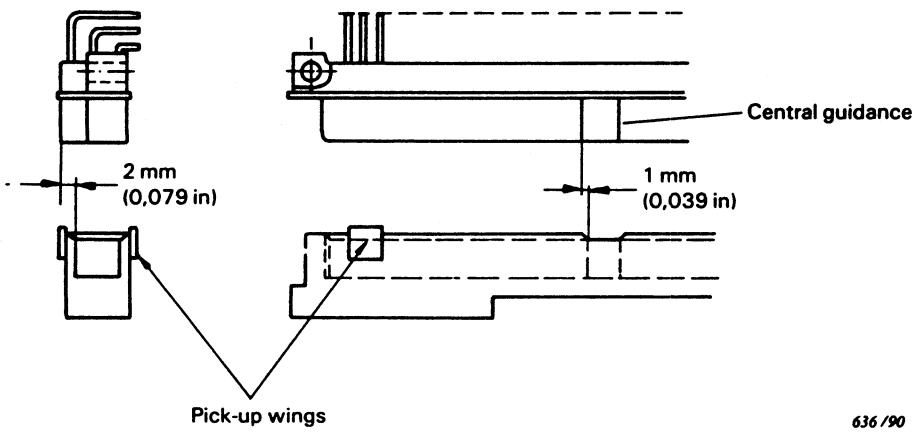


Figure 7

3.2.3 ***Inclination***

The design of the board-mounted and fixed connectors is such as to allow for an initial angular misalignment of 4° in longitudinal axis and 2° in transverse axis, and still ensure the first-to-make/last-to-break mating when the contacts with this function are placed in each row in the 1st or 2nd position from both ends of each connector (see Figure 8).

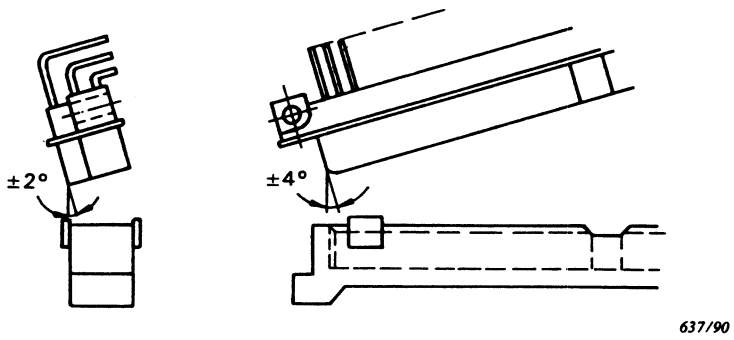


Figure 8

3.3 Survey of types

Table 2

<table>
<tr><th>Type and number of contacts</th><th>A032</th><th>A064</th><th>A096</th><th>M014</th><th>M028</th><th>M042</th><th>C004</th><th>C010</th><th>C020</th><th>C064</th></tr>
<tr><td>Smallest pitch of adjacent connectors
$n \times 2{,}54$ mm
($n \times 0{,}100$ in)</td><td colspan="6">5</td><td>4</td><td>4</td><td>4</td><td>6</td></tr>
<tr><td>Current carrying capacity at 70 °C (see Clause 6)</td><td colspan="3">1,3 A</td><td colspan="3">Signal contacts: 1,3 A
Power[a] Contacts: 30 A</td><td colspan="4">1,3 A</td></tr>
<tr><td>Minimum creepage and clearance[b]
between contacts and chassis
creepage</td><td colspan="6">1,8 mm (0,071 in)</td><td colspan="4"></td></tr>
<tr><td>clearance
between adjacent contacts on 2,54 mm (0,100 in) grid</td><td colspan="6">1,6 mm (0,063 in)</td><td colspan="4"></td></tr>
<tr><td>creepage</td><td colspan="6">1,2 mm (0,047 in)</td><td colspan="4">0,5 mm (0,020 in)</td></tr>
<tr><td>clearance
between adjacent contacts on 5,08 mm (0,200 in) grid</td><td colspan="6">1,2 mm (0,047 in)</td><td colspan="4">0,5 mm (0,020 in)</td></tr>
<tr><td>creepage</td><td colspan="6">3,0 mm (0,118 in)</td><td colspan="4"></td></tr>
<tr><td>clearance</td><td colspan="6">3,0 mm (0,118 in)</td><td colspan="4"></td></tr>
<tr><td colspan="11">[a] Maximum current rating per contact, depending also on the crimp connection. The current rating per connector at 70 °C is 65 A max.
[b] Application information:
— Permissible operating voltages depend on the application and the applicable or specified safety requirements.
— Reductions in creepage or clearance distances may occur due to the printed board or the wiring used and shall be duly taken into account.</td></tr>
</table>

4 Dimensions

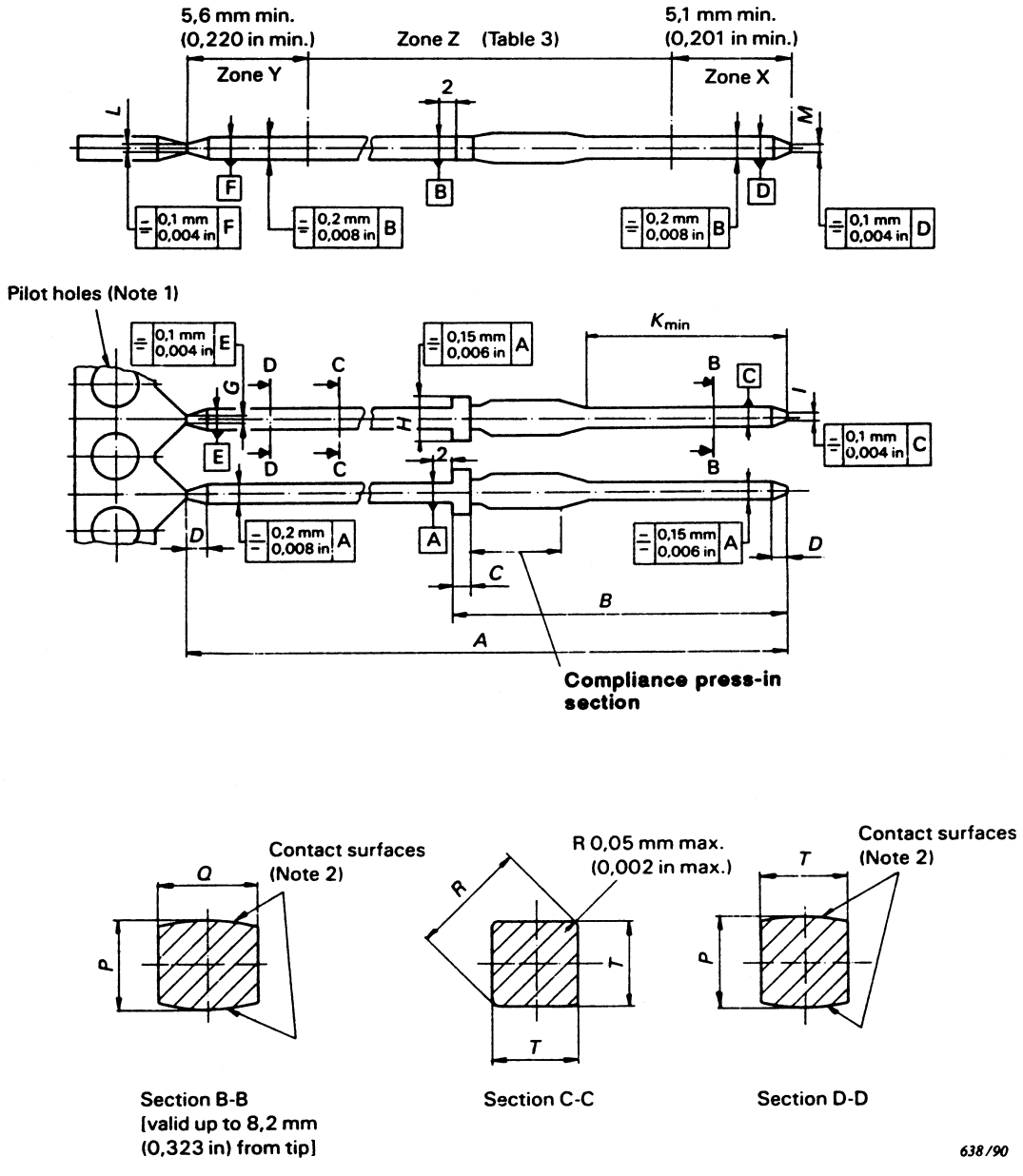
4.1 General

The dimensions in millimetres are original. The following drawings are shown in first angle projection. The shapes of the connectors may deviate from those given in the drawings below as long as the specified dimensions are not influenced. The basic dimensions contained in Clause **3** are mandatory but only repeated in subsequent clauses if necessary.

4.2 Fixed connector and header dimensions

4.2.1 *Dimensions of male contacts (range 1)*

4.2.1.1 *Male signal contact for cable connectors and solderless wrapped connections, types 603-9 IEC-A001 ME-SX-X*



NOTE 1 For dimensions related to carrier strips, it is recommended that pilot holes be agreed upon between manufacturer and user (to suit automatic or semi-automatic insertion in production).
NOTE 2 Contact surface coined to guarantee male-female contact on the contact surface when the terminal is turned 6° max.

Figure 9

Table 3

Zone	X	Y	Z
Mates with	Board-mounted connector	Free cable connector	Backpanel and wire wrap connection

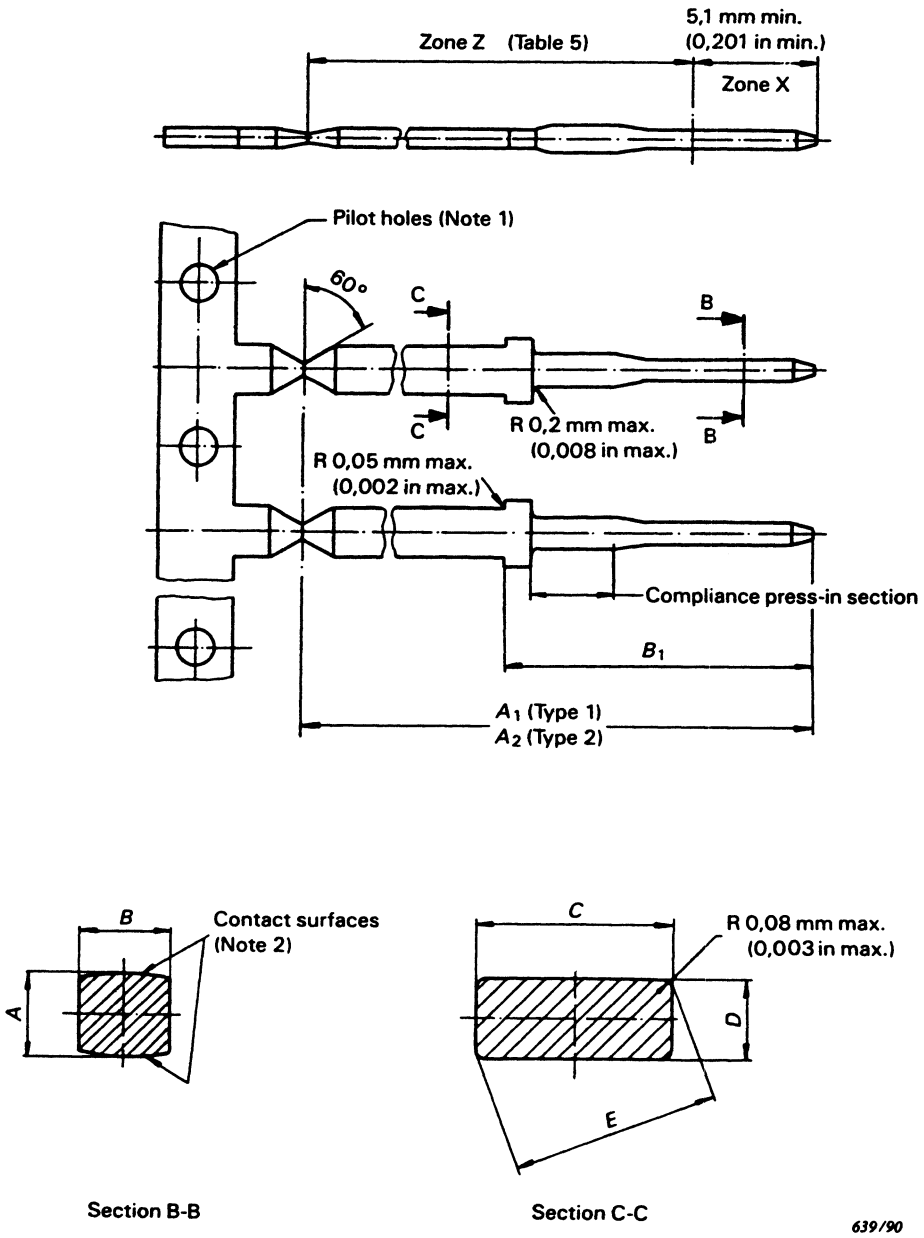
Table 4 — Values of dimensions shown in Figure 9, page 16

	A	*B*	*C*	*D*		
mm	32,40 32,20	14,65 14,50	0,75 0,70	0,55 0,45		
in	1,276 1,268	0,577 0,571	0,0295 0,0276	0,022 0,081		

	G	*H*	*I*	*K*	*L*	*M*
mm	0,45 0,35	1,35 1,25	0,25 0,15	min. 8,2	0,3 0,2	0,25 0,10
in	0,018 0,014	0,053 0,049	0,010 0,006	min. 0,323	0,012 0,008	0,010 0,004

			P	*Q*	*R*	*T*
mm			0,61 0,56	0,70 0,65	0,86 0,76	0,69 0,59
in			0,024 0,022	0,028 0,026	0,034 0,030	0,027 0,023

4.2.1.2 *Male single contact for solderless wrapped connections according to IEC Publication 352-1, types 603-9 IEC-A000 MF-SX-X*



NOTE 1 For dimensions related to carrier strips, it is recommended that pilot holes be agreed upon between manufacturer and user (to suit automatic or semi-automatic insertion in production).

NOTE 2 Contact surface coined to guarantee male-female contact on the contact surface when the termination is turned 6° max.

Figure 10

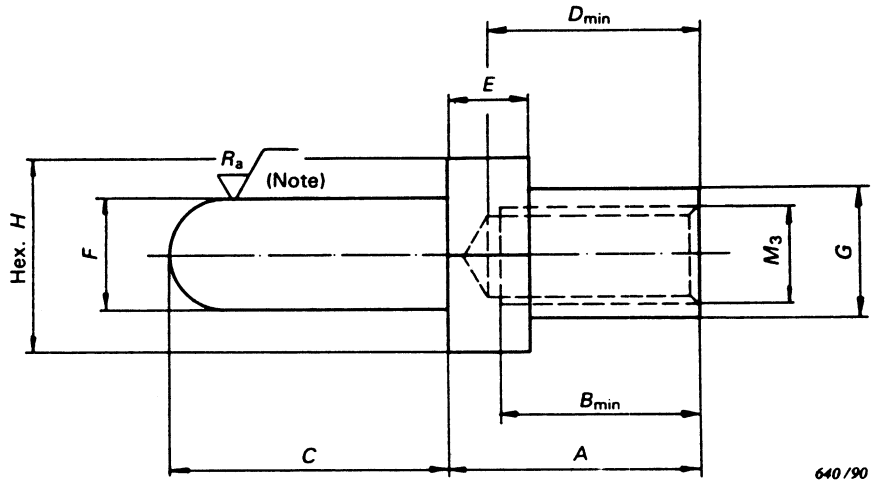
Table 5

Zone	X	Z
Mates with	Board-mounted connector	Backpanel and wire wrap connection

Table 6 — Values of dimensions shown in Figure 10, page 18

	A	A_1	A_2	*B*	B_1	*C*	*D*	*E*
mm	0,66 0,56	24,1 23,9	29,1 28,9	0,70 0,65	15,35 15,20	1,6 1,4	0,68 0,58	1,65 1,50
in	0,026 0,022	0,949 0,941	1,146 1,138	0,028 0,026	0,604 0,598	0,063 0,055	0,027 0,023	0,065 0,059
(For other dimensions, see Figure 9, page 16, and Table 4.)								

4.2.1.3 *Male power contact (version with threaded fixing), types 603-9 IEC-M001 ML-SX-X*



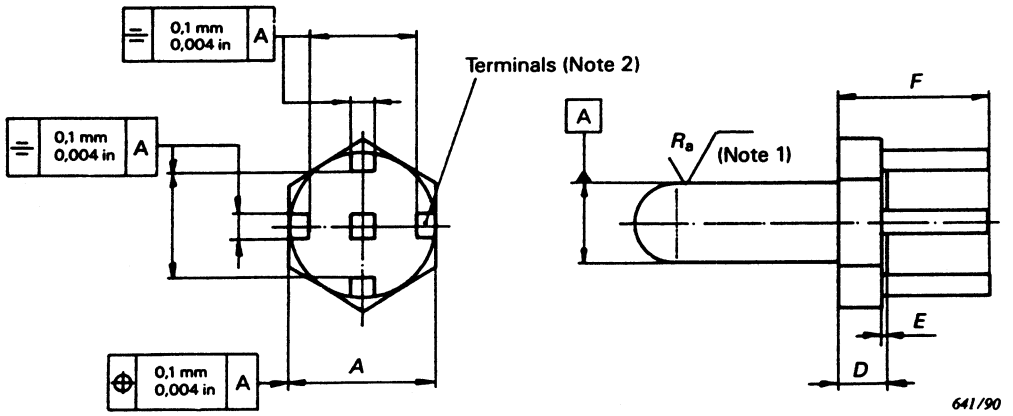
NOTE $R_a \leq 0{,}8$ µm (31 µin); surface roughness according to ISO Standard 468.

Figure 11

Table 7 — Values of dimensions shown in Figure 11

	A	*B*	*C*	*D*	*E*	*ØF*	*ØG*	*H*
mm	7,6 7,4	min. 5	8,6 8,4	min. 6	2,6 max.	3,62 3,55	4,0 3,8	6,1 5,9
in	0,299 0,291	min. 0,197	0,339 0,331	min. 0,263	0,102 max.	0,143 0,140	0,157 0,150	0,240 0,232

4.2.1.4 *Male power contact (version for solder fixing), types 603-9 IEC-M001 MC-SX-X*



NOTE 1 $R_a \leq 0{,}8$ µm (31 µin); surface roughness according to ISO Standard 468.
NOTE 2 Suitable for holes 1,6 mm (0,063 in) nominal diameter in accordance with IEC Publication 326, grid 2,54 mm (0,100 in).

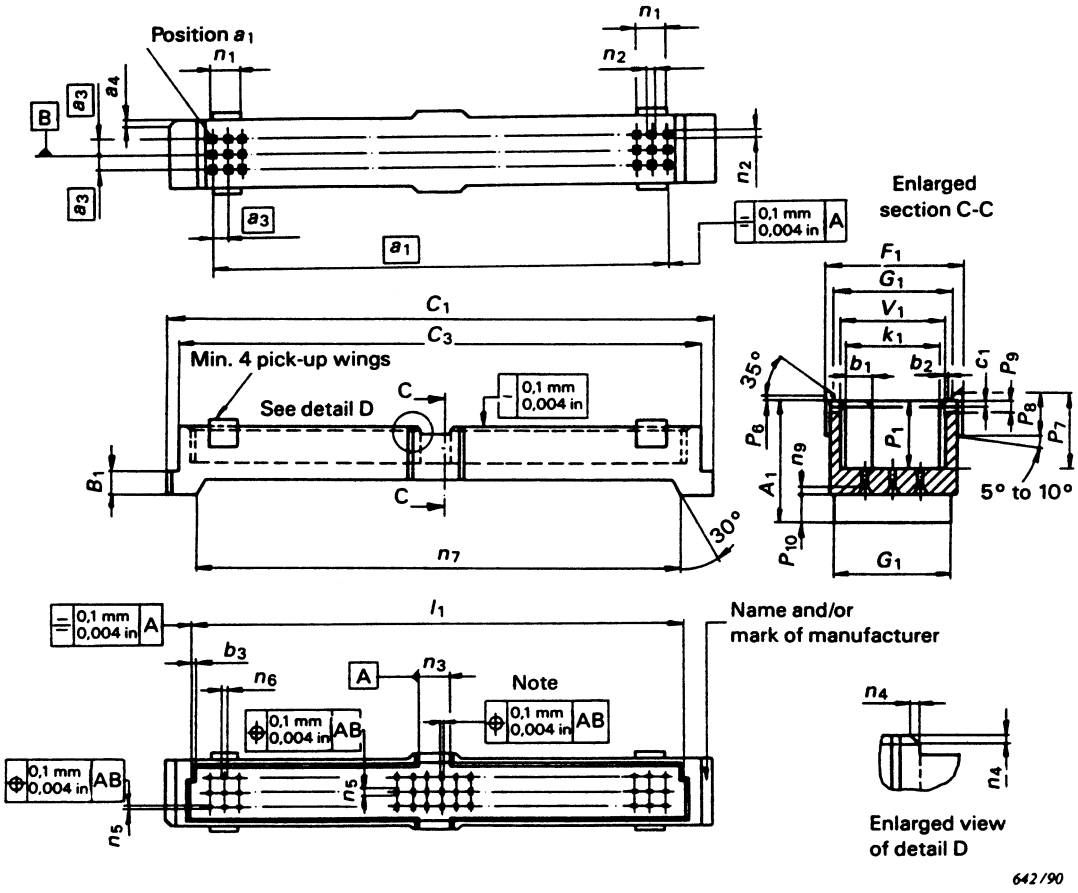
Figure 12

Table 8 — Values of dimensions shown in Figure 12

	A	*D*	*E*	*F*
mm	5,9 5,8	2,4 2,25	0,5 0,2	6,15 5,95
in	0,232 0,228	0,094 0,089	0,020 0,008	0,242 0,234
(For other dimensions, see Figure 11, page 19, and Table 7.)				

4.2.2 *Mouldings for fixed connectors (range 1)*

4.2.2.1 *Dimensions of fixed male connector moulding, signal version, types 603-9 IEC-A096 MO-BO-X*



NOTE Cavities in positions 14 to 19 shall be such that the force to press on and pull off the male moulding over the male signal contacts is in accordance with Sub-clause **6.3**.

Figure 13

Table 9 — Values of dimensions shown in Figure 13, page 21

	A_1	B_1	C_1	C_3	G_1	F_1	P_1
mm	11,55 11,45	4,1 3,9	94,0 max.	90,1 89,9	11,10 10,90	12,7 12,5	7,8 7,7
in	0,455 0,451	0,161 0,153	3,701 max.	3,547 3,539	0,437 0,429	0,500 0,492	0,307 0,303

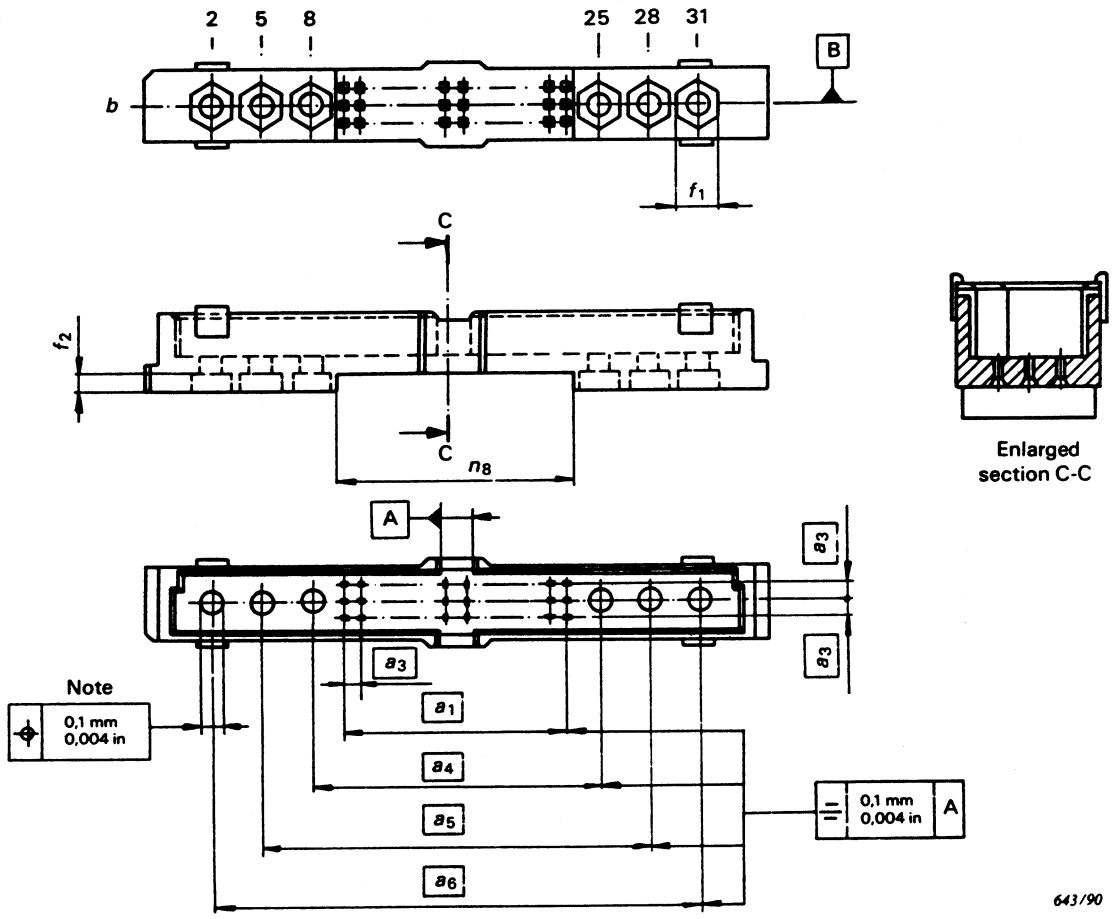
	P_6	P_1	P_s	P_9	P_{10}	V_1	a_1
mm	0,5 0,3	8,5 8,3	4,6 4,4	1,3 1,2	1,6 1,4	9,8 9,7	31 × 2,54 = 78,74
in	0,020 0,012	0,335 0,327	0,181 0,173	0,051 0,047	0,063 0,055	0,386 0,382	31 × 0,1 = 3,100

	a_3	a_4	b_1	b_2	b_3	c_1	k_1
mm	2,54	0,8 × 45°	2,5 2,3	0,9 0,8	1,0 0,9	0,65 0,55	8,8 8,7
in	0,100	0,031 × 45°	0,098 0,091	0,035 0,031	0,039 0,035	0,026 0,022	0,346 0,343

	l_1	n_1	n_2	n_3	n_4	n_5	n_6
mm	85,8 85,6	(5,08)	1,7 1,5	5,10 5,05	0,65 0,55	0,68 max.	0,8 0,7
in	3,378 3,370	(0,200)	0,067 0,059	0,201 0,199	0,026 0,022	0,027 max.	0,031 0,028

	n_7	n_9					
mm	83,7 83,5	0,8 0,6					
in	3,295 3,287	0,031 0,024					

4.2.2.2 *Dimensions of fixed male connector moulding, mixed version, types 603-9 IEC-M042 MO-BO-X*



NOTE In the power cavity position, the diameter shall be such that the force to press in and pull out male power contacts from the male housing is in accordance with Sub-clause **6.3**.

Figure 14

Table 10 — Values of dimensions shown in Figure 14

	a_1	a_3	a_4	a_5	a_6
mm	13 × 2,54 = 33,02	2,54	43,18	58,42	73,66
in	13 × 0,100 = 1,300	0,100	1,700	2,300	2,900

	f_1	f_3	n_8		
mm	6,3 6,1	2,8 2,6	35,6 35,3		
in	0,248 0,240	0,110 0,102	1,401 1,390		
(For other dimensions, see Figure 13, page 21, and Table 9.)					

4.2.2.3 *Dimensions of the front header, types 603-9 IEC-C064 MO-BO-X*

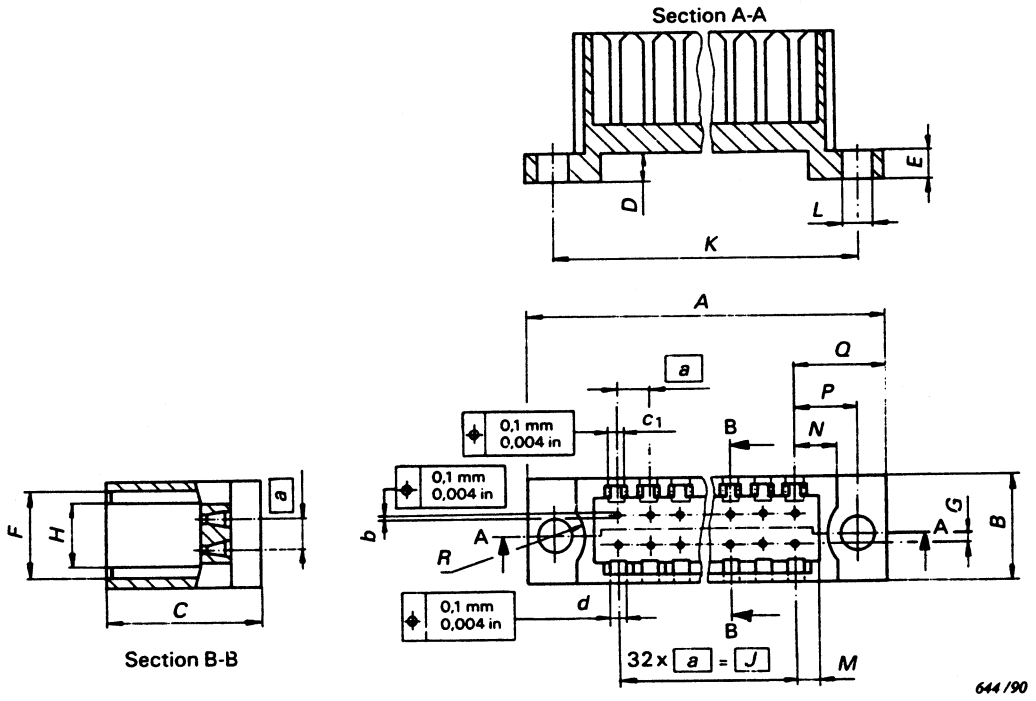


Figure 15

Table 11 — Values of dimensions shown in Figure 15

	A	*B*	*C*	*D*	*E*	*F*
mm	97,54 max.	10,10 9,90	12,95 12,85	1,60 1,40	4,35 4,05	8,40 8,20
in	3,840 max.	0,398 0,390	0,510 0,506	0,063 0,055	0,171 0,159	0,331 0,323

	G	*H*	*J*	*K*	*ØL*	*M*
mm	0,40 0,20	6,20 6,00	32 × 2,54 = 81,28	92,64 92,44	2,90 2,80	2,20 2,00
in	0,016 0,008	0,244 0,236	32 × 0,100 = 3,200	3,647 3,639	0,114 0,110	0,087 0,079

	N	*P*	*Q*	*R*		
mm	3,65 3,55	5,68 5,58	8,18 8,08	3,00 2,90		
in	0,144 0,140	0,224 0,220	0,322 0,318	0,118 0,114		

	a	*Øb*	c_1	*d*		
mm	2,54	1,10 0,90	1,15 1,10	1,70 1,65		
in	0,100	0,043 0,035	0,045 0,043	0,067 0,065		
(For other dimensions, see Figure 16, page 25, and Table 12.)						

4.2.2.4 *Dimensions of rear header, types 603-9 IEC-C128 MO-BO-X*

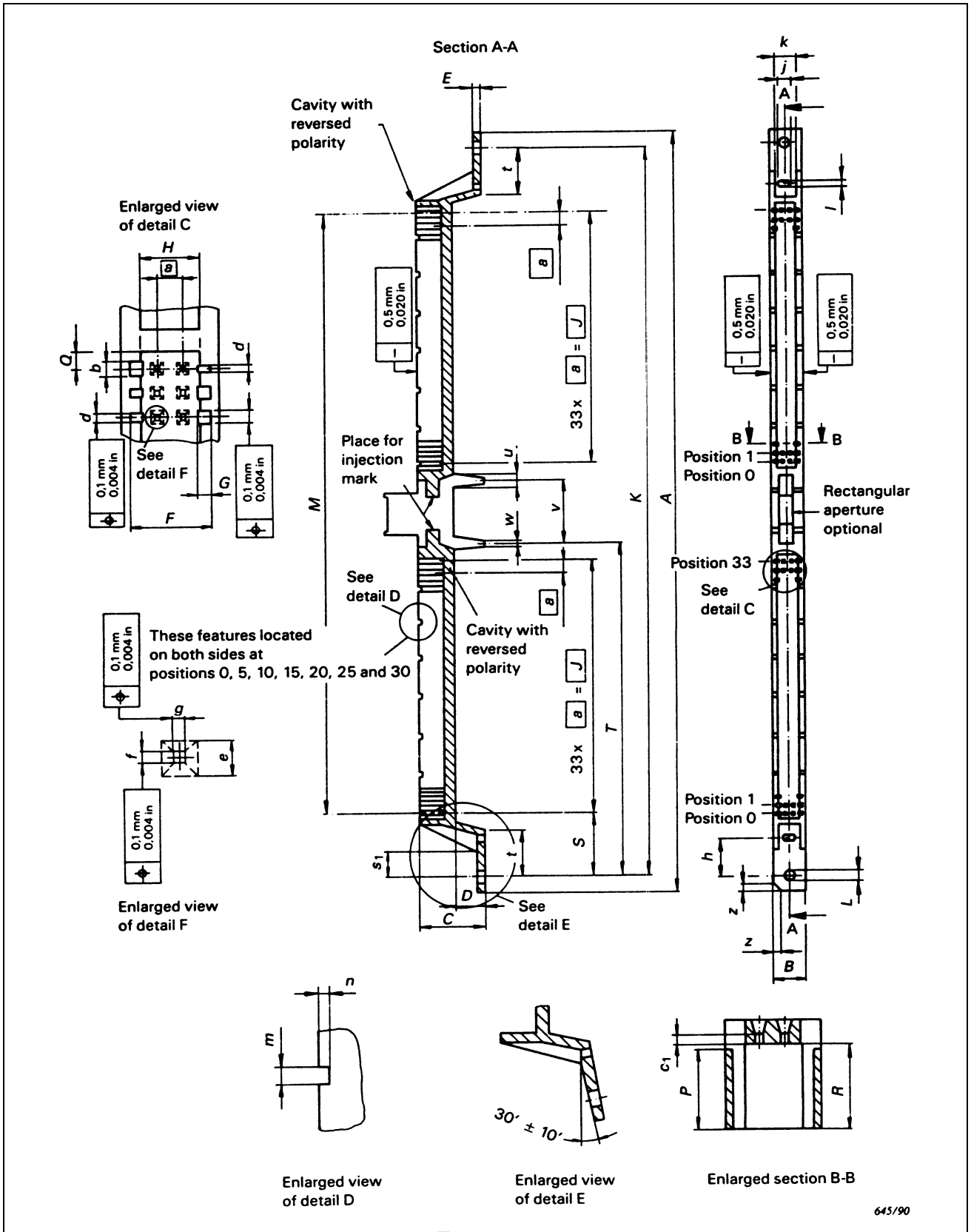


Figure 16

Table 12 — Values of dimensions shown in Figure 16, page 25

	A	*B*	*C*	*D*	*E*	*F*
mm	246,63 246,13	10,15 9,85	22,40 22,20	10,90 10,70	2,60 2,40	8,40 8,20
in	9,710 9,690	0,400 0,388	0,882 0,874	0,429 0,421	0,102 0,094	0,331 0,323

	G	*H*	*J*	*K*	*L*	*M*
mm	1,55 1,35	6,20 6,00	33 × 2,54 = 83,82	236,47 235,97	4,45 4,30	195,83 195,33
in	0,061 0,053	0,244 0,236	33 × 0,100 = 3,300	9,310 9,290	0,175 0,169	7,710 7,690

		P	*Q*	*R*	*S*	*T*
mm		8,85 8,75	2,2 2,0	9,2 9,0	20,37 20,27	109,32 109,12
in		0,348 0,344	0,087 0,079	0,362 0,354	0,802 0,798	4,304 4,296

	a	*b*	c_1	*d*	*e*	*f*
mm	2,54	1,70 1,65	0,60 0,40	1,15 1,10	2,35 2,25	0,75 0,70
in	0,100	0,067 0,065	0,024 0,016	0,045 0,043	0,093 0,089	0,030 0,028

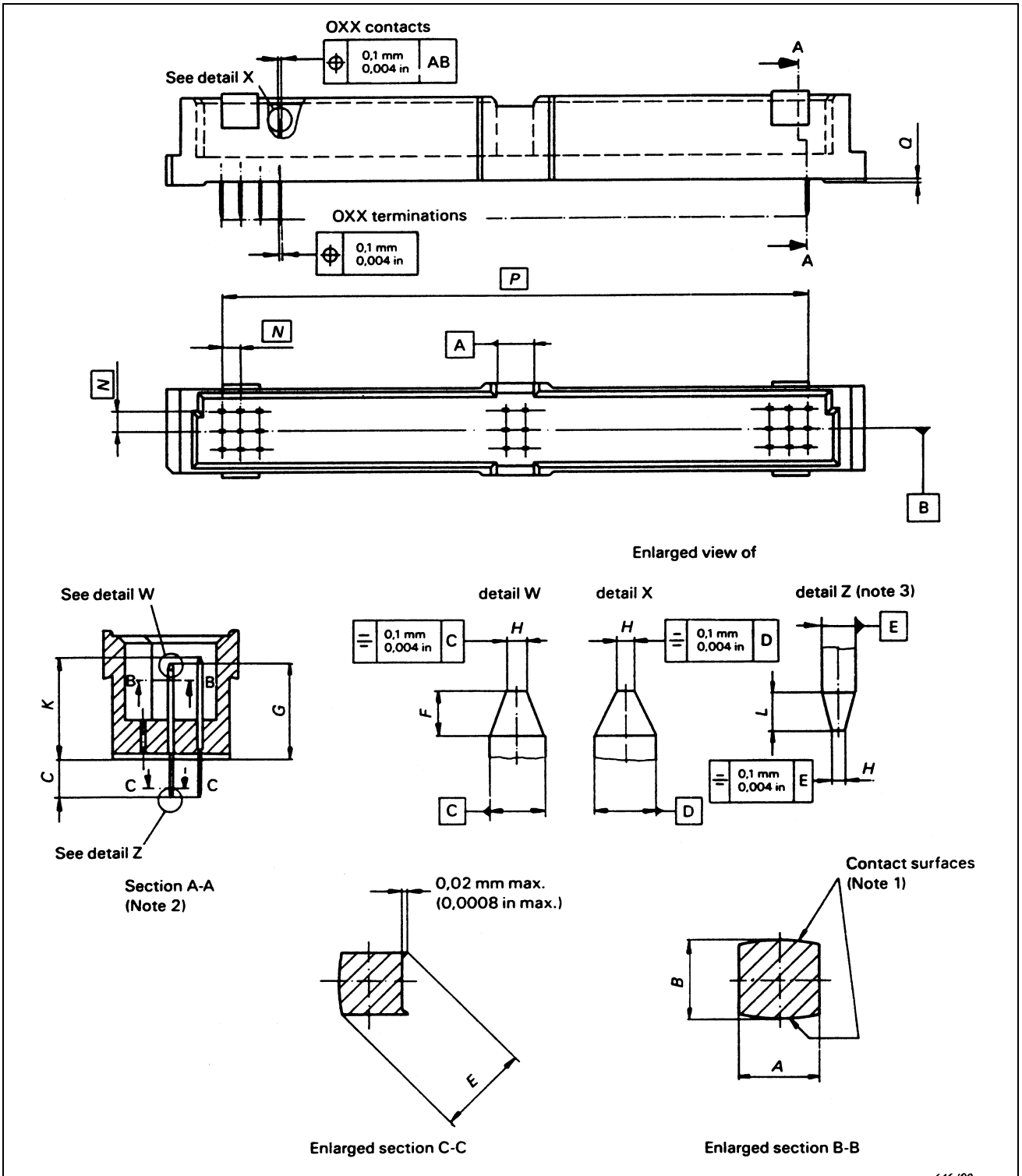
	g	*h*	*j*	*k*	*l*	
mm	0,70 0,65	12,85 12,55	5,64 5,44	7,15 6,85	3,10 2,90	
in	0,028 0,026	0,506 0,494	0,222 0,214	0,281 0,270	0,122 0,144	

	m	*n*			s_1	*t*
mm	1,20 1,00	0,60 0,40			8,89 8,59	14,98 14,68
in	0,047 0,037	0,024 0,016			0,350 0,338	0,590 0,578

	u	*v*	*w*	*z*		
mm	3,60 3,40	17,88 17,68	3,00 2,40	2,60 2,40		
in	0,142 0,134	0,704 0,696	0,118 0,094	0,102 0,094		

4.2.3 ***Connector assemblies (range 2)***

4.2.3.1 *Dimensions of fixed male connector, signal version, types 603-9 IEC-A0XX MC-CX-X*



NOTE 1 Contact surface coined to guarantee male-female contact on the contact surface when the contact is turned 6° max.

NOTE 2 For-first to-make/last-to-break contacts, see Figure 6, page 13.

NOTE 3 The termination shall be suitable for holes 1 mm (0,039 in) nominal diameter in accordance with IEC Publication 326.

Figure 17

Table 13 — Values of dimensions shown in Figure 17, page 27

	A	*B*	B_1	*C*		*E*
mm	0,70 0,65	0,61 0,56	0,70 0,50	4,20 3,40		0,65 0,56
in	0,028 0,026	0,024 0,022	0,028 0,020	0,165 0,134		0,026 0,022

	F	*G*	*H*		*K*	*L*
mm	0,55 0,45	9,20 9,00	0,25 0,15		10,05 9,85	0,55 0,45
in	0,022 0,018	0,362 0,354	0,010 0,006		0,396 0,388	0,022 0,018

		N	*P*	*Q*		
mm		2,54	31 × 2,54 = 78,74	0,70 0,50		
in		0,100	31 × 0,100 = 3,100	0,028 0,020		
(For other dimensions, see Figure 13, page 21, and Table 9.)						

Contact arrangement of types A

NOTE An × denotes a contact.

Contact No.		1	2	3	4	5	6	...	28	29	30	31	32
	a		×		×		×	...	×		×		×
A32 row	b												
	c		×		×		×	...	×		×		×

There are no contacts in row b and in the odd numbered positions but contact cavities are provided.

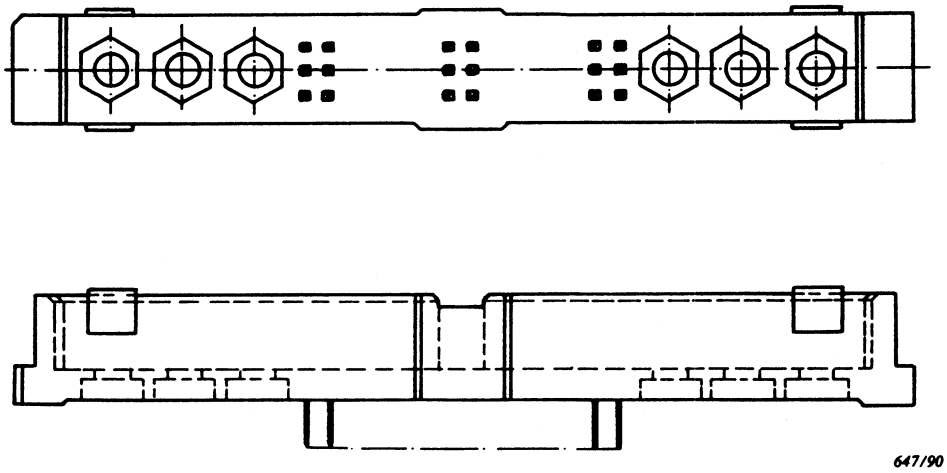
Contact No.		1	2	3	4	5	6	...	28	29	30	31	32
	a	×	×	×	×	×	×	...	×	×	×	×	×
A64 row	b	×	×	×	×	×	×	...	×	×	×	×	×
	c												

There are no contacts in row c but contact cavities are provided.

Contact No.		1	2	3	4	5	6	...	28	29	30	31	32
	a	×	×	×	×	×	×	...	×	×	×	×	×
A96 row	b	×	×	×	×	×	×	...	×	×	×	×	×
	c	×	×	×	×	×	×	...	×	×	×	×	×

If earthing positions are to be used, their location shall be agreed upon between user and manufacturer.

4.2.3.2 *Dimensions of fixed male connector, mixed version, types 603-9 IEC-M0XX MC-CX-X*



NOTE Dimensions see Figure 13, Figure 14 and Figure 17, pages 21, 23 and 27.

Figure 18

Contact arrangement of types M

NOTE An × denotes a contact.

Contact No.		10	11	12	13	14	15	16	17	18	19	20	21	22	23
	a	×		×		×		×		×		×		×	
M14 row	b														
	c	×		×		×		×		×		×		×	

There are no contacts in row b and in the odd numbered positions but contact cavities are provided.

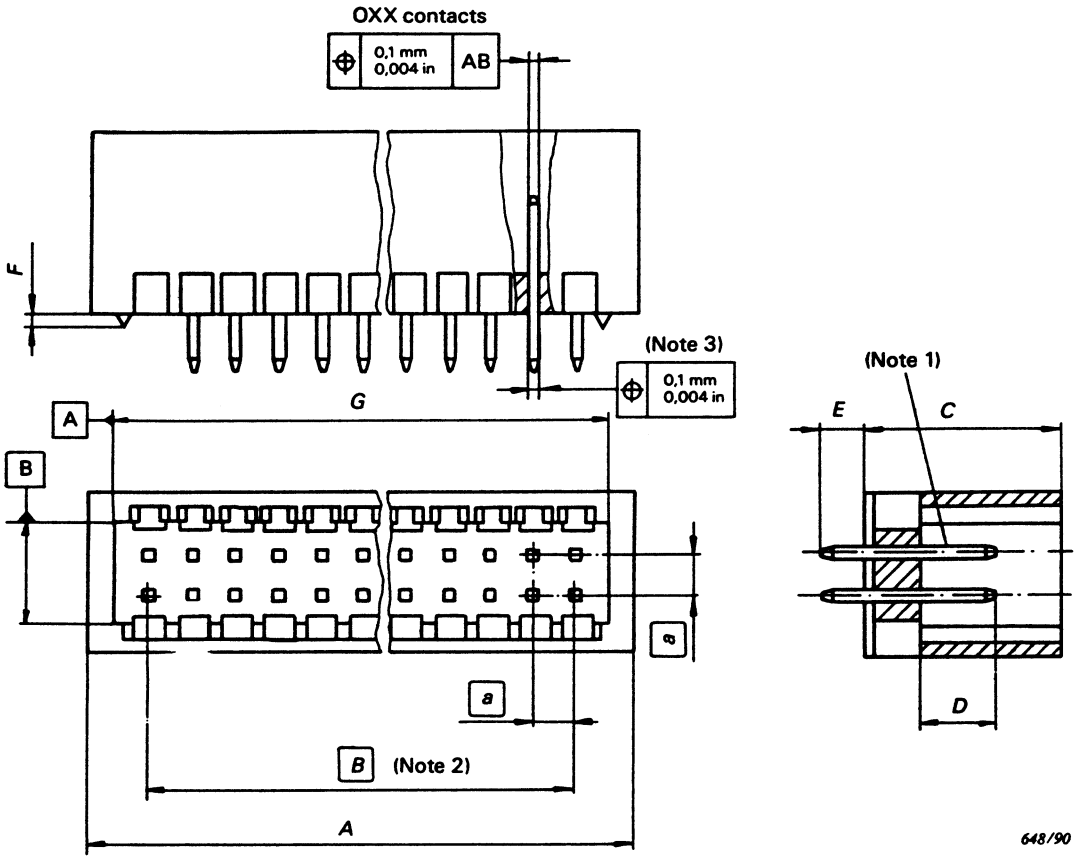
Contact No.		10	11	12	13	14	15	16	17	18	19	20	21	22	23
	a	×	×	×	×	×	×	×	×	×	×	×	×	×	×
M28 row	b	×	×	×	×	×	×	×	×	×	×	×	×	×	×
	c														

There are no contacts in row c but contact cavities are provided.

Contact No.		10	11	12	13	14	15	16	17	18	19	20	21	22	23
	a	×	×	×	×	×	×	×	×	×	×	×	×	×	×
M42 row	b	×	×	×	×	×	×	×	×	×	×	×	×	×	×
	c	×	×	×	×	×	×	×	×	×	×	×	×	×	×

If earthing positions are to be used, their location shall be agreed upon between user and manufacturer.

4.2.3.3 *Dimensions of the pre-assembled male connector with straight solder terminals, types 603-9 IEC-C0XX MA-CX-XC*



NOTE 1 Cross-section of contact: round, diameter 0,63 ± 0,05 mm (0,0248 ± 0,0020 in), or as shown in Figure 9, page 16 section D-D.

NOTE 2 For 64-way connectors, first and last position of each row without pins and last position with reversed polarity slots. For other types first position of each row without pins.

NOTE 3 The terminations shall be suitable for holes 1 mm (0,039 in) nominal diameter in accordance with IEC Publication 326.

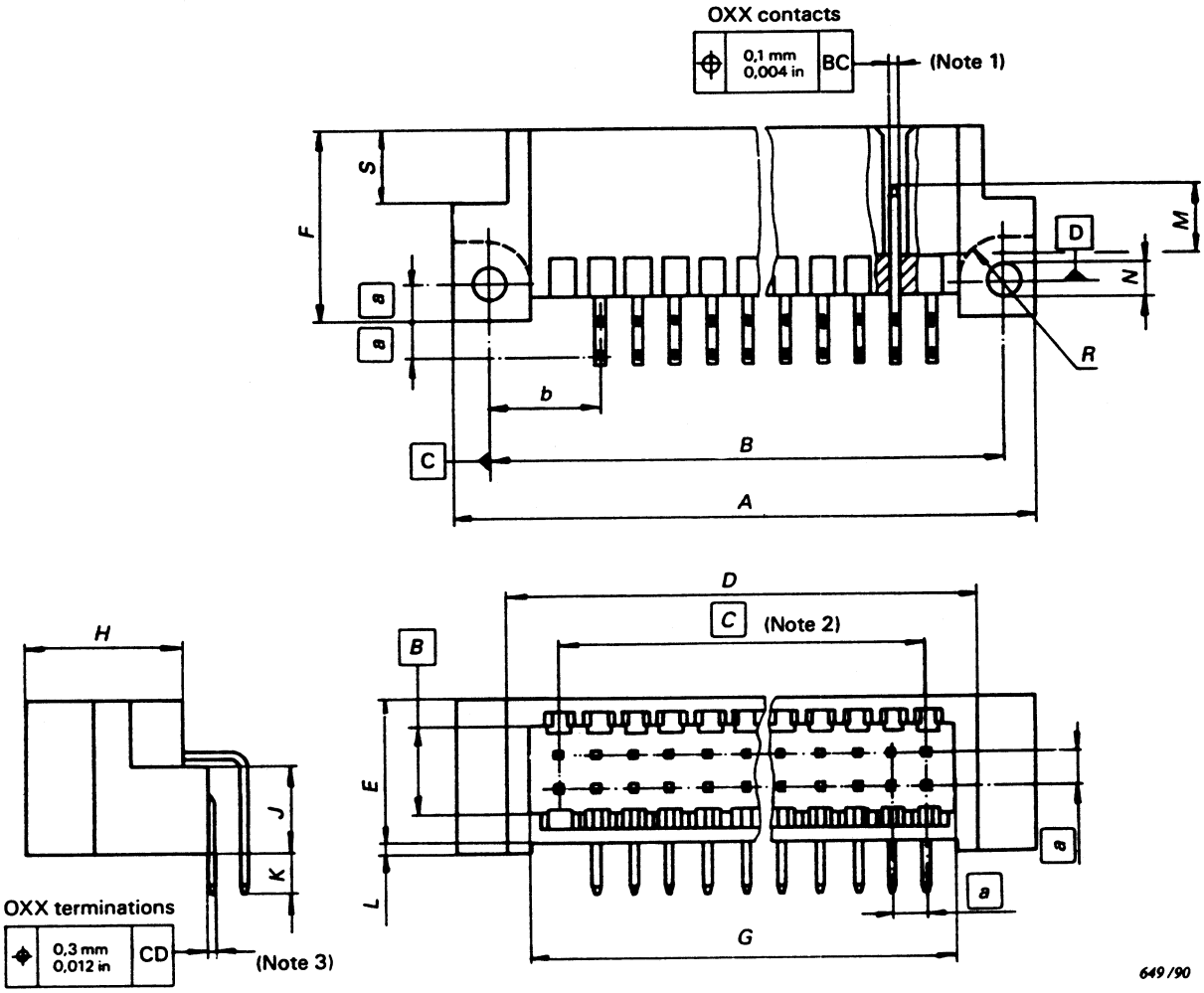
Figure 19

Table 14 — Values of dimensions shown in Figure 19, page 30

Number of contacts		*A*	*B*	*C*	
4	mm	20,39 20,21	2 × 2,54 = 5,08	9,33 9,23	
	in	0,803 0,796	2 × 0,100 = 0,200	0,367 0,363	
10	mm	28,01 27,91	5 × 2,54 = 12,7	16,95 16,85	
	in	1,103 1,099	5 × 0,100 = 0,500	0,667 0,663	
20	mm	40,71 40,61	10 × 2,54 = 25,4	29,65 29,55	
	in	1,603 1,599	10 × 0,100 = 1,000	1,167 1,163	
42	mm	68,65 68,55	21 × 2,54 = 53,34	57,59 57,49	
	in	2,703 2,699	21 × 0,100 = 2,100	2,267 2,263	
64	mm	99,13 99,03	33 × 2,54 = 83,82	88,07 87,97	
	in	3,903 3,899	33 × 0,100 = 3,300	3,467 3,463	

	C	*D*	*E*	*F*	*a*
mm	12,10 11,90	5,00 4,80	2,90 2,60	0,70 0,50	2,54
in	0,476 0,469	0,197 0,189	0,114 0,102	0,028 0,020	0,100
(For other dimensions, see Figure 16, page 25, and Table 12.)					

4.2.3.4 *Dimensions of pre-assembled male connector with terminals bent over 90°, types 603-9 IEC-C0XX MB-CX-X*



NOTE 1 Cross-section of contact: round, diameter 0,63 ± 0,05 mm (0,0248 ± 0,0020 in), or as shown in Figure 9, page 16, section D-D.

NOTE 2 For 64-way connectors, first and last position of each row without pins, for other types first position and last position with reversed polarization slots.

NOTE 3 The terminations shall be suitable for holes 1,00 mm (0,039 in) nominal diameter in accordance with IEC Publication 326.

Figure 20

Table 15 — Values of dimensions shown in Figure 20, page 32

Number of contacts		*A*	*B*	*C*	*D*	*G*
4	mm	20,39 20,29	15,29 15,19	2 × 2,54 = 5,08	12,33 12,23	9,33 9,23
	in	0,803 0,799	0,602 0,598	2 × 0,100 = 0,200	0,485 0,481	0,367 0,363
10	mm	28,01 27,91	22,91 22,81	5 × 2,54 = 12,7	19,95 19,85	16,95 16,85
	in	1,103 1,099	0,902 0,898	5 × 0,100 = 0,500	0,785 0,781	0,667 0,663
20	mm	40,71 40,61	35,61 35,51	10 × 2,54 = 25,4	32,65 32,55	29,65 29,55
	in	1,603 1,599	1,402 1,398	10 × 0,100 = 1,000	1,285 1,281	1,167 1,163
42	mm	68,65 68,55	63,55 63,45	21 × 2,54 = 53,34	60,59 60,49	57,59 57,49
	in	2,703 2,699	2,502 2,498	21 × 0,100 = 2,100	2,385 2,381	2,267 2,263
64	mm	99,13 99,03	94,03 93,93	33 × 2,54 = 83,82	91,07 90,97	88,07 87,97
	in	3,903 3,899	3,702 3,698	33 × 0,100 = 3,300	3,585 3,581	3,467 3,463

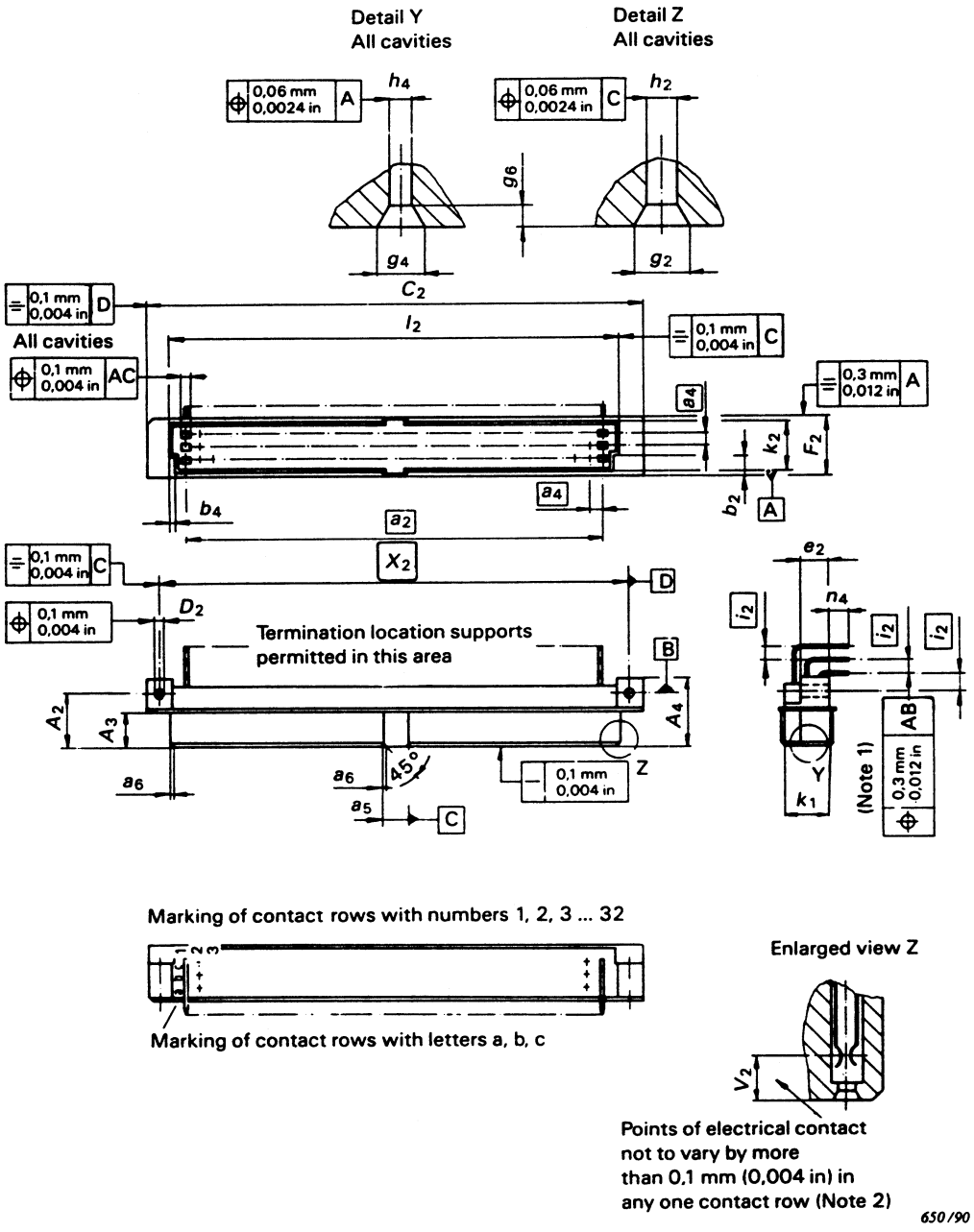
	E	*F*	*H*	*J*	*K*	*L*
mm	10,10 9,90	13,10 12,90	11,45 11,35	6,10 5,90	2,90 2,60	0,70 0,50
in	0,398 0,390	0,516 0,508	0,451 0,447	0,240 0,232	0,114 0,102	0,028 0,020

	M	*N*	*R*	*S*	*a*	*b*
mm	5,00 4,80	2,80 2,60	3,10 2,90	5,10 4,90	2,54	7,72 7,52
in	0,197 0,189	0,110 0,102	0,122 0,114	0,201 0,193	0,100	0,304 0,296
(For other dimensions, see Figure 16, page 25, and Table 12.)						

4.3 Female connector dimensions

4.3.1 *Connector assemblies*

4.3.1.1 *Signal version, types 603-9 IEC-A0XX FB-CX-X*



NOTE 1 The termination shall be suitable for holes 1 mm (0,039 in) nominal diameter in accordance with IEC Publication 326.

NOTE 2 The shape and positioning of the female contacts, within the female moulding shall be such that it guarantees the first-to-make/last-to-break function in worst case tolerance conditions. The protruding male contacts shall make contact before any other contact.

Figure 21

Table 16 — Values of dimensions shown in Figure 21, page 34

	A_2	A_3	A_4	C_2	D_2	F_2
mm	11,31 11,21	7,70 7,60	13,80 13,70	94,00 93,80	2,75 2,65	10,60 10,40
in	0,445 0,441	0,303 0,299	0,543 0,539	3,701 3,693	0,108 0,104	0,417 0,409

		V_2	X_2			
mm		2,10 1,60	89,00 88,80			
in		0,083 0,063	3,504 3,500			

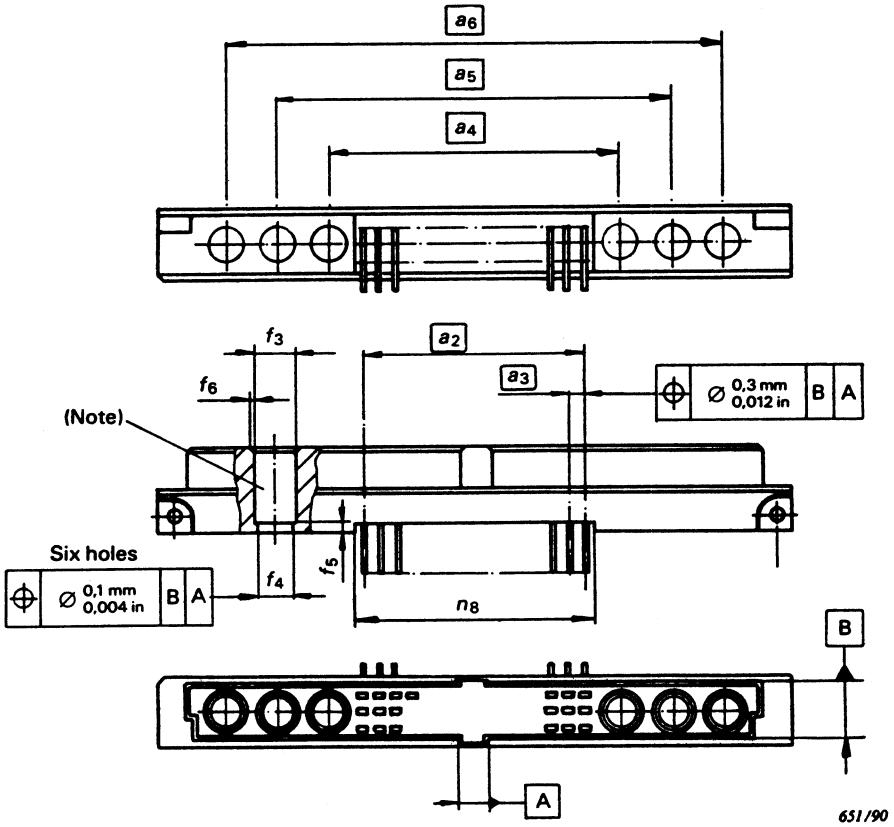
	a_2	a_4	a_5	a_6	b_2	b_4
mm	31 × 2,54 = 78,74	2,54	4,65 4,60	0,65 0,55	3,20 3,00	1,10 1,00
in	31 × 0,100 = 3,100	0,100	0,183 0,181	0,026 0,022	0,126 0,118	0,043 0,039

		e_2	g_2	g_4	g_6	h_2
mm		6,05 5,95	2,20 2,10	1,70 1,60	(0,50)	1,30 1,20
in		0,238 0,234	0,087 0,083	0,067 0,063	(0,020)	0,051 0,047

	h_4	i_2	k_1	k_2	l_2	
mm	0,90 0,80	2,54	8,50 8,40	9,50 9,40	85,00 84,80	
in	0,035 0,031	0,100	0,335 0,331	0,374 0,370	3,346 3,339	

	n_4					
mm	3,30 3,00					
in	0,130 0,118					

4.3.1.2 *Mixed version (without power contacts), types 603-9 IEC-M0XX FB-CX-X*



NOTE The female power contact is snap-in mounted in this cavity.

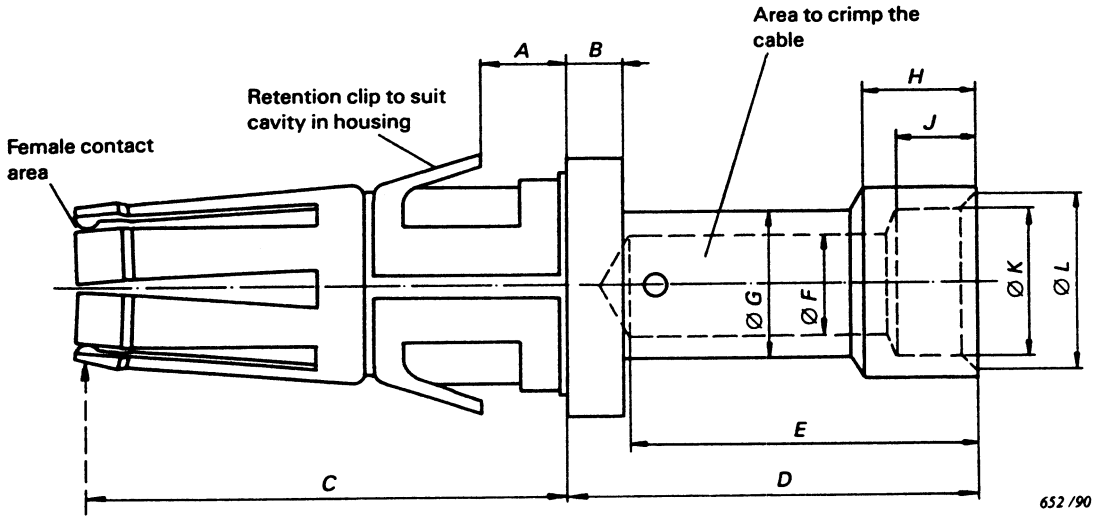
Figure 22

Table 17 — Values of dimensions shown in Figure 22

	a_2	a_3	a_4	a_5	a_6	$Øf_3$
mm	13 × 2,54 = 33,02	2,54	43,18	58,42	73,66	5,50 5,35
in	13 × 0,100 = 1,300	0,100	1,700	2,300	2,900	0,216 0,211

	f_4	f_5	f_6	n_8		
mm	4,90 4,80	2,05 1,95	0,50 0,40	35,60 35,40		
in	0,193 0,189	0,081 0,077	0,020 0,016	1,402 1,394		
(For other dimensions, see Figure 21, page 34, and Table 16.)						

4.3.2 *Female power contact, types 603-9 IEC-M001 FL-SX-X*



NOTE The exact shape and the undefined dimensions are optional; the contact point shall however ensure reliable contact with the male power contact when the male and female connectors are disengaged by 2,3 mm (0,091 in).

Figure 23

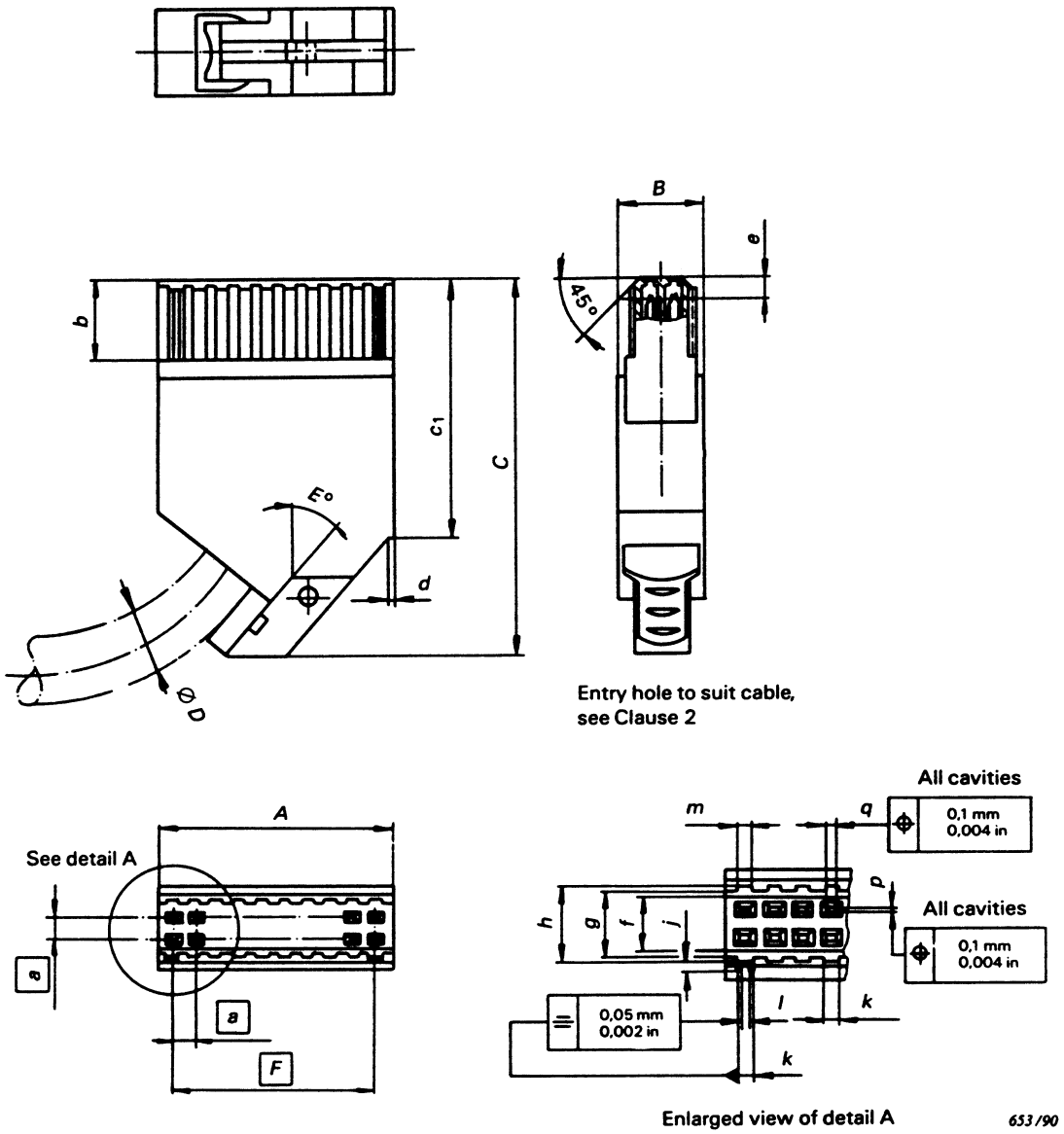
Table 18 — Values of dimensions shown in Figure 23

	A	*B*	*C*	*D*	*E*	
mm	2,05 min.	1,10 0,90	12,20 12,00	9,80 max.	5,0 min.	
in	0,081 min.	0,043 0,035	0,480 0,472	0,386 max.	0,197 min.	

Crimp barrel 1	*F*	*G*	*H*	*J*	*K*	*L*
mm	2,45 2,35	3,50 3,30	2,95 2,55	2,40 2,00	3,95 3,85	4,80 4,60
in	0,096 0,093	0,138 0,130	0,116 0,100	0,094 0,079	0,156 0,152	0,189 0,181
Crimp barrel 2	*F*	*G*	*H*	*J*	*K*	*L*
mm	2,95 2,85	3,90 3,70	— —	— —	— —	— —
in	0,116 0,112	0,154 0,146	— —	— —	— —	— —
Crimp barrel 3	*F*	*G*	*H*	*J*	*K*	*L*
mm	3,85 3,75	4,70 4,50	— —	— —	— —	— —
in	0,152 0,148	0,185 0,177	— —	— —	— —	— —

4.3.3 *Cable connectors*

4.3.3.1 *Cable connectors for round cables, types 603-9 IEC-C0XX FG-CX-X or 603-9 IEC-C0XX FH-CX-X*



NOTE The terminals shall be suitable for ID connection[a] to round cable with nominal conductor diameter of 0,50 mm (0,020 in) or 0,25 mm (0,010 in).

[a] Insulation displacement connections are under consideration.

Figure 24

Table 19a — Values of dimensions shown in Figure 24, page 38

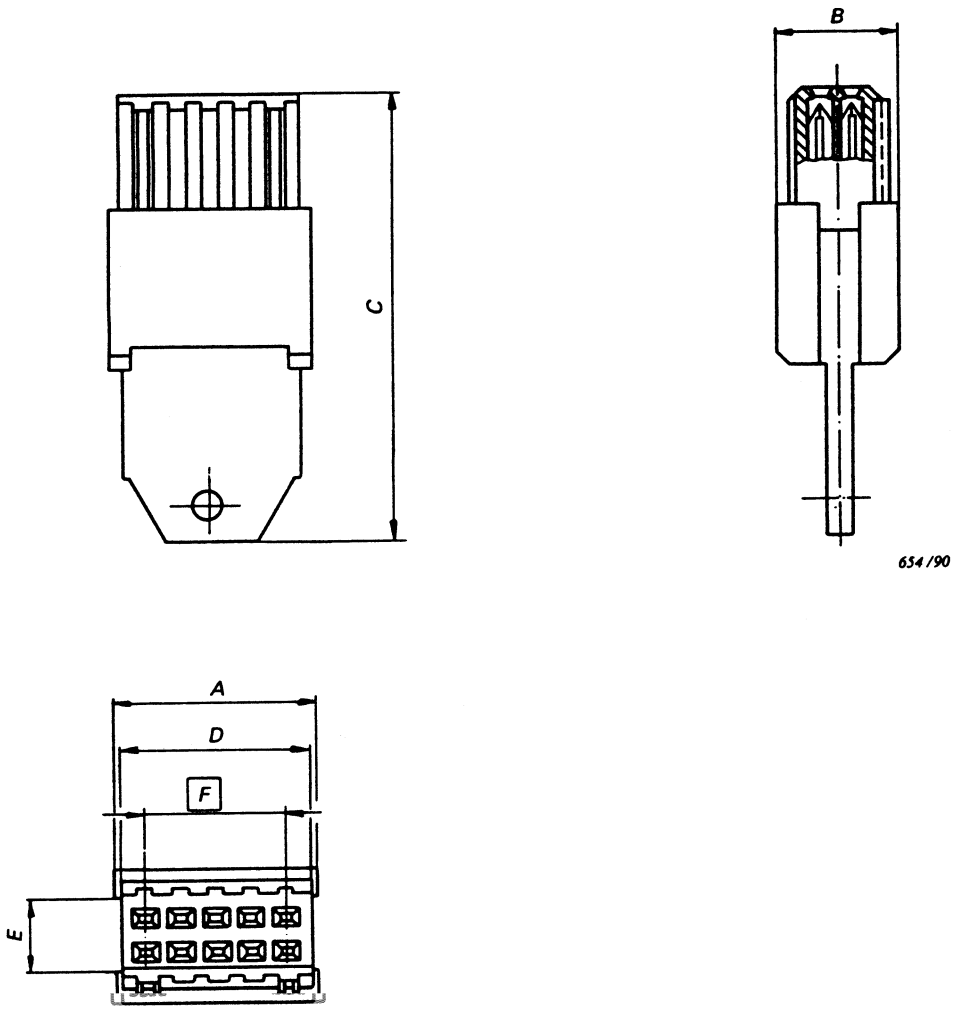
Number of contacts		*A*	*B*	*C*	⌀*D*	*E*	*F*
4	mm	6,40 max.	10,15 9,95	42,55 42,05	5,00 max.	15°	1 × 2,54 = 2,54
	in	0,252 max.	0,400 0,392	1,675 1,656	0,197 max.		1 × 0,100 = 0,100
10	mm	14,00 max.	10,15 9,95	37,85 37,65	6,00 max.	20°	4 × 2,54 = 10,16
	in	0,551 max.	0,400 0,392	1,490 1,482	0,236 max.		4 × 0,100 = 0,400
20	mm	26,70 max.	10,15 9,95	44,25 43,75	9,00 max.	40°	9 × 2,54 = 22,86
	in	1,051 max.	0,400 0,392	1,742 1,722	0,354 max.		9 × 0,100 = 0,900
64	mm	82,58 max.	14,50 max.	52,00 max.	12,50 max.	60°	31 × 2,54 = 78,74
	in	3,251 max.	0,571 max.	2,047 max.	0,492 max.		31 × 0,100 = 3,100

Table 19b — Values of dimensions shown in Figure 24

	a	*b*	c_1	*d*	*e*	*f*	*g*
mm	2,54	9,25 8,95	30,45 29,95	0,70 0,60	2,40 1,70	5,10 réf.	6,00 5,90
in	0,100	0,364 0,352	1,199 1,179	0,028 0,024	0,094 0,067	0,201 réf.	0,236 0,232

	h	*j*	*k*	*l*	*m*	*p*	*q*
mm	7,00 6,90	0,60 0,50	1,55 1,50	0,75 0,70	1,00 0,95	0,90 0,80	1,28 1,18
in	0,276 0,272	0,024 0,020	0,061 0,059	0,030 0,028	0,039 0,037	0,035 0,031	0,050 0,046

4.3.3.2 *Cable connectors for flat cables, types 603-9 IEC-C010 FJ-CX-X*



NOTE The terminals shall be suitable for ID connections[a] to flat cable with nominal conductor diameter of 0,25 mm (0,010 in).

[a] Insulation displacement connections are under consideration.

Figure 25

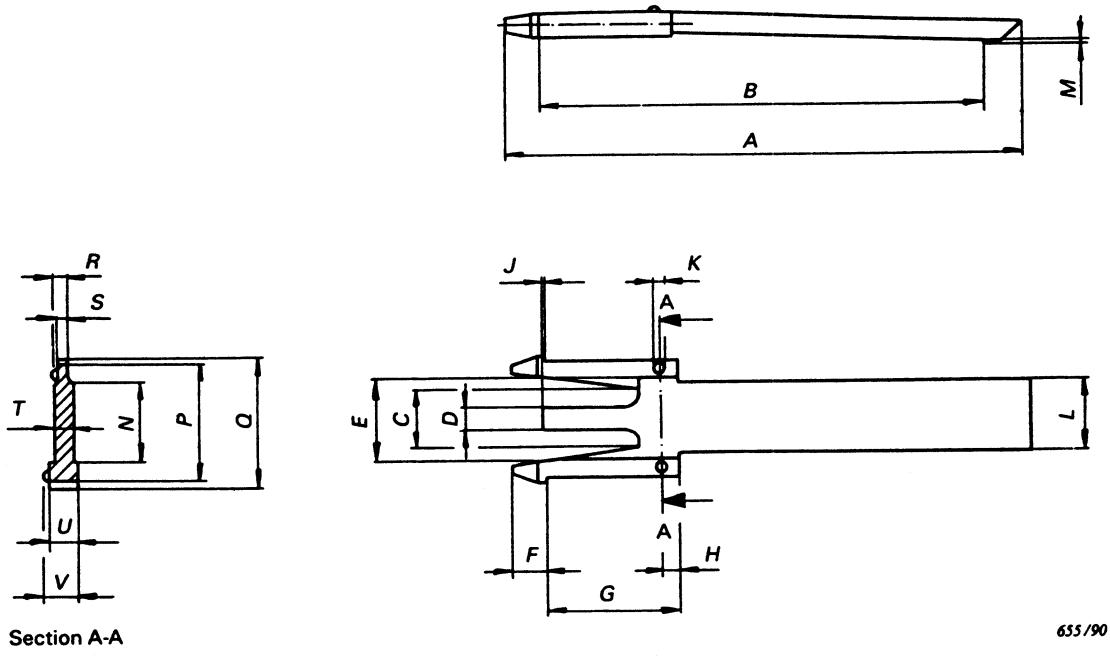
Table 20 — Values of dimensions shown in Figure 25

	A	*B*	*C*	*D*	*E*	*F*
mm	5,12 max.	10,15 9,95	35,40 34,80	14,00 max.	5,30 5,10	4 × 2,54 = 10,16
in	0,202 max.	0,400 0,392	1,394 1,370	0,551 max.	0,209 0,201	4 × 0,100 = 0,400
(For other dimensions, see Figure 24, page 38, and Table 20.)						

4.4 Accessories

Dimensions of the locking latch

The locking latch is used as shown in Figure 1 and Figure 2, pages 6 and 7, to fix the cable connectors to the header or to the attached male connectors.



NOTE Retention force:
locking latch — header: 15 ± 5 N;
cable connector — locking latch: 15 ± 5 N.

Figure 26

Table 21 — Values of dimensions shown in Figure 26

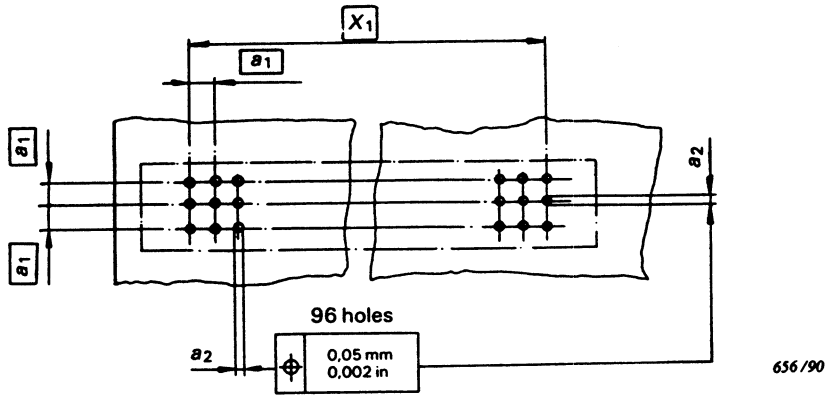
	A	*B*	*C*	*D*	*E*	*F*	*G*
mm	36,20 35,80	30,50 30,40	3,60 3,40	1,65 1,55	6,58 6,48	2,5 2,3	9,15 8,85
in	1,425 1,409	1,201 1,197	0,142 0,134	0,065 0,061	0,259 0,255	0,098 0,091	0,360 0,348

	H	*J*	*ØK*	*L*	*M*	*N*	*P*
mm	1,35 1,15	0,20 0,10	1,10 0,90	4,80 4,60	0,60 0,40	6,10 6,00	9,40 9,30
in	0,053 0,045	0,008 0,004	0,043 0,035	0,189 0,181	0,024 0,016	0,240 0,236	0,370 0,366

	Q	*R*	*S*	*T*	*U*	*V*	
mm	8,30 8,20	1,20 1,15	1,00 0,95	1,20 1,10	1,55 1,50	1,75 1,70	
in	0,327 0,323	0,047 0,045	0,039 0,037	0,047 0,043	0,061 0,059	0,069 0,067	

4.5 Mounting information, fixed connectors

4.5.1 *Holes in backpanels for signal contacts*



NOTE The pattern shown is used in conjunction with a connector completely filled with contacts. If an under-equipped connector is used the holes corresponding to contacts not fitted need not be provided.

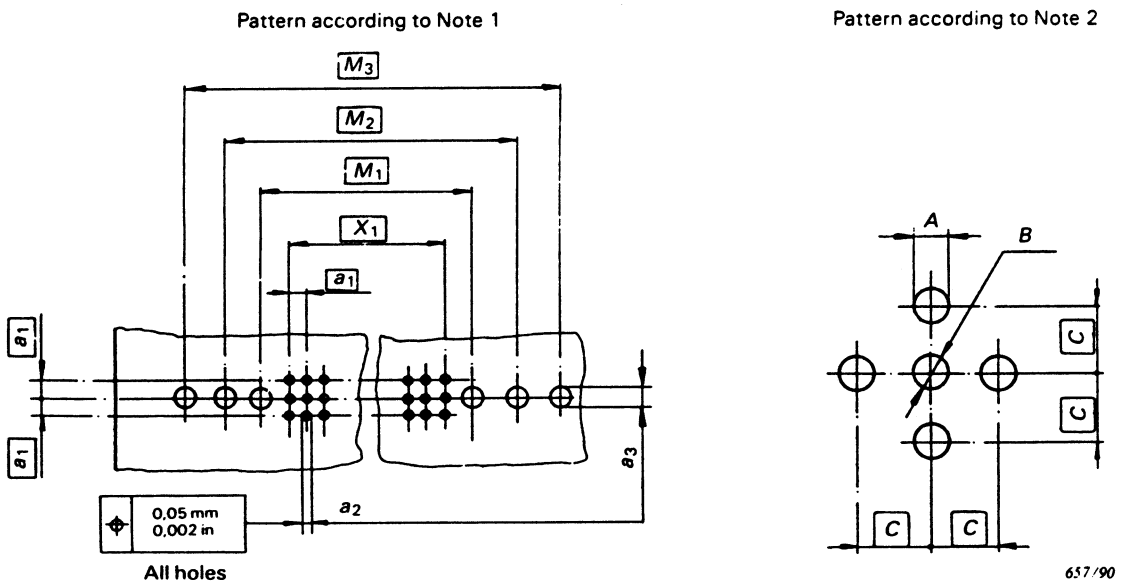
Figure 27

Table 22 — Values of dimensions shown in Figure 27

	X_1	a_1	a_2[a]
mm	31 × 2,54 = 78,74	2,54	—
in	31 × 0,100 = 3,100	0,100	—

[a] Hole size finished to suit press-in or solder requirements as applicable, (An IEC standard on the press-in technique is under consideration.)

4.5.2 *Holes in backpanels for mixed version contacts*



NOTE The pattern shown is used in conjunction with a connector completely filled with signal contacts and power contacts with screw fixing. If an under-equipped version is used the holes corresponding to contacts not fitted need not be provided.
NOTE When male power contacts for solder fixing are used the holes with dimension *a*3 are replaced by 5-hole patterns as shown.

Figure 28

Table 23 — Values of dimensions shown in Figure 28

	X_1	M_1	M_2	M_3
mm	13 × 2,54 = 33,02	43,18	58,42	73,66
in	13 × 0,100 = 1,300	1,700	2,300	2,900

	a_1	a_2[a]		a_3		
mm	2,54			4,45 4,30		
in	0,100			0,175 0,169		

	A	*B*	*C*			
mm	1,75 1,60	1,85 1,70	2,54			
in	0,069 0,063	0,073 0,067	0,100			

[a] Hole size finished to suit the press-in or solder requirements as applicable. (An IEC standard on the press-in technique is under consideration.)

4.5.3 *Mounting of power contacts (threaded version shown)*

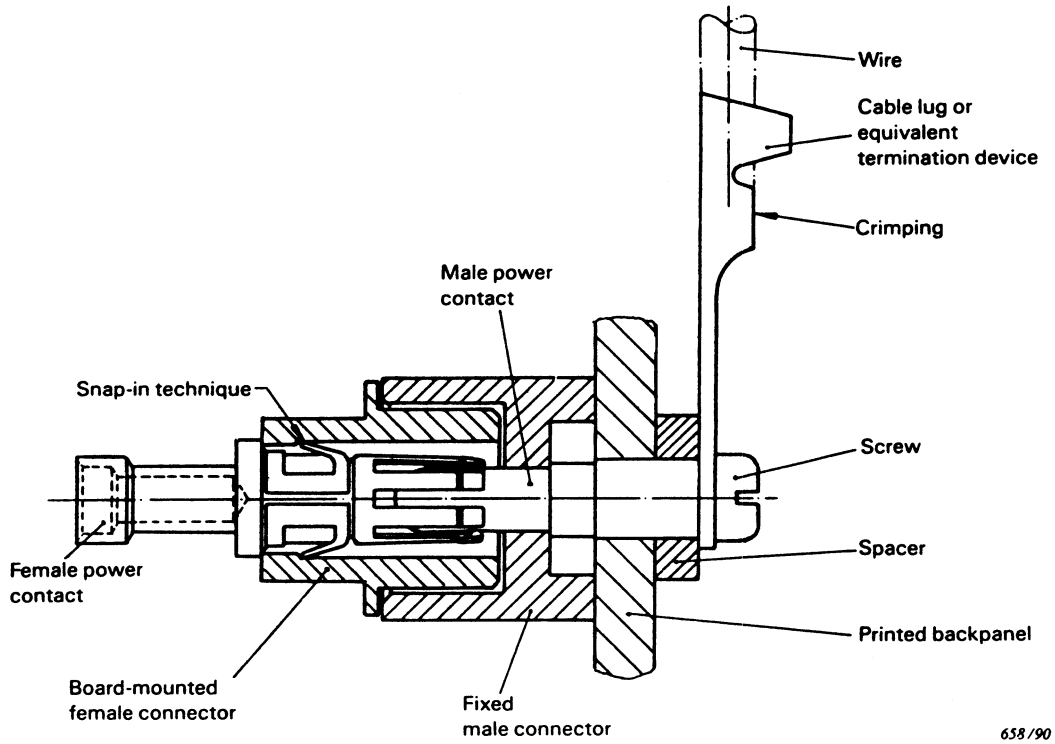
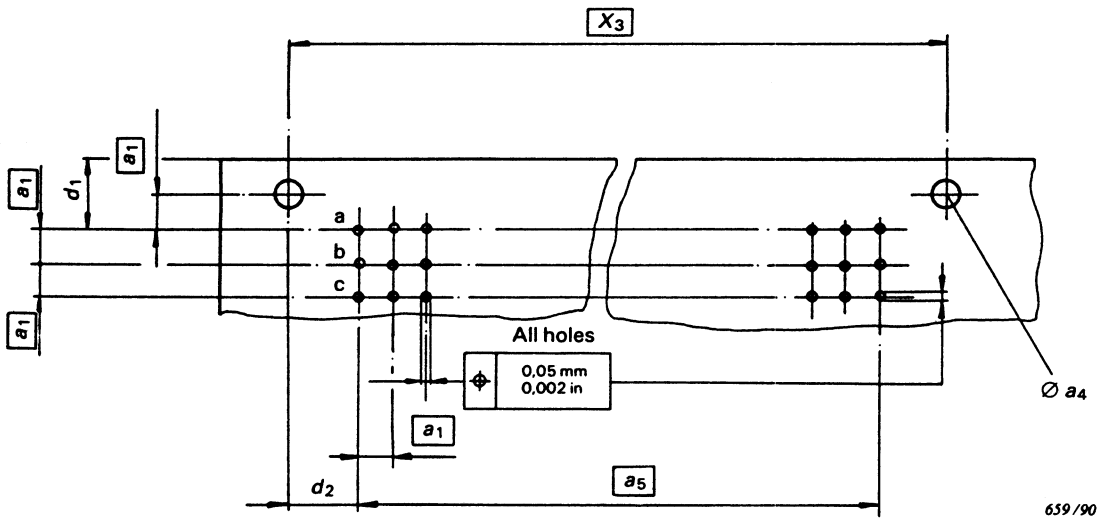


Figure 29

4.6 Mounting information, board-mounted free connectors

4.6.1 ***Holes in printed boards for signal version contacts***



All contact holes are 1 mm (0,039 in) diameter in accordance with IEC Publication 326.

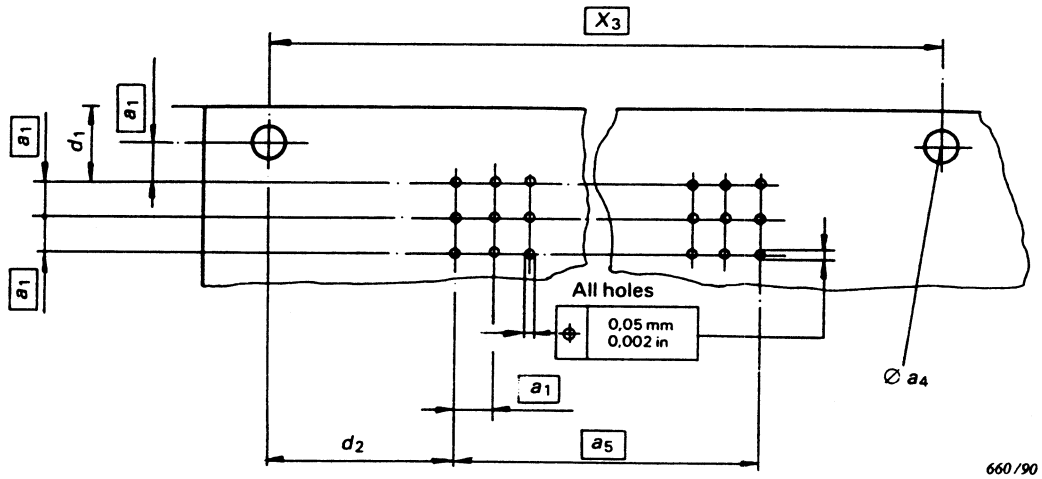
NOTE The pattern shown is used for a connector completely filled with contacts. If an under-equipped connector is used the holes corresponding to contacts not fitted need not be provided.

Figure 30

Table 24 — Values of dimensions shown in Figure 30

	X_3	a_5	d_1	d_2	a_1	a_4
mm	88,90	31 × 2,54 = 78,74	(5,08)	(5,08)	2,54	2,90 2,80
in	3,500	31 × 0,100 = 3,100	(0,200)	(0,200)	0,100	0,114 0,110

4.6.2 ***Holes in printed boards for mixed version contacts***



All contact holes are 1 mm (0,039 in) diameter in accordance with IEC Publication 326.

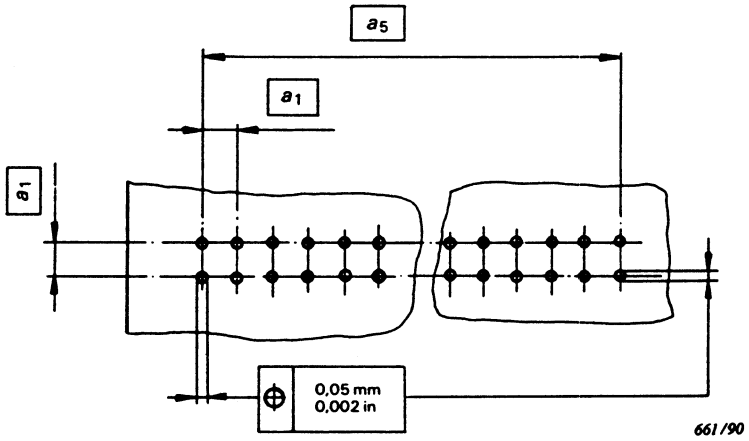
NOTE The pattern shown is used for a connector completely filled with contacts. If an under-equipped connector is used, the holes corresponding to contacts not fitted need not be provided.

Figure 31

Table 25 — Values of dimensions shown in Figure 31

	X_3	a_1	a_4	a_5	d_1	d_2
mm	88,90	2,54	2,90 2,80	13 × 2,54 = 33,02	(5,08)	(27,94)
in	3,500	0,100	0,114 0,110	13 × 0,100 = 1,300	(0,200)	(1,100)

4.6.3 *Holes in printed boards for male connector type C, straight terminals*



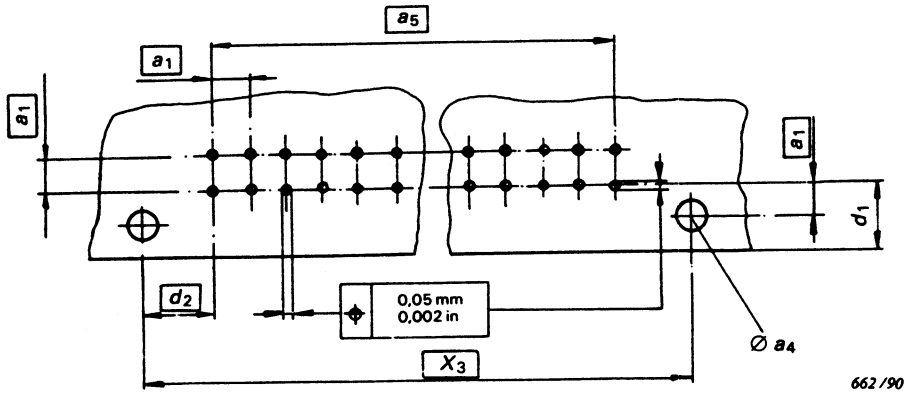
All contact holes are 1 mm (0,039 in) diameter in accordance with IEC Publication 326.

Figure 32

Table 26 — Values of dimensions shown in Figure 32

	Number of contacts and values of a_5					a_1
	4	10	20	42	64	
mm	1 × 2,54 = 2,54	4 × 2,54 = 10,16	9 × 2,54 = 22,86	20 × 2,54 = 50,80	31 × 2,54 = 78,54	2,54
in	1 × 0,100 = 0,100	4 × 0,100 = 0,400	9 × 0,100 = 0,900	20 × 0,100 = 2,000	31 × 0,100 = 3,100	0,100

4.6.4 *Holes in printed boards for male connector type C, terminals bent 90°*



All component holes are 1 mm (0,039 in) diameter in accordance with IEC Publication 326. Mounting holes Ø *a*4 are suitable for the mounting means used.

Figure 33

Table 27 — Values of dimensions shown in Figure 33

Number of contacts		X_3	a_1	a_5	d_1	d_2
4	mm	15,34 15,14	2,54	1 × 2,54 = 2,54	5,08	(7,62)
	in	0,604 0,596	0,100	1 × 0,100 = 0,100	0,200	(0,300)
10	mm	22,96 22,76		4 × 2,54 = 10,16		
	in	0,904 0,896		4 × 0,100 × 0,400		
20	mm	35,66 35,46		9 × 2,54 = 22,86		
	in	1,404 1,396		9 × 0,100 = 0,900		
42	mm	63,60 63,40		20 × 2,54 = 50,80		
	in	2,504 2,496		20 × 0,100 = 2,000		
64	mm	94,08 93,88		31 × 2,54 = 78,74		
	in	3,704 3,696		31 × 0,100 = 3,100		

5 Gauges

The gauges specified in sub-clauses **5.1** and **5.2** shall be used, as appropriate, for contact sizing and gauge retention force.

5.1 Signal contact gauge

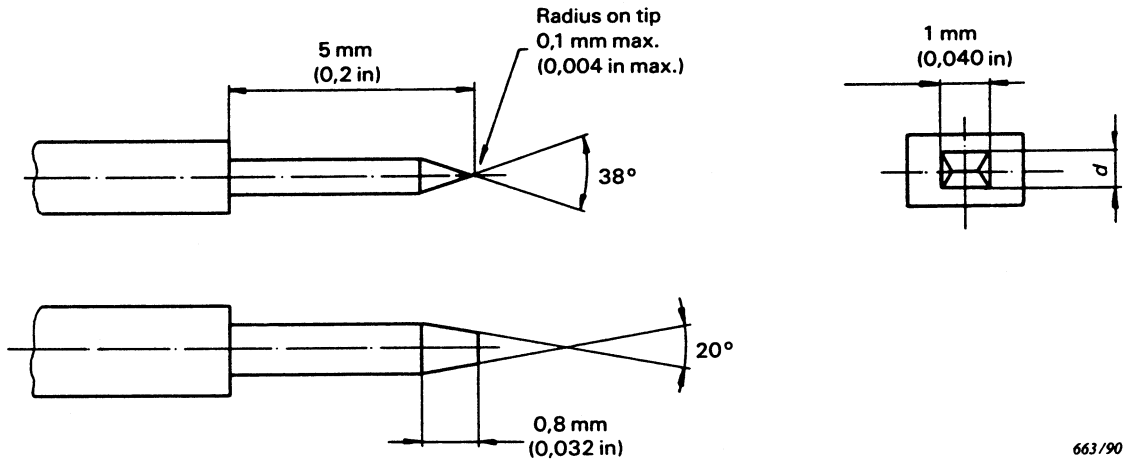


Figure 34

Material: tool steel, hardened.
Finish: surface roughness according to ISO Standard 468.
Tip $R_a \leqslant 0{,}25$ µm (10 µin).

Table 28

Gauge		Dimension d		Mass g
No.	Type	Maximum	Minimum	
1	Maximum contact sizing	0,62 mm (0,0244 in)	0,61 mm (0,0240 in)	—
2	Minimum contact retention	0,56 mm (0,0220 in)	0,55 mm (0,0217 in)	15,3

5.2 Power contact gauge

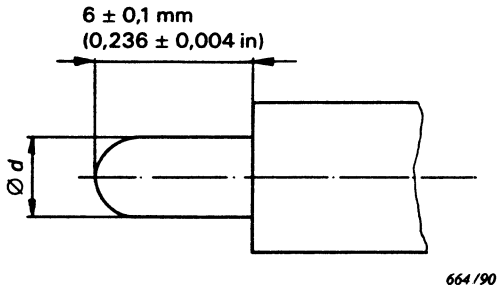


Figure 35

Material: tool steel, hardened.
Finish: surface roughness according to ISO Standard 468.
Tip $R_a \leqslant 0{,}25$ µm (10 µin).

Table 29

Gauge		Dimension Ø d		Mass g
No.	Type	Maximum	Minimum	
1	Maximum contact sizing	3,62 mm (0,1425 in)	3,61 mm (0,1421 in)	—
2	Minimum contact retention, SnPb finish contacts	3,56 mm (0,1402 in)	3,55 mm (0,1398 in)	163
3	Minimum contact retention, Au finish contacts	3,56 mm (0,1402 in)	3,55 mm (0,1398 in)	81,6 81,6

6 Characteristics

6.1 Climatic category 55/125/56

Temperature range: – 55 °C to + 125 °C.
Damp heat, steady state: 56 days.

6.2 Electrical

6.2.1 *Clearance and creepage distances*

The permissible operation voltages depend on the application and on the applicable or specified safety rules.

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

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 be duly taken into account.

Table 30

Type	Minimum distance between contacts and chassis				Minimum distance between adjacent contacts			
	Creepage		Clearance		Creepage		Clearance	
	mm	in	mm	in	mm	in	mm	in
Signal contacts on 2,54 mm (0,100 in) grid and power contact	1,8	0,071	1,6	0,063	1,2	0,047	1,2	0,047
Signal contacts on 5,08 mm (0,200 in) grid					[a] 3,0	[a] 0,118	[a] 3,0	[a] 0,118
Cable connector contacts on 2,54 mm (0,100 in) grid					0,5	0,020	0,5	0,020

[a] 64 contacts spaced on 5,08 mm (0,200 in) grid in rows "a" and "c".

6.2.2 *Voltage proof*

Conditions: IEC Publication 512-2, Test 4a;
standard atmospheric conditions;
mated connectors.

Table 31

Type	Signal contacts on 2,54 mm (0,100 in) grid and power contacts	Signal contacts on 5,08 mm (0,200 in) grid	Cable connectors contacts on 2,54 mm (0,100 in) grid
Contact/contact	1 000 V (r.m.s.)	1 550 V (r.m.s.)	500 V (r.m.s.)

6.2.3 ***Current-carrying capacity***

Conditions: IEC Publication 512-3, Test 5b. Signal contacts and cable connector contact.

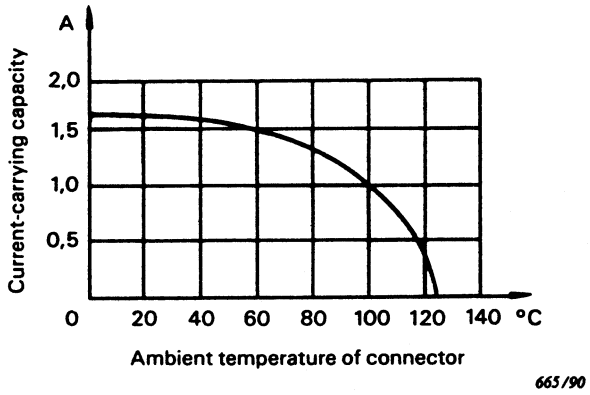


Figure 36

Power contacts

Up to 30 A per contact depending also on the crimp connection (barrel size) and up to 65 A per connector at 70 °C depending upon application.

6.2.4 ***Initial contact resistance***

Conditions: IEC Publication 512-2, Test 2a;
standard atmospheric conditions;
mated connectors.

Signal contacts and cable
connector contacts: 20 mΩ max.
Power contacts: 1 mΩ max.

Connection points, see Figure 37, page 51.

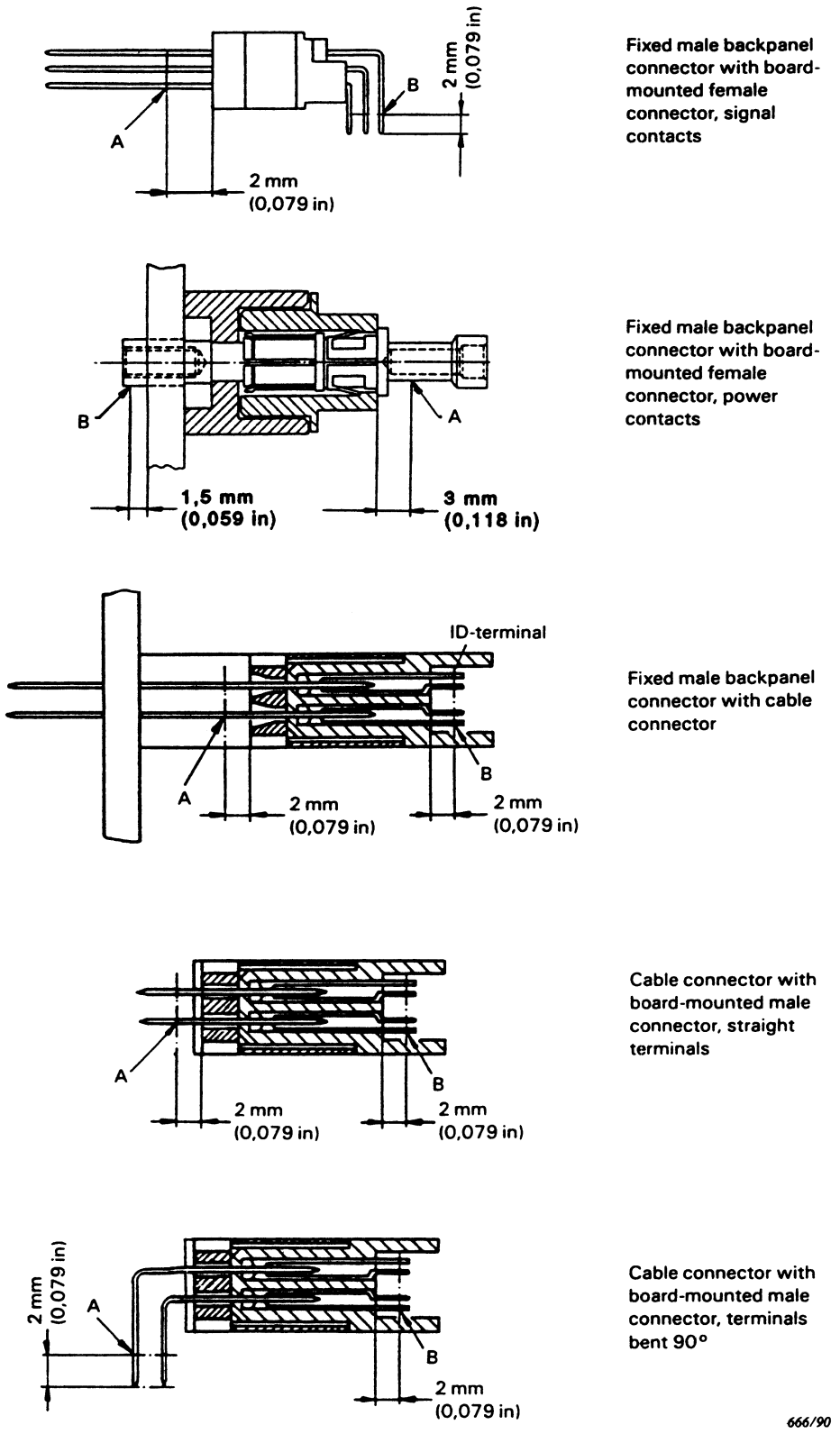


Figure 37 — Connection points for contact resistance measurements

6.2.5 *Initial insulation resistance*

Conditions: IEC Publication 512-2, Test 3a: Method A;
standard atmospheric conditions;
test voltage 100 V;
mated connectors.

All variants: 10^6 MΩ, min.

6.3 Mechanical

6.3.1 *Number of mechanical operations*

Printed board connectors:

— performance level 1: 500 min.

— performance level 2: 100 min.

Cable connectors: 100 min.

6.3.2 *Signal version connectors*

Table 32

Force	Value (N)		Notes
	min.	max.	
Insertion force — 96-way connector — 64-way connector — 32-way connector	 — — —	 90 60 30	
Withdrawal force — 96-way connector — 64-way connector — 32-way connector	 18 12 6	 90 60 30	
Gauge retention force	0,15	—	
Force to press on male moulding	25	100	1, 2, 4
Force to pull off male moulding	25	100	1, 2, 3, 4

NOTE 1 Force per row of 32 contacts.
NOTE 2 Force to be evenly distributed over the whole length of the moulding.
NOTE 3 Each moulding shall only be pushed on and removed once.
NOTE 4 The force to press on or to pull off a male moulding shall not exceed 20 N on any single pin.

6.3.3 *Mixed version connectors*

Table 33

Force	Value (N)		Notes
	min.	max.	
Insertion force a) Fully equipped connector, i.e. 42 signal + 6 power contacts		100	
b) Connectors with 42 signal contacts only		40	
Withdrawal force a) Fully equipped connector, i.e. 42 signal + 6 power contacts	17,6	100	
b) Connectors with 42 signal contacts only	7,8	40	
Gauge retention force — Signal contact — Power contact, SnPb finish — Power contact, Au finish	 0,15 1,6 0,8		
Force to press male power contact into moulding	5	50	3
Force to pull male power contact out of moulding	5	50	3
Force to press male moulding over signal contacts	25	100	1, 2, 3, 4
Force to remove male moulding from signal contacts	25	100	1, 2, 3, 4

NOTE 1 Force per row of 14 contacts.
NOTE 2 Force to be evenly distributed over the whole length of the moulding.
NOTE 3 Each moulding shall only be pushed on and removed once.
NOTE 4 The force to press on or to pull off a male moulding shall not exceed 20 N on any single pin.

6.3.4 *Cable connector versions*

Table 34

Force	Value (N)	
	min.	max.
Insertion force:		
4-way	—	4
10-way	—	10
20-way	—	20
64-way	—	64
Withdrawal force:		
4-way	0,76	4
10-way	1,90	10
20-way	3,80	20
64-way	12,20	64
Gauge retention force	0,15	—
Contact retention force	2,00	—

7 Test schedule

7.1 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.

For connector parts to be assembled by the user, visual and dimensional examination of these parts shall be carried out first. Then the parts shall be assembled to complete connector assemblies according to current practice. If required for male contacts of Figure 9 and Figure 10, pages 16 and 18, a dummy backpanel shall be used. In cases where positioning of the parts to one another is important (see Figure 6, page 13), dimensional examination of the positioning shall be carried out.

For connector assemblies, mated sets of connectors shall be tested. Particular care shall be taken to keep a given combination of connectors together during the complete test sequence, i.e. when unmating is necessary for a certain test the same connectors as before shall be mated for the subsequent tests.

In the following, a mated set of connectors is called a “specimen”. For a complete test sequence, at least 20 specimens are necessary.

For the measurements of contact resistance, the points A and B shown in Figure 37, page 51, shall be used.

The measurements of contact resistance shall be carried out on the number of contacts specified. Any subsequent measurement of contact resistance shall be made on the same contacts.

7.2 Basic (minimum) test schedule for printed board and cable connectors

Where the basic (minimum) test schedule is appropriate the following tests shall be carried out:

a) General examination:	IEC Publication 512-2, Test 1.
b) Insertion and withdrawal force:	IEC Publication 512-7, Test 13b.
c) Contact resistance:	IEC Publication 512-2, Test 2a or 2b.
d) Insulation resistance:	IEC Publication 512-2, Test 3a.
e) Voltage proof:	IEC Publication 512-2, Test 4a.
f) Applicable termination test:	

7.3 Full test schedule for printed board connectors

Preliminary group P

All specimens shall be subjected to the following tests:

Test phase	IEC test			Measurement to be performed		Requirements
	Title	Publication 512 Test NO.	Severity or condition of test	Title	Publication 512 Test NO.	
P1	General examination		Unmated connectors	Visual examination	1a	The dimensions including creepage distances and clearances shall comply with those specified in Clauses **3** and **4**
				Dimensional examination	1b	There shall be no defects that would impair normal operation
P2	Polarizing method	13e				It shall be possible to correctly align and mate the appropriate mating connectors It shall not be possible to mate the connectors other than in the correct manner
P3			Connection points as in Sub-clause **6.2.4** Six contacts per specimen	Contact resistance	2a	20 mΩ max., signal contact 1 mΩ max., power contact
P4			Test voltage 100 ± 15 V Method A Three contacts	Insulation resistance	3a	10^6 MΩ min.
P5			Contact/contact	Voltage proof	4a	As specified in Table 31: 1 000 V (r.m.s.) for signal contacts, 2,54 mm grid and power contacts 1 550 V (r.m.s.) for signal contacts, 5,08 mm grid

The specimens shall be divided into five groups. All connectors in each group shall undergo the tests specified for the relevant group.

Group A

Test phase	IEC test			Measurement to be performed		Requirements			
	Title	Publication 512 Test No.	Severity or condition of test	Title	Publication 512 Test No.				
AP1	Gauge retention force	16e	Female contacts only Female contacts per specimen Sizing tool and gauge (see Clause **5**)			Retain the gauge			
AP2	Insertion force	13b				96-way	64-way	32-way	With power contacts 42- + 6-way
						90 N max.	60 N max.	30 N max.	100 N max.
AP3	Soldering	12a							
AP4			Contact/contact	Voltage proof	4a	As specified in Table 31: 1 000 V (r.m.s) for signal contacts, 2,54 mm grid and power contacts 1 550 V (r.m.s) for signal contacts, 5,08 mm grid			
AP5	Voltage surge		Contact/contact Test voltage: 0...1 200 V d.c. in 10 µs falling to 600 V in 700 µs			NOTE Test procedure not standardized in IEC. No breakdown or flashover between adjacent contacts			
AP6	Vibration	6d	10 Hz – 500 Hz 0,35 mm (0,014 in) or 5 g Duration: 6 h	Contact disturbance	2e	Electrical discontinuity $\leq$ 1 µs No damage due to conditioning			
AP7						Not applicable			
AP8						Not applicable			
AP9	Rapid change of temperature	11d	– 55 °C to + 125 °C No. of cycles: 5						

Group A

Test phase	IEC test			Measurement to be performed		Requirements
	Title	Publication 512 Test No.	Severity or condition of test	Title	Publication 512 Test No.	
AP10			100 ± 15 V Method A Three contacts	Insulation resistance	3a	10^4 MΩ min.
AP11			Contact/ contact	Voltage proof	4a	As specified in Table 31: 1 000 V (r.m.s) for signal contacts, 2,54 mm grid and power contacts 1 550 V (r.m.s) for signal contacts, 5,08 mm grid
AP12			Unmated	Visual examination	1a	No damage due to conditioning
AP13	Climatic sequence	11a				
AP13.1	Dry heat	11i	+ 125 °C, unmated, 16 h Recovery time: 2 h	Insulation resistance at high temperature	3a	10^4 MΩ min.
AP13.2	Damp heat, cyclic, first cycle	11m	Variant 1 Temperature: + 55 °C Recovery time: 2 h			
AP13.3	Cold	11j	– 55 °C, 2 h Recovery time: 2 h			
AP13.4						Not applicable
AP13.5	Damp heat, cyclic, remaining cycle(s)	11m	Variant 1 Temperature: + 55 °C Recovery time: 2 h One cycle			
AP14			100 ± 15 V Method A Three contacts	Insulation resistance	3a	10^4 MΩ min.

Group A

Test phase	IEC test			Measurement to be performed		Requirements			
	Title	Publication 512 Test No.	Severity or condition of test	Title	Publication 512 Test No.				
AP15			Connection points as in sub-clause **6.2.4** Six contacts per specimen	Contact resistance	2a	20 mΩ max., signal contact 1,5 mΩ max., power contact			
AP16			Contact/contact	Voltage proof	4a	As specified in Table 31: 1 000 V (r.m.s) for signal contacts, 2,54 mm grid and power contacts 1 550 V (r.m.s) for signal contacts, 5,08 mm grid			
AP17				Insertion force	13b	96-way	64-way	32-way	With power contacts 42- + 6-way
						90 N max.	60 N max.	30 N max.	100 N max.
AP18			Unmated	Visual examination	1a	No damage due to conditioning			

Group B

Test phase	IEC test			Measurement to be performed		Requirements
	Title	Publication 512 Test No.	Severity or condition of test	Title	Publication 512 Test No.	
BP1				Gauge retention force	16e	Retain the gauge
BP2	Mechanical operation	9a	Performance level 1: 100 operations 2: 50 operations Speed 25 mm/s (1 in/s) Rest: 30 s (when unmated)			
BP3	Industrial atmosphere (Under consideration) or Dry heat	11g 11a	Half mated, half unmated Performance level 1: 21 days SO_2 2: 10 days SO_2 + 125 °C, mated, 500 h Recovery time: 2 h			Under consideration
BP4			Connection points as in Sub-clause **6.2.4** Six contacts/specimen	Contact resistance	2a	20 mΩ max., signal contact 1,5 mΩ max., power contact
BP5	Mechanical operation	9a	Performance level 1: 100 operations 2: 50 operations Speed 25 mm/s (1 in/s) Rest: 30 s (when unmated)			
BP6			100 + 15 V Method A Three contacts	Insulation resistance	3a	10^4 MΩ min.
BP7			Contact/contact	Voltage proof	4a	As specified in Table 31: 1 000 V (r.m.s.) for signal contacts, 2,54 mm grid and power contacts 1 550 V (r.m.s.) for signal contact, 5,08 mm grid

Group B

Test phase	IEC test			Measurement to be performed		Requirements			
	Title	Publication 512 Test No.	Severity or condition of test	Title	Publication 512 Test No.				
BP8						Not applicable			
BP9				Insertion force	13b	96-way	64-way	32-way	With power contacts 42- + 6-way
						90 N max.	60 N max.	30 N max.	100 N max.
BP10				Gauge retention force	16e	Retain the gauge			
BP11			Unmated	Visual examination	1a	No damage due to conditioning			

Group C

Test phase	IEC test			Measurement to be performed		Requirements
	Title	Publication 512 Test No.	Severity or condition of test	Title	Publication 512 Test No.	
CP1	Damp heat steady state	11c	56 days			
CP2			100 ± 15 V Method A Three contacts	Insulation resistance	3a	10^4 MΩ min.
CP3			Connection points as in Sub-clause **6.2.4** Six contacts per specimen	Contact resistance	2a	20 mΩ max., signal contacts 1,5 mΩ max., power contacts
CP4			Contact/contact	Voltage proof	4a	As specified in Table 31: 1 000 V (r.m.s.) for signal contacts, 2,54 mm grid and power contacts 1 550 V (r.m.s.) for signal contacts 5,08 mm grid
CP5				Visual examination	1a	No damage due to conditioning

Group D

Test phase	IEC test			Measurement to be performed		Requirements
	Title	Publication 512 Test No.	Severity or condition of test	Title	Publication 512 Test No.	
DP1						Not applicable
DP2	Electrical load and temperature	9b	1 000 h + 70 °C			Signal contacts: 1,3 A (all contacts) Power contacts: 10 A (all contacts) 30 A (two contacts)
DP3			Connection points as in Sub-clause **6.2.4** Six contacts per specimen	Contact resistance	2a	20 mΩ max., signal contacts 1,5 mΩ max., power contacts
DP4			Contact/contact	Voltage proof	4a	As specified in Table 31: 1 000 V (r.m.s.) for signal contacts, 2,54 mm grid and power contacts 1 550 V (r.m.s.) for signal contacts 5,08 mm grid
DP5						Not applicable
DP6			Contact/contact	Partial discharge	4b	1 000 V min.
DP7						Not applicable
DP8				Visual examination	1a	No damage due to conditioning

Group E

Test phase	IEC test			Measurement to be performed		Requirements
	Title	Publication 512 Test No.	Severity or condition of test	Title	Publication 512 Test No.	
EP1	Robustness of terminations	16f				20 N min., signal contact
EP2	Contact retention in insert	15a				20 N min., power contact
EP3						Not applicable
EP4						Not applicable
EP5	Flammability					Under consideration
EP6				Visual examination	1a	No damage due to conditioning

7.4 Full test schedule for cable connectors and relative male connectors

Preliminary group P

All specimens shall be subjected to the following test:

Test phase	IEC test			Measurement to be performed		Requirements
	Title	Publication 512 Test No.	Severity or condition of test	Title	Publication 512 Test No.	
P1	General examination		Unmated connectors	Visual examination	1a	The dimensions including creepage distances and clearances shall comply with those specified in Clauses **3** and **4**
				Dimensional examination	1b	There shall be no defects that would impair normal operation
P2	Polarizing method	13e				It shall be possible to correctly align and mate the appropriate mating connectors It shall not be possible to mate connectors in any other than the correct manner.
P3			Connection points as in Sub-clause **6.2.4** Six contacts per specimen	Contact resistance	2a	20 mΩ max.
P4			Test voltage 100 ± 15 V Method A Three contacts	Insulation resistance	3a	10^6 MΩ min.
P5			Contact/contact	Voltage proof	4a	As specified in Table 31: 500 V (r.m.s.) between adjacent contacts

The specimens shall be divided into six groups. All connectors in each group shall undergo the test specified for the relevant group.

Group A

Test phase	IEC test			Measurement to be performed		Requirements			
	Title	Publication 512 Test No.	Severity or condition of test	Title	Publication 512 Test No.				
AP1	Gauge retention force	16e	Female contacts only Five contacts per specimen Sizing tool and gauge: see Clause **5**			Retain the gauge			
AP2	Insertion and withdrawal force	13b				Number of contacts			
						4	10	20	64
				Insertion force		4 N max.	10 N max.	20 N max.	64 N max.
				Withdrawal force		0,76 – – 4 N	1,9 – – 10 N	3,8 – – 20 N	12,2 – – 64 N
AP3	Solderability	12a							
AP4			Contact/contact	Voltage proof	4a	As specified in Table 31: 500 V (r.m.s.) between adjacent contacts			
AP5	Voltage surge		Contact/contact Test voltage: 0 ... 1 200 V d.c. in 10 µs falling to 600 V in 700 µs			NOTE Test procedure not standardized in IEC. No breakdown or flashover between adjacent contacts			
AP6	Vibration	6d	10 Hz – 500 Hz 0,35 mm (0,014 in) or 5 g Duration: 6 h	Contact disturbance	2e	Electrical discontinuity: $\leq$ 1 µs No damage due to conditioning			
AP7						Not applicable			
AP8						Not applicable			
AP9	Rapid change of temperature	11d	– 55 °C to + 125 °C No. of cycles: 5						
AP10			100 ± 15 V Method A, three contacts	Insulation resistance	3a	10^4 MΩ min.			
AP11			Contact/contact	Voltage proof	4a	As specified in Table 31: 500 V (r.m.s.) between adjacent contacts			
AP12			Unmated	Visual examination	1a	No damage due to conditioning			

Group A

Test phase	IEC test			Measurement to be performed		Requirements
	Title	Publication 512 Test No.	Severity or condition of test	Title	Publication 512 Test No.	
AP13	Climatic sequence	11a				
AP13.1	Dry heat	11i	+ 125 °C, unmated, 16 h Recovery time: 2 h	Insulation resistance at high temperature	3a	10^4 MΩ min.
AP13.2	Damp heat, cyclic, first cycle	11m	Variant 1 Temperature: + 55 °C Recovery time: 2 h			
AP13.3	Cold	11j	– 55 °C, 2 h Recovery time: 2 h			
AP13.4						Not applicable
AP13.5	Damp heat, cyclic, remaining cycle(s)	11m	Variant 1 Temperature: + 55 °C Recovery time: 2 h One cycle			
AP14			100 ± 15 V Method A Three contacts	Insulation resistance	3a	10^4 MΩ min.
AP15			Connection points as in Sub-clause **6.2.4**. Six contacts per specimen	Contact resistance	2a	20 mΩ max.
AP16			Contact/contact	Voltage proof	4a	As specified in Table 31: 500 V (r.m.s.) between adjacent contacts
AP17					13b	Number of contacts
						4 | 10 | 20 | 64
				Insertion force		4 N max. | 10 N max. | 20 N max. | 64 N max.
				Withdrawal force		0,76 – 4 N | 1,9 – 10 N | 3,8 – 20 N | 12,2 – 64 N
AP18			Unmated	Visual examination	1a	No damage due to conditioning

Group B

Test phase	IEC test			Measurement to be performed		Requirements
	Title	Publication 512 Test No.	Severity or condition of test	Title	Publication 512 Test No.	
BP1				Gauge retention force	16e	Retain the gauge
BP2	Mechanical operation	9a	50 operations Speed: 25 mm/s (1 in/s) Rest: 30s (when unmated)			
BP3	Industrial atmosphere or Dry heat	11g 11a	Half mated, half unmated 21 days SO_2 + 125 °C, mated, 500 h Recovery time: 2 h			Under consideration
BP4			Connection points as in Sub-clause **6.2.4** Six contacts per specimen	Contact resistance	2a	20 mΩ max.
BP5	Mechanical operation	9a	50 operations Speed: 25 mm/s (1 in/s) Rest: 30 s (when unmated)			
BP6			100 ± 15 V Method A Three contacts	Insulation resistance	3a	10^4 MΩ min.
BP7			Contact/contact	Voltage proof	4a	As specified in Table 31: 500 V (r.m.s.) between adjacent contacts
BP8						Not applicable
BP9					13b	Number of contacts
						4 | 10 | 20 | 64
				Insertion force		4 N max. | 10 N max. | 20 N max. | 64 N max.
				Withdrawal force		0,76 – 4 N | 1,9 – 10 N | 3,8 – 20 N | 12,2 – 64 N
BP10				Gauge retention force	16e	Retain the gauge
BP11			Unmated	Visual examination	1a	No damage due to conditioning

Group C

Test phase	IEC test			Measurement to be performed		Requirements
	Title	Publication 512 Test No.	Severity or condition of test	Title	Publication 512 Test No.	
CP1	Damp heat, steady state	11c	56 days			
CP2			100 ± 15 V Method A Three contacts	Insulation resistance	3a	10^4 MΩ min.
CP3			Connection points as in Sub-clause **6.2.4** Six contacts per specimen	Contact resistance	2a	20 mΩ max.
CP4			Contact/contact	Voltage proof	4a	As specified in Table 31: 500 V (r.m.s.) between adjacent contacts
CP5				Visual examination	1a	No damage due to conditioning

Group D

Test phase	IEC test			Measurement to be performed		Requirements
	Title	Publication 512 Test No.	Severity or condition of test	Title	Publication 512 Test No.	
DP1						Not applicable
DP2	Electrical load and temperature	9b	1 000 h, 1,3 A + 70 °C			
DP3			Connection points as in Sub-clause **6.2.4** Six contacts per specimen	Contact resistance	2a	20 mΩ max.
DP4			Contact/contact	Voltage proof	4a	As specified in Table 31: 500 V (r.m.s.) between adjacent contacts
DP5						Not applicable
DP6			Contact/contact	Partial discharge	4b	500 V min.
DP7						Not applicable
DP8				Visual examination	1a	No damage due to conditioning

Group E

Test phase	IEC test			Measurement to be performed		Requirements
	Title	Publication 512 Test No.	Severity or condition of test	Title	Publication 512 Test No.	
EP1						Not applicable
EP2	Contact retention in insert	15a				2 N min.
EP3						Not applicable
EP4						Not applicable
EP5	Flammability					Under consideration

Group F

Test phase	IEC test			Measurement to be performed		Requirements
	Title	Publication 512 Test No.	Severity or condition of test	Title	Publication 512 Test No.	
FP1	Resistance to cable rotation	17b	No. of revolutions: 10	Visual examination	1a	
FP2	Resistance to cable putting	17c	Force: 4-way and 10-way: 30 N 20-way and 64-way: 50 N			Cable displacement: 2 mm max.
FP3	Resistance to cable bending	17a	Force: equal to the weight of 3 m of the cable Distance from cable clamp: 100 mm No. of blends: 20			Cable displacement: 2 mm max.
FP4	Resistance to cable torsion	17d	Twist through 180° and return to normal No. of twists: 100			Cable displacement: 1 mm max.

Annex ZA (normative)
Normative references to international publications with their corresponding European publications

This European Standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies (including amendments).

NOTE When an international publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

Publication	Year	Title	EN/HD	Year
IEC 60050(581)	1978	International Electrotechnical Vocabulary (IEV) Chapter 581: Electromechanical components for electronic equipment	—	—
IEC 60097	1970[a]	Grid system for printed circuits	—	—
IEC 60194	1988	Terms and definitions for printed circuits	HD 142 S3	1991
IEC 60326	series	Printed boards	—	—
IEC 60352-1	1983	Solderless connections Part 1: Solderless wrapped connections General requirements, test methods and practical guidance	EN 60352-1[b]	1994
IEC 60512	series	Electromechanical components for electronic equipment Basic testing procedures and measuring methods	EN 60512	series
IEC 60603-1	1981[c]	Connectors for frequencies below 3 MHz for use with printed boards Part 1: General rules and guide for the preparation of detail specifications	—	—
ISO 468	1982	Surface roughness Parameters, their values and general rules for specifying requirements	—	—

[a] IEC 60097:1991 is harmonized as EN 60097:1993.
[b] EN 60352-1 is superseded by EN 60352-1:1997, which is based on IEC 60352-1:1997.
[c] IEC 60603-1:1991 + A2:1992 are harmonized as EN 60603-1:1998.

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BS EN 60603-9:1998 IEC 60603-9: 1990

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