ED122

SPECIFICATION FOR THE WIRING OF EQUIPMENT

British Broadcasting Corporation
Engineering Directorate

PREFACE TO 1990 REPRINT

This reprint of ED122 has been produced to meet urgent demands in advance of the updating of the specification.

SAFETY

The Safety Section of the document has been overtaken by changes in statutory requirements and BBC policy.

As a consequence it is essential that the user consults the relevant source document and does not depend upon the information in the Safety Section of this specification.

To assist users the Safety Bibliography has been incorporated at the front of the specification.

The D & ED Specification which sets out D & ED policy in respect of the Earthing of Equipment has also been added.

Also, the following statutory documents, not listed in the Safety Bibliography, are of importance relative to particular activities covered by ED122.

1. The Control of Substances Hazardous to Health Regulations 1988. ("C.O.S.H.H.")

2. The Electricity at Work Regulations 1989.

3. Regulations under the powers of the Consumer Protection Act 1987 i.e. The Electrical Equipment (Safety) Regulations 1975, and Amendments 1976, and Plug & Sockets etc Regulations 1987.

NOTE Part 5 of the EMSC Guidance Paper No. 4, reproduced below, explains the significance of the above documents. It is important that no assumptions as to prospective utilisation of equipment are made, e.g. Broadcasting Equipment is often taken into domestic situations and members of the public are often in locations alongside Broadcasting Equipment.

5. THE LEGAL BACKGROUND

5.1 Introduction

Electrical equipment used by the BBC ranges from domestic appliances and office machinery to specialized broadcasting plant. The safety of such equipment as supplied or installed is governed by separate areas of legislation depending on whether the item was originally intended for domestic or for occupational use and on whether the supplier understood that it was being purchased for occupational use.

Some locally purchased equipment will have been designed primarily for the consumer market. Many of the standards and test procedures recommended in the Vetters' Guide and Code are therefore based on Regulations, British Standards, etc. intended for consumer protection as there is no other appropriate source. Both the EVALUATOR and TESTER must be aware of this, and decide whether the BBC's proposed conditions and frequency of use require any additional precautions to be taken.

5.2 Duties of an Employer

The Health and Safety at Work Act 1974 places a duty of care upon the employer to provide and maintain safe working conditions and safe equipment. It also imposes a corresponding duty on all employees (including line managers) to co–operate in the implementation of safe procedures.The Electricity (Factories Act) Regulations 1908 and 1944 further control electrical safety in industry but are expected to be superseded in the near future by new Electricity at Work Regulations. These future regulations will apply to all work places covered by the Health and Safety at Work Act, 1974, will reinforce the authority of many existing Standards and Codes of Practice and also will ensure compatibility with European Community law such as the Low Voltage Directive (Ref 2).

5.3 Duties of a Supplier

The Consumer Protection Act 1987 has amended the law covering the safety of goods. It is now an offence to supply consumer goods which are not reasonably safe having regard to all the circumstances. Manufacturers and importers, as well as suppliers, must consider reasonably foreseeable risks during handling, maintenance, and storage as well as use, and must see that safety information is supplied to the customer.Section 6 of the Health and Safety at Work Act 1974 places a specific duty on those who can ensure that articles are as safe and without risks to health as it is reasonably practicable to make them before they are used, and that they are properly installed and used. This covers items which, though capable of domestic use, are designed also to be used at work.The Electrical Equipment (Safety) Regulations 1975 and the Electrical Equipment (Safety) (Amendments)

Regulations 1976, made under the powers of the Consumer Protection Act, further control the safety of electrical equipment sold over the counter for use 'in and around the home'. The Plugs & Sockets etc. Regulations 1987 provide (amongst other things) that domestic mains plugs, sockets, and adapters must meet the relevant BS regarding safety or provide an equivalent level of safety, as well as outlawing certain misleading practices such as marking a plug 'BS1363 gauge'.

5.4 Guidance from the Department of Trade and Industry

The Department of Trade and Industry (DTI) has issued Administrative Guidance (Ref 3) indicating those standards which, in the opinion of the DTI, offer the degree of safety required by the Regulations, although only the Courts can offer authoritative rulings on points of law. The Administrative Guidance also lists those APPROVALS BODIES in the UK and other Member States of the EC which have been notified to the EC as competent to establish Approval MARKS OR CERTIFICATES under Article 10 of the Low Voltage Directive (Ref 2). These MARKS OR CERTIFICATES are regarded by the DTI as a reliable indication of compliance with the safety provisions of RECOGNIZED STANDARDS. Also listed are AUTHORIZED TESTING BODIES who may issue reports which may be used by APPROVALS BODIES to assess whether to award MARKS OR CERTIFICATES.For the guidance of EVALUATORS, relevant bodies and their marks regularly notified as above are listed in Appendix 1 of this guidance paper..

DISPOSAL OF ITEMS CONTAINING BERYLLIUM

Instructions in respect of the disposal of items containing Beryllium are included in the Engineering Components Catalogue and are repeated in this preface. These supersede the statement which refers to Valve Section in ED122.



DEVICES CONTAINING TOXIC COMPOUNDS INCLUDING BERYLLIUM



1. Devices identified by a "TOXIC WARNING LABEL" **must not** be broken into, machined or any action taken which will expose the material contained within to human contact

2. If devices, as delivered, are identified as containing, or it is suspected that they contain, Beryllium and the devices appear to be damaged in any way **do not** remove final packaging but return to Stores Manager, Central Stores.

   See "Disposal" procedures, as set out in 3 below.

3. **Disposal of components containing Beryllium**

Components to be disposed of should be packed in accordance with Engineering Safety Regulation ESR 2.9.2, and returned to Stores Manager, Avenue House, Power Road, Chiswick, W4 5PG.

The following disposal kit is available free of charge from Stores Manager, Avenue House

Disposal kit comprises :–

a) 1 pair disposable gloves
b) 1 disposable face mask
c) 1 anti–puncture bag
d) 2 internal caution labels
e) 1 external caution label
f) 1 Jiffy envelope

The following methods should be used when returning Beryllium devices.

1) Don gloves and face mask
2) Place broken devices into anti–puncture bag
3) Place gloves and face mask into anti–puncture bag
4) Seal bag with internal caution label
5) Place anti–puncture bag in Jiffy envelope and seal
6) Place external cautionary label on front of Jiffy envelope and return to Stores Manager, Avenue House

EVERY EFFORT SHOULD BE MADE TO USE BBC TRANSPORT FOR RETURNING BERYLLIUM DEVICES. WHERE AN EXTERNAL CARRIER IS USED TO RETURN GOODS IT IS A STATUTORY REQUIREMENT TO INFORM THEM OF THE TOXIC SUBSTANCE INVOLVED.

4. Further information in respect of Beryllium – health and safety precautions is detailed in Health and Safety Executive Guidance Note EH 13.

5. See also Control of Substances Hazardous to Health (COSHH) information on page VII.

6. Any further advice required in respect of TOXIC COMPOUNDS should be sought from Safety Officers.

7. If in doubt as to the presence of a Toxic substance within a device please consult Standards Section.

ENGINEERING MANAGEMENT SAFETY COMMITTEE

SAFETY BIBLIOGRAPHY: 1990 (2nd Edition)

July 1990

SAFETY BIBLIOGRAPHY 1990

The following bibliography of BBC published safety documents is intended for the use of BBC staff with engineering responsibilities (whether working within Engineering or an Output Directorate). The first part lists documents produced within Engineering. The second contains various general items, concentrating in the main on those with technical implications.

Other documents may help staff to discharge their duties under the Health & Safety at Work Act 1974. The following lists of publications may be useful:

HEALTH AND SAFETY EXECUTIVE. Publications in Series. 1990. (Free).
BRITISH STANDARDS INSTITUTION. BSI Catalogue. (Cost 30 pounds sterling)

If you wish to consult a safety document, BBC Reference Libraries may be able to lend it to you. If you need a copy for retention, consult the BBC source shown on this list for internal documents, or the BBC Data's Purchasing and Acquisition Unit for externally published documents (Room C110, Woodlands, PABX TC 4724).

Also attached as Appendices to this Bibliography are lists of the members of the Corporate Health and Safety Committee (which replaces the Central Safety Committee), of the Engineering Management Safety Committee, and of the Managers, Safety Services. In all cases of difficulty and doubt on safety matters, including the interpretation of the Regulations and Codes, the relevant MSS or Committee Member should be approached through the correct Line Management.

Many of the BBC documents are also available in machine–readable form. Please enquire of the normal supplier as listed if this is of interest to you.

1. ENGINEERING

Engineering Safety Regulations	Available from:
ESRs 9th Edition, reprinted with amendments 1–4 (November 1985)	Central Stores Avenue Ho Ref 50022778
Amendment 5 to above (February 1988)	Central Stores Avenue Ho Ref 50022786
Amendment 6 to above (March 1990)	Central Stores Avenue Ho Ref 50014952
Red binder	Central Stores Avenue Ho Ref 50024571
Supplementary ESRs for Managers (Second Edition, January 1987)	Central Stores Avenue Ho Ref 50024563

IF IN DOUBT CONSULT MANAGER, SAFETY SERVICES, ENGINEERING.

NEW TECHNIQUES

There can be no doubt that ED122, Issue 9, provides essential information since demand has forced this reprint.

However there is no reference to techniques that have come into use since 1984 e.g. Surface Mount Technology and Insulation Displacement Termination.

These, and other omissions from this reprint should not be taken as lack of approval.

Until ED122 is reissued it is for the engineer in charge of the project to authorise the use of techniques not described in the specification.

EMSC Guidance Papers:

No. 1	Safe Work on Masts and Similar High Structures (Third Edition, December 1986)
No. 2	The Effects of Electric Shock (Second Edition April 1989)
No. 2(B)	Background Information on Electric Shock (Revised title: Second Edition April 1989)
No. 3	The use of Residual Current Circuit Breakers (Third Edition, June 1984) (under revision)
No. 4	The Safety Evaluation of Locally Purchased Equipment [Vetters' Guide] (Third Edition, April 1989)
No. 5	Solvents and Cleaners used on Technical Equipment and in Workshops (Third Edition, June 1988)
No. 6	Non–ionizing RF Radiation (December 1978) (under revision)
No. 7	Lasers (August 1980)
No. 8	Ionizing Radiation (Second Edition, December 1986)
No. 9	Responsibilities of Managers (Second Edition, under revised title, March 1988) (under revision). See also Corporate Guidance Paper No.1
No.10	The use of Oxy–acetylene Torches (January 1985)
No.11	Responsibility for Contractors (September 1985)

Other relevant publications	Available from:
Fuses: Protection of Supplies to Technical Apparatus: SCPD Report G/1971/2	PID Tel (Though old, this document is still rele–vant)
Notes for Guidance of Engineering Representatives Meeting Health and Safety Executive Inspectors (Second Edition, June 1981) (under revision)	Secretary to EMSC
Safety Bonds for Luminaires and other Suspended Equipment: Recommendations for Use and Manufacture (Revised Issue, March 1982)	Power, Mechanical and Lighting Section, PID
Work at Heights – Safety Training Manual for BBC staff (Re–issued February 1990) (Issued only to staff involved in such work)	Transmitter Manager, Support Services
Conditions of Contract and Specification for Scaffolds (April 1988) List of Approved Scaffold Contractors (April 1990)	Secretary to EMSC
Conditions of Contract for Hire of Hydraulic Platforms (April 1988) List of Approved Hydraulic Platform Hire Contractors (April 1990)	

Amendment 1 to above (February 1988)	Central Stores Avenue Ho Ref 50024555
Amendment 2 to above (August 1989)	Central Stores Avenue Ho Ref 50014309
Regulations for work on High Voltage Power Equipment [HV Rules] (Second Edition, February 1988) (for use by staff authorised to work on such equipment)	Transmitter Manager, Support Services
The following publications are available from:	Secretary to EMSC

Protective Multiple Earth Approvals

England and Wales (issued by the Department of Energy: effective May 1983)
Scotland (issued by the Scottish Economic Planning Department: effective May 1983)

EMSC Codes of Practice

No. 1	Electrical Safety (Fourth Edition, under revised title, March 1990)
No. 2	Earthing and Protection in Technical Vehicles (October 1980)(under revision)
No. 3	Safety in Vehicle Workshops (Third Edition, April 1988)
No. 4	Fire Safety for Contractors Carrying Out Work in Occupied BBC Buildings (Second Edition, January 1989)
No. 5	Connectors for use on Mains Voltages not Exceeding 250 V (nominal) (Second Edition, July 1987)
No. 6	Electrical Safety Bonding in Television Studios (November 1984)
No. 7	Use of Headphones in the BBC (Provisional / Second Edition, December 1989)
No. 8	Standard Safety Procedures for Contractors Carrying Out Work in BBC Studios (September 1986) (under revision)
No. 9	Standard Safety Procedures for Contractors Carrying Out Work at BBC Transmit ting Stations (September 1986) (under revision).
No.10	The management of Poly–Chlorinated Biphenyl (PCB) filled components (January 1986)
No.11	High Sound Levels (Provisional Second Edition December 1989)
No.12	The Handling, Storage and Use of Compressed Gases (July 1988)
No.13	The Safety Testing of Locally Purchased Equipment [Vetters' Code] (April 1989)
No.14	The Treatment of Water Systems (issued in several Parts as required: June 1990)

2. NON–ENGINEERING

General Safety Regulations etc.	Available from:
BBC Health & Safety at Work 1990	Central Stores Avenue Ho Ref 50025213
Part B – Radio (1981)	Central Stores Avenue Ho Ref 50022680
Part B – Local Radio (Revised September 1984)	Central Stores Avenue Ho Ref 50024547
Part B – Television (includes a comprehensive list of local standing instructions) (Revised February 1987)	MSS Tel under the title: 'Television Safety Regulations'
Part B External	MSS WS
Part C Regional (a separate document may be issued by for each Region)	H Pers and Admin Region concerned
BBC Regulations for Scaffolds and Permanent Platforms (June 1986)	MCSS

Corporate Health and Safety Committee Guidance Papers

No.1 Responsibility for Health and Safety (April 1990)	Central Stores Avenue Ho Ref 50025193

Other relevant papers

General Rules for Manual Lifting (ETD: February 1985)	Handout Library, Malvern Wing, ETD Wood Norton
Why Produce your own Aches and Pains? (RoSPA)	
BBC Code of Practice for the Selection, Installation and use of Visual Display Terminals in Offices (April 1990)	MCSS
BBC Guide to Working Conditions (February 1983)	
BBC Fire Policy and Practice Guidance Paper (which includes a Code of Practice for Installation of Fire Protection Measures in BBC Premises) (November1983) (under revision)	Fire Prevention Officer

Code of Wiring Practice for Scenic Construction (June 1984) — J W

Guide to Scaffold Practice (November 1984)
BBC Policy on the Control of Asbestos based Materials (November 1984) (under revision) — MCSS
BBC List of Approved Asbestos Removal Contractors (Re–issue No 3, November 1985) (under revision)
Code of Practice : Bulk Sampling of Asbestos based Materials (October 1985) (under revision)

ENGINEERING MANAGEMENT SAFETY COMMITTEE MEMBERSHIP

Name, Department, Room No & Telephone or Post Building

B L H	(Chairman)	TAM S & E	Crystal Palace CP
D C D	(Deputy Chairman)	MSS Eng	HWH LBH
M G N	(Secretary)	SS Eng	HWH LBH
M B		MCSS	33 Cav Sq LBH
P C		Tx Supp	Warwick WK
D R C		ETD	Wood Norton WN
K R G		Man Ops NW	Portakabin NBH (MR) MR
S P D H		ACED	HWH LBH
P H J		Inf TE	Woodlands TC
P E J		WS	CB Bush BU
T G L		RD	Kingswood Warren KW
P E L		EID	HWH LBH
R P M		D & ED	Avenue House AH
M R		MSS	TC TC
D B R		PID Tel	Woodlands TC
E J R		Transport	Park Western KA
K R T		Radio	Western House LBH
D J T		SS Eng	HWH LBH
J D W		Tel Tech Invest	TC TC
C F W		MCES NI	BH Belfast BH

Low Voltage Sub–Committee

D C D	MSS Eng (Chairman)
B R A	Stds Man., D & ED
P C	Tx Support Service
N R H	Inf TE
P E J L	WS Bush

High Sound Level Sub–Committee

D C D	MSS Eng (Chairman)
L G	H Tel Sound
Dr C G	SMO, TC
K G	Man Ops NW R
P E J L	HE Bush S

M G N	SS Eng (Secretary)	R K L	Hd Sound Sect, D & ED
D B R	HPMLS, PID Tel	C D M	RD
J S	D&ED		
K R T	Radio LBH	K R T	Radio LBH
J D W	Tel Tech Investigations	D J T	CSS Eng
K W	Tx Eng Dept	J W	Tel Tech Investigations
C F W	MCES NI	R W	NCA

High Voltage Sub–Committee

D C D	MSS Eng (Chairman)
P C	Tx Support Services
A J E	H Elec Services Tel
A J L	ETD
D J T	CSS Eng (Secretary)
K W	Tx Eng Dept

ESRs Sub–Committee

D J T	CSS Eng (Chairman)
P C	Tx Support Services
M G N	SS Eng (Secretary)
K R T	Radio
J W	Tel Tech Investigations

APPENDIX 2 CORPORATE HEALTH AND SAFETY COMMITTEE MEMBERSHIP

As from late 1989, this new Committee replaced the previous Central Safety Committee (CSC). The members are the safety Directors and Controllers listed in Appendix 3, together with:

Dr A F	Corporation Medical Officer
B L H	Chairman of EMSC
G P D J	H Em P (Secretary of CSC)
M B	MCSS

APPENDIX 3 CORPORATE SAFETY MANAGEMENT

In July 1988, BoM assigned responsibility for overseeing safety arrangements in their respective Directorates to:

R H B	ACRB(F&R) Regional Broadcasting
E R B	ADNCA News & Current Affairs
M J B	CIS Corporate Affairs
Dr H M R C	GRMPPU Policy and Planning Unit
R R C	D Pers Personnel (Chairman of CSC)
M D	GCA Finance
C C I	CRAWS World Service
J F K	DBAE Enterprises
G R	Legal Adviser Legal Adviser's Division
C P S	DDE Engineering
C T	DR Tel,Network Television
D P T	DRR Network Radio
G B W	HEBSSEC Educational Broadcasting

APPENDIX 4 MANAGERS, SAFETY SERVICES

In order to establish a comprehensive and effective safety management structure across the BBC a new category of Manager, Safety Services has been created. The following are in post:

MCSS	M B	33 Cav Sq	LBH
MSS Eng	D C D	HWH	LBH
MSS Tel	M R	TC	TC
MSS Radio	I G	Yalding House	LBH
MSS WS	W G S	NE Bush Ho	BU
MSS NCA	M R	TC	TC
MSS Regional Broadcasting	Mrs B W	33 Cav Sq	LBH

AMCSS (Mr J M) is Manager, Safety Services, for Corporate Affairs, Finance, Personnel, and DDG's establishment.

BRITISH BROADCASTING CORPORATION

ENGINEERING DIRECTORATE

DESIGN AND EQUIPMENT DEPARTMENT

SPECIFICATION D.E.D. 159

SAFETY EARTHING

OF

ELECTRONIC EQUIPMENT

ISSUE 2
OCTOBER 1989

Written by :-

P.J. A
Standards Section

Approved by :

For Head of Design & Equipment Department

SAFETY EARTHING OF ELECTRONIC EQUIPMENT

INDEX

1. GENERAL

2. DOCUMENTS

3. REASON FOR EARTHING

4. GENERAL REQUIREMENTS

5. EARTHING TERMINAL

6. EARTH BUS–BAR

7. EARTH CONDUCTORS

8. ELECTRICAL TESTS

APPENDIX I – DEFINITIONS

APPENDIX II – EARTH TERMINAL ASSEMBLY

SPECIFICATION D.E.D. 159

BRITISH BROADCASTING CORPORATION

ENGINEERING DIRECTORATE

DESIGN AND EQUIPMENT DEPARTMENT

SAFETY EARTHING OF ELECTRONIC EQUIPMENT

1. GENERAL

This Specification defines the requirements for earthing as it applies to Class 1 electronic equipment constructed by the BBC for its own use. (See Appendix 1 for definition of Class 1 equipment.)
It is intended that it shall apply to general–purpose panel–mounted, bay–mounted and portable/transportable equipment.
The guidelines laid down in this Specification shall also be applicable to commercial equipment purchased for use as an integral part of Class 1 electronic equipment constructed by the BBC for its own use.

2. DOCUMENTS

The documents listed below relate to electrical and electronic equipment similar to broadcasting equipment and it is on the relevant parts of these that this Specification is based.

BS2754	–	Construction of Electrical Equipment for Protection Against Electric Shock.
BS3192 (IEC 215)	–	Specification for Safety Requirements for Radio (including TV) Transmitting Equipment.
BS415 (IEC 65)	–	Specification for Safety Requirements for Mains Operated Electric and Related Apparatus for Household and Similar General Use.
BS5850	–	Safety of Electrically Energized Office Machines.
IEE	–	Wiring Regulations, 15th Edition.
BS3042	–	Standard Test Finger for Checking Protection against Electric Shock.

3. REASON FOR EARTHING

The prime reason for safety earthing is for the protection of personnel should a fault occur on equipment which would lead to accessible metalwork becoming live. Under such conditions a safety earth conductor is intended to provide a low impedance discharge path for the fault current and, in so doing, to operate an overcurrent protective device.

4. GENERAL REQUIREMENTS

The general requirement is that accessible metalwork, not normally required to carry current, and which might come into contact with a live conductor under a fault condition shall be connected to an earth contact or terminal (as shown in Appendix 2).

Small metal parts (screws, labels, etc.,) which are fixed to insulating material are exempt from the above requirement, providing that the insulation meets the requirements of BS415 in respect of creepage and clearance, (see Appendix 1).

It is important that, prior to securing any earthing tag or terminal to metalwork, paint, anodizing or other non–conductive surface treatment shall be removed from that metalwork over an area not less than the head size of the fixing screw. (See Appendix 2.)

5. EARTHING TERMINAL

Bayframes:-

An earthing terminal shall be provided on each Bayframe for connection of the incoming safety earth conductor. The construction of the terminal shall be such that there is no risk of corrosion resulting from contact with the copper of the earth conductor or any other metal with which it will be in contact. It shall not be possible to loosen the earth terminal without the use of hand tools. The terminal shall not be used for any purpose other than safety earthing.

An earth terminal shall be provided on each piece of mains powered equipment which is removable from a bayframe. The earth terminal shall be connected by flexible conductor to the Bayframe bus-bar, (see clause 6). Hinged metal panels shall be connected by flexible conductor to the metalwork of its parent equipment. This conductor shall be fixed with a dedicated fixing screw, i.e. screws used for mechanical assembly are not to be used for fastening earth terminals. The length of earth conductor connected to removable equipment shall be sufficient to allow partial withdrawal of the equipment. Complete removal of equipment will require the disconnection of the safety earth conductor and, where appropriate, any mains or other connectors. The metalwork of plug–in modules or equipment panels that are removed from a bayframe, to allow electrical tests to be carried out remote from the bayframe, shall be connected to a local earth terminal by a flexible earthing conductor. The responsibility for ensuring the correct removal and refitting procedure and the provision of any additional earth conductor, where required, shall lie with the supervising engineer.

Portable/Transportable Equipment:–

The earthing of all accessible metalwork on portable/transportable equipment shall be derived from the earthing conductor of the mains input cord.

This conductor shall be connected within the equipment to an earth terminal adjacent to the mains connector, if fitted, or adjacent to the point of entry of the cord, if hard–wired. Accessible metal parts shall be connected to the earth terminal by flexible earth conductors, see Clause 7.

6. EARTH BUS–BAR

An earth bus–bar, constructed of heavy gauge wire or metal strip (not less than 6.0mm ^{2} c.s.a.), shall be fastened to bayframe metalwork using screws, nuts and shakeproof washers. A conductor shall be connected between the bayframe earth terminal and the bus–bar.
Earth conductor connections to a wire bus–bar shall be by soldered joint. Connection to a metal strip bus–bar shall be by screws, nuts (one plain, one locking) and shakeproof washers.

7. EARTH CONDUCTORS

Earthing conductors shall be flexible (stranded) copper wire covered with PVC insulation. The insulation colour shall be green/yellow. They shall not be used for any purpose other than safety earthing. A bayframe incoming earthing conductor shall be not less than 6 mm ^{2} c.s.a. Internal conductors (i.e. those from equipment to the bayframe) shall be not less than 2.5 mm ^{2} c.s.a., (e.g. PUF1/2M). The choice of conductor c.s.a. should be commensurate with the prospective fault current.

(For guidance the above conductors are rated as follows:–

2.5mm^2	–	15A max (at 35^0 C in free air)
6.0mm^2	–	50A max (" " " ")

De–rating applies at temperatures greater than 35^0 C.)

8 ELECTRICAL TESTS

A test meter (such as the Clare V152, Electrical Safety Tester for Earthed and Double Insulated Equipment) should be used to check the impedance to earth of all metal parts which are accessible to Standard Test Finger 'I' as specified in BS3042. The test meter should be capable of giving a current of 25 amps at a voltage not exceeding 6V a.c. The potential between the earth terminal and any accessible metalwork shall not exceed 2.5 volts (corresponding to a resistance of 0.1 ohm).

APPENDIX I
DEFINITIONS

Class 1 Equipment (as defined by BS 2754)

Equipment in which protection against electric shock does not rely on basic insulation only, but which includes an additional safety precaution in such a way that means are provided for the connection of accessible conductive parts to the protective (earthing) conductor in the fixed wiring of the installation in such a way that accessible conductive parts cannot become live in the event of a failure of the basic insulation.

NOTE 1.

For equipment intended for use with a flexible cord or cable, this provision includes a protective conductor as part of the flexible cord or cable.

NOTE 2.

Where equipment designed as Class 1 is allowed by a Technical Committee to be fitted with a 2–core flexible cord or cable, provided that it is fitted with a plug which cannot be introduced into a socket outlet with earthing contact, the protection is then equivalent to that of Class 0, but the earthing provision of the equipment in all other respects should fully comply with the requirements of Class 1.

Earthing Conductor

A protective conductor connecting an external (to the equipment) earth of an installation to an earth terminal of the equipment.

Earth Terminal

A terminal connected to conductive parts of any equipment for the purpose of connecting a safety earth conductor.

Accessible Metal Part

Any metal part which can be touched with a BS 3042 Standard Test Finger, or any metal which is electrically connected to such parts.

Live Part

A part, contact with which may cause an electric shock.

Creepage and Clearance

a) Creepage distance in air denotes the shortest distance measured in air over the surface of insulation between conductive parts.

b) Clearance denotes the shortest distance in air between conductive parts. The creepage and clearance distance applicable to 250 V R.M.S. (354 V peak) is 3.0mm minimum for basic and supplementary insulation.

SYMBOLS

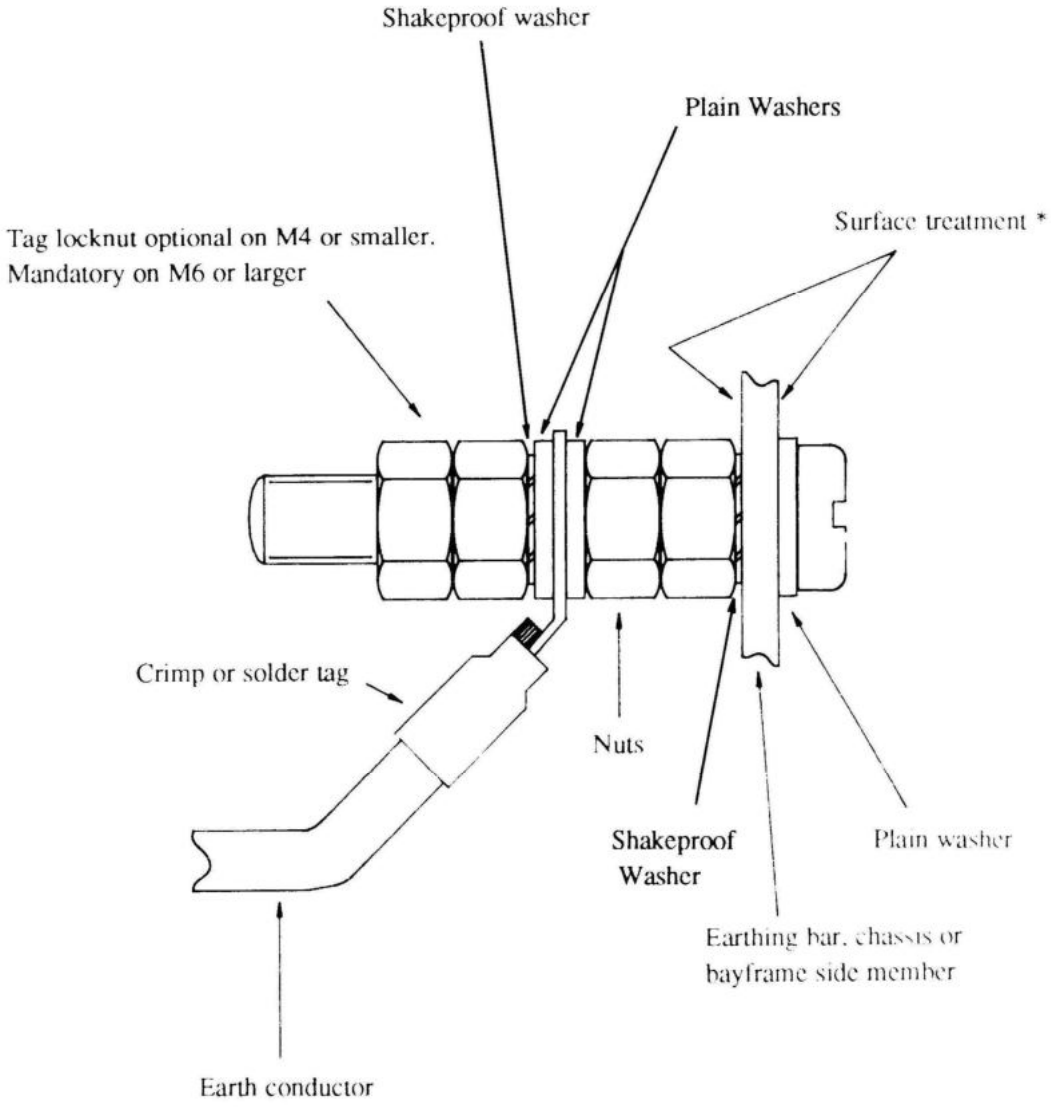
Protective Earth Symbol:–

The protective earth symbol is the standard earth symbol within a circle, i.e.,



APPENDIX II

EARTH TERMINAL ASSEMBLY



* See Clause 4 reference the removal of surface treatment in these areas.

BRITISH BROADCASTING CORPORATION

ENGINEERING DIVISION

EQUIPMENT DEPARTMENT

SPECIFICATION ED.122

WIRING OF TECHNICAL EQUIPMENT

Re-written by C. S
B.R. A
G.S. J
B. B

Issue 9 September 1984

The British Broadcasting Corporation
Equipment Department
Avenue House, Power Road, Chiswick
LONDON
W4 5PG

Revised Edition published August 1984

© British Broadcasting Corporation 1984

All Rights Reserved. No part of this publication may be reproduced, stored in a retrieval system, or transmitted, in any form or by any means, electronic, mechanical, photocopying, recording or otherwise, without the permission of the British Broadcasting Corporation.

Printed in Great Britain by

The Print Unit
BBC Engineering Training Centre

FOREWORD

E.D. 122 is intended to define the engineering practice to be used in assembly and wiring work, by those engineers, technicians and craftsmen engaged in designing, building or installing broadcasting and associated equipment.

The objective is to achieve safe working and reliable and consistent standards of performance and to ensure a uniform approach to layout for ease of maintenance and future modification.

It is not possible to cover every eventuality, and the general instructions in E.D. 122 are superseded by specific instructions on drawings, or the instructions of the engineer responsible for the work undertaken.

The contents of E.D. 122 are the joint responsibility of Head of Production Group and Standards Engineer, acting on behalf of Engineering Division. Suggestions as to any additional information thought necessary, or other amendment, should be made direct to Standards Engineer or via Departmental Representation in the Manufacturing and Production Techniques Group.

CONTENTS

SECTION A	SAFETY
SECTION B	ASSEMBLY AND WIRING PRACTICES
SECTION C	CABLES, WIRES AND CABLE ACCESSORIES
SECTION D	WIRING AND MECHANICAL DATA
SECTION E	COMPONENT CODING
SECTION F	MANUFACTURING SPECIFICATIONS
SECTION G	GUIDE TO ENGINEERING COMPONENTS CATALOGUE

SECTION A SAFETY

A1 Health and Safety
A1.1 General
A1.2 Protective Clothing
A1.3 Equipment and Site Working
A1.4 Access and Security

A2 Components Safety
A2.1 Mains Rated Components
A2.2 Mains Fuses
A2.2.1 Fuseholders
A2.3 Hazardous Material
A2.3.1 Components Containing Beryllium Compounds

A3 Earthing of Metal Work
A3.1 Earthing of The Exposed Metal Work of Components or Mains Operated Equipment.
A3.2 Alternative Protection
A3.3 Relevant Safety Specfications

A4 Safety Labels

A5 BBC Safety Publications

SECTION B ASSEMBLY & WIRING PRACTICES

B1 Soldering
B1.1 General
B1.2 Solder and Flux
B1.3 Soldering Heat and Time
B1.4 Machine Soldering
B1.5 Plated Through-hole P.C.B.'s
B1.6 Soldering Instructions given as part of P.C.B. Component Location Legend.

B2 Printed Wiring Board Assemblies

B2.1 General
B2.2 Lead Formation
B2.3 Component Orientation
B2.4 Copper Roundel
B2.5 Shorting
B2.6 Colour Coding

B3 M.O.S. & C.M.O.S. Semi-Conductors
B3.1 General
B3.1.2 Identification of Devices
B3.1.3 Packaging and Transportation
B3.1.4 Assembly
B3.1.5 Working Precautions

B4 Transistor & I.C. Regulator Assemblies
B4.1 General
B4.1.1 Use of Torque Controlled Assembly Tools
B4.1.2 Strain Relief on Terminals
B4.1.3 Soldering Heat
B4.2 Method of mounting Heatsinks Redpoint Type 5C and Similar
B4.3 Use of Mounting Pads with 10 pin TO5 Integrated Circuits

B5 **Leadless Ceramic Disc & Chip Capacitors**
B5.1 General
B5.1.1 Pre-heating
B5.1.2 Soldering
B5.2 Capacitor Identification
B5.3 Method of Mounting Capacitors
B5.4 Disc Soldered to Copper Surface
B5.5 Disc Fitted into Hole in P.C.B.
B5.6 Chip Soldered to Copper Surface

B6 **Printed Wiring Boards, Cleaning & Rework**
B6.1 Cleaning after Assembly
B6.1.1 Cleaning Method
B6.1.2 Industrial Boiling-Solvent Equipment
B6.1.3 Manual Method
B6.2 Approved Solvents
B6.2.1 Trichlorotrifluroethane (TCTFE) with IPA
B6.2.2 TCFE with Ethyl Alcohol
B6.2.3 TCFE
B6.3 Rework and Component Removal
B6.3.1 Component Removal, Plated-Through-Hole Boards

B7 **Equipment Wiring**
B7.1 General
B7.2 Joined Wires
B7.3 Mains Wiring
B7.4 Point-to-Point
B7.5 Cableforming
B7.6 Bay Wiring
B7.7 Desk Wiring
B7.8 Miniature Sealed Relays
B7.9 Components with Spring Contacts
B7.10 Hinged Panels
B7.11 Cable Clamping
B7.12 Wiring Space

B8 **Connections to Tags and Terminals**
B8.1 Wiring to Tags
B8.1.1 Open slotted Tags
B8.1.2 Closed Slotted Tags
B8.1.3 Connector Tags and Terminals
B8.1.4 Close Pitched Tags
B8.1.5 Mains
B8.2 Wiring to Terminals
B8.3 Solderless Wire Wrapping
B8.3.1 Wire and Wire Stripping
B8.3.2 Type of Wrap
B8.3.3 Acceptable Modified Wrap
B8.3.4 Tools and Bits
B8.3.5 Cut, strip and Wrap Bits

B9 **Crimped Contacts on Multipole Varicon Connectors**
B9.1 General
B9.2 Method of Crimping
B9.3 Tools
B9.4 Method of Contact Insertion

B10 **Termination of Screened and Coaxial Cable to Tags**

B11 Termination of Coaxial Cable to Connectors and Adapters
B11.1 General
B11.2 Preparation of Cable
B11.3 Assembly of Connectors
B11.3.1 Excess Solder

B12 Earthing
B12.1 General
B12.2 Audio and Video Frequency Equipment
B12.3 Connectors
B12.4 Mains Powered Equipment
B12.5 483 mm BMM Equipment Panels

B13 Jumpering on Distribution Frames
B13.1 General
B13.2 Principle of Jumpering
B13.3 General Result

B14 Insulation Displacement Interconnection System
B14.1 General
B14.2 Principles of Connection
B14.3 Method of Mounting
B14.4 Wiring Practice

B15 Guide to Colour Coding

SECTION C CABLES, WIRES & CABLE ACCESSORIES

C1 Cables and Wires

C2 Cable Accessories
C2.1 Insulating Sleeving
C2.2 Lacing Materials
C2.3 Tapes
C2.4 Cable Markers
C2.5 Cable Sleeves
C2.6 Heat Sleeves
C2.7 Heat Shrinkable Solder Sleeves

SECTION D WIRING AND MECHANICAL DATA

D1 Wiring Terms
D1.1 Box Forming
D1.2 Bunched Pair
D1.3 Butt
D1.4 Fanning
D1.5 Form
D1.6 Gate or Goose Neck
D1.7 Lacing
D1.8 Laying-in
D1.9 Skinner
D1.10 Stitch
D1.11 Tip (of Form)
D1.12 Tails
D1.13 Tram-Line
D1.14 Turnouts

D2 Wiring and Mechanical Illustrations

SECTION E COMPONENT CODING

Attenuators
Cables and Wires
Capacitor, Ceramic
Capacitor Letter and Digit Code
Capacitor, Polyester
Capacitor, Tantalum
Fuses
Resistor Colour Code Systems

SECTION F MANUFACTURING SPECIFICATIONS

F1 General Specification

SECTION G GUIDE TO ENGINEERING COMPONENTS CATALOGUE

LIST OF ILLUSTRATIONS

SECTION A

Fig Ref.	
A4 Fig.1	**Safety Labels**

SECTION B

B1	**Soldering**
B1Fig.1	Soldered Joints (Colour)
B1 Fig.2	P.C.B. Component Location Legend
B2	**Printed Wiring Board Assemblies**
B2 Fig.1	Hollow Tags
B2 Fig.2	'Bullet Nose' Tags
B2 Fig.3	Splined Terminals
B2 Fig.4	Axial Leaded Components
B2 Fig.5	Radial Leaded Components
B2 Fig.6	Typical Printed Wiring Board Assembly (Colour)
B4	**Transistor & I.C. Regulator Assemblies**
B4 Fig.1	Heatsink Mounting
B4 Fig.2	Use of Mounting Pad
B4 Fig.3	Power Transistor & I.C. Regulator Assembly (T.O.3)
B4 Fig.4	Transistor/Regulator Assembly (TO-220)
B5	**Leadless Ceramic Disc & Chip Capacitors**
B5 Fig.1	Disc Mounted on Copper Track
B5 Fig.2	Disc Mounted in Hole in P.C.B.
B5 Fig.3	Chip Mounted on Copper Track
B7.5	**Cableforming**
B7.5 Fig.1	Knots for Cable Form Lacing
B7.5 Fig.2	Box Forming Cables (No Lacing Bar available)
B7.5 Fig.3	Box Forming Cables Against a Lacing Bar
B8	**Connections to Tags & Terminals**
B8 Fig.1	Wiring to B.T. Tag Block (Colour)
B8 Fig.2	Soldering to a Tag with Two Open Slots
B8 Fig.3	Soldering to a Tag with a Hole
B8 Fig.4	Wire Wrap
B9	**Crimp Contacts on Multipole Varicon Connectors**
B9 Fig.1	Wire Prepared for Crimping
B9 Fig.2	Examples of Crimped Contacts
B10	**Method of Terminating:-**
B10 Fig.1	Screened Cable to Tags
B10 Fig.2	Co-Axial Cables to Tags
B10 Fig.3	Cable using Solder Sleeve

B11	**Cable Terminations, R F. Co-Axial**
B11 Fig 1	Musa, Socket, Free BBC type 201, 202, 203 or 204
B11 Fig 2	Musa, Socket, Free, T-Junction, BBC type 211, 212, 213 or 214
B11 Fig 3	Musa, Socket, 90C Entry, BBC type 221, 222, 223 or 224
B11 Fig 4	Musa, Socket, Free, T-Junction, BBC type 231, 232, 233 or 234
B11 Fig 5	Musa, Plug & Socket, Free or Fixed, BBC type 251-255 incl., 351-355 incl.
B11 Fig 6	Musa, Plug & Socket, Free or Fixed, BBC type 251-255 incl., 351-355 incl. (Alternative method when crimp tools are not available)
B11 Fig 7	Musa, Socket, Free, Dual Cable Entry BBC type 261, 262, 263 or 264
B11 Fig 8	Musa, Plug, Fixed, P.O. No 1 or I.C. fitted with BBC Adapter type 411, 412, 413 or 414
B11 Fig 9	Musa, Plug, Fixed, Dual Entry, 35C type 303 fitted with Adapters type 421, 422, 423 or 424
B12	**Earthing**
B12 Fig 1	Earthing of Metal Case
B12 Fig 2	Earthing via Captive Screw
B13	**Jumpering on Distribution Frames**
B13 Fig 1	Distribution Frame Components (Schematic)
B13 Fig 2	Distribution with Horizontal OR Vertical Components Only
B13 Fig 3	Distribution with Horizontal AND Vertical Components Only
B14	**Insulation Displacement Interconnection System**
B14 Fig 1	Insulation Displacement Interconnection System
B15	**Guide to Colour Coding**
B15 *	Relay Wiring Showing Wire Colours

SECTION D

D	**Wiring and Mechanical Data**
D Fig 1	4 Pole, Mains Voltage Plug & Socket, Wiring & Assembly
D Fig 2a	Edge Connector, Contact Insertion (U.E.C.L.)
D Fig 2b	Edge Connector, Contact Removal (U.E.C.L.)
D Fig 3	Edge Connector, Typical Board Locating Key Insertion
D Fig 4	Edge Connector, Contact Removal and Insertion (Ferranti EZD)
D Fig 5a	Edge Connector Contact Removal (Ferranti EPT, EFT)
D Fig 5b	Edge Connector Contact Insertion (Ferranti EPT, EFT)
D Fig 6a	Plugs & Sockets, Miniature (2-12 pole) Contact Arrangement
D Fig 6b	Plugs & Sockets, Miniature (2-12 pole) Panel Cut-Out
D Fig 7a	Plugs & Sockets, Miniature (6 & 10 pole) Contact Arrangement
D Fig 7b	Plugs & Sockets, Miniature (6 & 10 pole) Panel Cut-Out
D Fig 8a	Plugs & Sockets, Miniature (18-33 pole) Panel Cut-Out
D Fig 8b	Plugs & Sockets, Miniature (18-33 pole) Panel Cut-Out
D Fig 9	Assembly Arrangement for Floating SMB Connector
D Fig 10	Plugs, Free, R.F. Co-Axial, Series 83 Method of Fitting Cable reducing Adapter
D Fig 11	Jack, Fixed (Telephone Type) Contact Arrangement
D Fig 12	Jack, Fixed, Short (Telephone Type) Contact Arrangement
D Fig 13	Solid State Lamp (L.E.D.)
D Fig 14	Relay, Illuminated Push-Button Terminating Pin Arrangement
D Fig 15	Relay P.O. Type 3000
D Fig 16	Switches, Contact Arrangements, Rotary Wafer, Sub-Miniature Mini 12
D Fig 17	Miniature Lever Key Switch
D Fig 18a	Switches, Illuminated, Push-Button, Highland Electronics Series 31
D Fig 18b	Switches, Illuminated, Push-Button, Highland Electronics Series 31LL
D Fig 19a	Designation Strips, Plastic, Recommended for General Use
D Fig 19b	Designation Strip, Recommended Drill Sizes

SECTION E

E	**Component Colour Coding**
E Fig.1a & 1b	Attenuators, Variable and Fixed, Coding
E Fig.2	Cables and Wires, Coding
E Fig.3	Capacitors, Ceramic, Colour Coding, 5 Unit Code
E Fig.4	Capacitors, Ceramic, Colour Coding, 6 Unit Code
E Fig.5	Capacitors, Ceramic, Typographic Code
E Fig.6	Capacitors, Letter & Digit Code
E Fig.7	Capacitors, Polyester Metallised, Colour Code, 5 Unit Code
E Fig.8	Capacitors, Tantalum, Solid, Colour Code
E Fig.9	Fuses, Cartridge, Colour Code
E Fig.10	Resistor Colour Code Systems

SECTION A SAFETY

A1 HEALTH AND SAFETY

A1.1 General

The need to ensure safe working practices cannot be over emphasized and this requires constant vigilance from every individual. The Factory Acts and Health and Safety at Work legislation make it a criminal offence for anyone to knowingly place themselves or other people at risk or to ignore the procedures and equipment required for the protection of any individual.

Safe working first and foremost involves awareness and common sense and the maxim 'if in doubt ask' is encouraged. Every project or work area is the responsibility of a qualified engineer or supervisor who is responsible for safe working and who will give advice for the identification of potential hazards to anyone working in an area.

A1.2 Protective Clothing

In general sensible comfortable clothes should be worn which are not loose fitting or ragged. Footwear should support and protect, sandals or canvas shoes are not acceptable on installation sites. Everyone building or installing equipment must have eye protection in the form of safety glasses or goggles to BS 2092, General Purpose.

Special clothing such as reinforced gloves or boiler suits will be made available as required.

A1.3 Equipment and Site Working

All electrical equipment, extension leads, power tools etc. must be checked for earth continuity when brought on to site and regularly inspected for damage. Steps or ladders must be in good condition, the latter being firmly secured during use.
Where floors or ducts are lifted or overhead work is undertaken the area must be cordoned off and warning notices clearly displayed. No work involving live equipment or power cables must be undertaken without the express permission of the site engineer or supervisor who has responsibility for the safe working of everyone on site.

A1.4 Access and Security

Before entering or starting work in any particular area, obtain the express permission of the person responsible for the area. Instruction will be given regarding safe working practices, fire precautions and evacuation arrangements, first aid facilities and procedures and security requirements. These instructions must be followed.

A2 COMPONENT SAFETY

A2.1 Mains Rated Components

Those components intended for direct connection to the public electricity supply are specifically designated as 'Mains' devices, e.g. XLR LNE connectors as shown on BBC Standards 24900, 24905, 27700 and 27705.

Many components other than those designated as suitable for 'mains' applications include typical mains potentials and currents within their ratings, however, such components can only be connected to the public supply, or any other hazardous potential, in circumstances where the equipment design meets the requirements of Statutory and BBC Safety Regulations.

A2.2 Mains Fuses

Mains powered equipment must have single pole mains fusing only, with the fuse connected in the live side of the incoming mains supply. When equipment is fitted with a mains switch the fuse is to be situated on the load side of the switch. See also section B7.4.

A2.2.1 Fuseholders, Panel Mounted

To avoid danger of contact with the supply when inserting a fuse, the wire from the live side of the supply must be connected to the rearmost tag of the fuseholder. It must not be connected to the front-ring tag. This is particularly applicable to fuseholders designed to accept 31.3mm x 6.25mm dia. and 15.6mm x 4.7mm dia. cartridge fuses. The construction of approved fuseholders for 20mm x 5.2mm dia. fuses precludes accidental contact with the supply. Wiring to them, however, must conform to the practice as stated above.

A2.3 Hazardous Material

Most components are inherently safe if operated within the rated conditions set out in relevant Standards but may contain or be formed from materials which decompose to a form hazardous to health if the items are grossly abused.

Sealed components should not be cut into and items should not be subjected to excessive heat nor to undue electrical or mechanical pressure and in particular any sign of deterioration of plastics should be reported.

BBC Engineering Safety Regulations set out the special precautions necessary when working on or disposing of some materials found within components and all concerned must satisfy themsleves as to the safety of any work to be carried out in modifying standard items.

A2.3.1 Components Containing Beryllium Compounds

Certain components, particularly U.H.F. transistors, contain a beryllium compound. These devices are entirely safe to handle provided they are not damaged. It is important that no attempt is made to open sealed components.

Should any component be damaged there can be a toxic hazard if dust or fine particles of the compound are inhaled or allowed to enter the body through cuts or abrasions.

If beryllium dust does enter the skin, the affected area should be thoroughly washed and treated by a doctor. Damaged or broken components should be placed in a plastic bag (preferably using plastic or rubber gloves) which is to be sealed, and labelled with a description of the contents. The incident must be regarded as an accident and reported on BBC form FS/156.

BBC staff should dispose of the items by reference to BBC Valve Section. Persons contracted by BBC departments should refer to the Head of that department for instructions on disposal. Components should not be disposed of with general waste.

A warning label will be fitted to all units containing components of this type.

A3 EARTHING OF METAL WORK

A3.1 Earthing of the Exposed Metal Work of Components or Mains Operated Equipment.

In general all metal work on mains operated equipment which is accessible without the use of hand tools must be earthed. All metal work on CLASS 1 equipment must be bonded to earth via a safety conductor. This conductor must be at least the same cross sectional area as the final local mains supply conductors, and colour coded green/ yellow or other wise identified as a safety earth (see 'Safety Labels' A4). See also section B12.

A3.2 Class 1 Equipment (Definition)

Equipment in which protection against electric shock does not rely on basic insulation only, but which includes an additional safety precaution in such a way that means are provided for the connection of accessible conductive parts to the protective (earthing) conductor in the fixed wiring of the installation in such a way that accessible conductive parts cannot become live in the event of a failure of the basic insulation.

NOTE 1. For equipment intended for use with a flexible cord or cable, this provision includes a protective conductor as part of the flexible cord or cable.

NOTE 2. Where equipment designed as class 1 is allowed by a Technical Committee to be fitted with a 2-core flexible cord or cable, provided that it is fitted with a plug which cannot be introduced into a socket with earthing contact, the protection is then equivalent to that of class 0, but the earthing provision of the equipment in all other respects should fully comply with the requirements of class 1.

A3.3 Alternative Protection (Definition)

Where equipment is intended to be secured by fasteners to metal work which is itself bonded to a safety earth the fasteners themselves may be used to earth the equipment so mounted providing that the fasteners are locked, e.g. by a shakeproof washer, and that tools are necessary to release the fasteners.

Where it is not desirable for engineering reasons to earth accessible metal work it is necessary to provide additional protection against unearthed metal becoming live due to the failure of the primary safety insulation of adjacent live parts.

The precautions to be taken depend upon the circumstances of each individual case but, for example, could include the provision of additional internal covers or the use of sheathed and insulated mains wiring within the equipment.

A3.4 Relevant Safety Specifications

The following British Standards give guidance which may be useful:-

BS 415 Safety requirements for mains-operated household sound and vision equipment.

BS 2754 Memorandum. Construction of electrical equipment for protection against electric shock.

BS 3192 Safety requirements for radio (including television) transmitting apparatus.

BS 4743 Safety requirements of electronic measuring apparatus.

In addition the Department of Prices and Consumer Protection publish a document 'Administrative guidance on the Electrical Equipment (Safety) Regulations and the Electrical Equipment (Safety) (Amendment) Regulations 1976' etc. which contains useful information.

Copies of these documents are available on loan from Standards Engineer.

A4 SAFETY LABELS

The following selection of 'Safety Labels' is available from Equipment Department, Central Stores. The range is periodically up-dated, hence it is advisable to refer to the Engineering Components Catalogue for current information.

















DISPLAY CARD W 315.0 H 508.0
"TREATMENT FOR ELECTRIC SHOCK"

SUITABLE FOR
WALL MOUNTING



WARNING NOTICE W 460.0 H 350.0

"PERYGL

GWAHEDDIR DRINGO'R
MAST HWN HEB
GANIATAD
RHAID TORRIR
CYSYLLTIAD TRYDAN
YN UNOL A
RHEOLAU DIOGELWCH"_

ENGLISH TRANSLATION

"DANGER
CLIMBING THIS MAST IS PROHIBITED
WITHOUT PERMISSION, ELECTRICITY
MUST BE SWITCHED OFF IN ACCORDANCE
WITH SAFETY REGULATIONS".

NOTE:
THIS LABEL IS FITTED WITH HAZARD WARNING
SYMBOLS IN ACCORDANCE WITH BS 5378.

A5 BBC SAFETY PUBLICATIONS, ENGINEERING

The following documents are available on request through Heads of Section.

Engineering Safety Regulations	**Available from:**
9th Edition of ESRs (1978)	Ware Stores
1st Amendment to ESRs (February 1980)	Ware Stores
2nd Amendment to ESRs (March 1981)	Ware Stores
3rd Amendment to ESRs (February 1983)	Ware Stores
Red binder	Ware Stores
Supplementary ESRs for Managers (1982)	Secretary to EMSC
1st Amendment to ESRM (April 1983)	
Regulations for work on High Voltage Power Equipment (HV Rules) (1977)	TCPD (issued only to staff authorised to work on such equipment)

EMSC Guidance Papers

No.2	The Effects of Electric Shock (1975)	Secretary to EMSC
2a	The Effects of Electric Shock (1975)	
3	The use of Current-Balance Earth Leakage Circuit Breakers in the BBC (Second Edition, December 1977) (Revision in progress)	
4	The Safety Evaluation of Locally Purchased Equipment (Vetters' Guide) (Second Edition, June 1981)	
5	Solvents and Cleaners used on Technical Equipment and in Workshops (Second Edition, September 1982)	
6	Non-ionizing RF Radiation (December 1978)	
7	Lasers (August 1980)	
8	Ionizing Radiation (November 1980)	
9	Safety and Management (December 1981)	

EMSC Codes of Practice

No.1	Safety in Electrical and Electronic Maintenance and Development (Third Edition, November 1983)	Secretary to EMSC
2	Earthing and Protection in Technical Vehicles (October 1980)	
4	Fire Safety for Contractors Carrying Out Work in Occupied BBC Buildings (December 1981)	
5	Connectors for use on Mains Voltages not Exceeding 250 V (nominal) (January 1982)	

British Standards	Available from:
BS 415: 1979 - Specification for safety requirements for mains-operated electronic and related apparatus for household and similar general use.	
BS 2754: 1976 - Memorandum. Construction of electrical equipment for protection against electric shock.	
BS 3456: - Specification for safety of household and similar electrical appliances.	
BS 4644: 1970 - Recommendations for safety of office machines and data processing equipment. (Other than electrical and acoustic safety)	Standards Engineer - on loan as available
BS 5378 - Safety signs and colours	
BS 5378: Part 1: 1980 - Specification of colour and design.	
BS 5378: Part 2: 1980 - Specification for colorimetric and photometric properties of materials.	
BS 5378: Part 3: 1982 - Specification for additional signs to those given in BS 5378: Part 1	
BS 5850: 1981 - Specification for safety of electrically energised office machines.	
BS 6204: 1982 - Specification for safety of data processing equipment.	

Other Engineering Publications	
Safety Bonds for Luminaires and other Suspended Equipment: Recommendations for Use and Manufacture (Revised Issue, March 1982)	Lighting and Mechanical Section, SCPD
Fuses: Protection of Supplies to Technical Apparatus: SCPD Report G/1971/2	SCPD (Though old, this document is still mostly relevant).

Other Relevant Papers:	
BBC Fire Policy and Practice Guidance Paper	Corporation Safety Officer
General Rules for Manual Lifting	ETD representative on EMSC
Code of Practice for the Installation and Use of Data Displays in the BBC (Revised March 1981)	Corporation Safety Officer

SECTION B ASSEMBLY AND WIRING PRACTICES

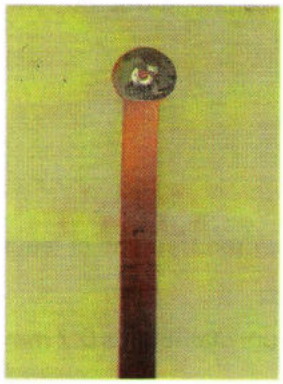
B1 SOLDERING

B1.1 General

An acceptable soldered joint has a clean, smooth and shiny appearance. The amount of solder used is such that the contours of the underlying conductors are visible, with concave solder fillets and thorough wetting of all surfaces.

Good soldered joints have neither an excess nor a deficiency of solder. Dry joints are caused by instruments operated below optimum temperature or by disturbing the joint during solidification. Such joints are typified by a dull grey appearance. Solder peaks and sharp points must be avoided and joints should be free from pits or holes.

Acceptable Solder Joints



MINIMUM QUANTITY OF SOLDER



OPTIMUM QUANTITY OF SOLDER



MAXIMUM QUANTITY OF SOLDER

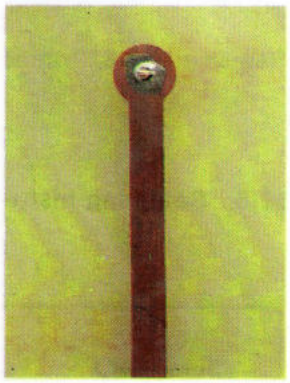
Unacceptable Solder Joints



INADEQUATE WETTING



EXCESS OF SOLDER



INSUFFICIENT SOLDER

B1 FIG.1

B1.2 Solder and Flux

For all light wiring a 60/40 tin-lead alloy solder is to be used in conjunction with a resin flux, this flux may be contained in the core of the solder e.g. Ersin Multicore.

A 62/36/2 tin/lead/silver alloy solder cream is to be used for soldering operations on leadless ceramic disc capacitors. (See section B5)

Corrosive flux must not be used.

B1.3 Soldering Heat and Time

Soldering heat and time is to be the minimum to achieve a good soldered joint, where circumstances require a shield is to be used to prevent thermal damage to adjacent components and or insulated wires.

The use of temperature controlled instruments is recommended but in any event the maximum soldering temperature to be used is 350°C. Heat sinks are to be used to protect small components, paricularly polystyrene capacitors, diodes and transistors, when the maximum soldering time is to be 3 seconds.

B1.4 Machine Soldering

Where flow, wave or drag soldering machine techniques are proposed prior approval must first be obtained. (Where the prospective work would be on behalf of Equipment Department such approval will be considered by Contracts Manager upon written application to the Head of Equipment Department, address as on page II of this document).

B1.5 Plated Through-hole P.C.B.'s

The soldered joints are to be made only on the side of the board through which the free end of leads protrude.

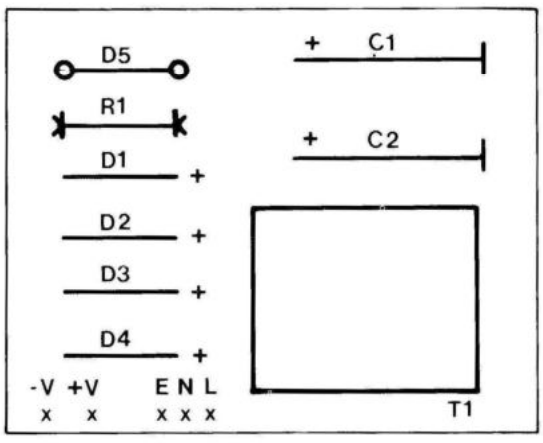
The solder used is to be a deactivated resin cored 60/40 tin/lead alloy, maximum diameter is 0.7 mm.

The soldering time is to be just sufficient to allow the solder to flow throughout the length of the plated hole. Excessive solder and soldering time, causing a build-up of solder around the lead on the component side of the board, is to be avoided.

No attempt should be made to remove components from, or otherwise rework, a P.T.H. printed board without the use of desoldering equipment approved by Equipment Department Electronic Laboratory.

See section B6, Printed Wiring Boards, Cleaning and Rework.

B1.6 Soldering Instructions given as part of P.C.B. Component Location Legend



B1 FIG.2

O -Indicates terminal pin etc. soldered to wiring side of board.

X - Indicates terminal pin etc. soldered to both sides of board.

⊣ - Indicates component lead-out soldered to comp. side of this board only.

⋊ -Indicates component lead-out soldered to both sides of the board.

B2. PRINTED WIRING BOARD ASSEMBLIES

B.2.1 General

Unless otherwise specified Printed Wiring Boards and components are to be assembled together as specified and illustrated later in this section

Where illustrations are used to provide guidance for simplicity they show single sided non P.T.H. boards. For guidance on soldering generally see Section B.2.

Apart from components in transistor type packages, e.g. TO5, mounted above the Printed Wiring Board, components must be fitted firmly against the Printed Wiring Board, this is to prevent pressure on the component causing the copper foil to become detatched from the Printed Wiring Board. Where transistors are fitted onto transistor mounting pads the transistor is to be a snug fit in the pad and the latter held firmly against the P.C.B.

B2.2 Lead Formation

Slight forming of component leads to retain the component prior to soldering is permissible. After soldering, the excess length of lead must be cut off slightly proud of the joint so that it can be clearly seen, but so that the distance from the cut end to the P.C.B. DOES NOT EXCEED 2 mm. Where component leads are cut prior to assembly wiring pliers are to be used to prevent shock damaging the component.

In general axial leads should not be formed closer than 2 mm from the body, any protrusions supporting the leads being considered part of the body. However metal film resistor leads may be formed within 1 mm of the body. In any event the lead must be supported during forming so that there is no stress to internal terminations. The leads of radial leaded components, including transistors, must not be formed closer than 3 mm from the seal.

B2.3 Component Orientation

The orientation of polarised components is indicated on the P.C.B. Component Location, as is the location of pin 1 for multi-leaded components such as Integrated Circuits.

B2.4 Copper Roundel

All component wires which pass through a copper roundel on a Printed Wiring Board must be soldered. The hole should normally be covered by solder but partial covering is acceptable where a component lead is of much smaller diameter than the hole.

B2.5 Shorting

When there is a possiblity of component lead-outs shorting they must be covered with insulating sleeving.

B2.6 Colour Coding

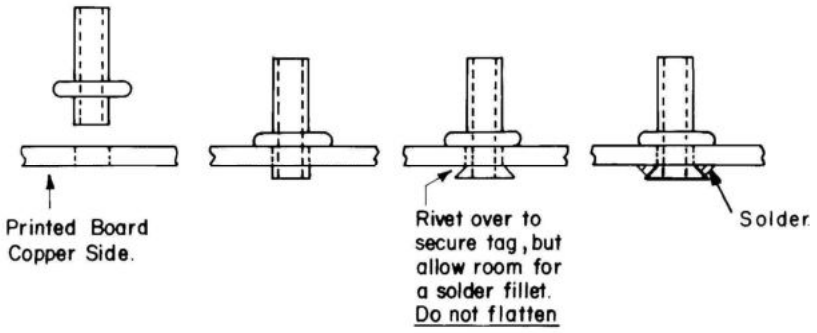
Where transistor leads are sleeved, or discrete wiring is used to extend transistor terminations the following colour code is to be used:-

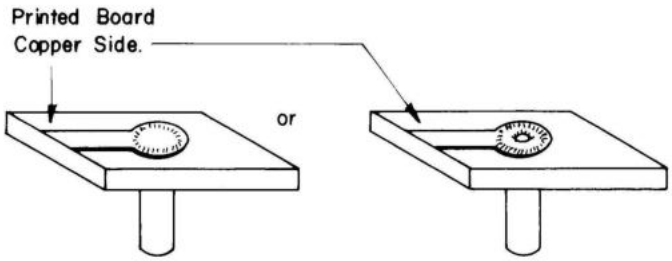
Collector	— Blue
Emitter	— Yellow
Base	— Green

B2.7 Tags and Terminals

B2.7.1 Hollow Tags

Where hollow tags are used, they are to be of an approved type and must be assembled as follows:-



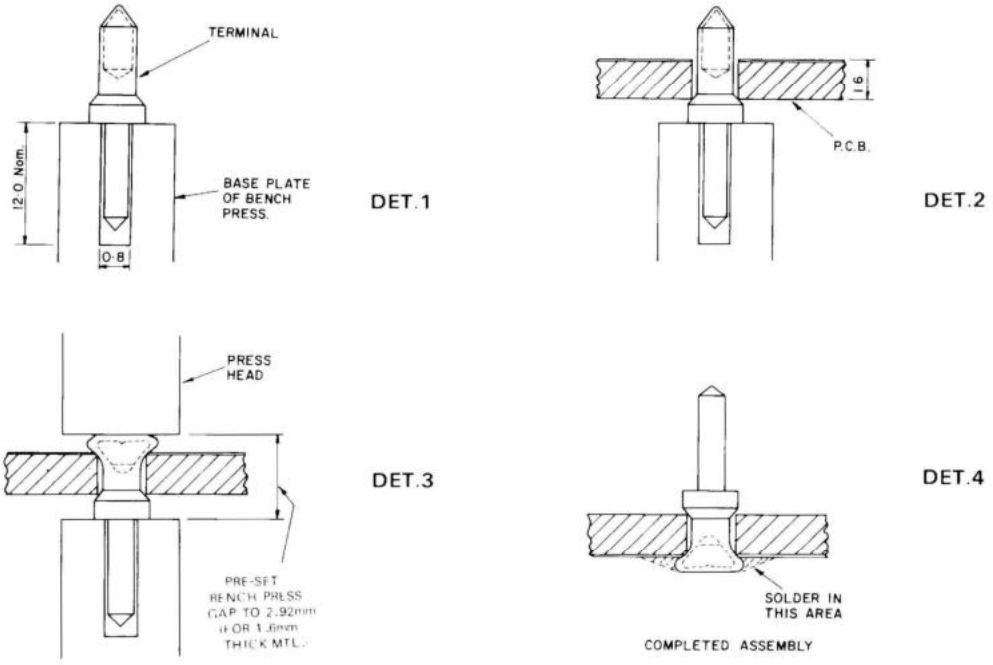


Tag may be soldered in either manner shown.
NO EXCESS SOLDER MUST BE ALLOW TO RUN DOWN THE BORE OF THE TAG.

B2 FIG.1

B2.7.2 'Bullet Nose' Terminals

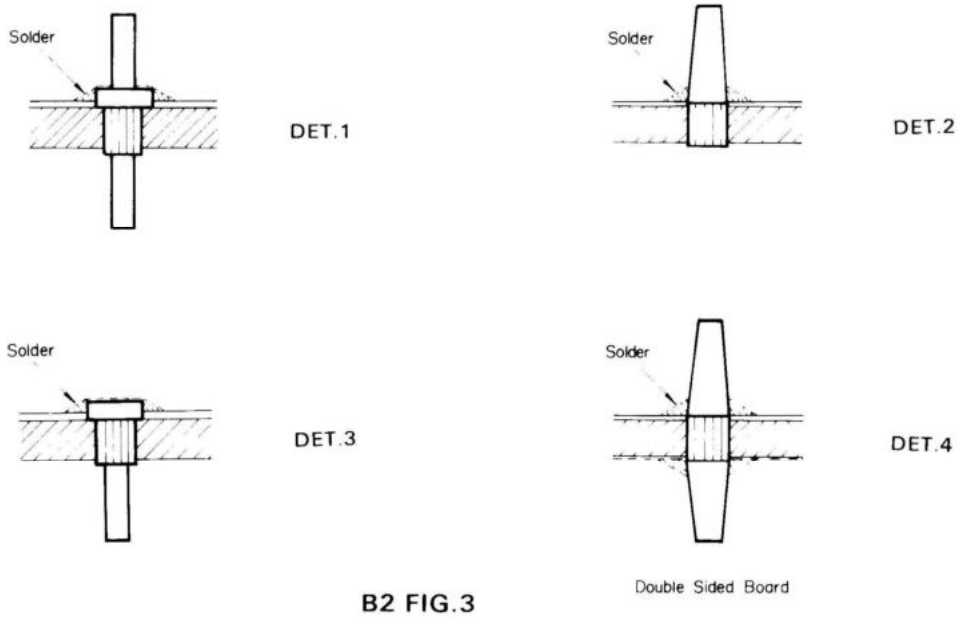
Bullet nosed tags are to be assembled thus:-



B2 FIG.2

B2.7.3 Splined Terminals

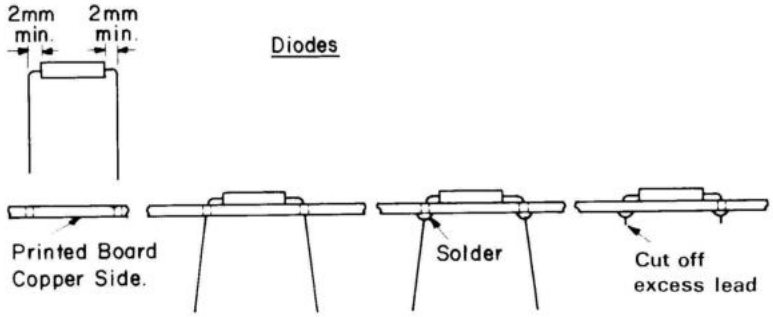
Splined tags are a push fit and are not to be rivetted over.



B2 FIG.3

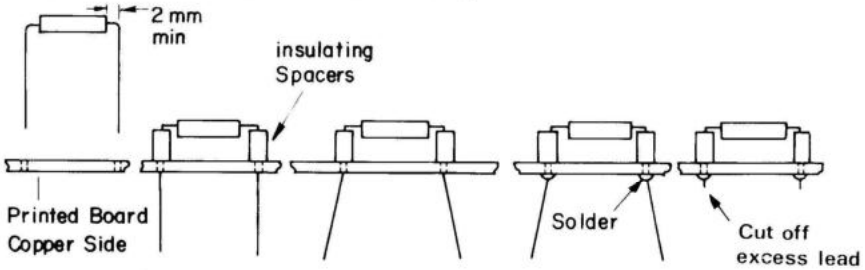
B2.8 Axial Leaded Components

B2.8.1 Directly Mounted

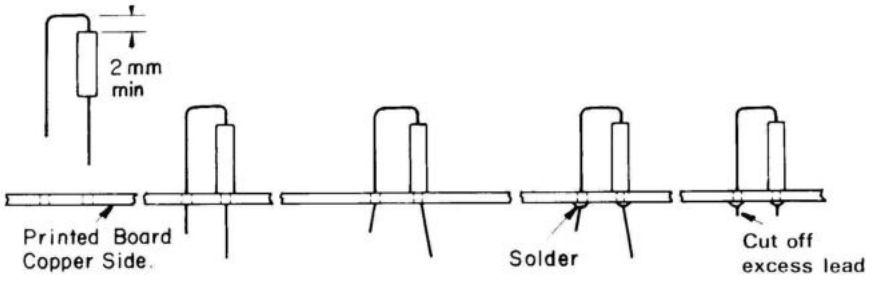


B2.8.2 Mounted on Spacers

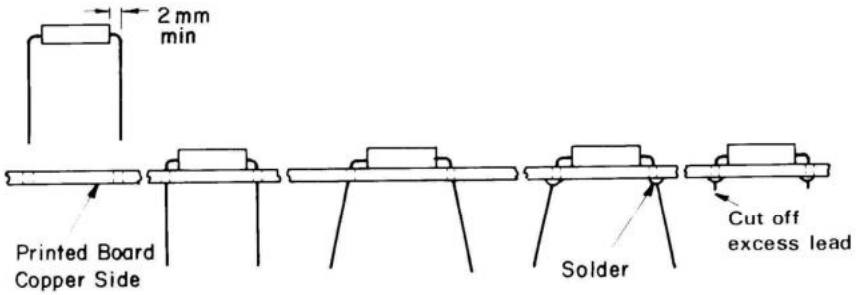
(Wirewound resistors are often mounted in this manner)



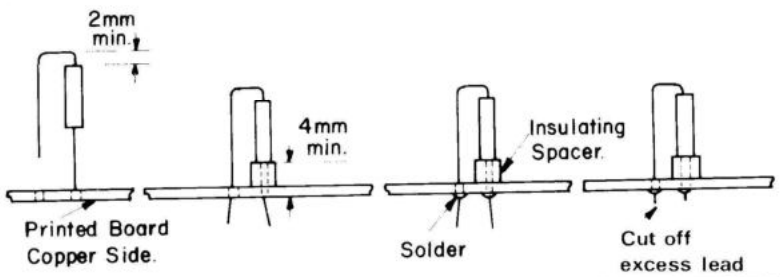
B2.8.3 Vertically Mounted



B2.8.4 Diodes



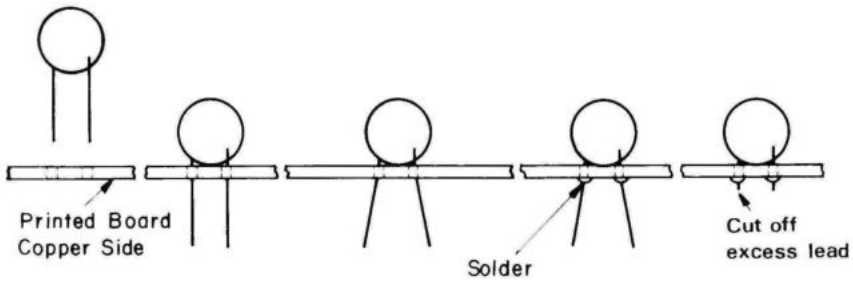
B2.8.5 Vertically Mounted Diodes



B2 FIG.4

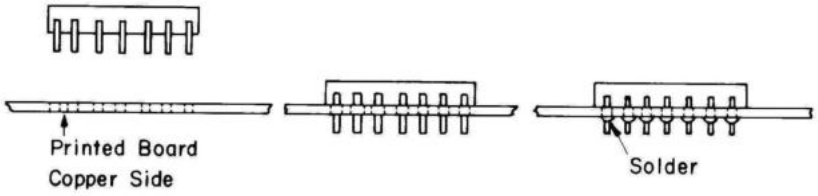
B2.9 Radial Leaded Components

Take care not to damage any coating. If coating covers part of lead do not force the body down, or bend the lead closer than 3 mm from the coating. Do not pull component leads through the board to form them.



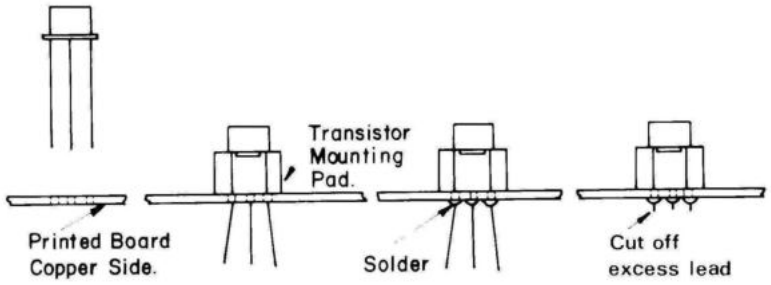
B2.10 'In Line' Packaged Components

S.I.L. & D.I.L. device terminals are not to be bent over or twisted during assembly. Note that the terminals of D.I.L. devices are commonly set to a pitch greater than nominal, this to enable retention. The use of insertion tools is recommended, since these spring the terminals into the nominal pitch during assembly. Take care to identify the orientation of the device relative to the component location shown on the board.

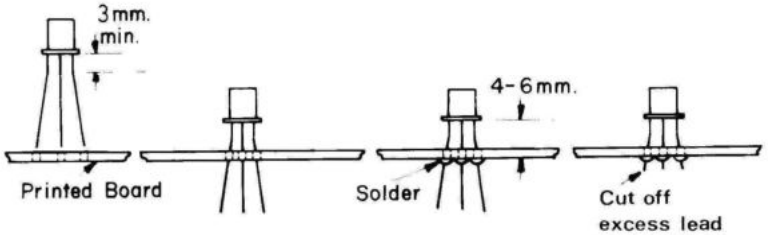


B2.11 Discrete Transistors

B2.11.1 With mounting pad



B2.11.2 Without mounting pad



B2 FIG.5

B2.12 A TYPICAL PRINTED WIRING BOARD ASSEMBLY



B2 FIG.6

Where possible wire running to a Printed Wiring Board must be long enough to enable both sides of the Board to be inspected. If this is not possible reference should be made to the particular equipment drawings where it may be required that the wires are not to be terminated at the assembly stage.

B3 M.O.S. and C.M.O.S. SEMI-CONDUCTORS

B3.1 General

The use of C-MOS and MOS Devices in equipment is becoming more frequent and it must be appreciated that these devices can be easily damaged and rendered useless by effects of static charges. These charges can easily be built up on the human body by contact with nylon and man made fibres found in clothing and carpeting etc. In order to reduce the possibility of damage certain methods of working and other precautions must be adopted as follows:-

B3.1.1 Identification of Devices

Most C-MOS and MOS are identified on B.B.C. documents by having the prefix MOS added to the typed number i.e. MOS/DIC 4001AN , MOS/DM 74C157, MOS/MC 14517CP etc.

B3.1.2 Packaging and Transportation

These devices are transported in conducting media, i.e. plastic foam (black carbon loaded), metal I.C. tubes, or plastic I.C. tubes (specially treated with conductive layers). Devices must not be removed from these packages for any purpose (Stock taking etc) until required for immediate assembly into the unit. Packages will also be labelled in red, 'WARNING, MOS devices take antistatic precautions'.

B3.1.3 Assembly

C-MOS or MOS devices must be fitted to the board after all other components. They must not be flow soldered.

B3.1.4 Working Precautions

Assembly and Soldering of the devices should take place at a suitable equipped work station. The immediate working surface should be fitted with an earthed (resistively conducting) surface e.g. Teknis conductive antistatic sheet. Soldering irons must be effectively earthed at all times and checks be instituted at regular intervals to ensure validity of the earth arrangements. D.I.L. devices should be removed from the package using an I.C. Insertion Tool connected to the earthed working surface. If possible the tool should remain in position until all pins on the device have been soldered into the board.

TO5 and TO18 devices may be fitted with a spring ring shorting band; this should be left in place until the item has been soldered into the board. Where a shorting ring is not supplied, all pins should be shorted together by winding a length of thin copper wire (0.4 mm) around the pins before removing from the conducting foam packaging. Operatives must not wear nylon overalls as these generate large static charges. To discharge any residual charges the operator should maintain frequent hand and skin contact with the work surface.

B4. TRANSISTOR & I.C. REGULATOR ASSEMBLIES

B4.1 General

Care is needed when mounting power transistors and I.C. regulators, since, very often, electrical isolation is required but good thermal contact is always essential.

B4.1.1 Use of torque controlled assembly tools

Fasteners should be set to the torques shown on assembly diagrams.

B4.1.2 Strain relief on terminals

Devices, particularly plastic and ceramic encapsulated devices, should be assembled prior to forming leads. When forming leads ensure that wiring pliers are used to relieve the strain between the bend and the body. Never bend the leads of power devices within 3 mm of the body.

B4.1.3 Soldering

Soldering should be carried out after the device has been fitted to the heatsink or mounting plate and the temperature/time should not exceed the recommendations laid down by the manufacturer of the device.

B4.2 Method of mounting Heatsink, Redpoint Type 5C and similar

(a) Unscrew and remove collar 'B' and place transistor into heatsink 'A'.

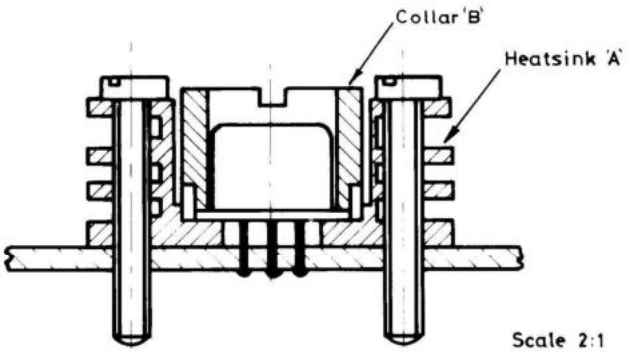
(b)*Inject small quantity of silicone grease then replace collar 'B', leaving it sufficiently slack to enable transistor to turn freely in heatsink.

(c) Insert transistor leads through appropriate holes in printed board, then rotate heatsink until its fixing holes line up with those in the board. Insert screws and tighten down, taking care that screws are not over tightened, which may cause bending of the upper cooling vane of the heatsink.

(d) Now tighten collar 'B', taking great care that transistor does not turn and twist its leads.

(e) Solder transistor leads to printed board and cut off excess wire.

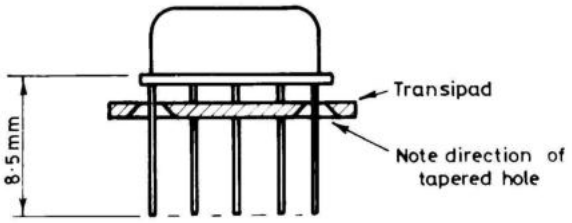
*N.B. Silicone grease to be type MS4 (Midland Silicones Ltd)



B4 FIG.1

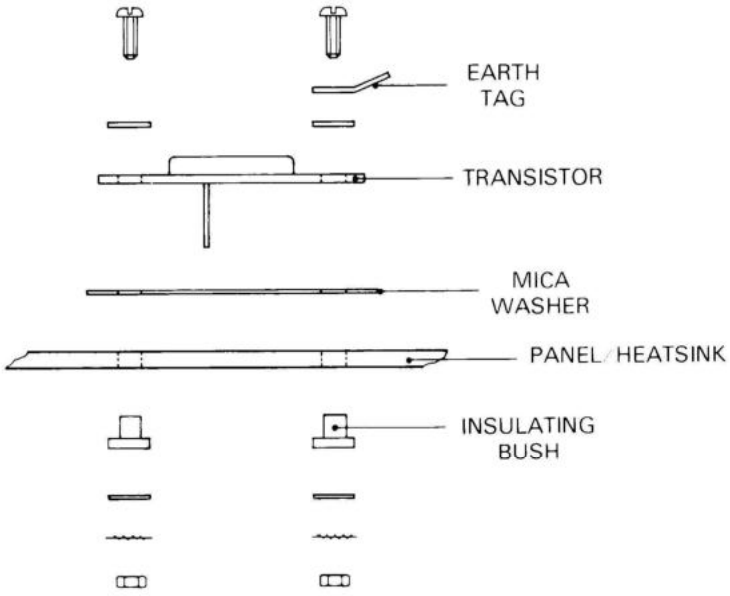
B4.3 Use of Mounting Pads with 10 pin TO.5 Integrated Circuits

Integrated circuits in 10 pin TO.5 cases with 5.8 mm P.C.D. leads are to have leads trimmed to dimension shown if necessary. Fit Transipad (Milton Ross Type M10051) over leads as shown and form leads using forming jig UN1A/1, ensuring correct orientation of leads to tag on case as required. Integrated circuit component to be pressed down firmly close to printed board.



B4 FIG.2

POWER TRANSISTORS & I.C. REGULATORS ASSEMBLIES



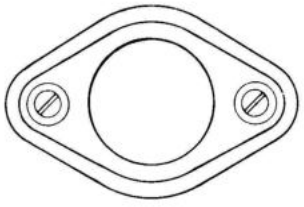
M3 FASTENERS	STD. REF.
SCREW	35356
EARTH TAG	28680
PLAIN WASHER	38557
SHK. PROOF WASHER	38575
HEX FULL NUT	31543

NOTE.

1. THE MICA WASHER MUST BE SMEARED ON BOTH SIDES WITH A SUITABLE HEATSINK COMPOUND BEFORE ASSEMBLY.

TO-3 TYPE

2. CONNECTION TO THE BODY OF THE TRANSISTOR IS MADE BY FITTING THE EARTH TAG UNDER THE SCREW HEAD (AS SHOWN) OR UNDER THE NUT.

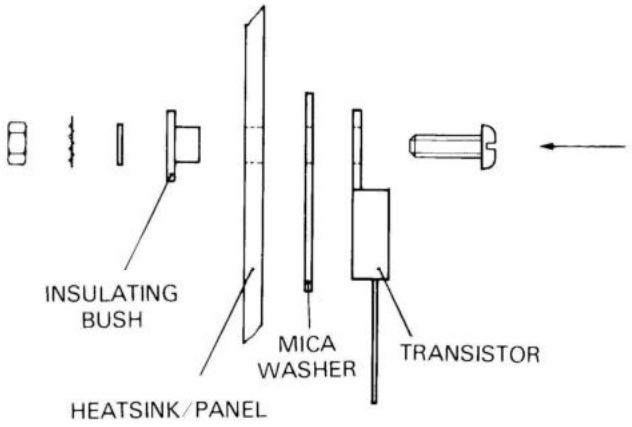


3. IT IS ESSENTIAL THAT THE HOLES IN THE PANEL/HEATSINK ARE DEBURRED TO PREVENT CONTACT THROUGH THE MICA WASHER.

TORQUE FOR GOOD THERMAL CONTACT 0.4Nm MIN - 0.5Nm MAX

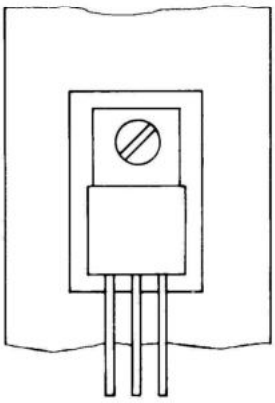
B4 FIG.3

TRANSISTOR/REGULATOR



M3 FASTENERS	STD. REF.
HEX FULL NUT	31543
SHK. PROOF WASHER	38575
PLAIN WASHER	38557
SCREW	35356

TO-220 TYPE



VIEW IN DIRECTION
OF ARROW

NOTE:

1. THE MICA WASHER MUST BE SMEARED ON BOTH SIDES WITH A SUITABLE HEATSINK COMPOUND BEFORE ASSEMBLY.

2. IT IS ESSENTIAL THAT THE HOLE IN THE PANEL IS DEBURRED.

TORQUE FOR GOOD THERMAL CONTACT 0.4Nm MIN - 0.5Nm MAX

B4 FIG.4

B5 LEADLESS CERAMIC DISC & CHIP CAPACITORS

B5.1 General

In order to protect chip capacitors they are supplied in sealed packages together with a desicant.

Only sufficient devices for the particular work in hand should be removed from the package, which should be resealed as quickly as possible

Chips which are difficult to solder or easily damaged during soldering are very likely to have absorbed moisture. They can be recovered by using the pre-heating procedure set out below.

B5.1.1 Preheating

It is desirable, though not essential with fresh chips, to pre-heat the devices and the p.c.b. at 120°C for 15 minutes.

B5.1.2 Soldering

Minimum soldering instrument temperature 200°C, period 3 seconds.
Use a low melting point silver bearing solder cream or solder wire, 62/36/2 5n/Pb/Ag e.g.

Frys Cream F270
Ersin Cream XM 27 330
Multicore Solder LMP (22 SWG)

If cream is utilised dispense sparingly from a syringe to barely cover the P.C.B. pad.

B5.2 Capacitor Identification

As the different values of capacitors are not readily identifiable great care is to be taken to avoid mixing them before assembly to the p.c.b. It is advisable to remove only sufficient quantity of a particular value from its packaging to complete the operation.

B5.3 Method of Mounting Capacitors

Two basic methods of mounting the disc capacitors are used:-

a) Directly on to the p.c.b. copper surface or chassis, see Fig. 1.

b) fitted into a clearance hole in the p.c.b. and held in position with two strips of copper foil, see Fig.2.

Variations of these methods may be required, but these will be indicated on the assembly drawing of the particular equipment.

B5.4 Disc Soldered to Copper Surface

Apply to the copper pad or track only sufficient solder cream to cover an area not greater than the silvered contact of the disc. Place a disc of the correct value on to the cream. The disc should be mounted centrally

on the copper pad. Apply the soldering iron, with bit temperature not greater than 200°C to the copper surface around the periphery of the disc. DO NOT apply the soldering iron directly on to the disc as this will cause permanent damage. Heat should be applied for several seconds after the flux starts to run to ensure that the solder flows throughout the joint. Note that the time to produce a good soldered joint will be considerably reduced if the p.c.b. and disc have been pre-heated.

If a foil strip is to be soldered to the other electrode of the disc refer to the method described below.

B5.5 Disc Fitted into Hole in P.C.B.

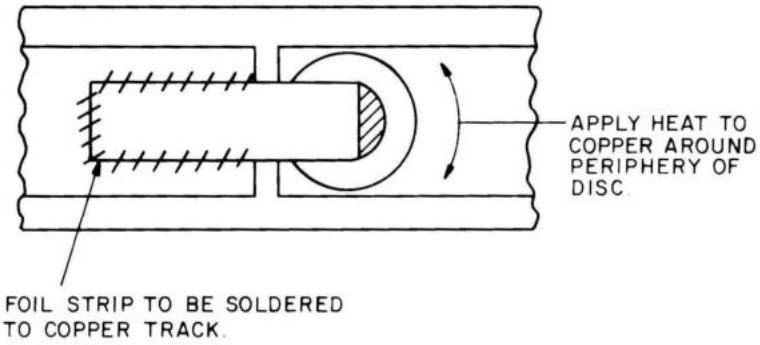
Cut two strips of copper foil to the size as specified on the assembly drawing of the particular equipment. Tin one strip of foil on both ends using the solder cream or a silver bearing solder wire and solder in position directly across the hole in the P.C.B. Invert the P.C.B. and apply a small amount of solder cream on to foil exposed in the hole. Lay the disc in position in the hole and apply the soldering iron to the underside of the foil strip immediately under the disc until the solder flows.

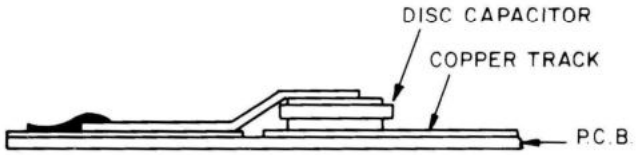
Repeat this procedure with the strip of foil on the other side of the p.c.b. after applying the solder cream to the exposed electrode of the disc.

B5.6 Chip soldered to copper surface.

The method of soldering chip capacitors to copper tracks on pcb's is the same as described in section B5.5. For illustration see Fig.3

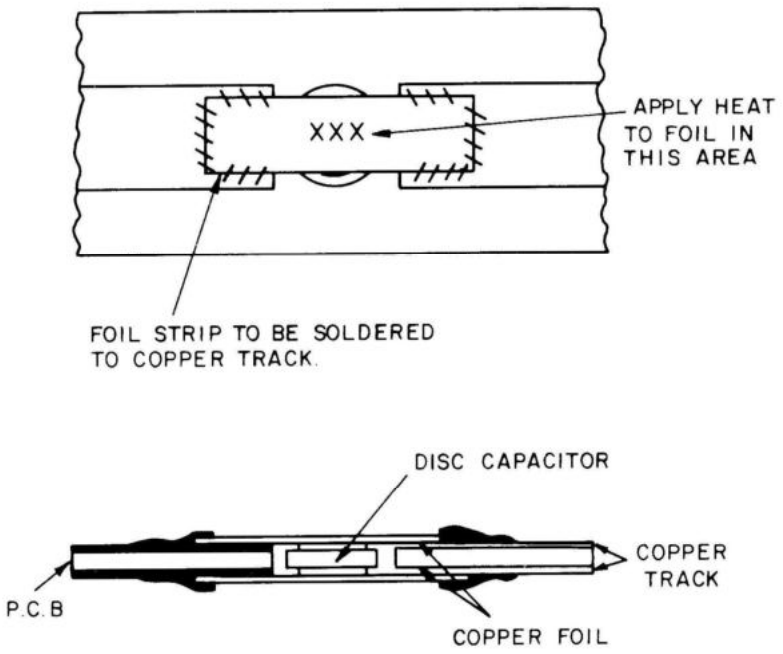
NOTE : CONNECTING FOIL TO BE IDEALLY SIMILAR TO TRACK WIDTH BUT LIMITED BY SINTERED PAD OF CAPACITOR





DISC MOUNTED ON COPPER TRACK.

B5 FIG.1



DISC MOUNTED IN HOLE IN P.C.B.

B5 FIG.2

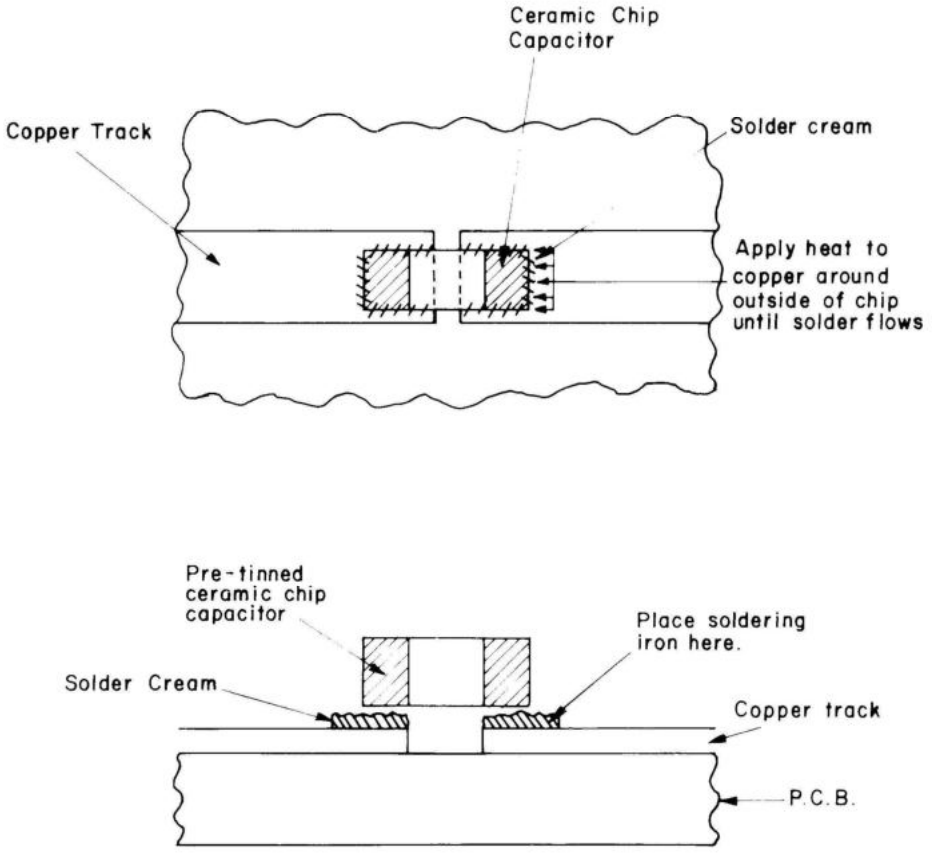


FIG. 3
CHIP MOUNTED ON COPPER TRACK

B5 FIG.3

B6 PRINTED WIRING BOARDS, CLEANING & REWORK

B6.1 Cleaning after Assembly

Printed wiring boards must have flux residues and other soils removed after assembly using an approved cleaning method and solvent system. Cleaning should be carried out as soon as possible after assembly and in any case within 72 hours. Particular installations and solvents must be approved by the BBC.

Whilst the majority of components may be cleaned by immersion, some, and particularly 'open' components such as variable capacitors, will be damaged by the fluid or by entrapment of fluid containing dissolved flux residues. Such components must be added after cleaning. Boards containing wound components should be cleaned before these items are assembled or alternatively cleaned by hand. Total immersion is to be avoided. Any queries in respect of suitability for immersion cleaning should be referred to Standards Engineer, Equipment Department.

B6.1.1 Cleaning Method

An industrial system is preferred (see below). Manual cleaning (see below also) should only be used for spot cleaning after rework, or if no approved equipment is available.

B6.1.2 Industrial Boiling-Solvent Equipment

(for example I.C.I. Minicleanline etc.). The bath must be operated in accordance with the manufacturer's instructions particularly in respect of solvent temperature and coolant flow rates. The solvent must be checked regularly for composition.

Immersion depth should be controlled to be the minimum consistent with proper cleaning of the wiring side of the board.

Immersion time must not exceed a total of 1 minute; 20 seconds in each bath should normally be sufficient. Immersion must be properly timed and not left to the operators discretion.

Ultrasonic agitation must NOT be used.

B6.1.3 Manual Method

The solvent should be contained in a shallow dish, and should be brushed liberally over the wiring side of the printed circuit board using a stiff industrial cleaning brush and employing a scrubbing action to remove residues. Care should be taken particularly with P.T.H. P.C.B's with unoccupied holes to avoid solvent on the component side of the board, and the solvent should be changed frequently to avoid contamination with flux. Only azeotropic solvents (see below) must be used.

B6.2 Approved Azeotropic Solvents

B6.2.1 Trichlorotrifluroethane (TCTFE) with IPA

Loose Form:	Arklone L (ICI Ltd)
	Arklone K (ICI Ltd)
Aerosol Form:	Electrolube Preclene (Electrolube Ltd)

B6.2.2 TCTFE with Ethyl Alcohol

Loose Form:	Fluorisol E (Penetone Co. Ltd)
	Freon TE (Du Pont)
	Arklone F (I.C.I.)
Aerosol Form:	Colclene TE (Alexander Cole Ltd.)

B.6.2.3 TCTFE

The pure solvent, being very mild, is only effective in removing flux residues within a few hours of soldering.

Loose Form:	Arklone P (ICI)
	Freon TF (Du Pont)
	Fluorisol (Penetone)

Safety : CARE MUST BE TAKEN TO AVOID INHALING SOLVENT VAPOURS. Refer to manufacturer instructions on solvent use.

B6.3 Rework and Component Removal

Removal of incorrectly assembled components must be carried out with great care to avoid damaging the underlying Printed Circuit Board. Excessive solder should be removed using a suitable solder sucker or solder removing braid.

B6.3.1 Component Removal, Plated-Through-Hole Boards

Changing of components, particularly multi-lead components can be difficult when a plated-through-hole board is involved. Removal of solder must be carried out using a work station such as the Pace Solder Extractor system. The use of hand operated solder extractors has been found to be unsuitable and the use of multiple desoldering bits with soldering irons is also deprecated. Any further advice as to alternative methods should be obtained from Equipment Department Electronics Laboratory.

B7. EQUIPMENT WIRING

B7.1 General

Components and piece parts will normally be found on a parts list. Numbers shown on assembly drawings:

e.g. (1) refer to assembly item nos' on parts list.

e.g. ((1)) refer to sub assembly item nos' on parts list.

B7.2 Joined Wires

Where two or more wires are to be joined together, the junction is to be made at a terminal tag. 'T' joints are not permitted unless specially called for. To produce a solder wrap joint, (not to be confused with 'wire-wrapping'), at least 3/4 of a turn and no more than 1 turn of wire should be wound around the tag or post.

When two or more wire ended components are to be connected to one tag the ends must not be twisted together.

B7.3 Mains Wiring

The colour coding of all mains wiring is to be as follows -

Brown	Live
Blue	Neutral
Green/Yellow	Safety Earth

Single pole fusing for mains supply is the standard arrangement on equipment (unless otherwise specified on certain portable equipment) the fuse being located on the equipment side of the mains switch. Where the fuseholder is of the ring and tip variety the incoming mains is to be on the tip i.e. furthest away from the fuse access point.

All components (switches, fuses, connectors etc.) carrying mains must be sleeved or booted wherever possible.

B7.4 Point-to-Point

When this method is indicated the wires are to be run from tag to tag between components in as direct a route as the layout of the components will permit, bearing in mind that other wiring tags, components, or component references must not be obscured and that runs high above the chassis, i.e. 'clothes line' wiring should be avoided.

B7.5 Cableforming

Where cableforms are called for, the cables to be included in the cableform are first to be colour coded where necessary, then bunched together to make a round cross section; the lay of the cable therein must be such that the cables do not cross over but run straight and parallel to each other. Turnouts and bends are to be radiused where possible and sharp right angles are to be avoided, particularly for video and R.F.

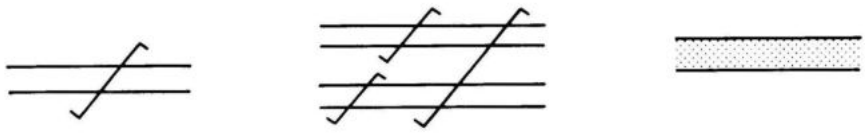
Equipment. The forms are to be laced, using a marline hitch as shown in Figs. 1a and 1b either with P.V.C. string or waxed nylon twine for cableforms made up from small cables, or a proprietary nylon tie for cableforms made up from large cables always taking care not to distort coaxial cable and hence change its characteristics. Twine etc. must not damage or distort equipment wires. Where Box forming is required it is to be as shown in Figs 2a and 2b or 3a and 3b. (See also section C2.2). Alternatively an approved plastic spiral wrapping may be applied.

Cable formed wiring in large units must have identification sleeves (cable markers) fitted on both ends of each run showing the run number. See C2.5

Twisted pairs are to comprise two flexible or non-flexible wires twisted together with a pitch of approximately 25 mm.

If twisted pairs are removed from a multi-cored cable to provide minor forms or turnouts the pitch may be as great as 80 mm. Such pairs are to have their pitch modified to approximately 25 mm, by hand. It is important not to over twist the pairs.

Cable-forms should include slack at the termination sufficient to enable each wire to be re-terminated if necessary.



Twisted Pair | Twin Twisted Pair | Cable Form

SYMBOLS

B7.6 Bay Wiring

Unless otherwise specified all bay wiring is to be cableformed and where practicable wiring jigs should be used. Cableforms should be attached to the bay lacing bars with approved nylon tie attachments.

When the bay is viewed from the rear, generally the mains cableforms are to be on the left, switching and signal cableforms on the right. In addition high and low level circuits should be separated. Where this discrimination is required full details will appear in the wiring information. For earthing see Section B12.

Fig. 1 shows Typical Bay Wiring.

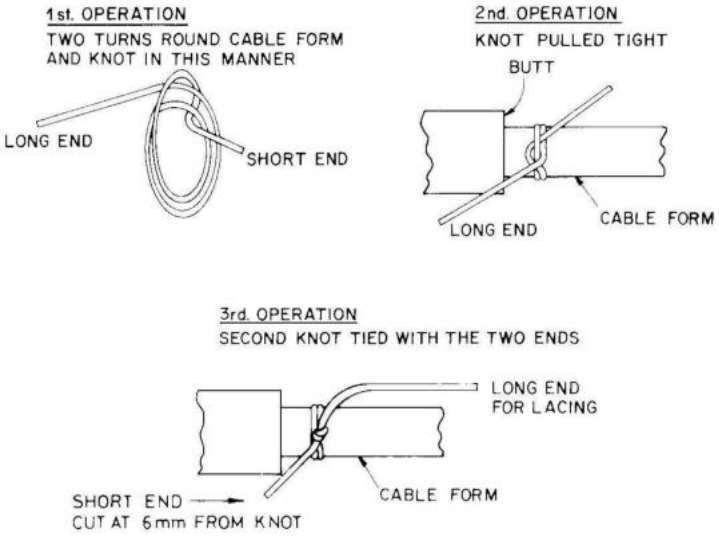
Items mounted on the bay are identified by numbering when viewed from the front of the bay as follows:-

Bottom to top with number one at the bottom.

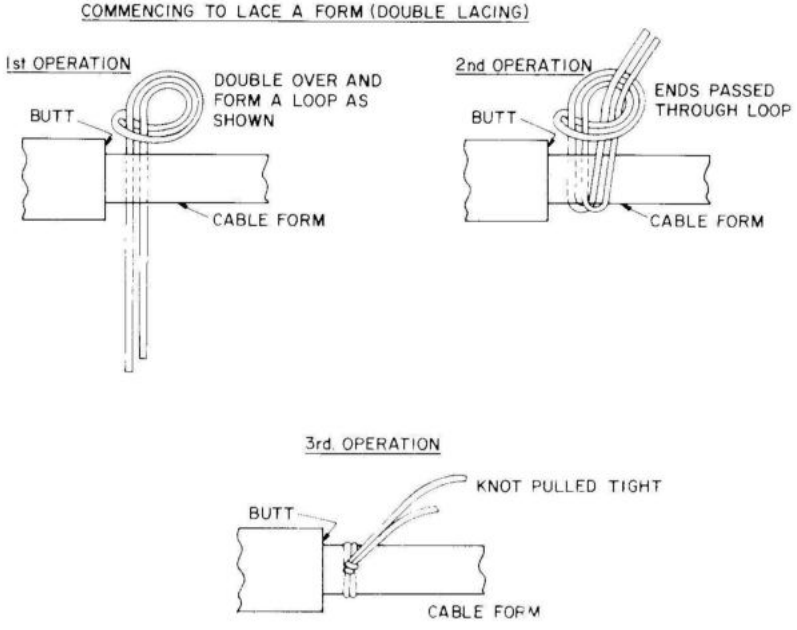
Left to right with number one on the left, e.g. 2(3) indicates a vertical position of 3rd from bottom, horizontal position 2nd from left.

Individual components e.g. Jacks mounted on a Jackfield, are numbered in a similar way i.e. with row one at the bottom and Jack one on the left, when viewed from the front.

COMMENCING TO LACE A CABLE FORM (SINGLE LACING.)



COMMENCING TO LACE A FORM (DOUBLE LACING)

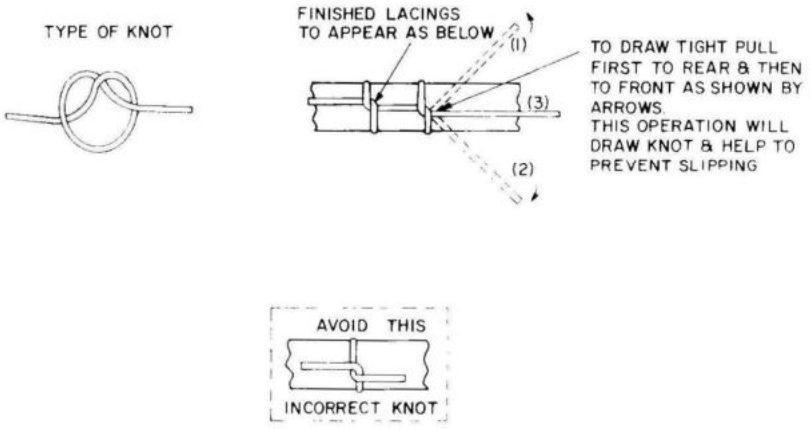


KNOTS FOR CABLE FORM LACING

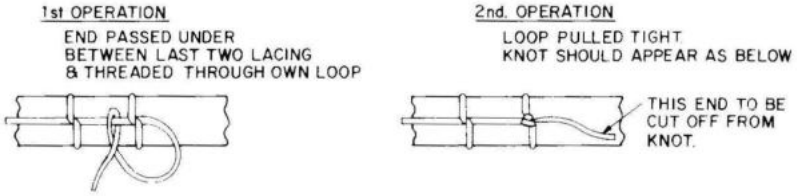
B7.5 FIG. 1a

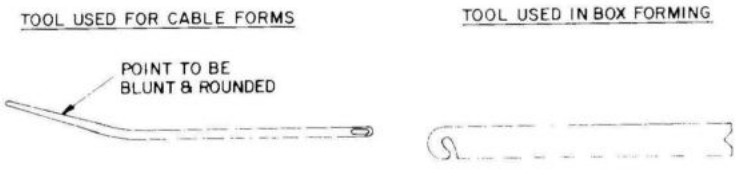
LOCKING KNOT TO BE USED FOR ALL CABLE LACING PURPOSES, (EITHER SINGLE OR DOUBLE LACING)

LACINGS TO BE SPACED EVENLY & AT RIGHT ANGLES TO LENGTH OF FORM



TERMINATING A LACING (EITHER SINGLE OR DOUBLE)



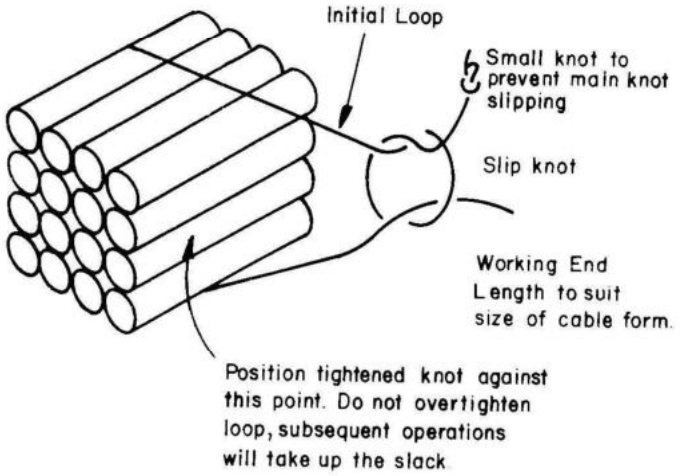


KNOTS FOR CABLE FORM LACING

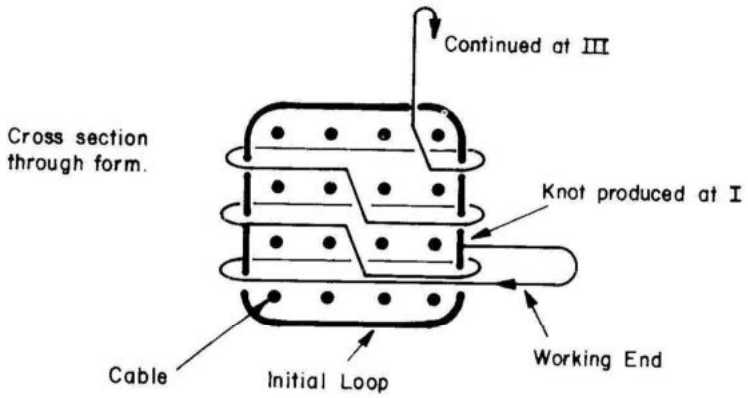
B7.5 FIG. 1b

Box Forming Cables (No lacing bar available)

I

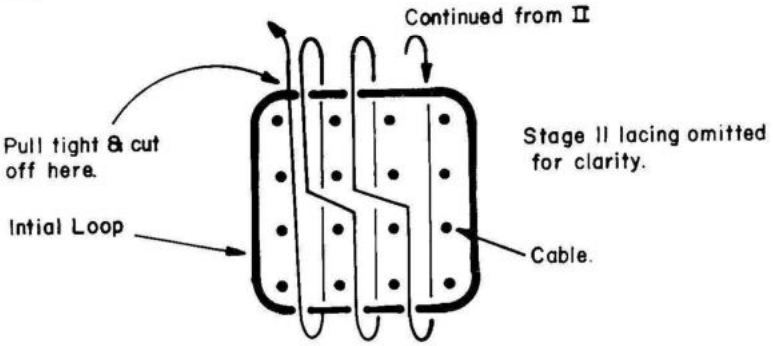


II

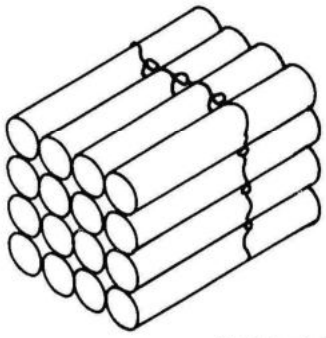


B7.5 FIG. 2a

III



IV

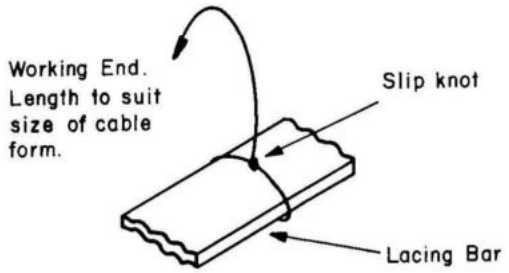


Finished Appearance

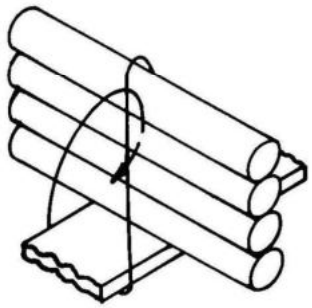
B7.5 FIG. 2b

Box Forming Cables Against a Lacing Bar.

I



II

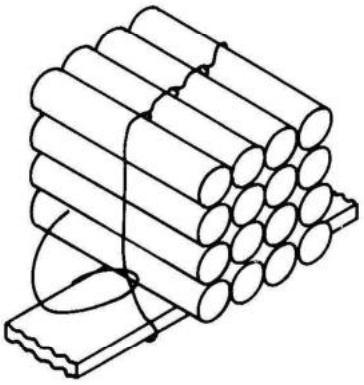


Place column of cables against slip knot and wrap string as shown Pull loop against cables but do not overtighten subsequent operations will take up the slack.

Place second column against the first & repeat the operation

B7.5 FIG. 3a

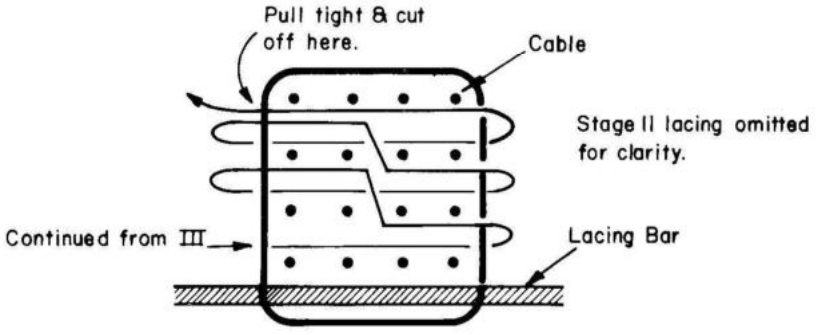
III



Continued at IV

Tighten knot close to bar.

IV



B7.5 FIG. 3b

B7.7.Desk Wiring

All desk wiring should be cable formed where possible and all equipment should, where practicable, be wired with sufficient slack to enable its removal from the desk without disconnecting soldered joints.

Additional lacing bars may be fitted where required, they are to be made of metal and if necessary covered with insulating material. For earthing see Section B12.

Where discrimination between high and low level circuits, or mains and switching circuits is required it will be fully specified in the wiring information.

B7.8 Miniature Sealed Relays

This type of relay is contained in a case on which is a circuit diagram showing the position of the contact and coil pins. Some of these diagrams, depending on the supplier, also show the spring numbers. When wiring these relays it should be noted that this diagram is a view of the termination as seen from the underside. Section D shows typical contact layout.

B7.9 Components with Spring Contacts.

When wiring to components which may require cleaning or other maintenance (e.g. Wafer Switches, Permanently wired relays, Lampholders, Jacks, etc.) the wiring must include sufficient slack to enable the component to be removed for maintenance without disconnecting or straining the soldered connection, e.g. Skinners from a Jackfield cableform.

Fig. 1 shows a typical example. Jackfield skinners may be formed horizontally or vertically, the preferred way must be specified and should be maintained throughout any one project.

B7.10 Hinged Panels

Where cables are terminated on a hinged unit a gate or 'goose neck' must be made in the cableform. This consists of a slack loop of un-laced cableform covered with insulating sleeving, arranged such that the operation of the hinge does not stress the wiring.

B7.11 Cable Clamping

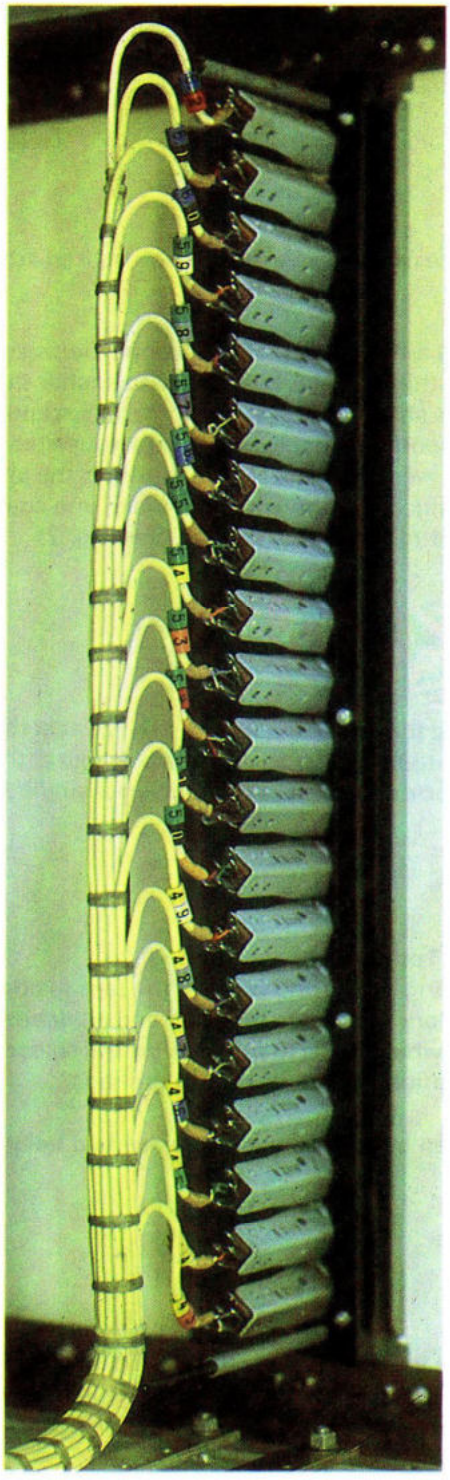
It is important that in securing cable clamping attachments excessive pressure is not applied such that damage to the insulation, or subsequent wire fracture, could result. On the other hand the cables must be sufficiently clamped to prevent direct pull on a soldered connection when the cable is tugged. It is important that cable clamps and lacing bars are adequately mounted so that they support cable forms. Loops are to be left in the cable sufficient to prevent any strain and to allow for easy removal of a connector, but they are not to be of such a size or weight that they will tend to displace it.

When clamping coaxial cable additional care must be taken not to change the dimensions of the cable and hence its characteristics.

B7.12 Wiring Space

There should be adequate space left after wiring to allow panels, particularly hinged panels, to be secured without stressing components or wires.

TYPICAL JACKFIELD WIRING



B8. CONNECTIONS TO TAGS & TERMINALS

B8.1 Wiring to Tags

It is essential that wire soldered to a tag be readily removable if required (see also A7.1). Lay-on joints to tags or solder spills are not to be used unless specified. Wires are not to be 'wrapped' around soldering tags but terminated as follows.

B8.1.1 Open Slotted Tags

Where tags with an open slot are used, the wires are to be hooked around the tag and cut off as close as possible to the tag.

Where tags with two open slots are used (e.g. on 'BT' connection strips), the wire is to make almost two complete turns around the tag, the back slot being used to anchor the insulating covering and the front slot only used for soldering. This shown in Fig. 1. One notable exception to this rule is that of distribution frames where considerable jumpering and retermination are inevitable. On these frames the connection strip tags are fitted with heat sleeves and in order both to protect the insulation covering of the wire and at the same time to assist in identification, the wire is to make one complete turn around the heat sleeve before going on to the back slot of the tag as before. (See Fig. 2)

B8.1.2 Closed Slotted Tags

Where tags with a hole are used the end of the wire is to be bent at right angles and passed through the hole, the projecting end is then to be cut off as close as possible to the underside of the tag. (See Fig. 3) Should the wire be too large for the hole, it is to be given a single turn around the tag.

B8.1.3 Connector Tags and Terminals

Care is to be taken when soldering cables and wires to the tags inside connectors; only the minimum of solder needed to make satisfactory joints is to be used, and all debris is to be carefully removed. When soldering wires with insulation which tends to run back during soldering the sleeves are to be fitted and pulled forward to provide insulation all the way up to the tag.

Run back can be greatly reduced by tinning the bore wire end before connection to stress relieve the insulation.

B8.1.4 Close Pitched Tags

When wires are soldered to tags which have less than 2 mm air space between them, or where there is a danger of shorting, an insulating sleeve is to be fitted over the joint on every other tag to prevent shorting. In some cases the particular equipment drawings will require that the joint is left exposed.

B8.1.5 Mains

Unless the terminations are totally enclosed by covers, which can only be removed by the use of tools, and the covers carry a warning label (see 'safety' section) when mains wiring is soldered to tags, the terminations must be covered with insulating material to prevent accidental contact.

B8.2 Wiring to Terminals

Wires which are to be connected to screw terminals are first to be fitted with solder tags which, together with shakeproof washers, are then to be secured under the terminals.

Where screw-down connector blocks are used it is important that the screw ends do not damage the wires when gripping them. Cables with either solid or stranded conductors of small diameter are therefore to be fitted with a suitable solder spill such as Stocko pillar lug type 8665 16. This is to be sweated in position on the end of the conductor with the shoulder towards the insulation before it is offered to the connector block screw. This Stocko lug will accept conductors up to and including 0.8mm diameter. Conductors above this diameter, if stranded, are to be twisted tightly together and soldered, or if single wires, doubled at the end and soldered before being screwed down.

B8.3 Solderless Wire Wrapping

Reference should be made to Equipment Department specification ED143 for more detailed information regarding wire wrapping methods.

The techniques and wires referred to in this section specifically relate to producing modified wraps on mini wrap posts with BBC type PUWR1/2M wire using power driven tools (air, battery or electric).

B8.3.1 Wire and Wire Stripping

PUWR1/2M is suitable for use with ordinary wrap bits requiring a separate wire stripper or 'cut, strip and wrap bits' (C.S.W.).

In order to prevent damage to wires it is essential to use only wire strippers dedicated for 0.25mm (30 a.w.g.). Adjustable wire strippers are unacceptable.

B8.3.2 Type of Wrap

All wraps will be 'modified' i.e. at least 6 and not more than 7 turns of bare wire shall applied with 1/2 to 1 turn of insulation. Basic metallic connection depends upon the formation of a gas tight impact welded joint between the wire and the corner of the terminal post. In practice a number of such joints are made in the course of applying 6 turns of wire. The insulated turn acts as a shock absorber when wrap connections are subject to vibration. (See Fig.4).

B8.3.3 Acceptable Modified Wrap

N.B. At least 3 of the uninsulated turns must be in continuous contact with each other. Any gap between groups of turns must not exceed 0.13mm.

B8.3.4 Tools and Bits

Hand tools are not recommended. Of the wide range of power tools available the Gardner Denver 14XA2 110V and Standard Pneumatic Motor Company type 668 (air driven) are particularly suitable. For any

given wire gauge the wrapping bit and sleeve must be selected dependant on the diagonal dimension and wrapping post length.

The Gardner Denver 507063 bit with 507100 sleeve are suitable for wrapping PUWR1/2M (30 AWG) wire on posts of effective diagonal between 0.79 and 0.86mm, 19mm long.

B8.3.5 Cut, strip and Wrap bits

The following are recommended for wrapping BBC standard connectors:-

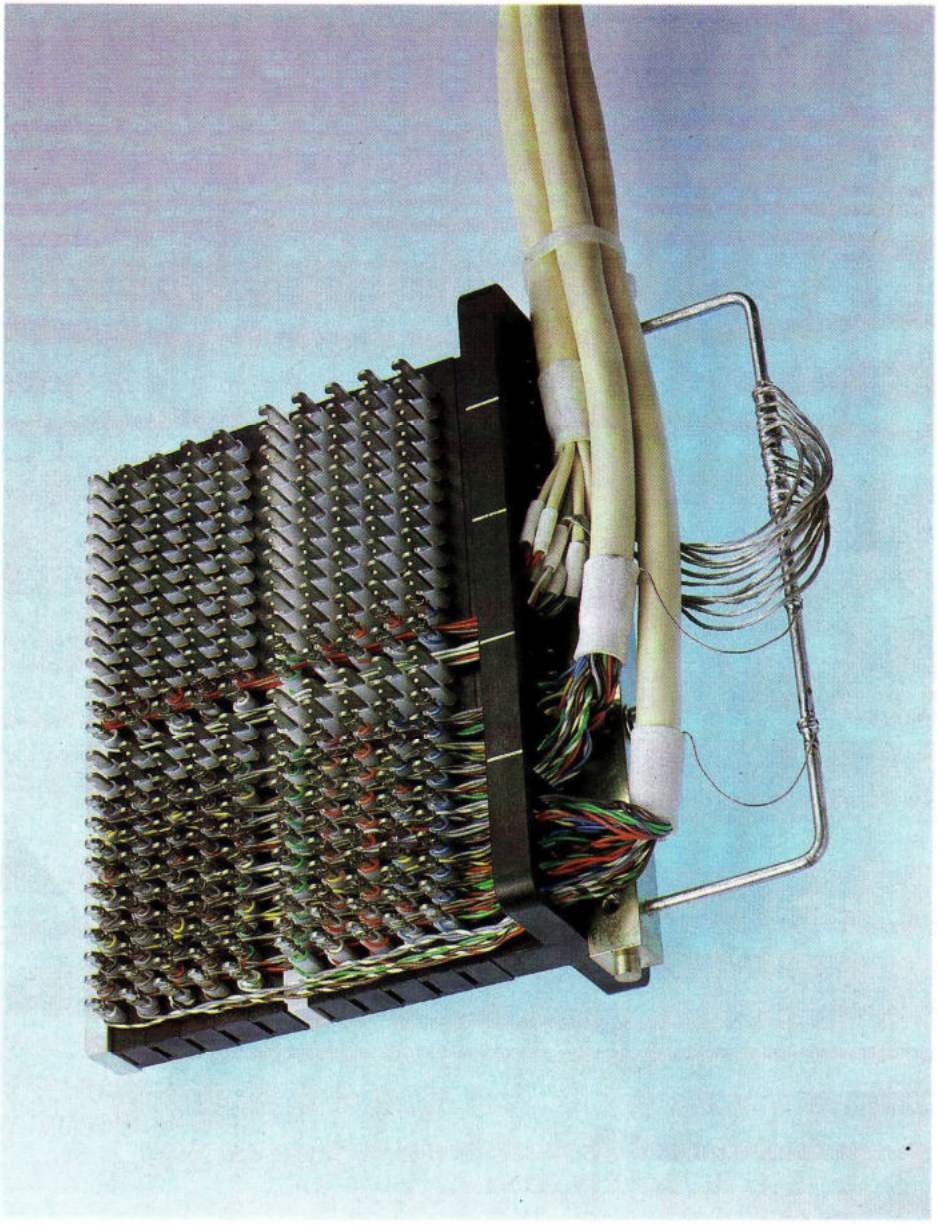
Nietronix type 23430 (bit + sleeve assembly)
Gardner Denver type 530877 (bit) + 530878 (sleeve)
Standard Pneumatic type 79301 (bit + sleeve assembly)

★'O.K.' machine and tool Co. type CSWB11 (bit) + CSWH.5 (sleeve)

★The 'O.K.' tool is not recommended for high density applications.

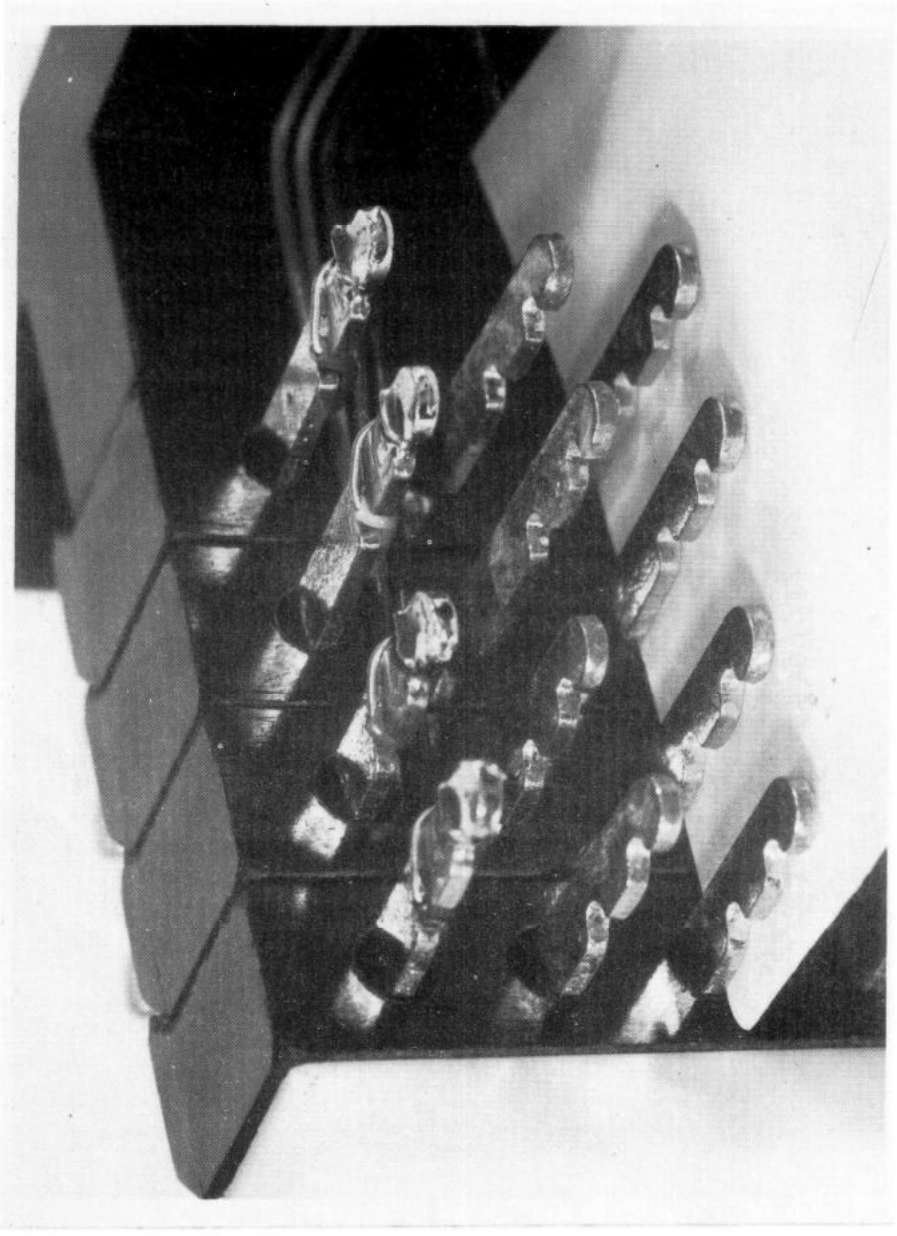
N.B. Bits and sleeves should always remain a mated pair i.e. never use a new bit with a worn sleeve etc.

WIRING TO B.T. TAG BLOCK.



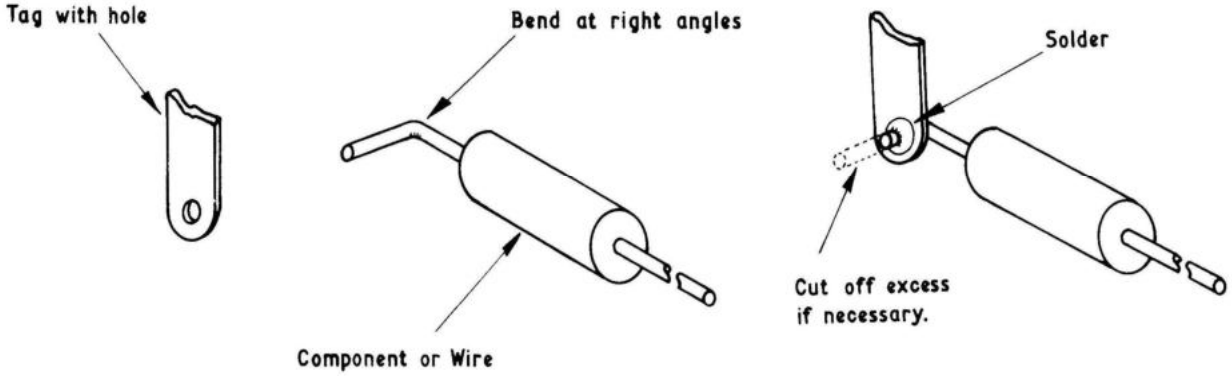
B8 FIG.1

SOLDERING TO A TAG WITH TWO OPEN SLOTS.

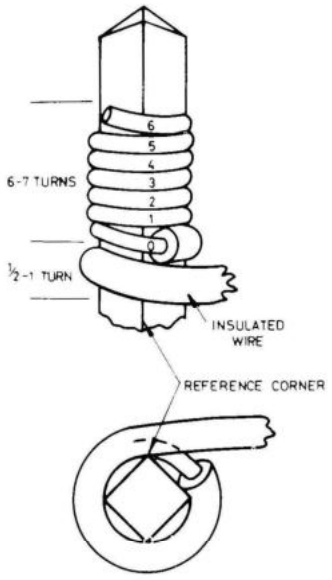


B8 FIG.2

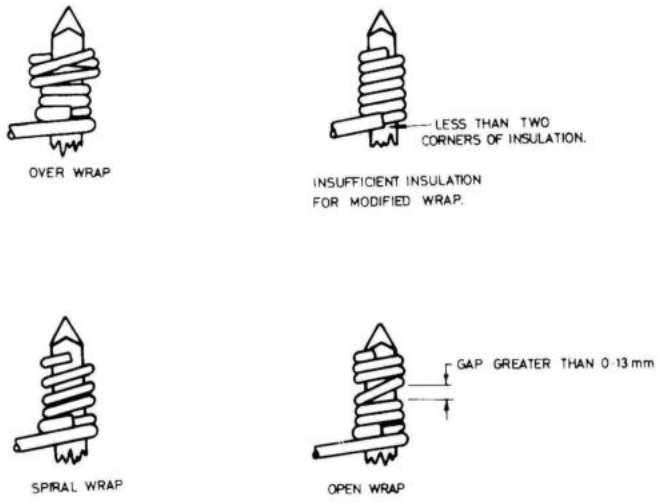
Soldering to a Tag with a Hole.



B8 FIG.3



B8 FIG.4



UNACCEPTABLE WIRE WRAPPING

B9. CRIMPED CONTACTS ON MULTIPOLE VARICON CONNECTORS

B9.1 General

Contacts of the crimp type must be terminated before insertion in the connector moulding. The crimp contact will accept stranded or solid wires with a cross sectional area ranging from 0.12 sq. mm. to 0.82 sq. mm. Examples of these wires are PUF1/3M, PUF1/6M, PUN1/1M, PUN2/3M and PSN/Multiways. It is essential that the total cross sectional area of the conductor within the crimp area, is at least 0.5 sq. mm. Where necessary wires can be bent back to provide the required filling.

B9.2 Method of Crimping

Insert contact into tool jaw, pushing front of contact into slot at rear of jaw, with crimping ears looking towards slots in tool jaws. Prepare wire by removing 3 mm of insulation. It is important that exposed conductor does not exceed 3 mm. Insert prepared end into jaw, so that it lies between 'ears' and slot in jaws. Ensure that contact does not protrude from jaws, and that wire is fully home in jaw. Operate tool. Note that tool incorporates a rachet mechanism which will not allow the contact to be released until properly crimped.

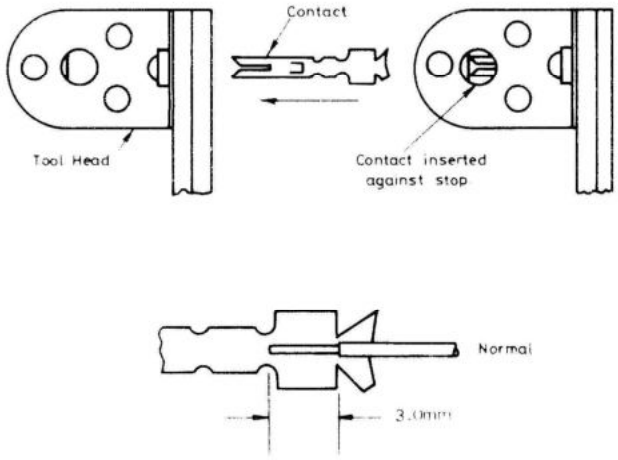
B9.3 Tools

Before starting a particular operation, the tool should be checked for correct crimping action by making a sample joint. Be sure to use the correct crimp aperture and to check that the contact guide floats to allow alignment. DO NOT ADJUST CRIMP TOOL.

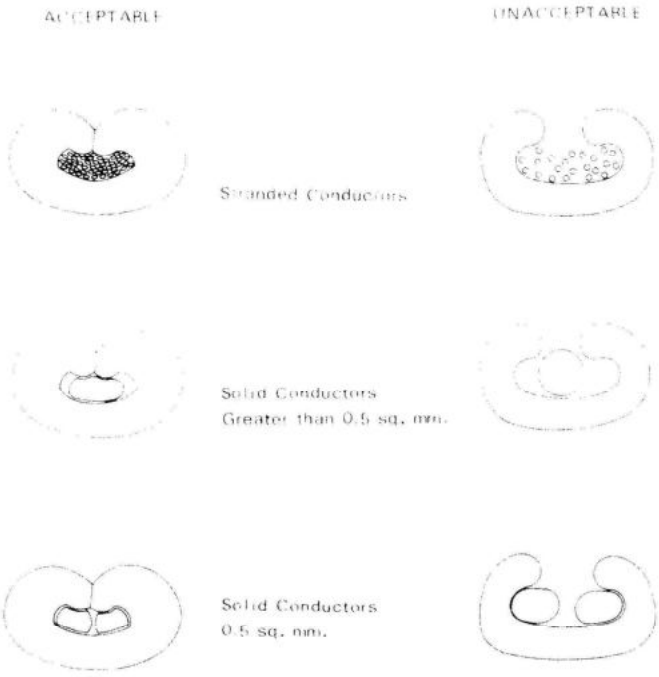
B9.4 Method of Contact Insertion

Lay the crimped conductor in slot provided in insertion tool, until closed crimp ears are in contact with blade of tool.

Offer contact at rear of moulding (round hole) so that contact width is at right angles to length of moulding. Push insertion tool towards moulding until retaining spring on contact operates, and click is heard and felt.



B9 FIG.1 WIRE PREPARED FOR CRIMPING



B9 FIG.2 EXAMPLES OF VARICON CRIMPED CONTACTS
(Cross section of contacts shown)

B10. TERMINATION OF SCREENED AND COAXIAL CABLE TO TAGS.

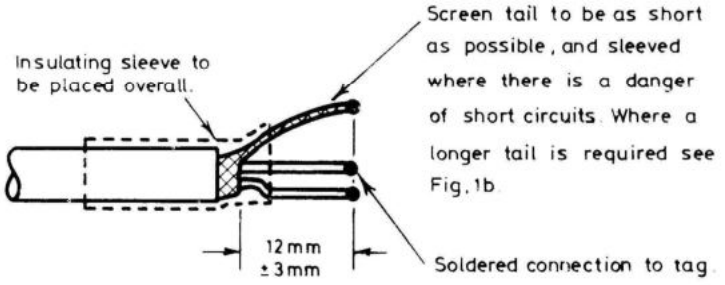
Unless otherwise specified cable in this category must be terminated in accordance with:-

Figs 1a-c for screened cable
Figs 2a-c or 3a-c for coaxial cable

Termination of individually screened pairs in multicore cables is as shown in Figs. 1a, 1b or 1c but in addition, the outer sheath is to be stripped and made off with a suitable sleeve at the nearest point convenient to the tags on which the cables are to be terminated.

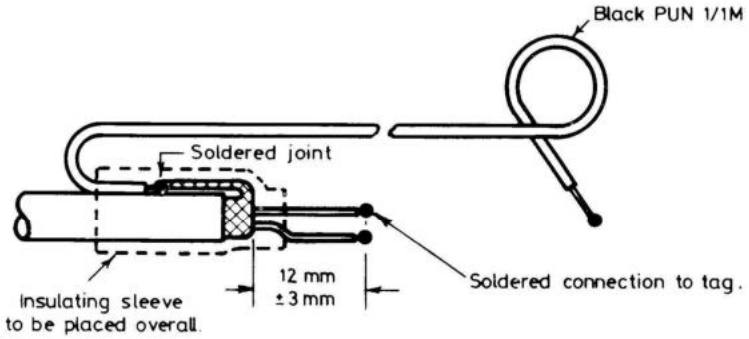
In addition to the above methods, where cables have a high melting-point dielectric, these can be terminated using heat-shrinkable solder sleeves as shown in Figs 4a-c.

METHOD OF TERMINATING SCREENED CABLE TO TAGS.



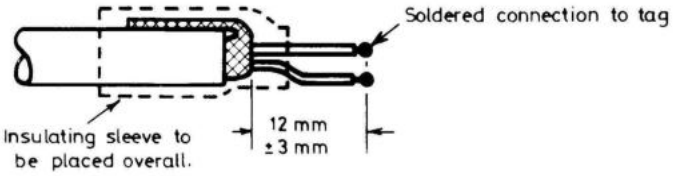
B10 FIG.1a

NORMAL TERMINATION



B10 FIG 1b

TERMINATION WHEN THE SCREEN TAIL IS CONNECTED TO TAG REMOTE FROM INNER CONDUCTOR TAGS.



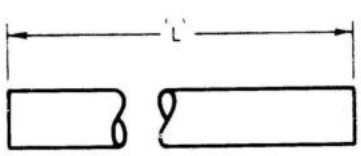
TERMINATION WHEN SCREEN IS NOT CONNECTED.

B10 FIG.1c

Screen tails :- Screen is to be separated from the cable and lightly twisted to form a tail.

METHOD OF TERMINATING CO-AXIAL CABLE TO TAGS

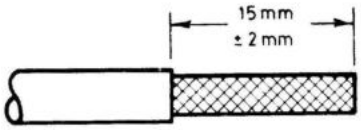
DET.1



Cut cable to length 'L' when specified.

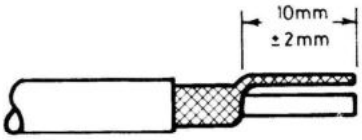
Tolerance when 'L' is
⩽ 300 mm ± 2 mm
⩾ 300 mm ± 5 mm

DET.2



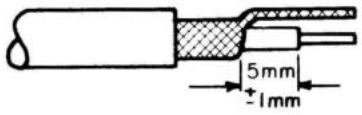
Remove 15mm of outer sheath.

DET.3



Screen to be separated from the cable and lightly twisted to form a thin tail, excessive twisting will cause the screen to tighten around and damage the dielectric.

DET.4

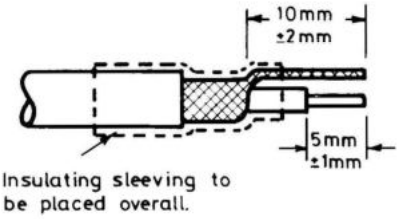


Remove 5mm dielectric. Screen tail to be sleeved where there is a danger of shorting.

Where the significant major dimension of the exceeds 2·5mm allow for an exposed wire length of twice the significant major dimensions.

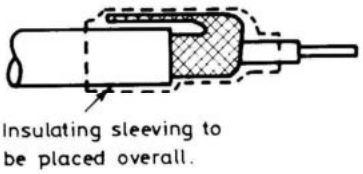
B10 FIG.2

METHOD OF TERMINATING CO-AXIAL CABLE TO TAGS



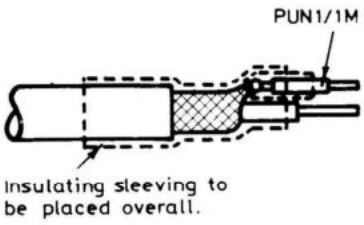
Termination when the screen is to be connected.

B10 FIG.3a



Termination when the screen is not connected.

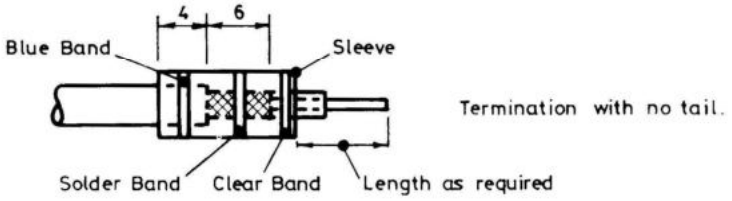
B10 FIG.3b



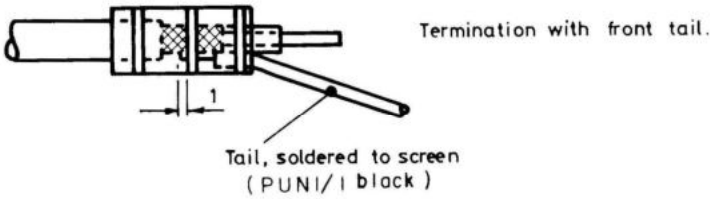
When more than one screen is connected to a tag, a short length of PUN1/1M (black) is to be soldered to the screen tail and insulating sleeving is to be placed over the joint.

B10 FIG.3c

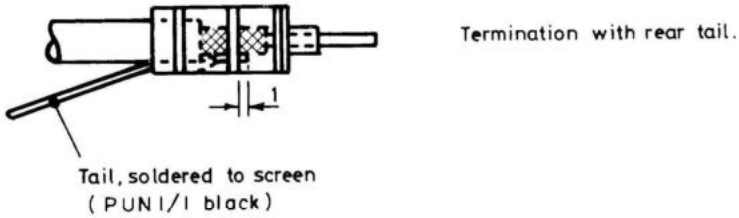
METHOD OF TERMINATING CABLE USING
APPROVED HEAT-SHRINKABLE SOLDER SLEEVE



B10 FIG.4a



B10 FIG.4b



B10 FIG.4c

N.B. ADVISE ON HOT AIR GUNS IS AVAILABLE FROM EQUIPMENT DEPARTMENT.

B11 TERMINATION OF COAXIAL CABLE TO CONNECTORS & ADAPTERS

B11.1 General

Specific instructions on the dimensions for stripping cable and the precise method of assembly will normally be supplied with each individual connector with the exception of musa connectors whose terminaion details appear in Figs. 1 to 9.

Typical terminations are shown on Figs 1 to 2, but the specific instructions should be followed where they differ from the typical.

B11.2 Preparation of Cable

Dimensions specified for the stripping of insulation, braid and inner conductor must be observed. It is essential that the cable is not damaged or deformed during preparation as this will adversely affect its characteristic impedance and hence performance at radio frequencies.

B11.3 Assembly of Connectors

Ensure the method of assembly is strictly in accordance with the information provided and that there is no movement inside the terminated connector. This requires care to ensure piece parts fit correctly and that the body, clamp etc. of the connector are tightened using the appropriate sized spanners.

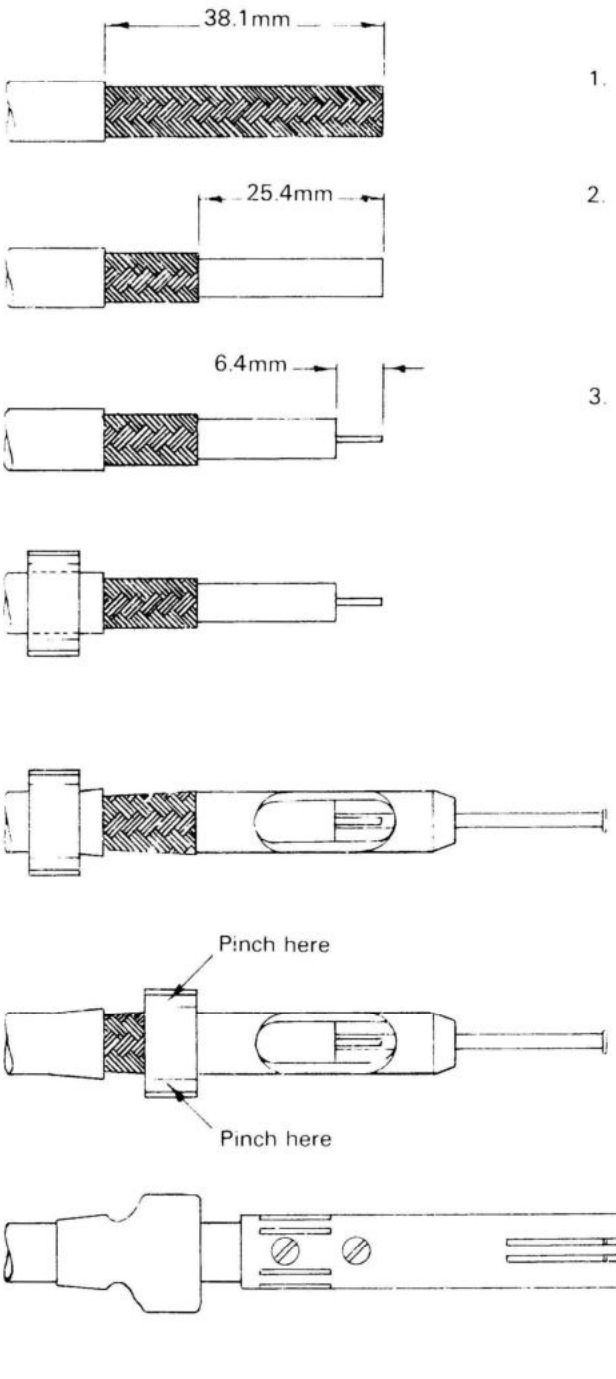
B11.3.1 Excess Solder

Excess solder must be removed from the centre pin without damaging the plating finish and any resultant swarf removed from the piece parts before assembly.

Do not mix component parts from different connectors even of the same type.

CABLE TERMINATIONS, R.F. COAXIAL, MUSA

SOCKET, FREE, BBC TYPE 201, 202, 203 or 204



ASSEMBLY INSTRUCTIONS

(for Cables UR 43, T 3172, T 3187, PSF 1/2 or PSF 1/3)

1. Cut end of cable even.
   Remove 38.1mm of outer sheath.

2. Remove 25.4mm of braided screen and trim ends (on cables PSF 1/2 & PSF 1/3 remove outer screen first and then inner screen to prevent damage to the dielectric).

3. Remove 6.4mm of the dielectric without damaging the inner conductor.

4. Slide O-Clip over cable
   - 4.8mm size for T 3187
   - 6.4mm size for UR 43, T 3172 or PSF 1/3
   - 7.9mm size for PSF 1/2

5. To fit socket to cable
   - Type 201 for UR 43 or T 3172
   - Type 202 for PSF 1/2
   - Type 203 for PSF 1/3
   - Type 204 for T 3187

   Remove fixing screws and outer case. Push conductor and dielectric through centre hole and braided screen over knurled portion on the outside of socket.

6. Slide O-Clip over braided screen and pinch with pincers at positions shown.

   Solder conductor to contact on socket.

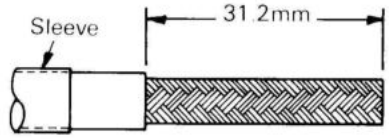
7. Fit Hellermann sleeve, white, over O-Clip and braided screen
   - Type N 40 x 25.4mm for T 3187
   - Type N 50 x 25.4mm for UR 43, T 3172 or PSF 1/3
   - Type N 70 x 25.4mm for PSF 1/2

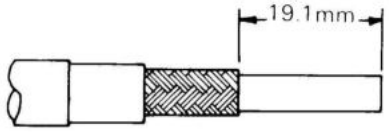
   Replace outer case and fixing screws.

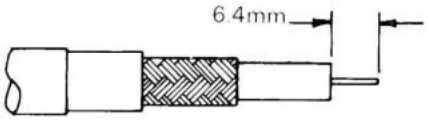
B11 FIG.1

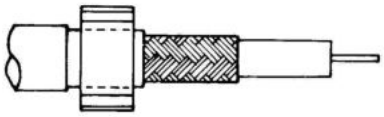
CABLE TERMINATIONS, R.F. COAXIAL, MUSA

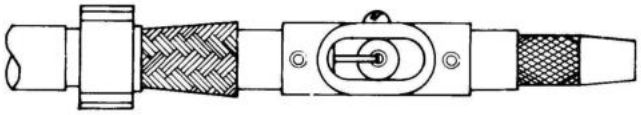
SOCKET, FREE, T-JUNCTION, BBC TYPE 211, 212, 213 OR 214

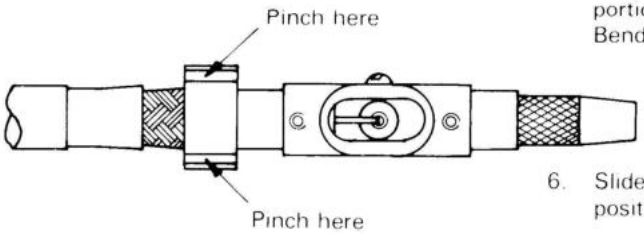


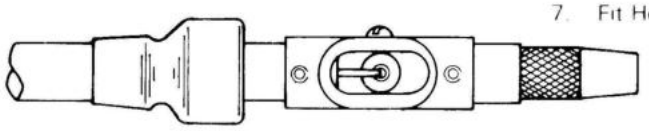












ASSEMBLY INSTRUCTIONS

(for Cables UR 43, T 3172, T 3187, PSF 1/2 or PSF 1/3)

1. Cut end of cable even.

Fit Hellermann sleeve, white
- Type N 40 x 25.4mm for T 3187
- Type N 50 x 25.4mm for UR 43 or PSF 1/3
- Type N 70 x 25.4mm for PSF 1/2

Remove 31.2mm of outer sheath.

2. Remove 19.1mm of braided screen and trim ends (on cables PSF 1/2 & PSF 1/3 remove outer screen first and then inner screen to prevent damage to the dielectric).

3. Remove 6.4mm of the dielectric without damaging the inner conductor.

4. Slide O-Clip over cable
- 4.8mm size for T 3187
- 6.4mm size for UR 43, T 3172 or PSF 1/3
- 7.9mm size for PSF 1/2

5. To fit socket to cable
- Type 211 for UR 43 or T 3172
- Type 212 for PSF 1/2
- Type 213 for PSF 1/3
- Type 214 for T 3187

Remove fixing screws and cover. Push conductor and dielectric through centre hole of adaptor and braided screen over knurled portion on the outside of socket.
Bend conductor 3.2mm from end at 90° upwards.

6. Slide O-Clip over braided screen and pinch with pincers at positions shown.

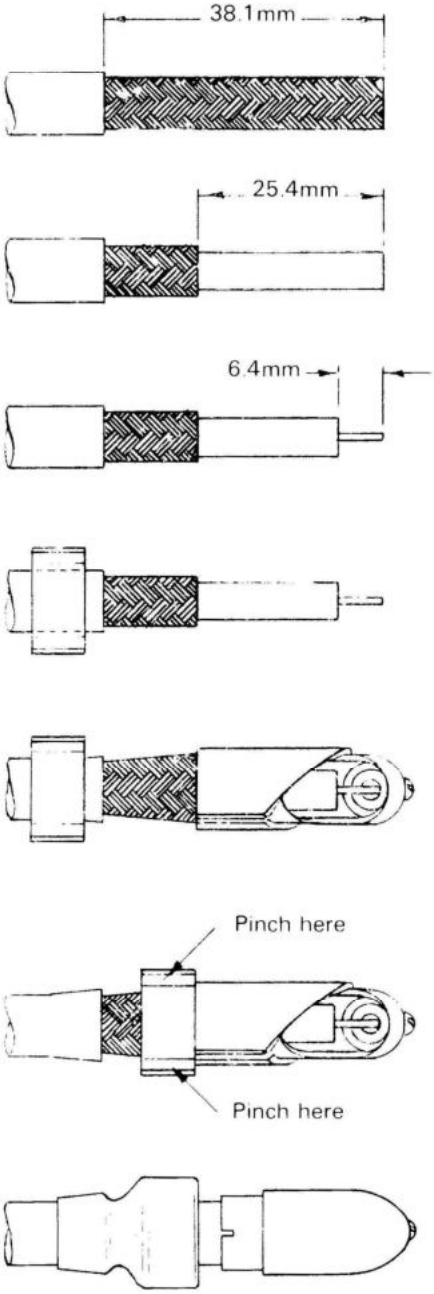
7. Fit Hellermann sleeve over O-Clip and braided screen.

8. Repeat the above procedure for cable terminated on opposite side of socket.
Solder both conductors to contact on socket.
Replace cover and fixing screws.

B11 FIG.2

CABLE TERMINATIONS, R.F. COAXIAL, MUSA

SOCKET, FREE, 90° ENTRY, BBC TYPE 221, 222, 223 or 224



ASSEMBLY INSTRUCTIONS

(for Cables UR 43, T 3172, T 3187, PSF 1/2 or PSF 1/3)

1. Cut end of cable even.
   Remove 38.1mm of outer sheath.

2. Remove 25.4mm of braided screen and trim ends (on cables PSF 1/2 & PSF 1/3 remove outer screen first and then inner screen to prevent damage to the dielectric).

3. Remove 6.4mm of the dielectric without damaging the inner conductor.

4. Slide O-Clip over cable
   - 4.8mm size for T 3187
   - 6.4mm size for UR 43, T 3172 or PSF 1/3
   - 7.9mm size for PSF 1/2

5. To fit socket to cable
   - Type 221 for UR 43 or T 3172
   - Type 222 for PSF 1/2
   - Type 223 for PSF 1/3
   - Type 224 for T 3187

   Revolve cover to open position. Push conductor and dielectric through centre hole and braided screen over knurled portion on the outside of socket.

6. Slide O-Clip over braided screen and pinch with pincers at positions shown.
   Solder conductor to contact on socket.

7. Revolve cover to closed position.

   Fit Hellermann sleeve, white, over O-Clip and braided screen
   - Type N 40 x 25.4mm for T 3187
   - Type N 50 x 25.4mm for UR 43, T 3172 or PSF 1/3
   - Type N 70 x 25.4mm for PSF 1/2

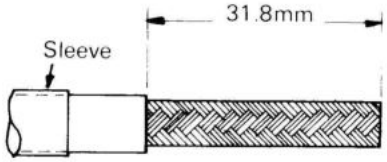
B11 FIG.3

CABLE TERMINATIONS, R.F. COAXIAL, MUSA

SOCKET, FREE, T-JUNCTION, BBC TYPE 231, 232, 233 OR 234

ASSEMBLY INSTRUCTIONS

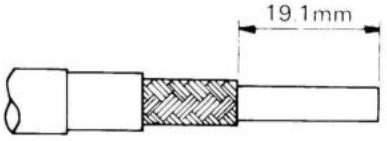
(for Cables UR 43, T 3172, T 3187, PSF 1/2 or PSF 1/3)



1. Cut end of cable even.

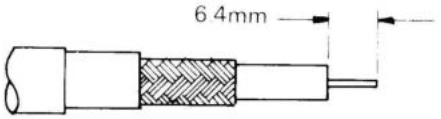
   Fit Hellermann sleeve, white
   - Type N 40 x 25.4mm for T 3187
   - Type N 50 x 25.4mm for UR 43, T 3172 or PSF 1/3
   - Type N 70 x 25.4mm for PSF 1/2

   Remove 31.8mm of outer sheath.

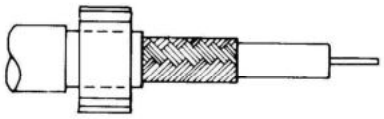


2. Remove 19.1mm of braided screen and trim ends (on cables PSF 1/2 & PSF 1/3 remove outer screen first and then inner screen to prevent damage to the dielectric).

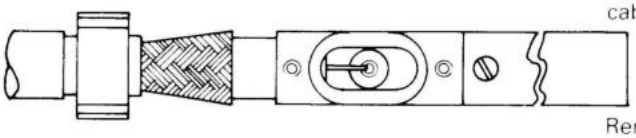
3. Remove 6.4mm of the dielectric without damaging the inner conductor.



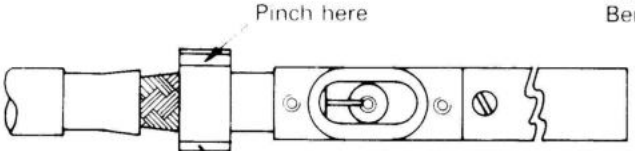
4. Slide O-Clip over cable
   - 4.8mm size for T 3187
   - 6.4mm size for UR 43, T 3172 or PSF 1/3
   - 7.9mm size for PSF 1/2



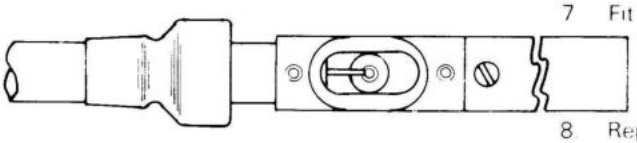
5. To fit socket to cable
   - Type 231 for UR 43 or T 3172
   - Type 232 for PSF 1/2
   - Type 233 for PSF 1/3
   - Type 234 for T 3187



Remove fixing screws and cover. Push conductor and dielectric through centre hole of adaptor and braided screen over knurled portion on the outside of socket.
Bend conductor 3.2mm from end at 90° upwards.



6. Slide O Clip over braided screen and pinch with pincers at positions shown.



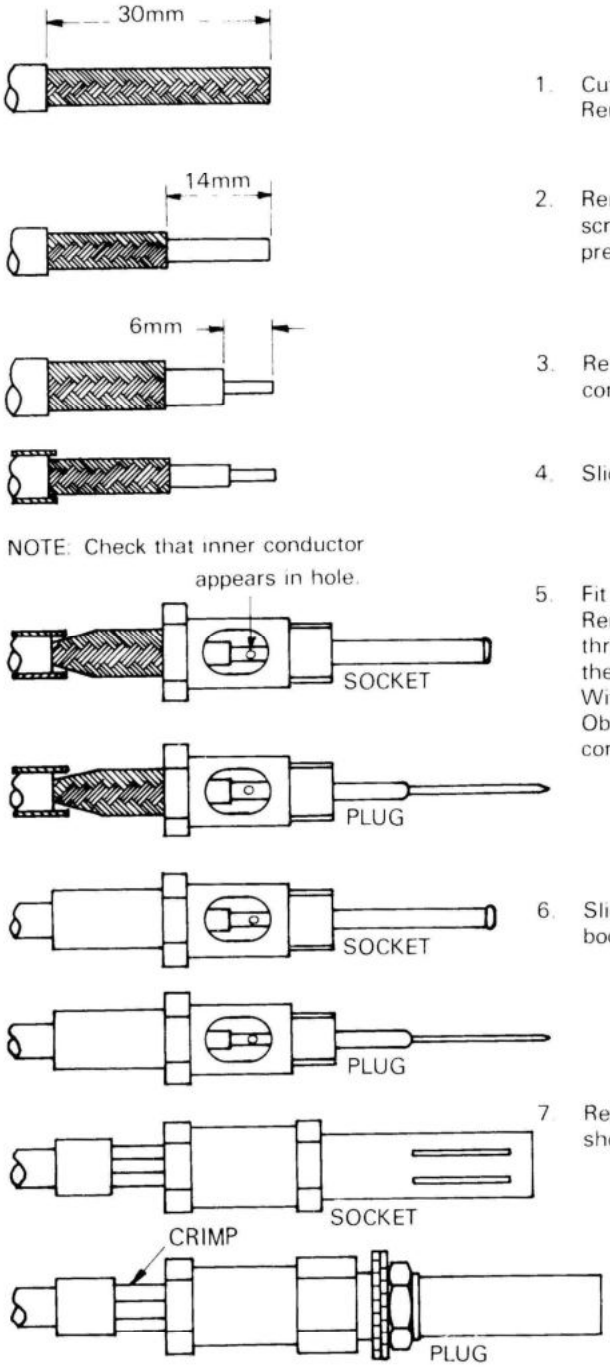
7. Fit Hellermann sleeve over O-Clip and braided screen.

8. Repeat the above procedure for cable terminated on opposite side of socket.
   Solder both conductors to contact on socket.
   Replace cover and fixing screws.

B11 FIG. 4

CABLE TERMINATIONS, R.F. COAXIAL, MUSA CRIMPED

CONNECTOR, FREE OR FIXED, BBC TYPES 251-255 incl., 351-355 incl.



ASSEMBLY INSTRUCTIONS

1. Cut end of cable square.
   Remove 30mm of outer sheath.

2. Remove 14mm of braided screen and trim ends (on double screen cables, remove outer screen first then inner screen, to prevent damage to the dielectric.

3. Remove 6mm of the dielectric without damaging the inner conductor.

4. Slide outer crimping sleeve over cable.

5. Fit connector to cable.
   Remove outer case and cover. Push conductor and dielectric through centre hole and braided screen over knurled portion on the outside of connector.
   With dielectric pressed against end of contact, crimp conductor. Observe marking on crimp heads "Cable entry" to obtain correct location of crimp.

6. Slide outer sleeve along cable until it butts against connector body, then crimp sleeve.

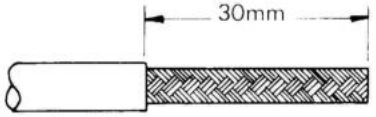
7. Replace cover and outer case, clamping cover between shoulder on connector body and outer case.

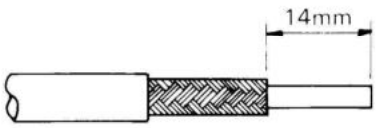
B11 FIG.5

CABLE TERMINATIONS, R.F. COAXIAL, MUSA

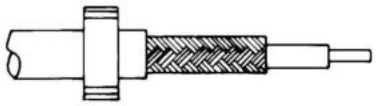
(ALTERNATIVE METHOD, FOR USE WHEN CRIMP TOOLS ARE NOT AVAILABLE)
CONNECTOR, FREE OR FIXED, BBC TYPES 251-255 incl., 351-355 incl.

TO SUIT CABLES T 3172, T 3205, T 3304, URM 111, PSF 1/2, PSF 1/2M, PSF 1/3 & PSF 1/3M









NOTE: Check that inner conductor appears in hole.

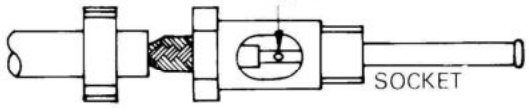
ASSEMBLY INSTRUCTIONS

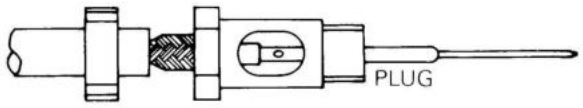
1. Cut end of cable square.
   Remove 30mm of outer sheath.

2. Remove 14mm of braided screen and trim ends (on double screen cables, remove outer screen first then inner screen, to prevent damage to the dielectric.

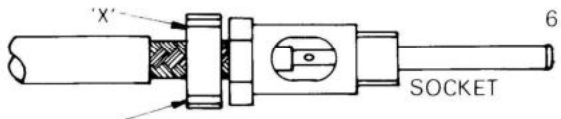
3. Remove 6mm of the dielectric without damaging the inner conductor.

4. Slide O-Clip over cable
   - 1/16" size for T 3187
   - 1/4" size for UR 43, URM 43, T 3172 PSF 1/3 & PSF 1/3M
   - 5/16" size for PSF 1/2 & PSF 1/2M

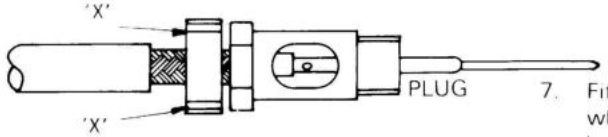




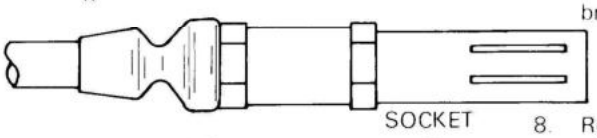
5. Fit connector to cable.
   Remove outer case and cover. Push conductor and dielectric through centre hole and braided screen over knurled portion on the outside of connector.
   With dielectric pressed against end of contact, apply solder to inspection hole whilst applying soldering instrument to adjacent side of inner contact.



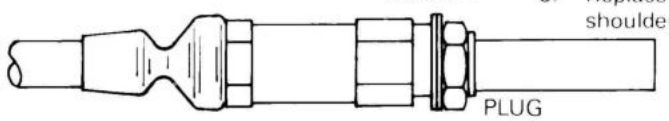
6. Slide O-Clip over braided screen. With O-Clip butted against face of hexagonal portion of connector, pinch with pincers at position 'X'.



7. Fit Hellermann sleeve, white, over O-Clip and braided screen
   - Type K 40 x 25mm for T 3187
   - Type TH 50 x 25mm for UR 43, URM 43, T 3172, PSF 1/3 & PSF 1/3M
   - Type TH 75 x 25mm for PSF 1/2 & PSF 1/2M



8. Replace cover and outer case, clamping cover between shoulder on connector body and outer case.



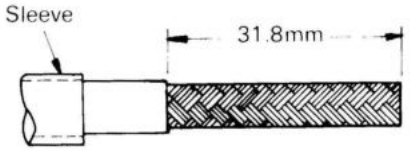
B11 FIG.6

CABLE TERMINATIONS, R.F. COAXIAL, MUSA

SOCKET, FREE, DUAL CABLE ENTRY BBC TYPE 261, 262, 263 OR 264

ASSEMBLY INSTRUCTIONS

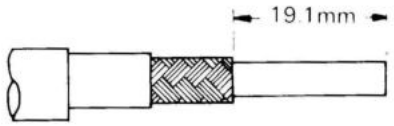
(for Cables UR 43, T 3172, T 3187, PSF 1 2 or PSF 1 3)



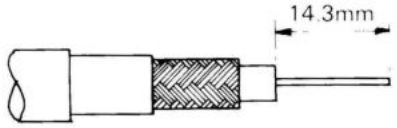
1. Cut end of cable even.

Fit Hellermann sleeve, white
- Type N 40 x 25.4mm for T 3187
- Type N 50 x 25.4mm for UR 43, T 3172 or PSF 1 3
- Type N 70 x 25.4mm for PSF 1 2

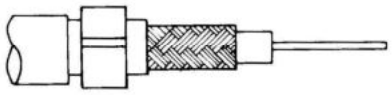
Remove 31.8mm of outer sheath.



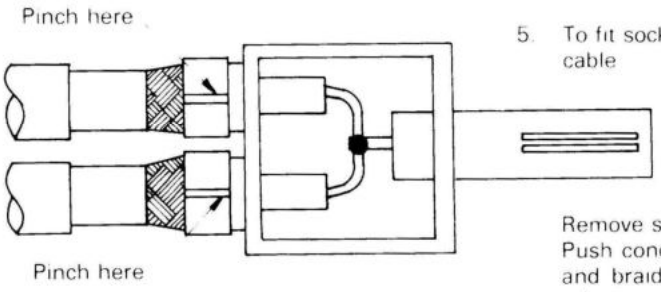
2. Remove 19.1mm of braided screen and trim ends (on cables PSF 1 2 & PSF 1 3 remove outer screen first and then inner screen to prevent damage to the dielectric).



3. Remove 14.3mm of the dielectric without damaging the inner conductor

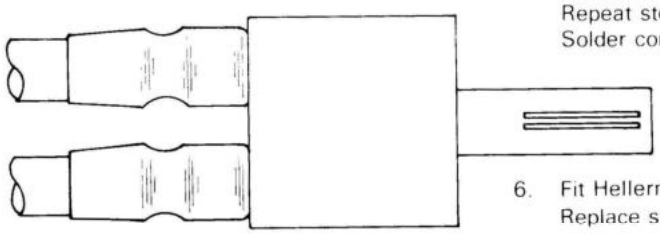


4. Slide O-Clip over cable
- 4.8mm size for T 3187
- 6.4mm size for UR 43, T 3172 or PSF 1 3
- 7.9mm size for PSF 1 2



5. To fit socket to cable
- Type 261 for UR 43 or T 3172
- Type 262 for PSF 1 2
- Type 263 for PSF 1 3
- Type 264 for T 3187

Remove side covers on socket.
Push conductor and dielectric through centre hole of adaptor and braided screen over knurled portion on the outside of adaptor.
Slide O-Clip over braided screen and pinch with pincers at positions shown.
Repeat steps 1 - 5 with second cable.
Solder conductors to contact on socket.

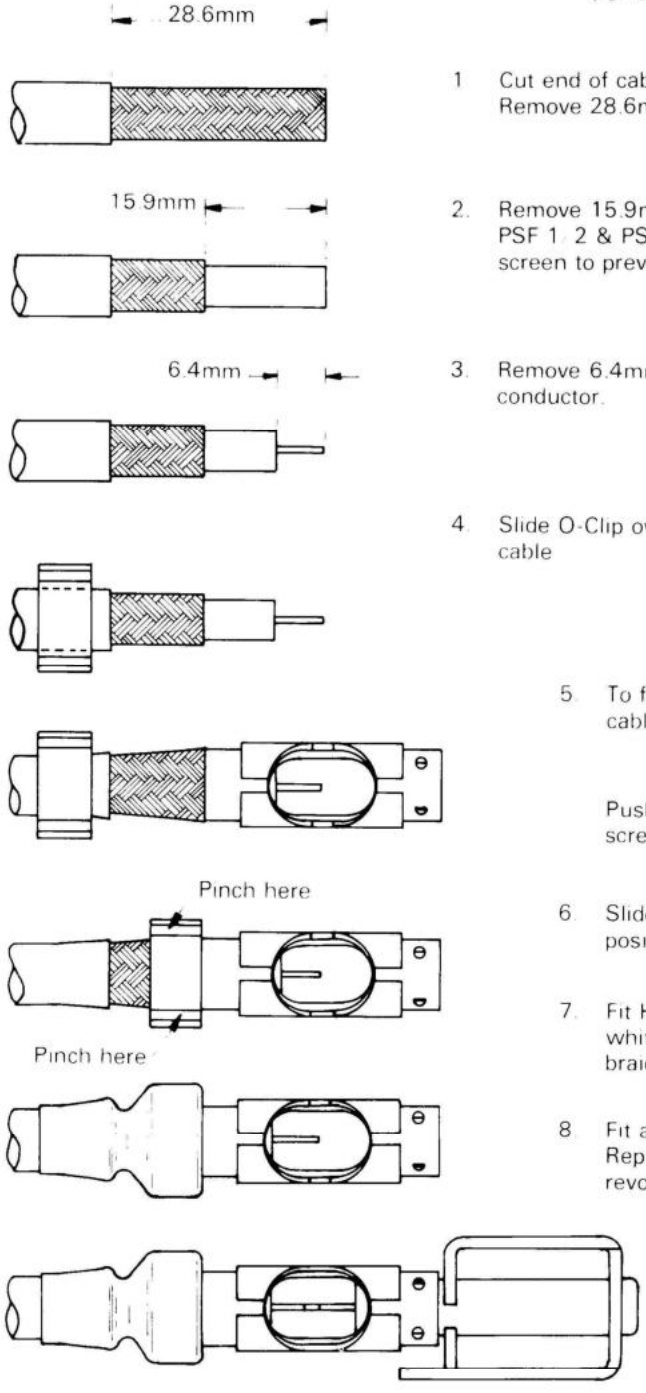


6. Fit Hellermann sleeves over O-Clips and braided screen.
Replace side covers on socket.

B11 FIG.7

CABLE TERMINATIONS, R.F. COAXIAL MUSA

PLUG FIXED, P.O. No. 1 OR 1C FITTED WITH BBC ADAPTOR
TYPE 411, 412, 413 OR 414



ASSEMBLY INSTRUCTIONS

(for Cables UR 43, T 3172, T 3187, PSF 1/2 or PSF 1/3)

1. Cut end of cable even.
   Remove 28.6mm of outer sheath.

2. Remove 15.9mm of braided screen and trim ends (on cables PSF 1/2 & PSF 1/3 remove outer screen first and then inner screen to prevent damage to the dielectric).

3. Remove 6.4mm of the dielectric without damaging the inner conductor.

4. Slide O-Clip over cable
   - 4.8mm size for T 3187
   - 6.4mm size for UR 43, T 3172 or PSF 1/3
   - 7.9mm size for PSF 1/2

5. To fit adaptor to cable
   - Type 411 for UR 43 or T 3172
   - Type 412 for PSF 1/2
   - Type 413 for PSF 1/3
   - Type 414 for T 3187

   Push conductor and dielectric through centre hole and braided screen over knurled portion on the outside of adaptor.

6. Slide O-Clip over braided screen and pinch with pincers at positions shown.

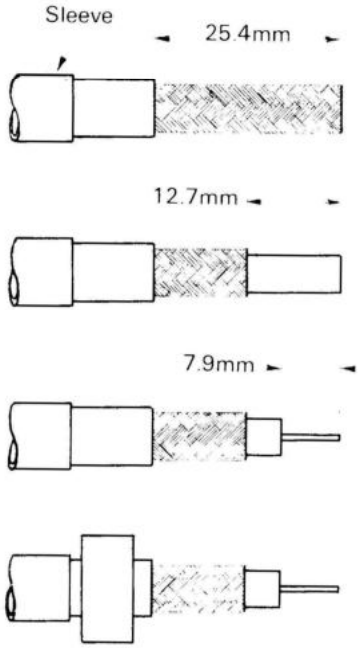
7. Fit Hellermann sleeve, white, over O-Clip and braided screen
   - Type N 40 x 25.4mm for T 3187
   - Type N 50 x 25.4mm for UR 43, T 3172 or PSF 1/3
   - Type N 70 x 25.4mm for PSF 1/2

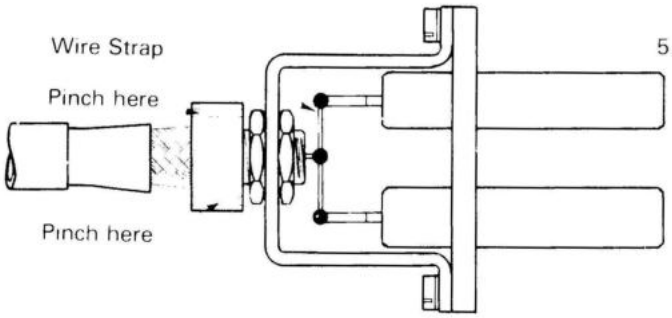
8. Fit adaptor to plug No. 1 or 1C, as required.
   Replace fixing screw, solder conductor to contact on plug and revolve adaptor cover to correction position.

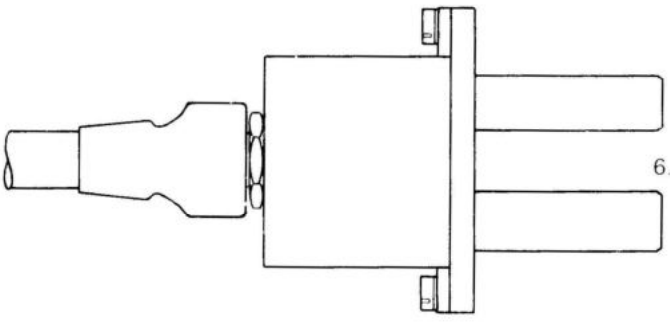
311 FIG.8

CABLE TERMINATIONS, R.F. COAXIAL, MUSA

PLUG, FIXED, DUAL ENTRY, 35C TYPE 303 FITTED WITH ADAPTORS
TYPE 421, 422, 423 or 424







ASSEMBLY INSTRUCTIONS

(for Cables UR 43, T 3172, T 3187, PSF 1/2 or PSF 1/3)

1. Cut end of cable even.

   Fit Hellermann sleeve, white
   - Type N 40 x 25.4mm for T 3187
   - Type N 50 x 25.4mm for UR 43, T 3172 or PSF 1/3
   - Type N 70 x 25.4mm for PSF 1/2

   Remove 25.4mm of outer sheath.

2. Remove 12.7mm of braided screen and trim ends (on cables PSF 1/2 & PSF 1/3 remove outer screen first and then inner screen to prevent damage to the dielectric).

3. Remove 7.9mm of the dielectric without damaging the inner conductor.

4. Slide O-Clip over cable
   - 4.8mm size for T 3187
   - 6.4mm size for UR 43, T 3172 or PSF 1/3
   - 7.9mm size for PSF 1/2

5. To fit plug to cable
   - Adaptor type 421 for UR 43 or T 3172
   - Adaptor type 422 for PSF 1/2
   - Adaptor type 423 for PSF 1/3
   - Adaptor type 424 for T 3187

   Remove side covers on plug.
   Push conductor and dielectric through centre hole of adaptor and braided screen over knurled portion on the outside of adaptor.
   Slide O-Clip over braided screen and pinch with pincers at positions shown.
   Solder wire strap across both contacts on plugs.
   Solder conductor to strap.

6. Fit Hellermann sleeve over O-Clip and braided screen.
   Replace side covers on plug.

B11 FIG.9

B12 EARTHING

B12.1 General

All metal parts in contact must make good electrical connection with each other. It is essential that paint and anodising (or other non-conducting finish) are removed from any such faces. The finish must also be removed from holes which have been counter-sunk or tapped.

Where earth continuity is achieved by means of a fixing screw, a shakeproof washer must be placed under the head of the screw, ensuring that it cuts through any non-conductive finish. This applies particularly to equipment panels fitted to bay-frameworks. In this case the shakeproof washer is to be fitted between the plain washer and the panel.

On CLASS 1 equipment the mains must not be connected until it has been proven that all exposed metal work is bonded to earth (including metal covers jack screws etc. associated with general wiring)

B12.2 Audio and Video Frequency Equipment

In audio frequency equipment two independent earths are to be maintained, i.e. Technical earth and Mains earth. These must not be interconnected unless specifically called for. This discrimination is often exercised in Video and Radio frequency equipment.

B12.3 Connectors

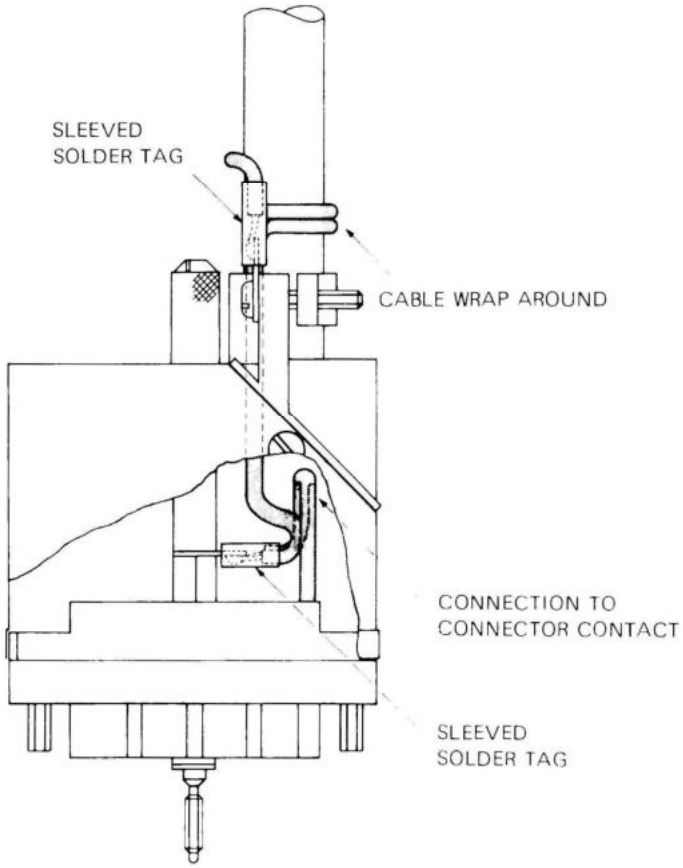
Unless specified otherwise, the metal cases of all connectors are to be earthed to the highest numbered contact. When the metal case is supplied connected to a contact other than that with the highest number, it is to be strapped to the highest number contact. When the metal case is not connected, it is to be earthed by running a Green Yellow wire from the contact at earth potential to a solder tag mounted at a convenient point on the case. This lead is to run via the cable entry hole in the case and is to make one complete turn around the cable before being terminated, ensuring that it is without slack as shown in Fig. 1.

B12.4 Mains Powered Equipment

Equipment which is mains powered and consisting of a number of sub-assemblies which are not bay-mounted, e.g. control desks, etc., is to have all metal parts of the sub-assemblies linked together with a flexible wire, e.g. PUF1/2M, green/yellow. Where the sub-assemblies can be operated away from the parent unit, for maintenance purposes, etc., this wire is to be of sufficient length to allow this. The cross sectional area of the flexible conductor used is to be at least equal to that of the live mains conductor.

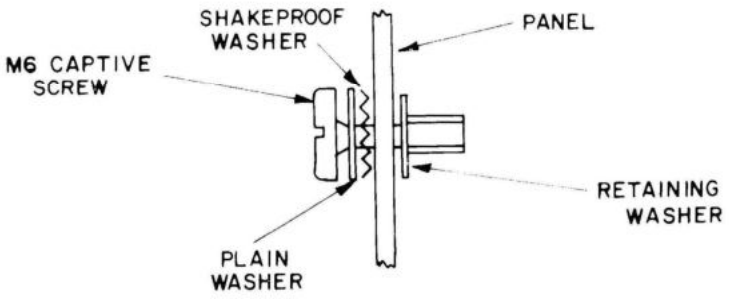
B12.5 483 mm BMM Equipment Panels, Earthed via Captive Screw

The captive earthing screw is to be assembled to the panel as shown in Fig. 2. Note that the shakeproof washer is fitted between the plain washer and the panel. It is to be located in the lower right hand (viewed from the front) fixing screw position. More may be fitted at the discretion of the specifying engineer.



B12 FIG.1

EARTHING OF METAL CASE



B12 FIG.2

EARTHING VIA CAPTIVE SCREW

B13 JUMPERING ON DISTRIBUTION FRAMES

B13.1 General

Jumpering is a method of interconnecting permanent cables wired to the termination blocks of a Distribution Frame which allows modifications to be readily carried out should these be necessary. For ease of maintenance, appearance and to conserve space for expansion it is essential that all jumpers are run by a correct route through the frame from one block to another, whether these blocks are on the same or opposite sides of the frame. This route must be made up of vertical and or horizontal components. Jumpers must never run directly from block to block without passing through a jumper ring.

B13.2 Principles of Jumpering

The basic principles of jumpering apply to both single and double sided frames.

The distribution frame is nominally divided into two sides, the 'Vertical' side and the 'Horizontal' side. The 'Vertical' side is generally that with the longer length of the cross arm (see Fig. 1), and on this side of the frame only the vertical components of the jumpers are to be made. Similarly only the horizontal components of the jumpers are to be made on the 'Horizontal' side of the frame.

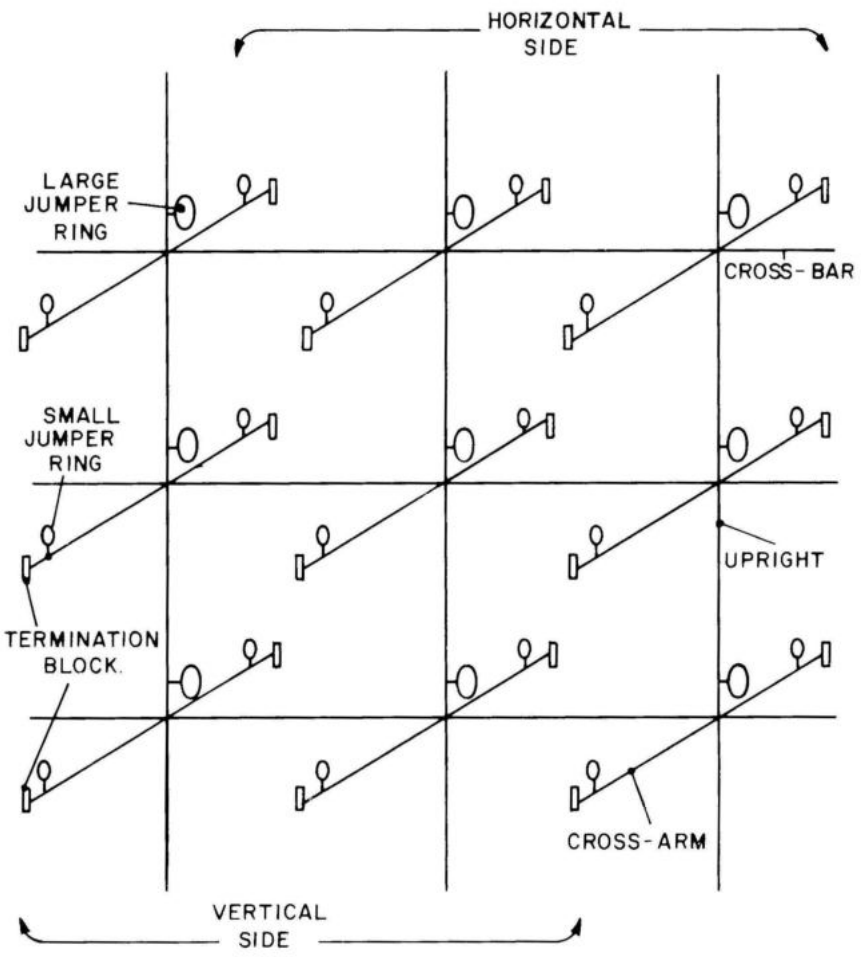
On a double-sided frame each termination block has a small jumper ring adjacent to it. All jumpers wired to a block must pass through the associated ring. A large ring is provided on the main frame upright at the junction of the cross-arm and the cross-bar. These are normally used where the jumper changes from a vertical to a horizontal direction.

Each jumper may have a horizontal or vertical component, or horizontal and vertical components depending on whether it has a change of upright or level, or a change of upright and level. A change of upright must always take place on the Vertical side. See Figs. 2 & 3 for examples of the routing of jumpers on a typical double-sided frame.

B13.3 General Result

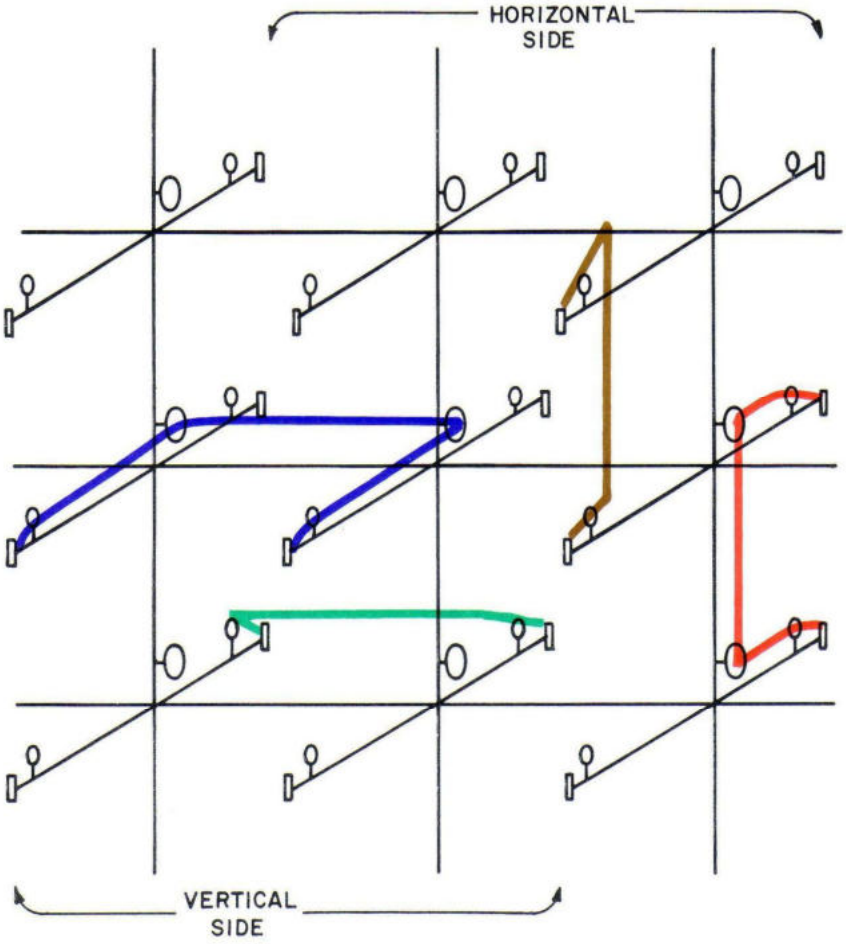
A correctly wired frame should meet the appearance test of having no vertical components on the 'Horizontal' side when viewed from the end of the frame and no horizontal components on the 'Vertical' side when viewed from the 'Vertical' side.

Section A



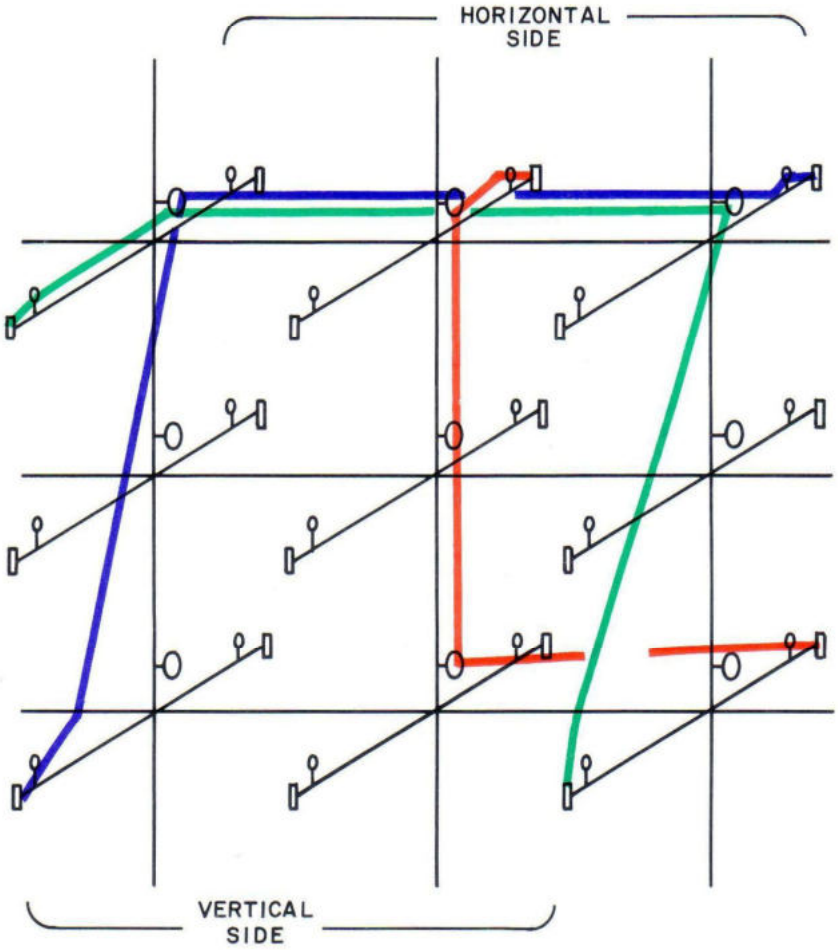
DISTRIBUTION FRAME COMPONENTS
(SCHEMATIC)

B13 FIG 1



JUMPERING WITH HORIZONTAL OR VERTICAL
COMPONENTS ONLY.

B13 FIG.2



JUMPERING WITH HORIZONTAL AND
VERTICAL COMPONENTS

B13 FIG.3

B14 INSULATION DISPLACEMENT INTERCONNECTION SYSTEM.

B14.1 General

This interconnection system employs the insulation displacement technique - no wire-stripping or soldering necessary. It is an alternative to the P.O. Tagblock and Hyphen systems as a method of jumpering or interfacing.

B14.2 Principles of Connection

Interconnections are made on a '10 pair in 10 pair out' module, which houses either straight through contacts or break contacts (for isolation of circuits).

Each contact will accept up to two 0.5 mm x 0.5 mm solid conductors. A hand-tool inserts and crops the conductor in one operation, producing a gas-tight joint.

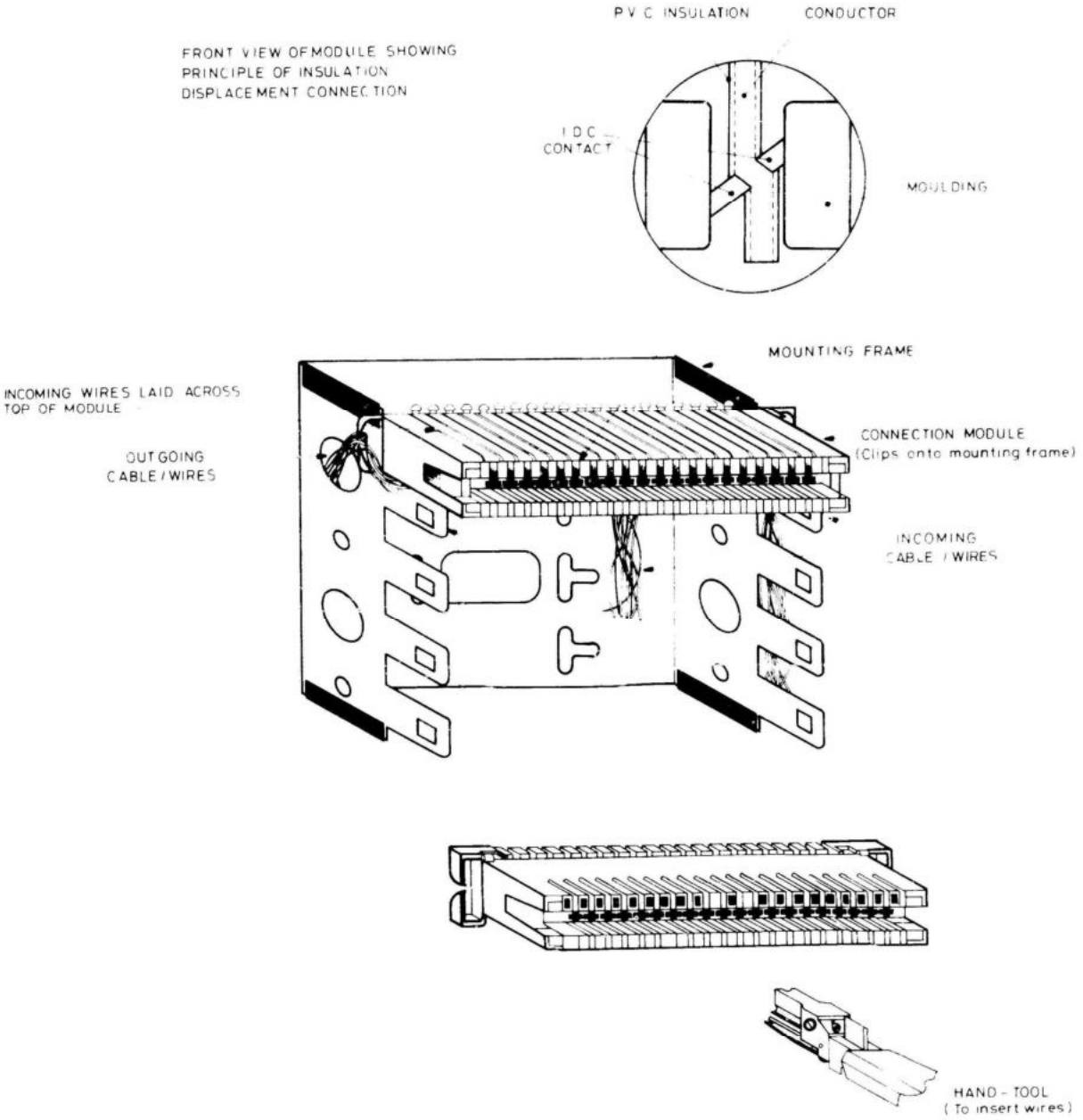
B14.3 Method of Mounting

The wired modules are clipped to a metal mounting frame in groups of five or ten, or multiples of each. The mounting frames can be mounted within equipment enclosures, to distribution frames or in wall-mounted boxes.

B14.4 Wiring Practice

Although at the time of publication of this Specification no wiring practice had been finalised, in general the interconnection cable-forms, whether of twisted pairs of multi-cored cables, should where possible be routed to the rear of the connection modules and clipped to the mounting frames.

Further advice on wiring should be sought from wiring supervisors or installation engineers.


P V C INSULATION
CONDUCTOR
FRONT VIEW OF MODULE SHOWING PRINCIPLE OF INSULATION DISPLACEMENT CONNECTION
I D C CONTACT
MOULDING
MOUNTING FRAME
INCOMING WIRES LAID ACROSS TOP OF MODULE
OUTGOING CABLE / WIRES
CONNECTION MODULE (Clips onto mounting frame)
INCOMING CABLE / WIRES
HAND - TOOL (To insert wires)
THRO CONTACT
MONITOR POINT
MODULE MOULDING
BREAK CONTACT
BREAK POINT
MODULE MOULDING
CONTACT STYLES (Side view)

B14 FIG 1

B15. GUIDE TO COLOUR CODING

This method of colour coding assists the manufacture of bayside wiring by laying down broad principles, the use of which will render constant references to wiring colours on drawings unnecessary. Future drawings sent to Equipment Department for the manufacture of apparatus need only, except in special cases, specify the type of cable and indicate the position of cable forms where it is necessary to differentiate between high and low level circuits, or programme and switching circuits etc.

In wiring pairs the primary colour is always to be wired:-

(a) to the lower numbered tag
(b) to the tip of the jack
(c) to the higher potential side of the circuit (i.e. the secondary colour of the pair is on the 'EARTHY' side of the circuit)
(d) to the right-hand side contacts of a key or relay looking at the rear, with the frame or winding at the bottom.

The sequence of primary colours is B, O, G, BN, S and that of secondary colours W, R, BK, Y, V

Battery connections on relay and switching units use the following convention:-

'R' for battery positive to the higher numbered tag (coil tag 'a' on relays) when directly connected.

'W' for battery non-earthy to the lower numbered tag (coil tag 'a' on relays) when directly connected.

'BK' for frame earth.

Ensure that the lower numbered tag is the high potential one. When Jackfields are wired directly to the bay connection strips, the outers are to be run in colours and whites or colours-whites:- B/W, O/W, G/W, BN/W, S/W, or B/B-W, O/O-W, G/G-W, BN/BN-W, S/S-W, and the inners in colours and reds or colours-reds:- B/R, O/R, G/R, BN/R, S/R or B/B-R, O/O-R, G/G-R, BN/BN-R, S/S-R, for jack number 1 to number 5 repeating the sequence as necessary for the others. Loops to Listen Jacks are to take the same colours as the wiring on the associated jacks.

Parallels between jacks are to take the same colours as the wiring on the associated jacks. Parallels not associated with other jacks are to be run:- outers B/W, inners B/R.

Screened Pair input circuits are to be run in colours and whites repeating after the first 5 circuits. Screened Pair output circuits are to follow the same procedure as inputs but with colours and reds. The second, fourth, etc. of units in a series chain will of necessity have these colours interchanged.

The colour coding is to start with the unit, i.e. amplifier, etc., with the lowest number, or where not numbered, with the first unit in the chain at the input to the bay.

For unit to unit wiring where runs go from the connection strip of one unit to the connection strip of another the colour coding is to start at Unit 1 with the lowest tag number and run through the colours as necessary reserving only W, R, and BK for battery negative, battery earth and frame earth respectively where 50V supply is involved.

Relay panels and Boxes are generally laid out to suit circuit nomenclature and may be numbered vertically, horizontally, or in groups as specified by the design engineer. If not specified the relays are to be numbered from left to right, bottom to top, looking at the front of the unit and ignoring the positions not wired. Relay designations must be indicated on the panel or relay.

When using insulated single solid conductor cable from the relays to a connection strip or any component other than another relay, this is to start at relay number one with B on the lowest spring number and continue in spring number order from relay to relay through the colour sequence as far as V, reserving W,

R, BK as before. When the 16 primary colours available have been used the relay concerned is to be completed by repeating the code again continuing with B on the nearest spring number. Where coil tags have wires other than battery connections these are to precede the lowest spring number in the colour sequence, i.e. coil tags are to be wired before spring sets.

Loops between relays are to use R-B to R-S (5 colours) starting at R-B on the lowest relay and spring number and keeping the same colour where they are continuous.

Single strapping, where there is no danger of shorting, is to be run in 0.8 mm B.T.C. (unsleeved). Where there is danger of shorting an insulated single solid conductor cable R-B to R-S is to be used.

50V positive circuits (battery earth) are to run in 'R'. All tags DIRECTLY connected to the battery earth tag of terminal on the unit (i.e. not through a spring set etc.) are to be in this colour, keeping the same colour where they are continuous. Similarly non-earthy in 'W', again looping-on where there is a direct connection. See Fig. 1.

Wiring in screened pairs, or a twisted pair of insulated single solid conductor cables, from the relays to the connection strip or any component other than another relay is to start at relay number one with colours and whites. Looping in pairs between relays is to be done with colours and reds.

For Key panels etc. the procedure for relays is to be followed when applicable. For panels incorporating switches relays and keys, etc. normally the colour coding is to start with the component having most wiring on it (terminal blocks or strips, plugs and sockets excluded).

The distribution of Mains supplies to, and within, equipment is to be carried out in accordance with the colour coding as stated below. This applies to both three core cables and single wires (flexible and non-flexible).

LIVE to be BROWN
NEUTRAL to be BLUE
EARTH to be GREEN/YELLOW

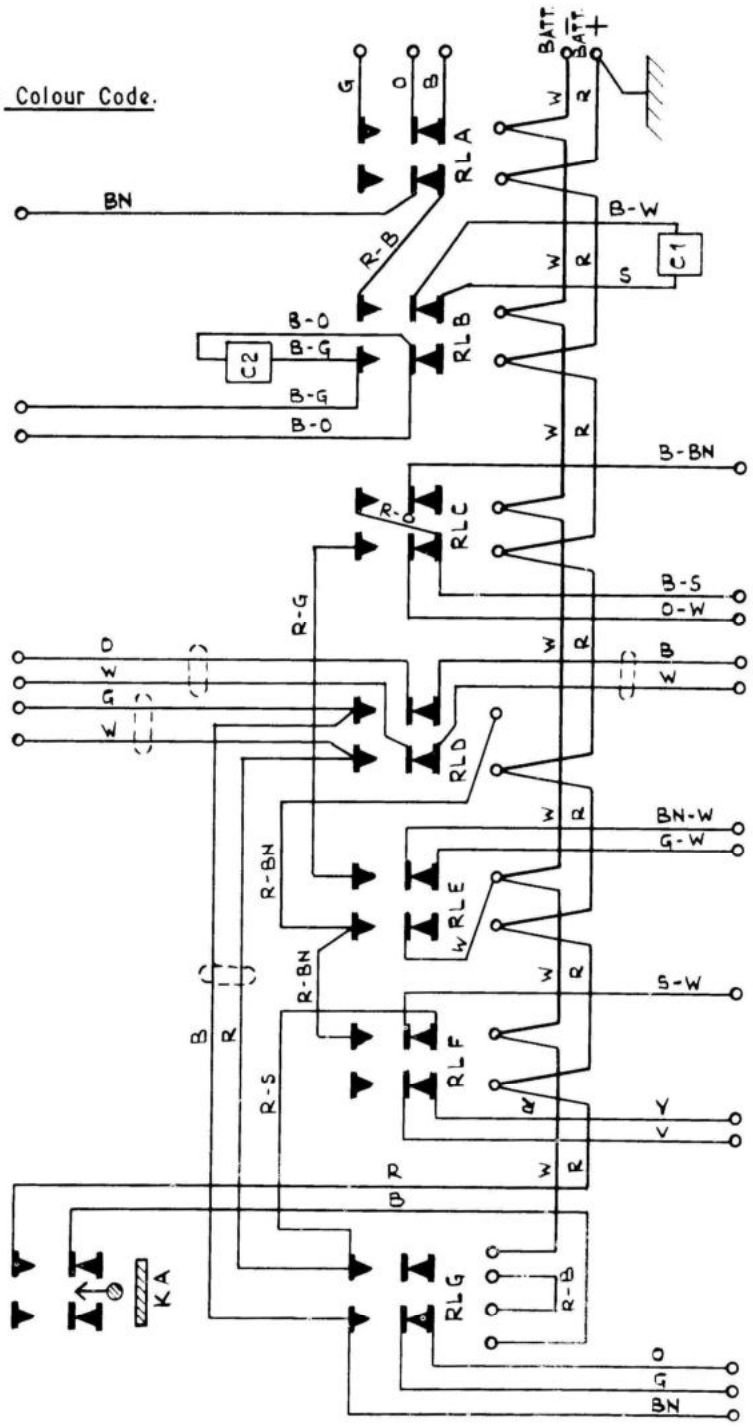
Mains Transformers, Colour Coding (for Transformers coded M500 and above)

Primary Winding:		
	BROWN (LIVE)	
	BLUE (NEUTRAL)	
Screen:	GREEN/YELLOW	
Secondary Windings:		
S1	RED	(START)
	ORANGE	(FINISH)
S2	YELLOW	(START)
	VIOLET	(FINISH)
S3	SLATE	(START)
	PINK	(FINISH)

When a secondary winding has a centre-tap this will be coded WHITE.

NOTE: Coding of Secondary windings relates only to the winding sequence during manufactur, i.e. S1 is not necessarily the highest voltage winding.

Relay Wiring Colour Code.



B15 FIG.1

SECTION C CABLE, WIRES AND CABLE ACCESSORIES

C1. CABLES AND WIRES

The types of cable and wires to be used will be called for on the drawings or specifications of individual units. Where cables or wires particular to the BBC are to be used these will normally be supplied to any Contractor on Embodiment Loan.

A complete list of BBC cables and their applications is included under the following groups:-

Camera Cable
Video Cable
R.F. Cable
Flexible Equipment Cable
Ribbon Cable
Non-Flexible Equipment Cable
Flexible Equipment Wires
Non-Flexible Equipment Wires
Power Supply Cords
Microphone Cables

See Section E Fig.2 for explanation of Cable and Wire Coding.

For further information on all cables and wires reference should be made to Standards Catalogue, Volume 1

For BBC cable and wire coding see page 131

CAMERA CABLE

PIF36/1MD	Construction:-	COAXIAL 3 CORES (R.F)	0.46	O/D 17.5 mm
		SINGLE INSULATED WIRE 4 CORES (★)	7/0.2	
		UNSCREENED QUADRUPLE (E)	0.3	
		SCREENED QUADRUPLE (C)	7/0.32	
		UNSCREENED 14 CORES (B)	0.3	
		SCREENED 7 CORES (D)	0.3	
	Colours:-	**R.F.** Y, W, BK.		
		★ B, G, W, R		
		E W, B, G, R		
		C Y, V, O, W		
		B B, R, W, Y, S, BN, BK, V, G, B, R, W, Y, S		
		D Y, S, BN, BK, G, V, W		
	General Use:-	Camera Connection		

VIDEO CABLE

PIF7/7M	Construction:-	7-1/0.4 mm	O/D 13.0 mm
	Colour:-	Cream	
	General Use:-	Multicore PSF1/7M Video Cable	
PIF14/2M	Construction:-	14-1/0.8 mm	O/D 39.8 mm
	Colour:-	Cream	
	General Use:-	Multicore PSF1/2M Video Cable	
PSF1/2M	Construction:-	1-1/0.8 mm	O/D 7.75 mm
	Colour:-	Cream	
	General Use:-	75Ω (close tolerance) Video & Pulse distribution	
PSF1/3M	Construction:-	1-1/0.61 mm	O/D 6.5 mm
	Colour:-	Cream	
	General Use:-	75Ω (close tolerance) Video & Pulse distribution	
PSF1/7M	Construction:-	1-1/0.4 mm	O/D 3.0 mm
	Colour:-	Cream	
	General Use:-	75Ω ruggedised miniature Video cable NOTE: This cable supersedes PSF1/5M	
PSF1/8M	Construction:-	1-1/0.75 mm	O/D 7.00 mm
	Colour:-	White	
	General Use:-	75Ω (close tolerance) Video & Pulse distribution	
PSN18/1M	Construction:-	9PR-0.4 mm	O/D 11.0 mm (A)
		7-7/0.2 mm	11.5 mm (B)
	Colours:-	B/W, O/W, G/W, BN/W, S/W, B/R, O/R, G/R, BN/R	
	General Use:-	Digital Video Cable	

R.F. CABLE

DRM 68	Construction:-	1PR-7/0.2 mm	O D 6.75 mm
	Colour:-	BK/Natural BK Sheath	
	General Use:-	Balanced R.F Feeder	
PSF1/4M	Construction:-	1-7/0.77 mm	O/D 10.55 mm
	Colour:-	Black	
	General Use:-	50Ω Low Power UHF Feeder	
PSF1/6M	Construction:-	1-7/0.32 mm	O/D 5.2 mm
	Colour:-	Black	
	General Use:-	50Ω double-screened cable. Low power VHF (short runs only)	
RG174U	Construction:-	1-7/0.17 mm	O/D 3.0 mm
	Colour:-	Black	
	General Use:-	50Ω suitable for UHF	
T3172	Construction:-	1-1/0.74 mm	O/D 5.1 mm
	Colour:-	Black	
	General Use:-	75Ω suitable for reception of Band 2 and 3	
T3187	Construction:-	1-1/0.56 mm	O/D 4.1 mm
	Colour:-	Black	
	General Use:-	72Ω Flexible interconnections	
URM 43	Construction:-	1-1/0.9 mm	O D 5.15 mm
	Colour:-	Black	
	General Use:-	50Ω very low power VHF	
URM 57	Construction:-	1-1/1.15 mm	O D 10.3 mm
	Colour:-	Black	
	General Use:-	75Ω Low Power VHF Feeder	
URM 110	Construction:-	1-7/0.11 mm	O D 1.9 mm
	Colour:-	Transparent	
	General Use:-	50Ω Miniature Flexible for use with SMB Snap On connectors, R.F. and as a screened wire in restricted space.	
URM 111	Construction:-	1-7/0.1 mm	O D 2.6 mm
	Colour:-	Transparent	
	General Use:-	75Ω Miniature Flexible for video applications	
URM 202	Construction:-	1-7/0.25	O/D 5.35 mm
	Colour:-	Grey or White	
	General Use:-	Aerial Downlead for T.V. Receiver Application	
URM 203	Construction:-	1-1/1.12	O D 7.50 mm
	Colour:-	Grey or White	
	General Use:-	Aerial Downlead for T.V. Receiver Application	

EQUIPMENT CABLES

Flexible

0776	See Microphone cables		
PSF1/1M	Construction:-	1/7 0.15	O/D 0.4 mm
	Colour:-	BK, R, Y, G, B, S, W,	
	General Use:-	Screened equipment wiring supersedes PUN1 1M	
PSF1/2M	See Video Cable		
PSF1/3M	See Video Cable		
PSF1/4M	See R.F. Cable		
PSF1/6M	See R.F. Cable		
PSF1/7M	See Video cable		
PSF2 11M	Construction:-	1PR-70.2 mm	O/D 4.0 mm
	Colours:-	R/B	
	General Use:-	Screened equipment wiring	
PSF3 1M	Construction:-	3-16/0.2 mm	O/D 5.25 mm
	Colours:-	R, W, BK	
	General Use:-	D.C. Power distribution (3 Amp)	
PSF3 2M	Construction:-	3-32/0.2 mm	O/D 5.6 mm
	Colours:-	R, W, BK	
	General Use:-	D.C.Power distribution (7 Amp)	
PSF4 1M	See Microphone Cable		
PSF4 2M	Construction:-	4-24 0.2	O/D 6.5 mm
	Colours:-	W, B, O, G	
	General Use:-	D.C. Power distribution	
PSF5 1M	See Microphone Cable		
PSF6 1M	Construction:-	6-16, 0.2 mm	O/D 9.5 mm
	Colours:-	B, G, W, R, BK, Y	
	General Use:-	D.C. Power distribution	
PSF7 1M	See Microphone Cable		
PSF8 1M	Construction:-	4-24 0.2 mm & 4-40 0.2 mm	O/D 12 mm
	Colours:-	O, BN, S, BK and	
		B, G, W, R resp.	
	General Use:-	Battery supply distribution, inter-connector cable.	
PSF8 2M	Construction:-	8-7 0.2 mm	O/D 6.7 mm
	Colours:-	B, O, G, BN, S, W, R, BK	
	General Use:-	Multi-core flexible control cable	
PSF10 2M	Construction:-	5PR-7 0.2	O/D 7.5 mm
	Colours:-	B/B-W, O/O-W, G/G-W, BN/BN-W, S/S-W	
	General Use:-	Multicore flexible control cable	

EQUIPMENT CABLES

Flexible (cont'd.)

PSF12 1M	Construction:-	12-7/0.2 mm	O/D 7.3 mm
	Colours:-	B, O, G, BN, S, W, R, BK, Y, V, B-W, B-O	
	General Use:-	Multicore flexible control cable	
PSF20 1M	Construction:-	20-7/0.2 mm	O/D 9.1 mm
	Colours:-	B, O, G, BN, S, W, R, BK, Y, V, B-W, B-O, B-G, B-BN, B-S, B-R, B-BK, B-Y, O-W, O-G	
	General Use:-	Multicore flexible control cable	
PSF20 2M	Construction:-	10 PR-7/0.2 mm	O/D 9.5 mm
	Colours:-	B/B-W, O/O-W, G/G-W, BN/BN-W, S/S-W, B/B-R, O/O-R, G/G-R, BN/BN-R, S/S-R	
	General Use:-	Multicore Flexible control cable	
PSF26 1M	Construction:-	26-7/0.2 mm	O/D 7.75 mm
	Colours:-	B, O, G, BN, S, W, R, BK, Y, V, P, R-B, R-G, R-Y, R-W, R-BK, R-BN, R-O, R-S, B-G, B-W, B-BN, B-O, B-S, G-BK, G-W.	
	General Use:-	Multicore Flexible control cable	
PSF38 1M	Construction:-	38-7/0.2 mm	O/D 12.04 mm
	Colours:-	B, O, G, BN, S, W, R, Bk, Y, V, B-W, B-O, B-G, B-BN, B-S, B-R, B-BK, B-Y, O/W, O-G, O-BN, O-S, O-R, O-BK, O-V, G-W, G-BN, G-S, G-R, G-BK, G-V, BN-W, BN-S, Bn-R, BN-Y, BN-V, S-W, S-R	
	General Use:-	Multicore flexible control cable	
PSF40/1M	Construction:-	20 PR-7/0.2 mm	O/D 12.80 mm
	Colours:-	B/B-W, O/O-W, G/G-W, BN/BN-W, S/S-W, B/B-R, O/O-R, G/G-R, BN/BN-R, S/S-R, B/B-BK, O/O-BK, G/G-BK, BN/BN-BK, S/S-BK, B/B-Y, O/O-Y, G/G-Y, BN/BN-Y, S/S-Y	
	General Use:-	Multicore flexible control cable	
PSF60 1M	Construction:-	60-7/0.2 mm	O/D 13.8 mm
	Colours:-	B, O, G, BN, S, W, R, BK, Y, V, B-W, B-O, B-G, B-BN, B-S, B-R, B-BK, B-Y, O-W, O-G, O-BN, O-S, O-R, O-BK, O-V, G-W, G-BN, G-S, G-R, G-BK, G-V, BN-W, BN-S, BN-R, BN-Y, BN-V, S-W, S-R, S-BK, S-Y, S-V, R-W, R-BK, R-Y, R-V, BK-Y, B-W-G, B-W-BN, B-W-S, B-W-R, B-W-BK, B-W-Y, G-W-BN, G-W-S, G-W-BK, G-W-Y, BN-W-S	
	General Use:-	Multicore flexible control cable	

EQUIPMENT CABLE

Ribbon Cable

PRF10/1M	Construction:-	10-7/0.12 Bonded insulation
	Colours:-	BN, R, O, Y, G, B, V, S, W, BK.
	General Use:-	For soldered inter P.C.B./unit connection.
		N.B. Not suitable for use with I.D.C.
PRF10/2M	Construction:-	10-7/0.12 Laminated Insulation
	Colours:-	BN, R, O , Y, G, B, V, S, W, BK.
	General Use:-	For inter P.C.B./Unit connection and I.D.C. termination.
PRF16/1M	Construction:-	16-7/0.12 Bonded Insulation
	Colours:-	BN, R, O, Y, G, B, V, S, W, BK, BN, R, O, Y, G, B
	General Use:-	For soldered inter P.C.B. unit connection.
		N.B. Not suitable for use with I.D.C.
PRF16/2M	Construction:-	16-7/0.12 Laminated Insulation
	Colours:-	BN, R, O, Y, G, B, V, S, W, BK, BN, R, O, Y, G, B
	General Use:-	For inter P.C.B. unit connection and I.D.C. termination.
PRF20/1M	Construction:-	20-7/0.12 Bonded Insulation
	Colours:-	BN, R, O, Y, G, B, V, S, W, BK. Repeated.
	General Use:-	For soldered inter P.C.B. unit connection.
		N.B. Not suitable for use with I.D.C.
PRF20/2M	Construction:-	20-7/0.12 Laminated Insulation
	Colours:-	BN, R, O, Y, G, B, V, S, W, BK. Repeated
	General Use:-	For inter P.C.B. unit connection and I.D.C. termination.
PRF26/2M	Construction:-	26-7/0.12 Laminated Insulation
	Colours:-	BN, R, O, Y, G, B, V, S, W, BK. Repeated
	General Use:-	For inter P.C.B./unit connection and I.D.C. termination.
PRF40/1M	Construction:-	40-7/0.12 Bonded Insulation
	Colours:-	BN, R, O, Y, G, B, V, S, W, BK. Repeated
	General Use:-	For inter P.C.B./unit connection.
		N.B. Not suitable for use with I.D.C.
PRF40/2M	Construction:-	40-7/0.12 Laminated Insulation
	Colours:-	BN, R, O, Y, G, B, V, S, W, BK. Repeated
	General Use:-	For inter P.C.B. unit connection and I.D.C. termination.
PRTF10/3M	Construction:-	5PR-7/0.12 Twisted Pair section 457 mm
		Flat termination section 50 mm
	Colours:-	B/R, O/Y, G/B, V/S, W/BK
	General Use:-	For inter P.C.B. unit connection and I.D.C. termination
PRTF26/3M	Construction:-	13PR-7/0.12 Twisted Pair Section 457 mm
		Flat termination section 50 mm
	Colours:-	B/R, O/Y, G/B, V/S, W/BK. Repeated.
	General Use:-	For inter P.C.B. unit connection and I.D.C. termination.
PRTF40/3M	Construction:-	20 PR-7/0.12 Twisted Pair Section 457 mm
		Flat termination section 50 mm
	Colours	B/R, O/Y, G/B, V/S, W/BK Repeated
	General Use:-	For inter P.C.B. unit connection and I.D.C. termination.

EQUIPMENT CABLE

Non-Flexible

PIN10/3M	Construction:- Colours:- General Use:-	5PR-1/0.5 mm, individually screened B/W, O/W, G/W, BN/W, S/W Interbay Wiring	O/D 10.0 mm
PIN20/30M	Construction:- Colours:- General Use:-	10PR-1/0.5 mm, individually screened B/W, O/W, G/W, BN/W, S/W, B/R, O/R, G/R, BN/R, S/R Interbay Wiring	O/D 14.5 mm
PSN1/1M		Superseded by PSF1/1M	
PSN2/2M	Construction:- Colours:- General Use:-	1PR-3/0.7 mm R/BK Battery Supplies, Bay & Interbay Wiring	O/D 8.2 mm
PSN2/3M	Construction:- Colours:- General Use:-	1PR-1/0.5 mm B/W Interbay Wiring (long runs)	O/D 4.45 mm
PSN2/4M	Construction:- Colours:- General Use:-	1PR-1/0.5 mm B/W, O/W, G/W, BN/W, S/W, B/R, O/R, G/R, BN/R, S/R, W/R Interbay, Bayside and Unit wiring.	O/D 3.0 mm
PSN10/3M	Construction:- Colours:- General Use:-	5PR-1/0.5 mm B/B-W, O/O-W, G/G-W, BN/BN-W, S/S-W Interbay Wiring	O/D 6.5 mm
PSN15/1	Construction:- Colours:- General Use:-	15-1/0.5 mm B, O, G, BN, S, B-W, O-W, G-W, BN-W, S-W, W, R, BK, Y, V Interbay, Bayside, Desk and Unit Wiring	O/D 7.1 mm
PSN20/4M	Construction:- Colours:- General Use:-	10PR-1/0.5 mm B/B-W, O/O-W, G/G-W, BN/BN-W, S/S-W, B/B-R, O/O-G, G/G-R, BN/BN-R, S/S-R Interbay Wiring	O/D 7.2 mm
PSN30/1M	Construction:- Colours:- General Use:-	30-1/0.5 mm B, O, G, BN, S, B-W, B-O, B-G, B-BN, B-S, O-W, O-G, O-BN, O-S, G-W, G-BN, G-S, BN-W, BN-S, S-W, W, R, BK, Y, V, R-B, R-O, R-G, R-BN, R-S Interbay, Bayside, Desk and Unit Wiring	O/D 9 mm
PSN32/1M	Construction:- Colours:- General Use:-	16PR-1/0.5 mm B/B-W, O/O-W, G/G-W, BN/BN-W, S/S-W, B/B-R, O/O-R, G/G-R, BN/BN-R, S/S-R, B/B-BK, O/O-BK, G/G-BK, BN/BN-BK, S/S-BK, B/B-Y Interbay, Bayside, Desk and Unit Wiring.	O/D 11.5 mm

EQUIPMENT CABLE

Non-Flexible (cont'd)

PSN40/2M	Construction:-	20PR-1/0.5 mm	O/D 11.5 mm
	Colours:-	B/B-W, O/O-W, G/G-W, BN/BN-W, S/S-W, B/B-R, O/O-R, G/G-R, BN/BN-R, S/S-R, B/B-BK, O/O-BK, G/G-BK, BN/BN/BK, S/S-BK, B/B-Y, O/O-Y, G/G-Y, BN/BN-Y, S/S-Y	
	General Use:-	Interbay, Bayside, Desk and Unit Wiring	
PSN50/3M	Construction:-	25PR-1/0.5 mm	O/D 12.2 mm
	Colours:-	B/B-W, O/O-W, G/G-W, BN/BN-W, S/S-W, B/B-R, O/O-R, G/G-R, BN/BN-R, S/S-R, B/B-BK, G/G-BK, BN/BN-BK, S/S-BK, B/B-Y, O/O-Y, G/G-Y, BN/BN-Y, S/S-Y, B/B-V, O/O-V, G/G-V, BN/BN-V, S/S-V	
	General Use:-	Interbay, Bayside, Desk and Unit Wiring	
PSN100 2M	Construction:-	50PR-1/0.5 mm	O/D 16.5 mm
	Colours:-	B/B-W, O/O-W, G/G-W, BN/BN-W, S/S-W, B/B-R, O/O-R, G/G-R, BN/BN-R, S/S-R, B/B-BK, O/O-BK, G/G-BK, BN/BN-BK, S/S-BK, B/B-Y, O/O-Y, G/G-Y, BN/BN-Y S/S-Y, B/B-V, O/O-V, G/G-V, BN/BN-V, S/S-V, B-W/W, O-W/W, G-W/W, BN-W/W, S-W/W, B-W/R-W, O-W/R-W, G-W/R-W, BN-W/R-W, S-W/R-W, B-W/BK-W, O-W/BK-W, G-W/BK-W, BN-W/BK-W, S-W/BK-W, B-W/Y-W, O-W/Y-W, G-W/Y-W, BN-W/Y-W, S-W/Y-W, B-W/V-W, O-W/V-W, G-W/V-W, BN-W/V-W, S-W/V-W	
	General Use:-	Interbay, Bayside, Desk and Unit Wiring	
PSN200/2M	Construction:-	100PR-1/0.5 mm	O/D 23 mm
	Colours:-	B/B-W, O/O-W, G/G-W, BN/BN-W, S/S-W, B/B-R, O/O-R, G/G-R, BN/BN-R, S/S-R, B/B-BK, O/O-BK, G/G-BK, BN/BN-BK, S/S-BK, B/B-Y, O/O-Y, G/G-Y, BN/BN-Y S/S-Y, B/B-V, O/O-V, G/G-V, BN/BN-V, S/S-V, B-W/W, O-W/W, G-W/W, BN-W/W, S-W/W, B-W/R-W, O-W/R-W, G-W/R-W, BN-W/R-W, S-W/R-W, B-W/BK-W, O-W/BK-W, G-W/BK-W, BN-W/BK-W, S-W/BK-W, B-W/Y-W, O-W/Y-W, G-W/Y-W, BN-W/Y-W, S-W/Y-W, B-W/V-W, O-W/V-W, G-W/V-W, BN-W/V-W, S-W/V-W R-B/R-W, R-O/R-W, R-G/R-W, R-BN/R-W, R-S/R-W, R-B/R, R-O/R, R-G/R, R-BN/R, R-S/R, R-B/R-BK, R-O/R-BK, R-G/R-BK, R-BN/R-BK, R-S/R-BK, R-B/R-Y, R-O/R-Y, R-G/R-Y, R-BN/R-Y, R-S/R-Y, R-B/RL-V, R-O/R-V, R-O/R-V, R-G/R-V, R-BN/R-V, R-S/R-V B-BK/BK-W, O-BK,BK-W, G-BK/BK-W, BN-BK/BK-W, S-BK/BK-W, B-BK/R-BK, O-BK/R-BK, G-BK/R-BK, BN-BK/R-BK, S-BK/R-BK, B-BK/BK, O-BK/BK, G-BK/BK, BN-BK/BK, S-BK/BK, B-BK/BK-Y, O-BK/BK-Y, G-BK/BK-Y, BN-BK/BK-Y, S-BK/BK-Y, B-BK/BK-V, O-BK/BK-V, G-BK/BK-V, BN-BK/BK-V, S-BK/BK-V	
	General Use:-	Interbay, Bayside, Desk and Unit Wiring.	

EQUIPMENT WIRE

Flexible

PUF1/2M	Construction:-	1-50/0.25 mm	O/D 3.55 mm
	Colours:-	B, O, G, BN, R, BK, G-Y	
	General Use:-	Unit Wiring	
PUF1/3M	Construction:-	1-14/0.12 mm	O/D 1.15 mm
	Colours:-	B, O, G, BN, S, P, W, R, BK, Y, V, G-Y B-W, B-O, B-G, B-BN, B-S, O-W, G-W, BN-W, S-W, R-B, R-O, R-G, R-BN, R-S, R-W	
	General Use:-	Unit Wiring, transformer lead-outs	
PUF1/5M	Construction:-	1/24/0.2 mm	O/D 2.45 mm
	Colours:-	B, O, G, BN, S, W, R, BK, Y, V, G-Y	
	General Use:-	Unit Wiring	
PUF1/6M	Construction:-	1-16/0.2 mm	O/D 2.25 mm
	Colours:-	B, O, G, BN, S, W, R, BK, Y, V, G-Y	
	General Use:-	Unit Wiring	
PUF1/7M	Construction:-	1-120/0.3 mm	O/D 8.0 mm
	Colour:-	Transparent Sheath	
	General Use:-	Earthing Wand Wire	
PUF3/1M	See Power Supply Cord		
PUF3/3M	Construction:-	3-19/0.1 (1 Amp)	O/D 3.0 mm
	Colour:-	G/Y, B, BN	
	General Use:-	For Wiring inside equipment or mains looping using 'D' 4-pole connector (STD 27702) N.B. Not to be used without adequate mechanical protection.	
RSF2/5M	See Microphone Cable		

Non-Flexible

PUN1/1M	Construction:-	1/0.5 mm	O/D 0.95 mm
	Colours:-	B, O, G, BN, S, B-W, B-O, B-G, B-BN, B-S, O-W, G-W, BN-W, S-W, W, R, BK, Y, V, R-B, R-O, R-G, R-BN, R-S, R-W,	
	General Use:-	Unit Wiring	
PUN1/2M	Construction:-	1/0.5 mm	O/D 1.0 mm
	Colours:-	R, W	
	General Use:-	For distribution Frame Jumper wiring	

EQUIPMENT WIRE

Non-Flexible

PUN2/2M	Construction:-	1PR-1/0.5 mm	O/D 1.9 mm
	Colours:-	B/W, O/W, G/W, BN/W, S/W, B/R, O/R, G/R, BN/R, S/R, W/R	
	General Use:-	Unit Wiring	
PUN2/3M	Construction:-	1PR-1/0.5 mm	O/D 2.0 mm
	Colours:-	B/R, O/R, G/R, BN/R, S/R, W/R	
	General Use:-	Distribution Frame Jumper wiring only	
PUWR1/2M	Construction:-	1/0.25 mm	O/D 0.58 mm
	Colours:-	B, O, G, BN, S, W, R, BK, Y, V	
	General Use:-	Solderless Wire Wrapping, Suitable for cut/strip and wrap operations.	

POWER SUPPLY CORDS

PUF3/1M	Construction:-	3-13/0.2 mm	O/D 5.1 mm
	Colours:-	BN, B, G-Y	
	General Use:-	Light duty mains cable. (Not suitable for soldering iron leads).	
RSF3/1M	Construction:-	3-50/0.25 mm	O/D 15.4 mm
	Colours:-	BN, B, G-Y	
	General Use:-	Heavy duty (semi-armoured), for O/B. use (15 Amp)	
RUF3/1M	Construction:-	3-16/0.2 mm	O/D 6.0 mm
	Colours:-	BN, B, G-Y	
	General Use:-	Soldering iron leads	

CERTIFICATION TRADE MARK

BASEC - BRITISH APPROVALS SERVICE FOR ELECTRIC CABLES.

THE FOLLOWING CABLES ARE APPROVED BY THE ABOVE AUTHORITY CONFORM TO BS 6500 1975, AND MEET RELEVANT EUROPLAN SPECIFICATIONS EACH CORD IS MANUFACTURED IN ACCORDANCE WITH A PARTICULAR TABLE WITHIN BS 6500.

CABLES APPROVED BY BASEC CAN BE IDENTIFIED BY THE SYMBOL ABOVE THE WORDS 'BASEC' OR 'BASEC HAR' OR A THREAD CONSISTING OF 1 STRAND RED, 1 STRAND BLACK AND 3 STRANDS YELLOW.

Table 15	Construction:-	3-16/0.2 mm	O/D 6.0 mm
	Colours:-	BN, B, G-Y	
	General Use:-	Mains distribution (3 Amp)	
Table 15A	Construction:-	3-16/0.2 mm Screened	O/D 8.8 mm
	Colours:-	BN, B, G-Y	
	General Use:-	Screened mains distribution (3 Amp)	
Table 6	Construction:-	3-24/0.2 mm	O/D 7.2 mm
	Colours:-	BN, B, G-Y	
	General Use:-	Mains distribution (6 Amp)	
Table 16	Construction:-	3-24/0.2 mm	O/D 8.0 mm
	Colours:-	BN, B, G-Y	
	General Use:-	Mains distribution (6 Amp)	
Table 6	Construction:-	3-32/0.2 mm	O/D 7.6 mm
	Colours:-	BN, B, G-Y	
	General Use:-	Mains distribution (10 Amp)	
Table 8	Construction:-	3-32/0.2 mm	O/D 11.5 mm
	Colours:-	BN, B, G-Y	
	General Use:-	Mains distribution. For use with portable equipment and as extension leads. (10 Amp)	
Table 16	Construction:-	3-32/0.2	O/D 8.4 mm
	Colours:-	BN, B, G-Y	
	General Use:-	Mains distribution (10 Amp)	

POWER SUPPLY CORDS (cont'd.)

Table 6	Construction:-	3-30/0.25 mm	O/D 9.3 mm
	Colours:-	BN, B, G-Y	
	General Use:-	Mains distribution (15 Amp)	
Table 16	Construction:-	3-30/0.25 mm	O/D 9.8 mm
	Colours:-	BN, B, G-Y	
	General Use:-	Mains distribution (15 Amp)	
Table 9	Construction:-	3-50/0.25 mm oil resistant insulation	O/D 13.0 mm
	Colours:-	BN, B, G-Y	
	General Use:-	Mains distribution (20 amp)	

MICROPHONE CABLE

HIGHLY FLEXIBLE	Construction:- Colours:- General Use:-	2-15/0.07 mm B/G Low level microphone use	O/D 3.5 mm
PIF14/3M	Construction:- Colours:- General Use:-	7PR-7/0.2 mm B/W, O/W, G/W, BN/W, S/W, B/R, O/R Multi microphone cable used to connect outlet console.	O/D 13.0 mm
PIF28/1M	construction:- Colours:- General Use:-	7 Quad.-14/0.12 mm W, R, G, B, Per Quad 7 Quad Microphone cable	O/D 17.5 mm
PSF2/9M	Construction:- Colours:- General Use:-	1PR-55/0.1 mm R/BK Low level microphone. Double screened for use in adverse R.F.I. areas.	O/D 6.8 mm
PSF4/1M	Construction:- Colours:- General Use:-	4-14/0.12 mm W, R, G, B Small, light duty, quad. microphone cable	O/D 4.7 mm
PSF5/1M	Construction:- Colours:- General Use:-	4-14/0.12 mm & 1-7/0.2 mm W, R, G, B & BK resp. Heavy duty, quint. (4 + core) microphone cable	O/D 8.0 mm
PSF7/1M	Construction:- Colours:- General Use:-	7-55/0.1 mm B, G, BN, W, R, BK, Y Capacitor microphones	
0776	Construction:- Colours:- General Use:-	1-PR-7/0.2 mm R/BK High level microphone use.	O/D 4.95 mm
RSF2/5M	Construction:- Colours:- General Use:-	1PR-24/0.2 mm R/BK Low level programme circuits	O/D 8.0 mm
TWO PAIRS (4 core)	Construction:- Colours:- General Use:-	2 PR - 15/0.07mm Individually screened R/Y,B/S Microphone and headphone use Twin feed	O/D 5.7mm

C2 CABLE ACCESSORIES

C2.1 Insulating Sleeving

Insulating sleeving is to be in accordance with BBC Specification ED.3002 unless otherwise specified.

Black sleeving, 3, 4, 7, 10, 16, 20 and 25 mm bore is to be used for lacing bars and cable forms etc. as specified

Sleeving of 1 mm bore, colours B, O, G, BN, S, W, R, BK, Y, V, or P is to be used to cover wires up to 0.8 mm diameter.

Sleeving of 1.5 mm bore, colours B, O, G, BN, S, W, R, BK, Y, V, or P is to be used to cover wires from 0.9 mm to 1.3 mm diameter.

Sleeving of 2 mm bore, colours B, R, and BK is to be used to cover 1.6 mm wires from 1.3 mm to 1.8 mm diameter.

Sleeving of 0.5 mm bore, colours B, O, G, BN, G, W, R, BK, Y or V is to be used to cover fine wires where specified, e.g. Transistor leads.

C2.2 Lacing Materials

For lacing cable forms made up with screened & co-axial cables, lacing twine made from 6, 9 or 12 cord flax impregnated with flameproof wax is to be used.

For cable forms made up with unscreened cables, P.V.C. string 1 mm diameter or lacing twine is to be used.

For large cable forms used in Bays, Desks or large units a proprietary nylon tie or spiral wrap may be used.

When using lacing twine or P.V.C. string care should be taken to avoid damage to cables by overtightening.

C2.3 Tapes

Where insulating tape is specified a black P.V.C. tape with good insulating properties is to be used.

C2.4 Cable Markers

For identification of cables by letter, colour code or number, cable markers are to be fitted to read from the termination. They are to be used on all Bay and Desk wiring, also on large units unless otherwise specified. Small units will not normally be fitted with cable markers.

C2.5 Cable Sleeves

Used in terminating multicore and screened cables. Suitable sleeves will normally be supplied to the contractor on Embodiment Loan.

C2.6 Heat Sleeves

Heat sleeves are used with B.T. type connection strips on distribution frames.

C2.7 Heat shrinkable solder sleeves

Raychem heat-shrinkable solder sleeves are used for terminating small diameter coaxial cables which have high melting-point dielectrics. (See Section B10 Fig.4 .)

SECTION D WIRING AND MECHANICAL DATA

Details of Panel Cut-Outs, for connectors etc, will be found in the relevant sections of the Engineering Components Catalogue. A guide to the sections appears on page 147 of this specification.

D1 WIRING TERMS

D1.1 Box Forming

A cable form having rectangular or square cross section (see B7.5 Figs. 2 and 3).

D1.2 Bunched Pair

A screened pair of wires where the ends of the wires are connected together to form a single screened connection.

D1.3 Butt

The point at which the wires issue from the unstripped portion of a cable.

D1.4 Fanning

The operation whereby groups of cable or wires are opened out (e.g. by passing either through 'Fanning Strips' or rings) prior to connection to soldering tags.

D1.5 Form

A group of cables and wires which have been arranged and laced in a particular formation to serve a group of soldering tags.

D1.6 Gate or Goose Neck

The slack portion of a cable form so constructed and secured that it normally lies or hangs in a loop, and is only brought into use when the panels or units the cable form serves are hinged open, or slid forward on runners etc.

D1.7 Lacing

The procedure of passing a length of twine or P.V.C. string around a cableform in such a manner that, by means of loops and knots, the wires are held in predetermined positions. (See 37.5 Figs. 1a and 1b.)

D1.8 Laying In

The way of tidily arranging cables or wires so that they lie neatly side by side taking up the minimum amount of space. Used between rows of tags and similar positions.

D1.9 Skinner

A wire issuing from a cableform for connection to a soldering tag or terminal.

D1.10 Stitch

A single loop (either single or double lacing twine, or P.V.C. string) of the lacing of a cableform (i.e. one marline hitch).

D1.11 Tip (of Form)

The end of a cable remote from the butt.

D1.12 Tails

Those lengths of cable turned out from a main cableform ready to be stripped and formed for termination on a connection strip or the like.

D1.13 Tram-line

To tram-line is to pull cables, particularly P.V.C. sheathed ones, taut, so that they lie straight and parallel.

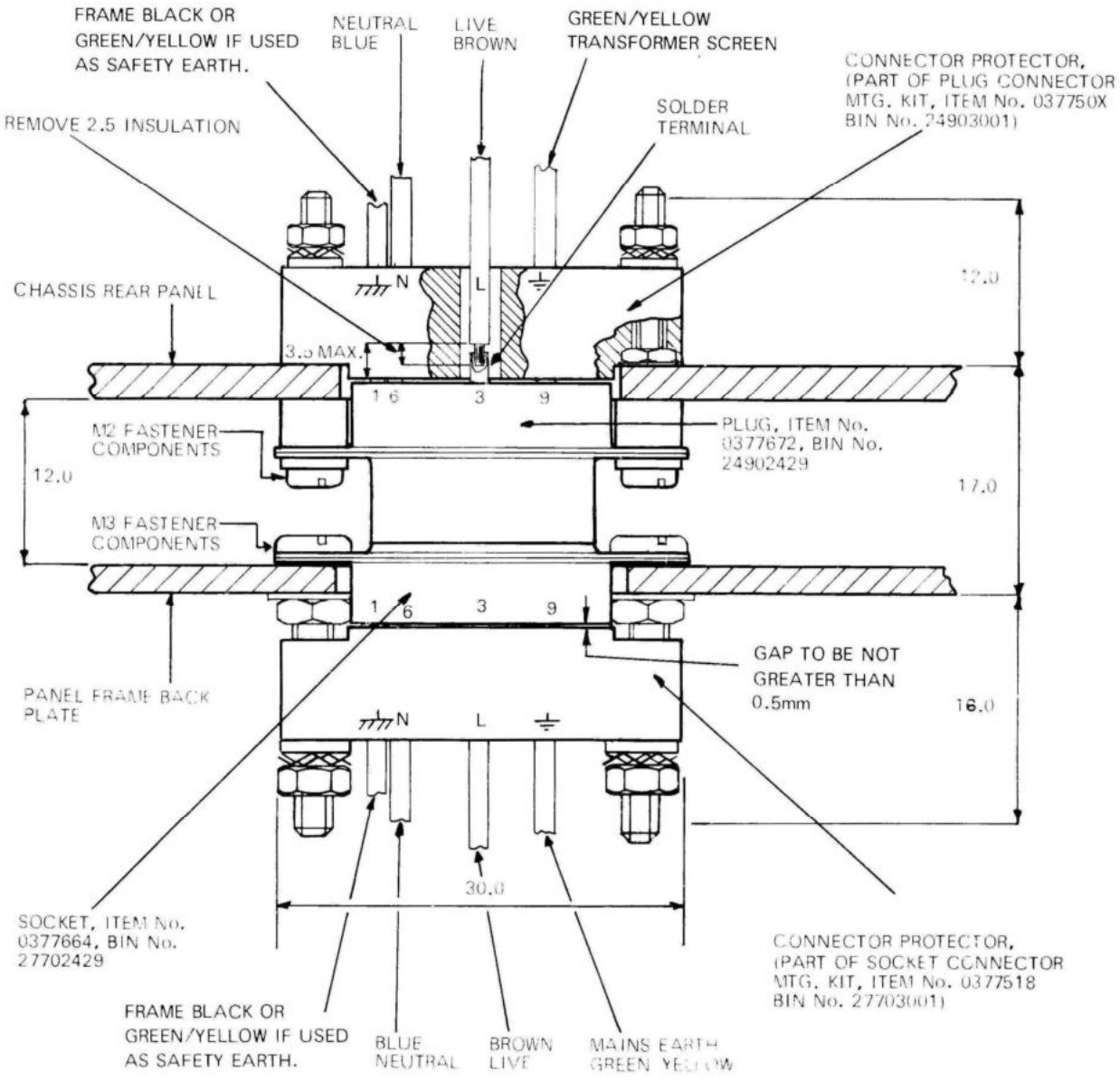
D1.14 Turnouts

Bunches of wires issuing from the main run of cables.

4 POLE MINIATURE MAINS CONNECTORS

WIRING AND ASSEMBLY

ALL DIMENSIONS IN mm

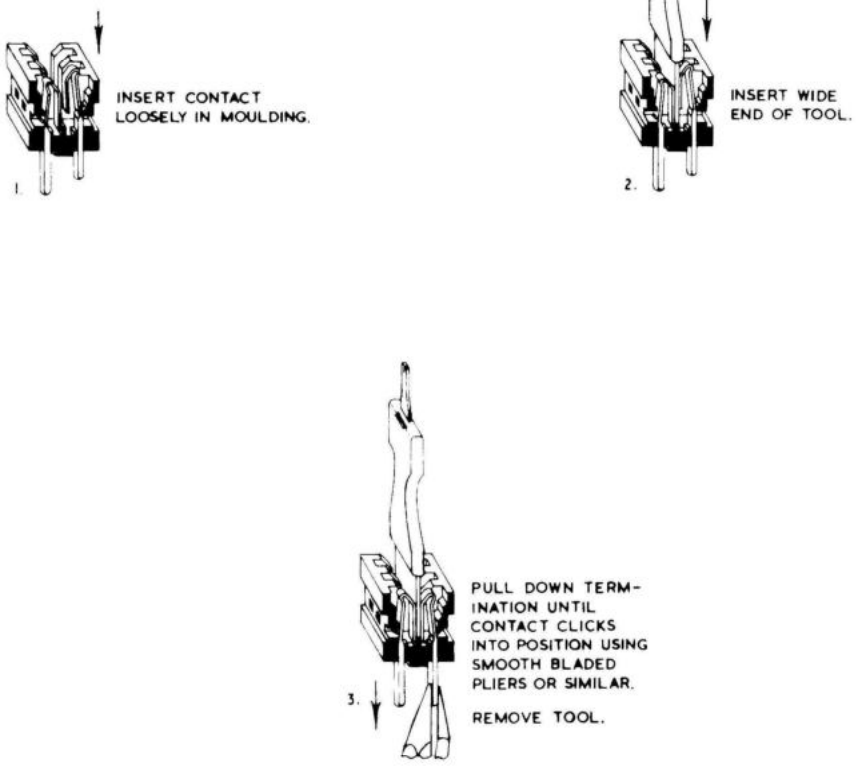


NOTES: 1. Recommended wire size :- conductor 0.5mm^2 max. insulation not greater than 2.5mm dia, nor less than 2.0mm dia., e.g. PUF1/6M.
2. Contact numbers appear on the rear face of the connectors, contact symbols appear on the rear face of the protector moulding.

D FIG 1

CONTACT INSERTION

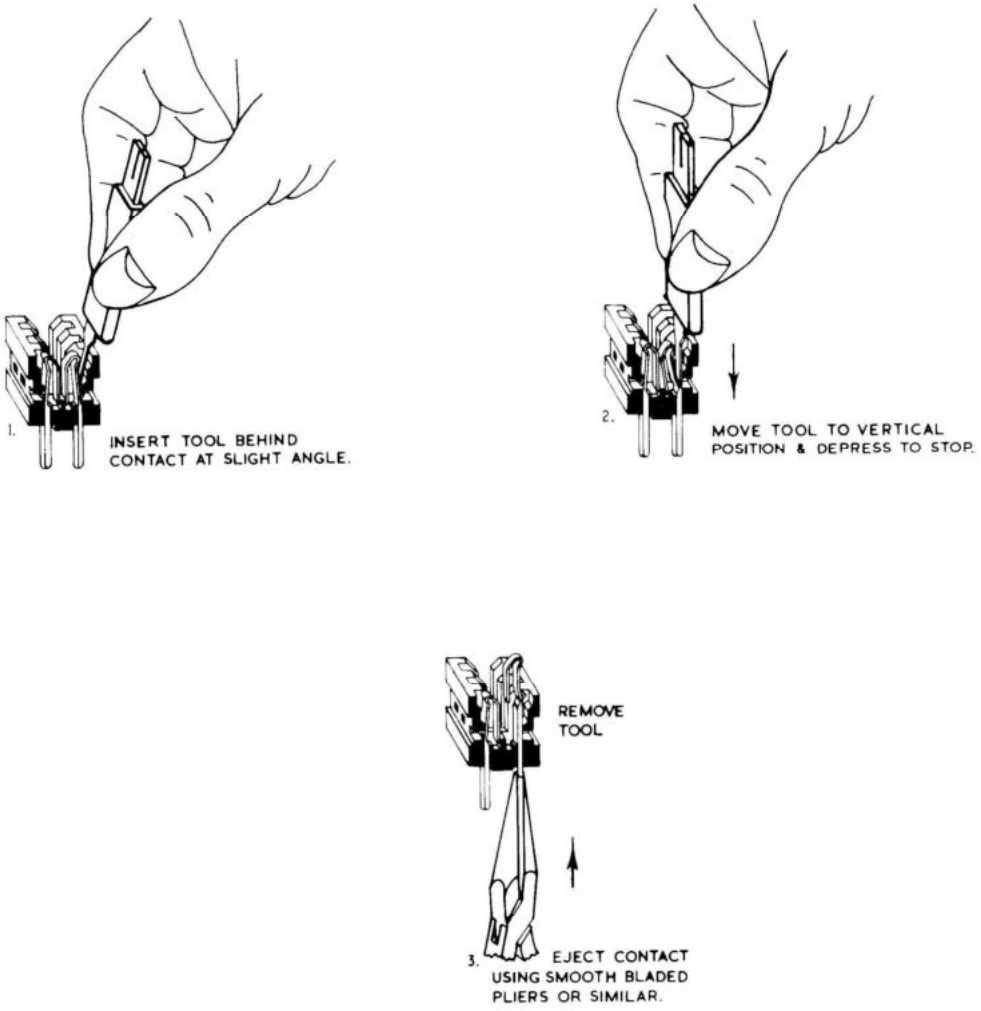
U.E.C.L. 2.54 mm (0.1'') PITCH EDGE CONNECTOR



D FIG 2a

CONTACT REMOVAL

U.E.C.L. 2.54 mm (0.1'') PITCH EDGE CONNECTOR

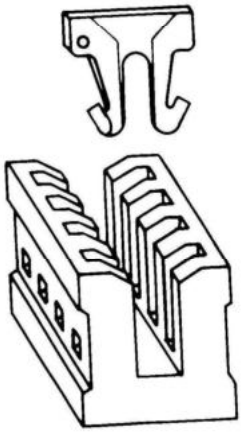


D FIG.2b

TYPICAL BOARD LOCATING KEY INSERTION

FOR FERRANTI EZD, EPT, AND UECL CONNECTORS

1

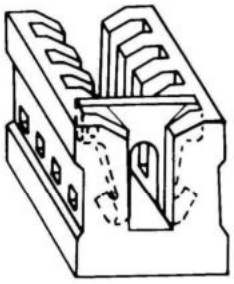


Remove the two contacts from the required aperture using the method detailed on STD 27870 **SHTS 4,7 AND 27867 SHT 8.**

Align the key to the vacant aperture.

CONTACTS NOT SHOWN FOR SIMPLICITY.

2



Insert the key into the moulding and push the key as far as it will go into the moulding, when a click will be heard as the key is retained.

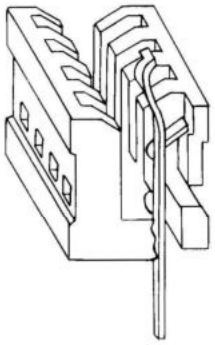
FOR SPECIFIC INSTRUCTIONS WITH OTHER KEYS CONSULT STANDARDS ENGINEER.

D FIG 3

CONTACT REMOVAL AND INSERTION, FERRANTI 'EZD' EDGE CONNECTOR

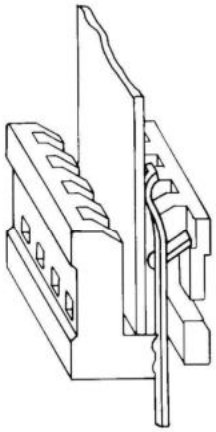
2.54 mm (0.1") PITCH

1



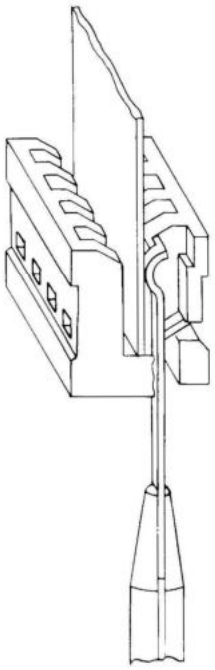
Insert the contact loosely into the connector moulding ensuring that contact head is still visible above the moulding.

2



Insert the handles of the contact insertion/withdrawal tool into the moulding in the same way as a p.c.b. The contact head is now depressed and parallel to the pre-loaded stop.

3



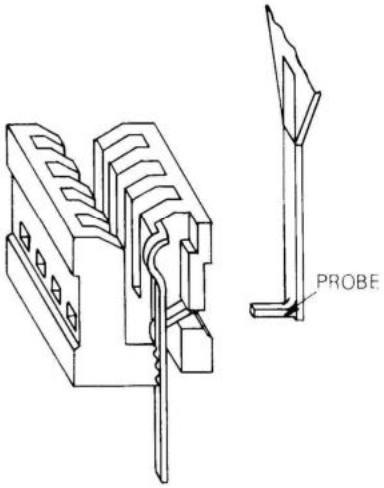
Using pliers pull the contact downward until it "clicks" home in the moulding.

D FIG 4

CONTACT REMOVAL AND INSERTION, FERRANTI 'EZD' EDGE CONNECTOR

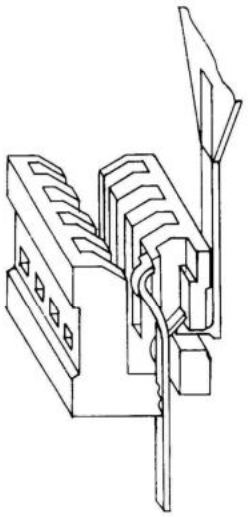
2.54 mm (0.1") PITCH

1



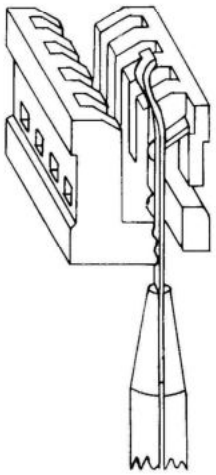
To use the tool for contact removal, position probe relative to the connector moulding as shown in Drg. No.1.

2



Insert the tip of the tool into the aperture at the side of the connector, apply pressure, sufficient to release the tine from its location.

3



Push upwards using pliers until it is possible to remove the contact by hand.

NOTE: CONTACTS SHOULD NOT BE RE-USED

CONTACT REMOVAL

FERRANTI EPT/EFT CONNECTOR

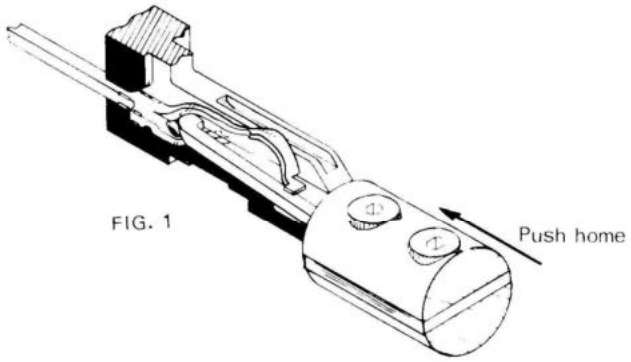


FIG. 1

Fig 1. Insert the tool into the connector moulding and push home, such that the shoulder of the tool butts against the face of the moulding as shown.

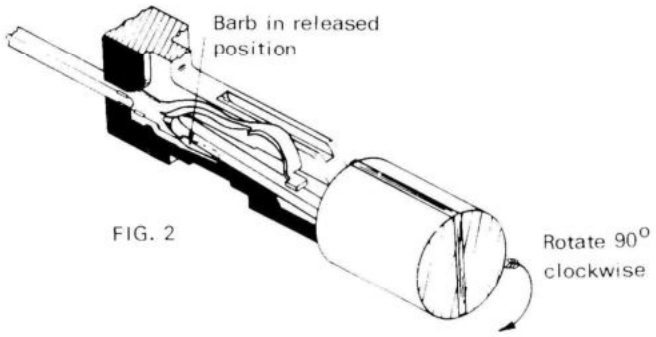


FIG. 2

Fig 2. Rotate the tool clockwise through 90° whilst maintaining slight pressure to keep the shoulder of the tool butted against the moulding. Return the tool to the original position i.e. rotate 90° anticlockwise, and remove carefully.

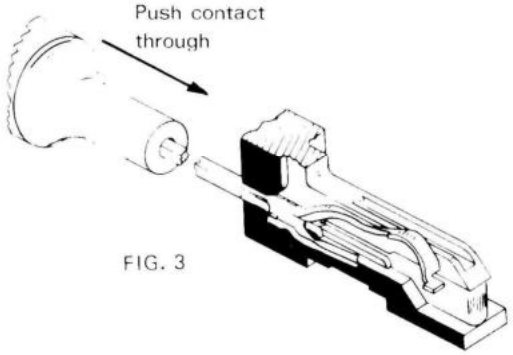


FIG. 3

Fig 3. The opposite end of the tool may now be used to ease the contact out of its seating, causing the contact to protrude and enable removal by hand.

NOTE: THE TOOL SHOULD BE KEPT IN LINE WITH THE CONTACT (SQUARE TO THE MOULDING) DURING USE. CONTACTS SHOULD NOT BE RE-USED.

CONTACT INSERTION

FERRANTI EPT/EFT CONNECTOR

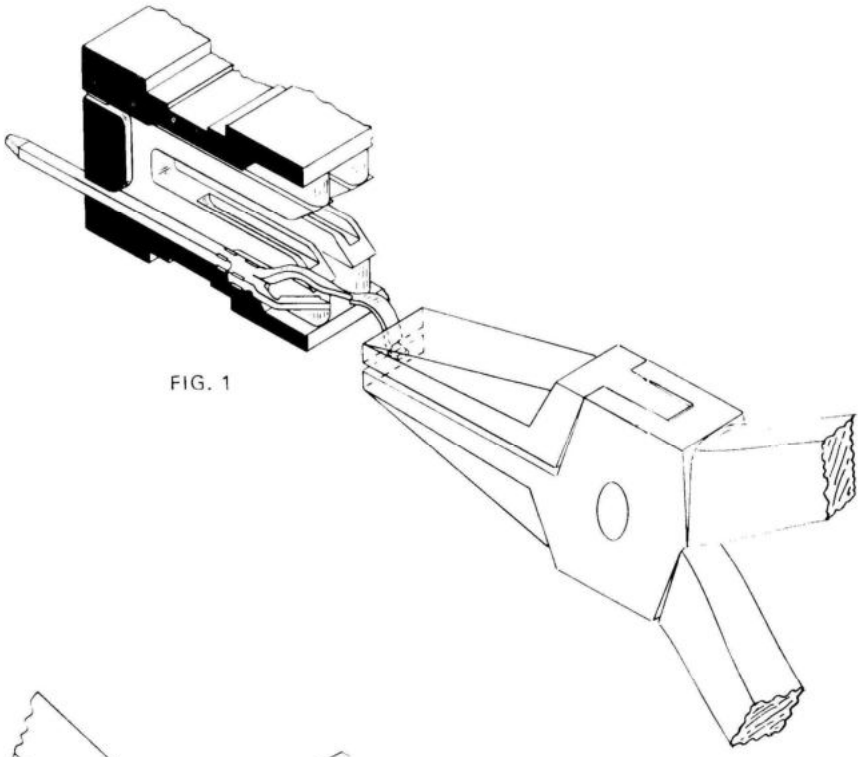


FIG. 1

1. Using smooth pliers as shown in fig 1, push the contact into the moulding, leaving about 10.0 mm of the contact head protruding.

2. Insert a board 1.4 mm to 1.8 mm thick into the slot to assist contact location, pulling the contact through the moulding until the contact post appears to be of similar length to the remainder of the contacts, then pull the contact into position to enable the contact to latch securely into the connector body as shown in fig 2.

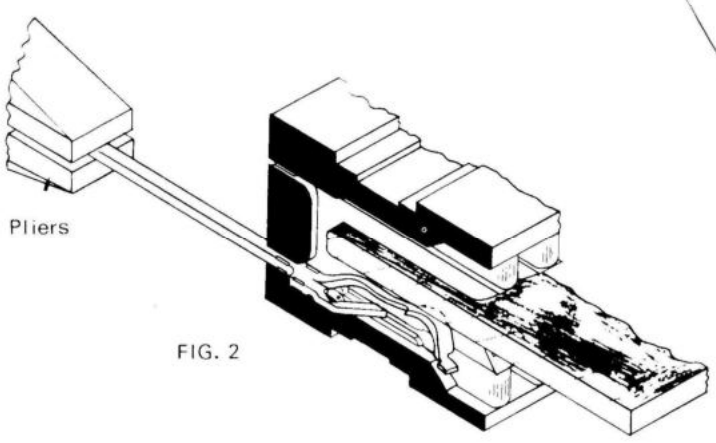


FIG. 2

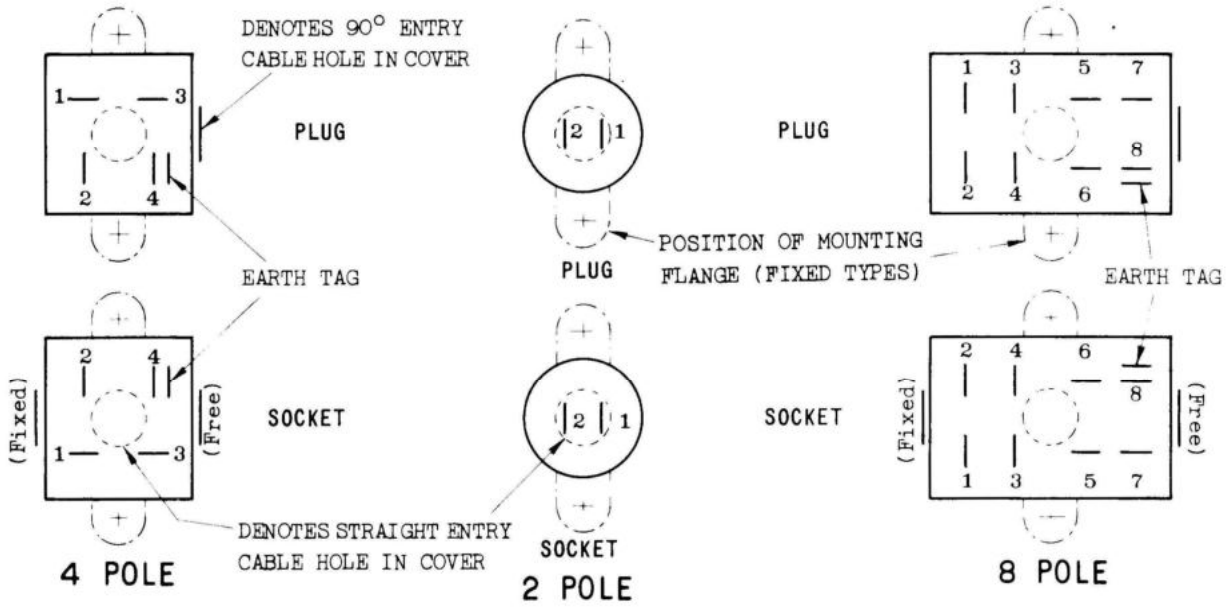
3. Remove the board and check that the contact is correctly seated.

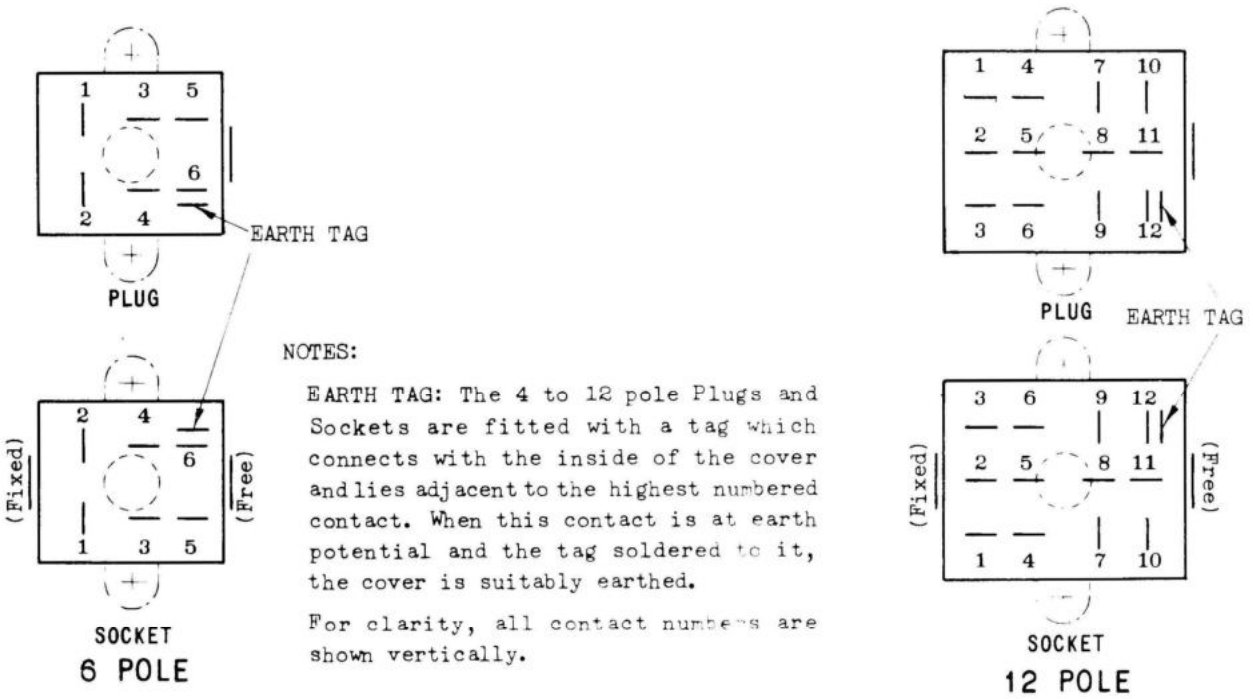
D FIG.5b

PLUGS & SOCKETS, CONTACT ARRANGEMENTS

2 TO 12 POLE, MINIATURE
(PAINTON)

REAR VIEW OF MOULDINGS





NOTES:

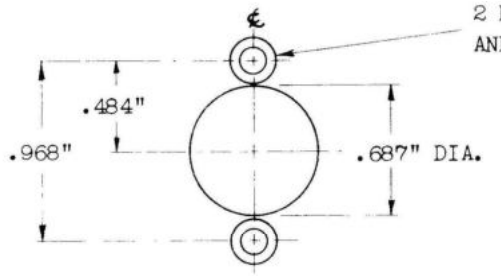
EARTH TAG: The 4 to 12 pole Plugs and Sockets are fitted with a tag which connects with the inside of the cover and lies adjacent to the highest numbered contact. When this contact is at earth potential and the tag soldered to it, the cover is suitably earthed.

For clarity, all contact numbers are shown vertically.

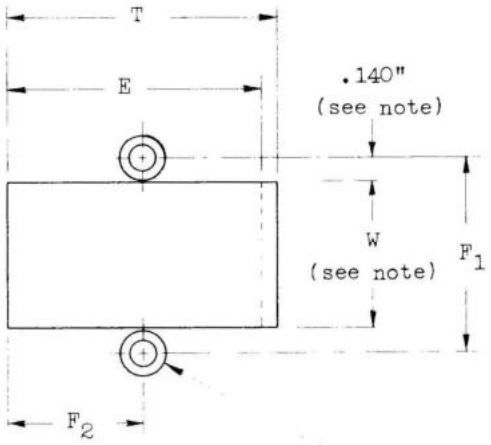
D FIG 6a

PLUGS & SOCKETS, PANEL CUT-OUTS

2 TO 12 POLE, MINIATURE
(PAINTON)



2 POLE PLUG OR SOCKET



NOTE:
When the panel thickness exceeds $\frac{5}{32}$" the following applies:-

Dimensions:
'W' to be increased by .031"
.140" to be reduced to .125"

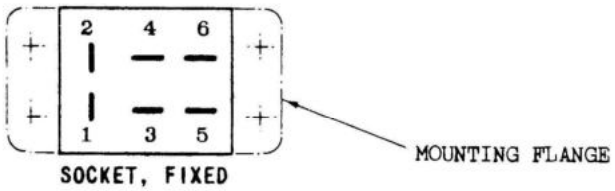
PLUG OR SOCKET	DIMENSIONS (INCHES)				
	W	F_1	F_2	FOR MATING COMPONENT WITH CABLE ENTRY	
				90°	STRAIGHT
				E	T
4 POLE	.750	1.031	.484	.875	.968
6 POLE	.750	1.031	.609	1.125	1.218
8 POLE	.750	1.031	.734	1.375	1.468
12 POLE	.969	1.250	.734	1.375	1.468

D FIG.6b

PLUGS & SOCKETS, CONTACT ARRANGEMENTS

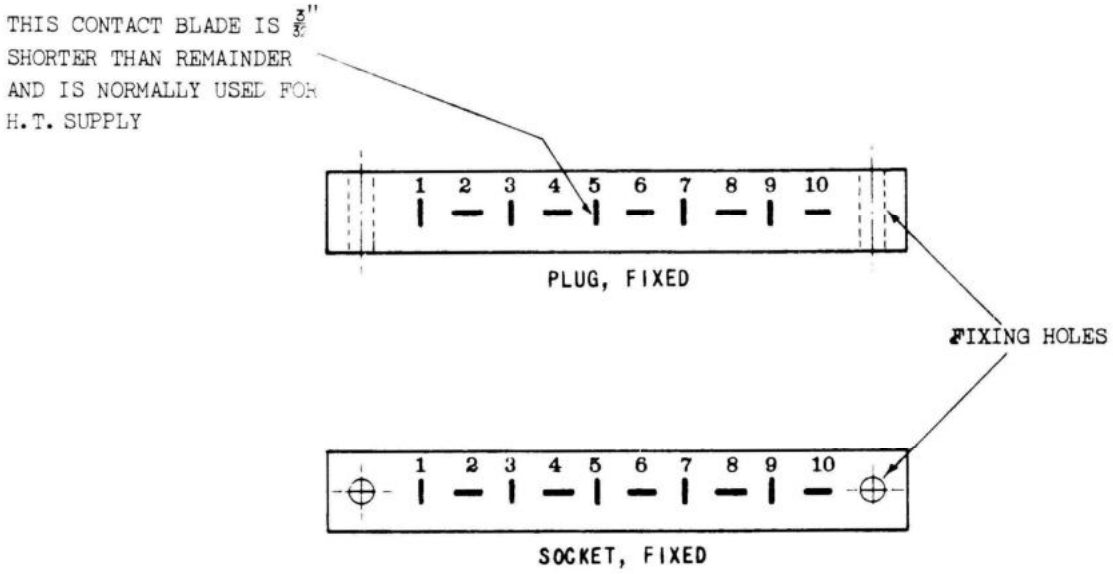
6 & 10 POLE, SPECIAL PURPOSE, MINIATURE
(PAINTON)

REAR VIEW OF MOULDINGS



SOCKET, FIXED
6 POLE

FOR USE WITH ATTENUATORS (PLUG-IN TYPE)
SEE COMPONENTS, SHEET 20221



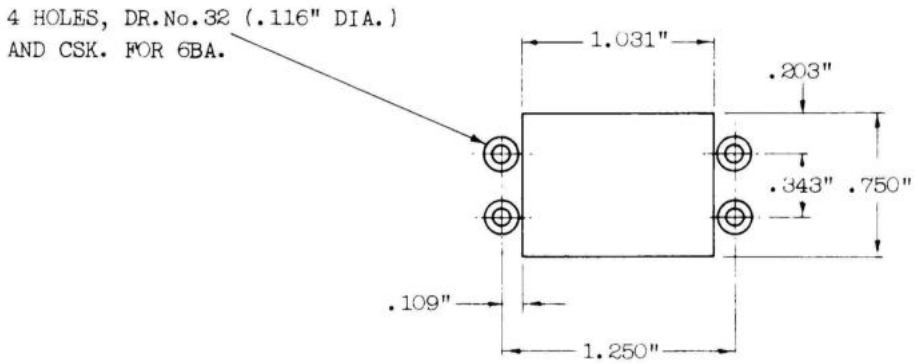
10 POLE (IN-LINE)

NOTE:
For clarity, all contact numbers are shown vertically.

D FIG 7a

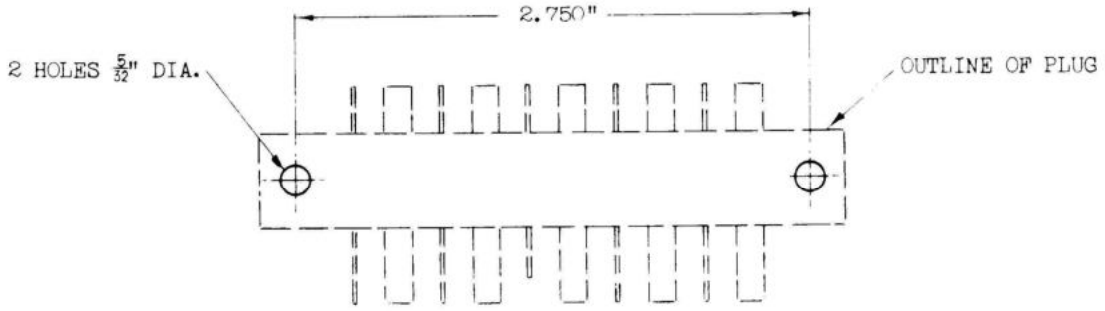
PLUGS & SOCKETS, PANEL CUT-OUTS

6 & 10 POLE, SPECIAL PURPOSE, MINIATURE
(PAINTON)



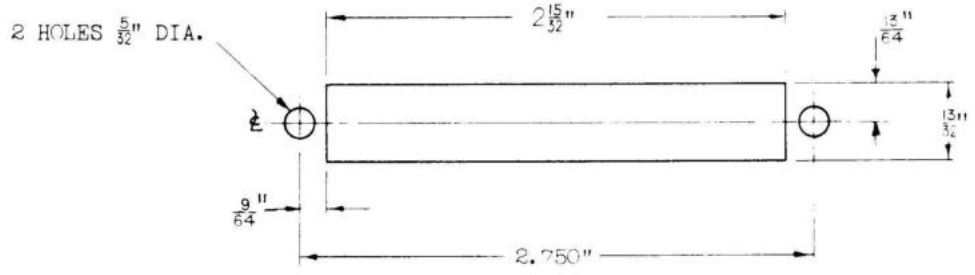
CUT-OUT FOR 6 POLE SOCKET

(PAINTON SOCKET TYPE 311521)



DRILLING FOR 10 POLE (IN-LINE) PLUG

(PAINTON PLUG TYPE 313170)



CUT-OUT FOR 10 POLE (IN-LINE) SOCKET

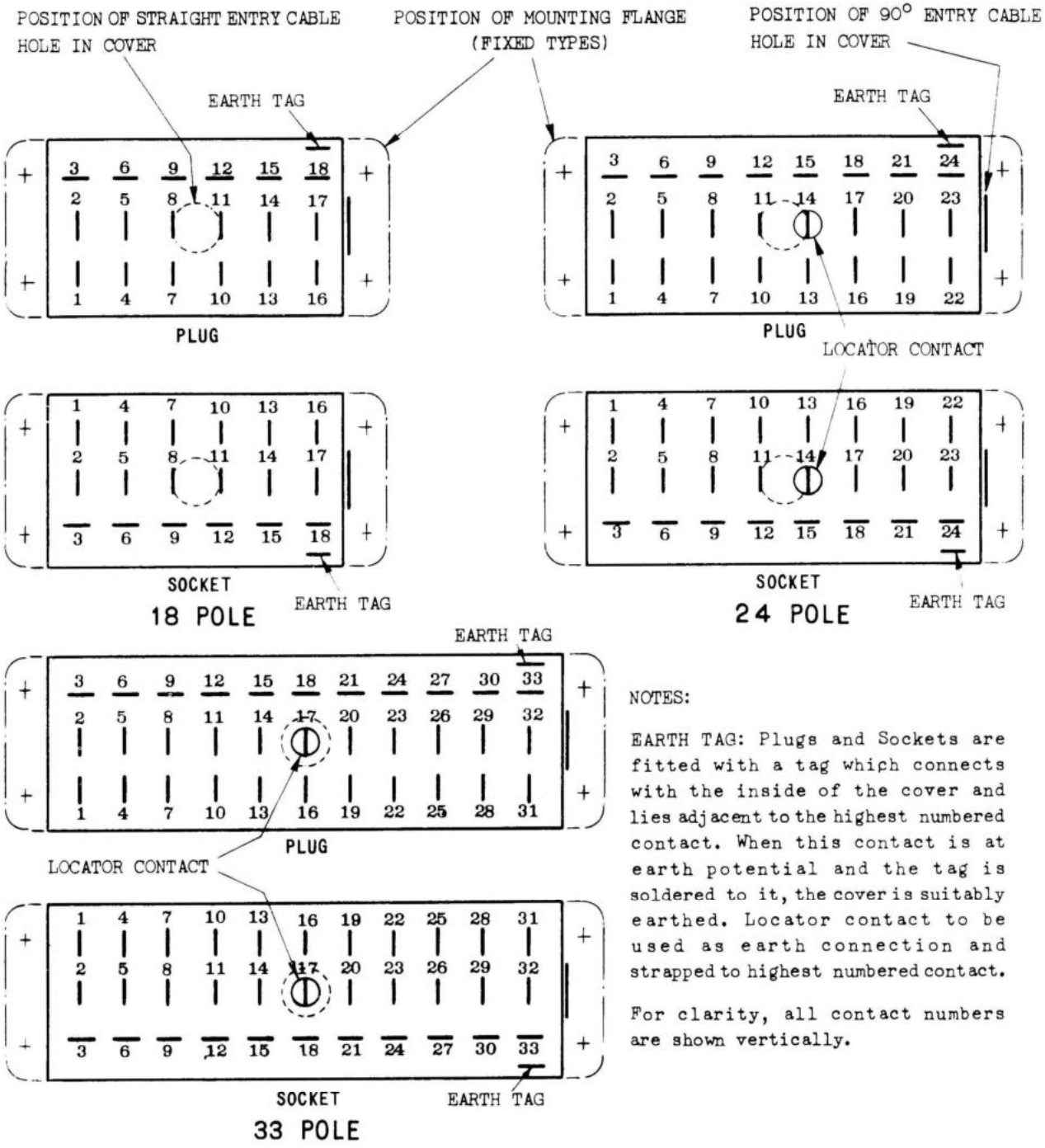
(PAINTON SOCKET TYPE 501462)

D FIG 7b

PLUGS & SOCKETS, CONTACT ARRANGEMENTS

18 TO 33 POLE, MINIATURE
(PAINTON)

REAR VIEW OF MOULDINGS



NOTES:

EARTH TAG: Plugs and Sockets are fitted with a tag which connects with the inside of the cover and lies adjacent to the highest numbered contact. When this contact is at earth potential and the tag is soldered to it, the cover is suitably earthed. Locator contact to be used as earth connection and strapped to highest numbered contact.

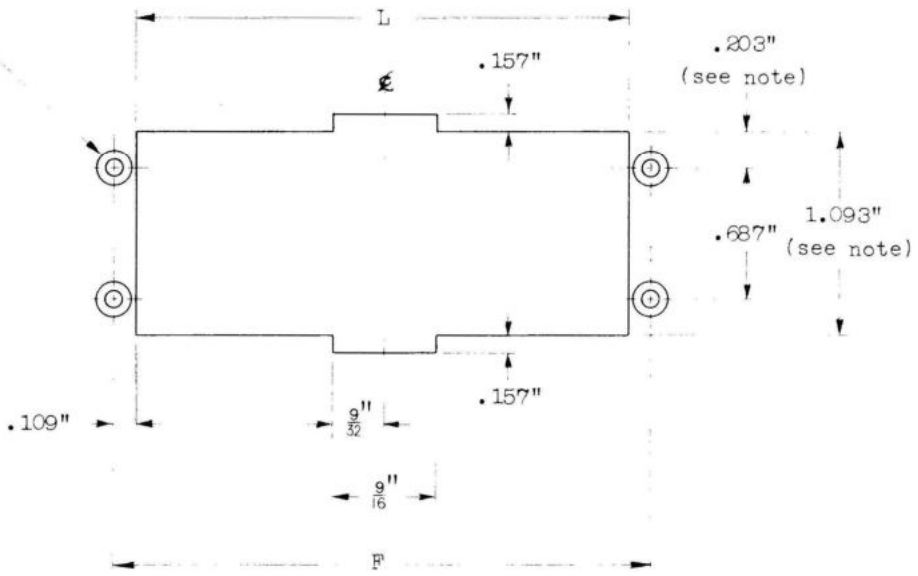
For clarity, all contact numbers are shown vertically.

D FIG.8a

PLUGS & SOCKETS, PANEL CUT-OUTS

18 TO 33 POLE, MINIATURE
(PAINTON)

4 HOLES, DR.No.32 (.116" DIA.)
AND CSK. FOR 6B A.



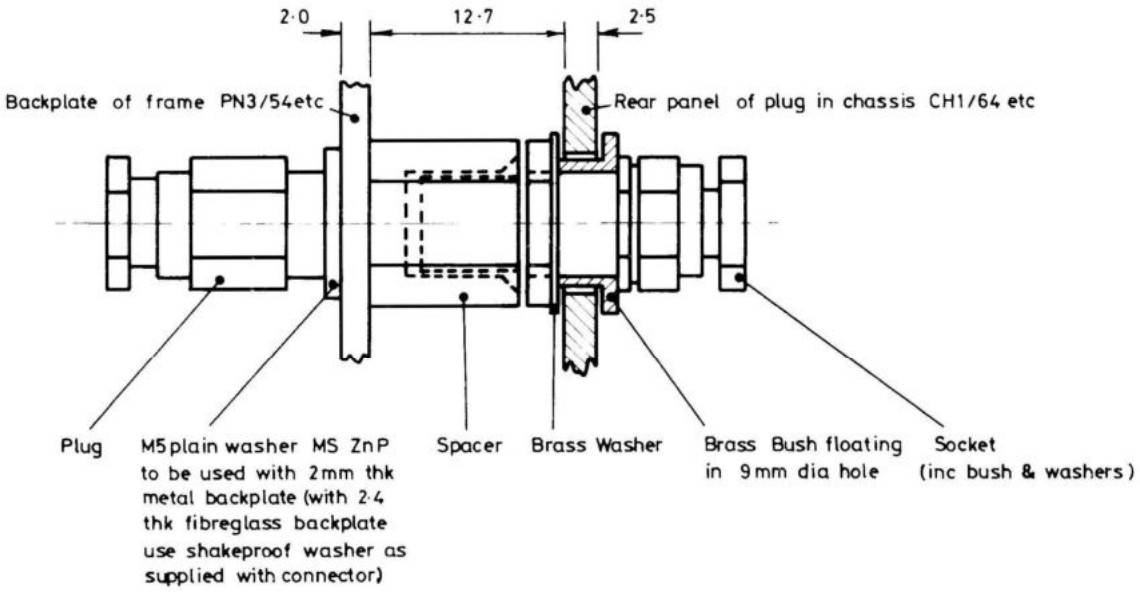
NOTE:
When the panel thickness exceeds 5/32" the following applies:-

Dimensions:
1.093" to be increased to 1.125"
.203" to be increased to .219"

PLUG OR SOCKET	DIMENSIONS (INCHES)	
	F	L
18 POLE	2.250	2.031
24 POLE	2.875	2.656
33 POLE	3.812	3.593

D FIG.8b

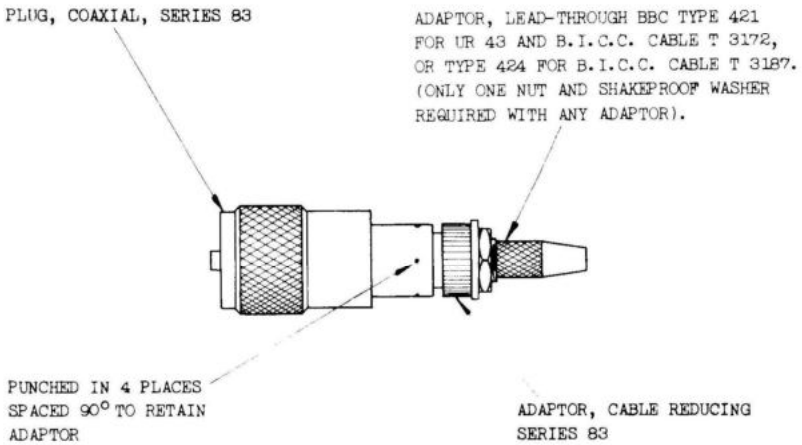
ASSEMBLY ARRANGEMENT FOR FLOATING SMB CONNECTOR



D FIG.9

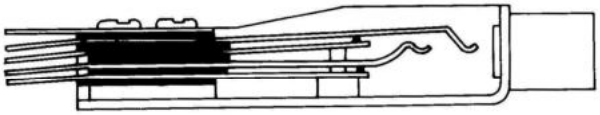
PLUGS, FREE, R.F. COAXIAL, SERIES 83

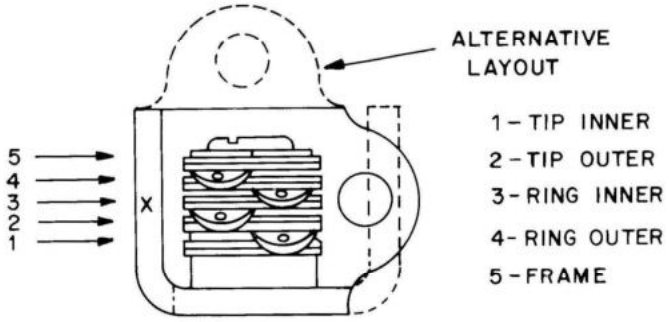
METHOD OF FITTING CABLE REDUCING ADAPTORS



D FIG.10

JACK, FIXED (TELEPHONE TYPE)
CONTACT ARRANGEMENT





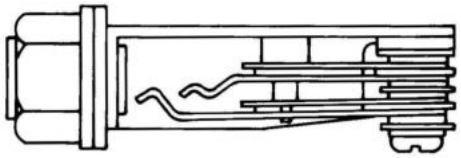
VIEW ON CONTACTS

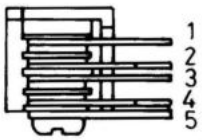
(SCALE 2:1)

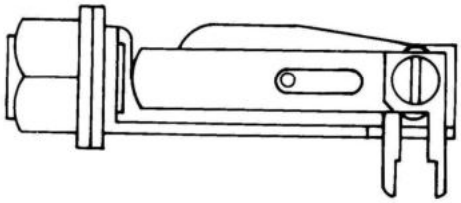
NOTE : CONTACT STACK MAY BE MOUNTED THROUGH 90° TO THAT SHOWN ABOVE, I.E. ON FACE MARKED 'X'.

D FIG 11

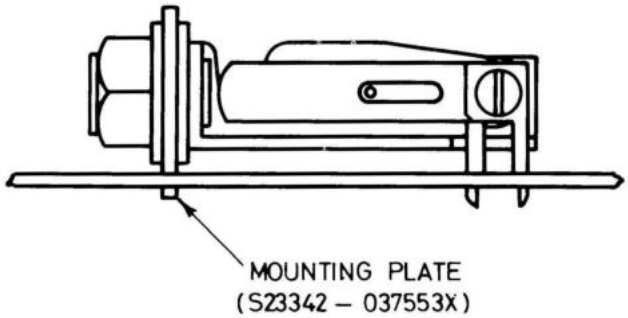
JACK, FIXED, SHORT (TELEPHONE TYPE)
P.C.B. MOUNTING
CONTACT ARRANGEMENT







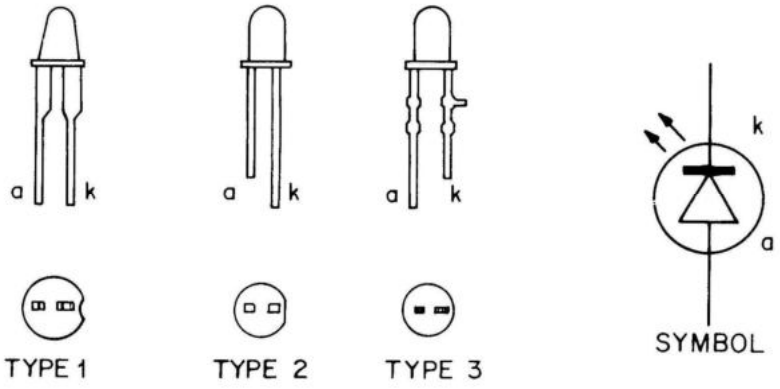
1.- TIP INNER
2.- TIP OUTER
3.- RING INNER
4.- RING OUTER
5.- FRAME



D FIG.12

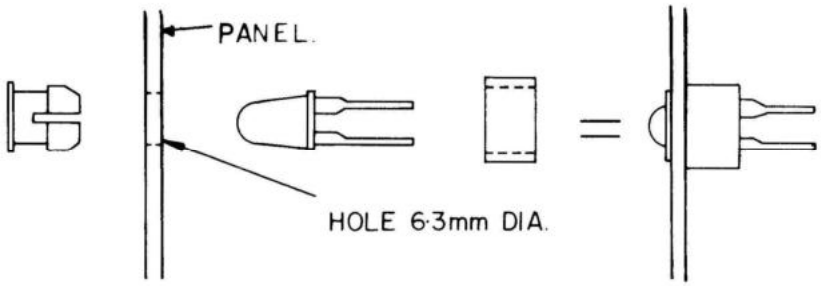
Section C

SOLID'-STATE LAMP (L.E.D)



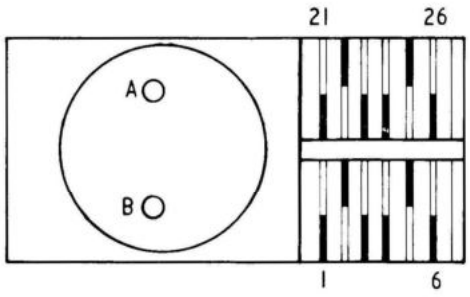
PIN IDENTIFICATION AND ASSEMBLY

NOTES:
1. THE ANODE IS TO BE CONNECTED TO THE MORE POSITIVE SIDE OF THE VOLTAGE SUPPLY
2. MAXIMUM SOLDERING TIME 5 SECS. AT 260°C
3. CATHODE TO BE IDENTIFIED BY FITTING A 5mm LENGH OF 0·5mm BORE BLACK SLEEVING BEFORE FITTING INTO MOUNTING CLIP.



LAMP AND CLIP ASSEMBLY

D FIG.13



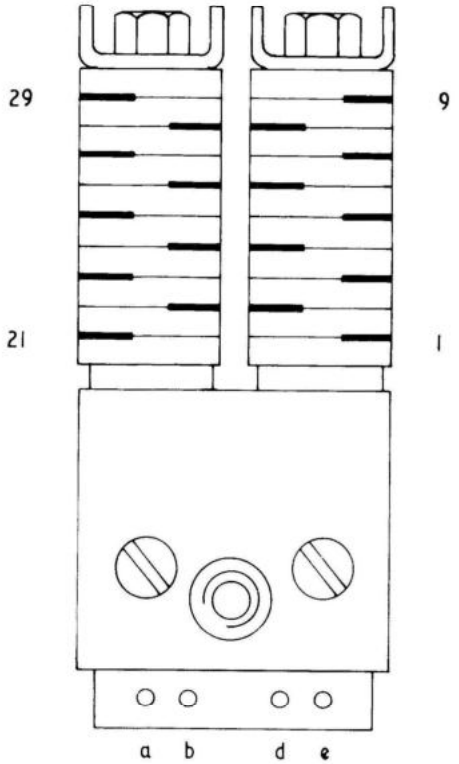
Switch, Illuminated,
Push-Button

View on Contacts

Relays and Illuminated Push Button Switch
Terminating Pin Arrangement.

D FIG.14

Relay, P.O. Type 3000



Coil Connection :

Single Coil Relay a—e

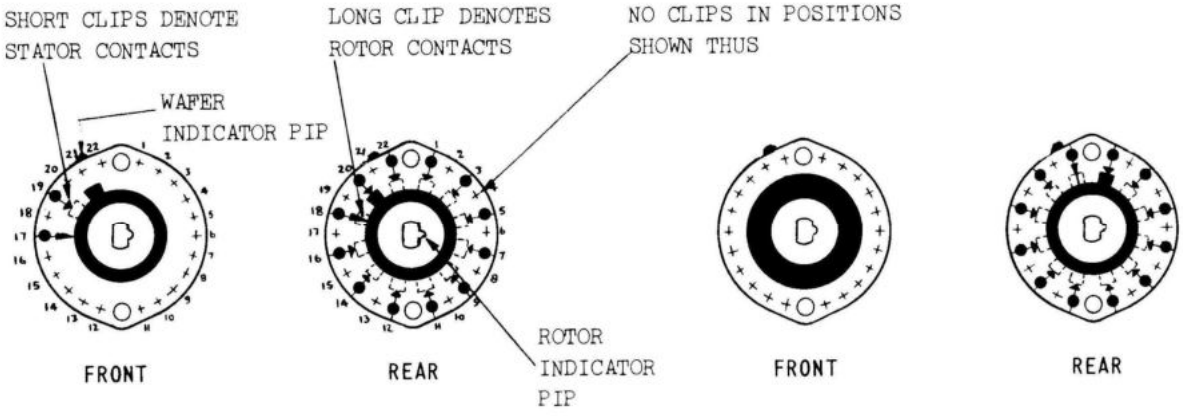
Double Coil Relay: Coil 1 a–b, Coil 2 b–d

Coil and Contact Arrangment
(View on Base)

D FIG 15

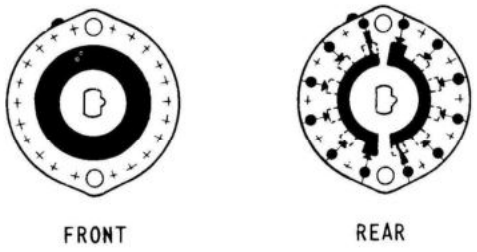
SWITCHES, CONTACT ARRANGEMENTS

ROTARY WAFER, SUB-MINIATURE, MINI-12



1 POLE, 12 POSITIONS

1 POLE, 11 POSITIONS



2 POLE, 5 POSITIONS

NOTES:

1. Contact arrangements are similar for wafers fitted with either 'Make Before Break' or 'Break Before Make' contacts.
2. Rotor and wafer indicator pips must be in positions shown when assembling switches.

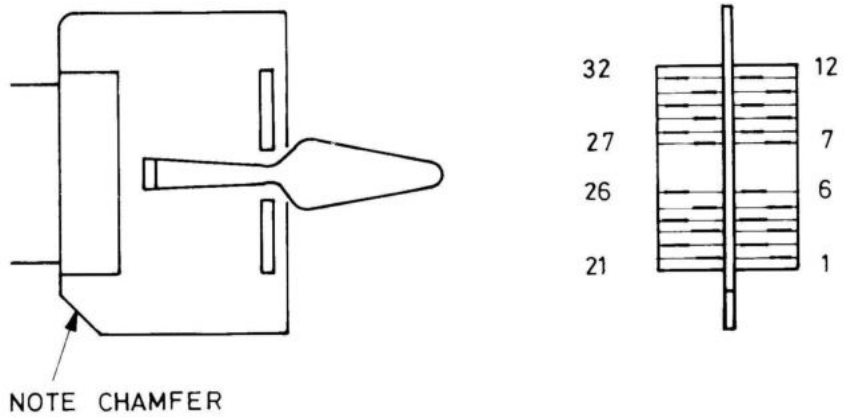


3 POLE, 3 POSITIONS

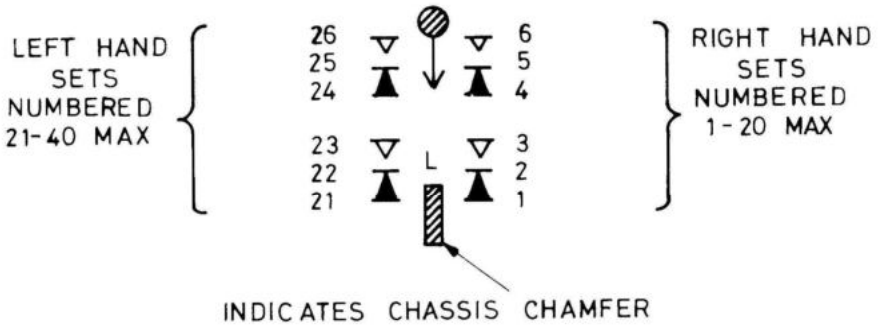
4 POLE, 2 POSITIONS

FRONT AND REAR OF WAFERS VIEWED FROM FRONT OR KNOB END OF SWITCH IN EXTREME ANTI-CLOCKWISE POSITION

D FIG.16



MECHANICAL LAYOUT



ARROW INDICATION OF SPRING MOVEMENT FROM NORMAL (UNOPERATED) POSITION. HANDLE OPERATES IN REVERSE DIRECTION.

TYPICAL CIRCUIT SYMBOL

(2 POSITION KEY WITH 4 CHANGEOVER CONTACTS LOCKING)

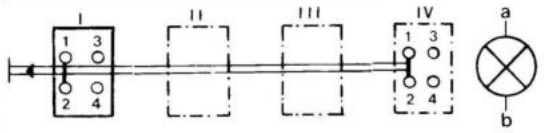
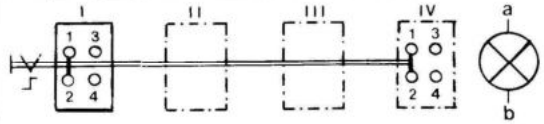
MINATURE LEVER KEY SWITCH

D FIG.17

SWITCHES, ILLUMINATED, PUSHBUTTON

HIGHLAND ELECTRONICS SERIES 31

STANDARD 28202

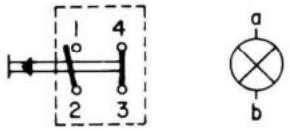
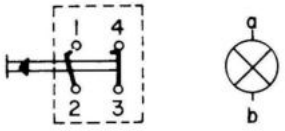
SUFFIX NUMBERS	ACTION	CONTACT ARRANGEMENT
001–003 011–013	LOCKING	
101–103 111–113	NON–LOCKING	

D FIG 18a

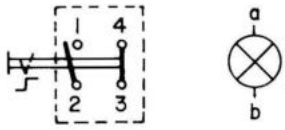
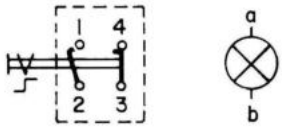
SWITCHES, ILLUMINATED, PUSHBUTTON

HIGHLAND ELECTRONICS SERIES 31LL

STANDARD 28203 NON LOCKING ACTION

SUFFIX NUMBERS	SWITCH ACTION	CONTACT ARRANGEMENT
201 - 202	BBM (NON-SHORTING) 1 MAKE 1 BREAK	
203 - 204	MBB (SHORTING) 1 MAKE 1 BREAK	

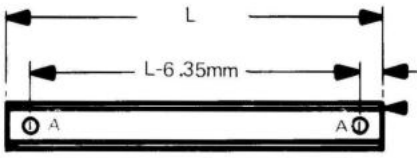
STANDARD 28203 LOCKING ACTION

SUFFIX NUMBERS	SWITCH ACTION	WIRING CONNECTIONS
211 - 212	BBM (NON-SHORTING) 1 MAKE 1 BREAK	
213 - 214	MBB (SHORTING) 1 MAKE 1 BREAK	

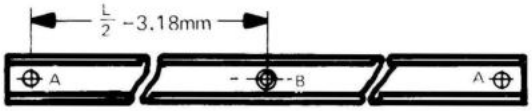
D FIG.18b

DESIGNATION STRIPS, PLASTIC

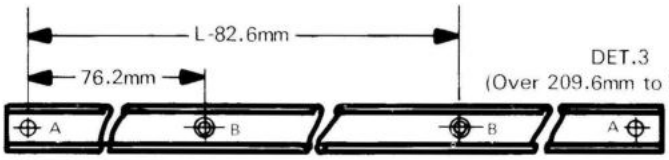
RECOMMENDED DRILLINGS FOR GENERAL USE



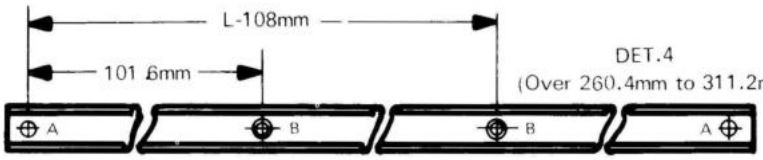
DET.1
(L 108 or less)



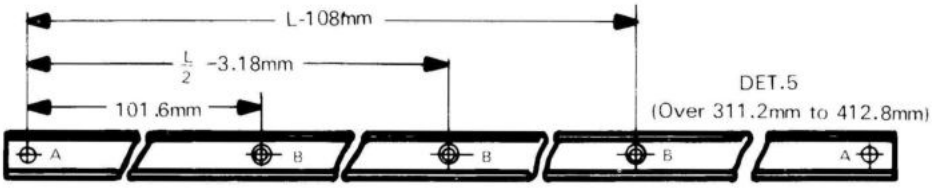
DET.2
(Over 108mm to 209.6mm)



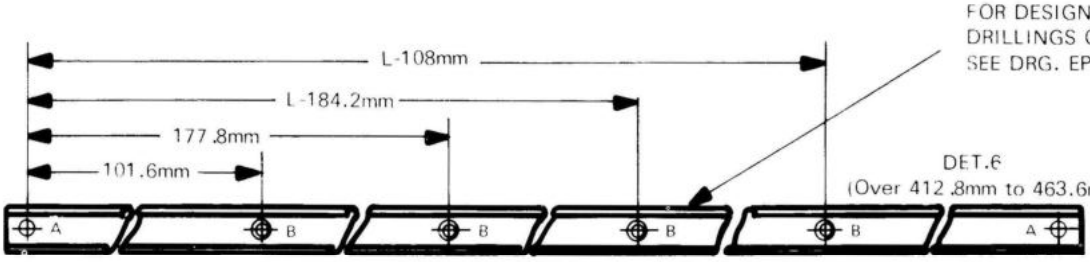
DET.3
(Over 209.6mm to 260.4mm)



DET.4
(Over 260.4mm to 311.2mm)

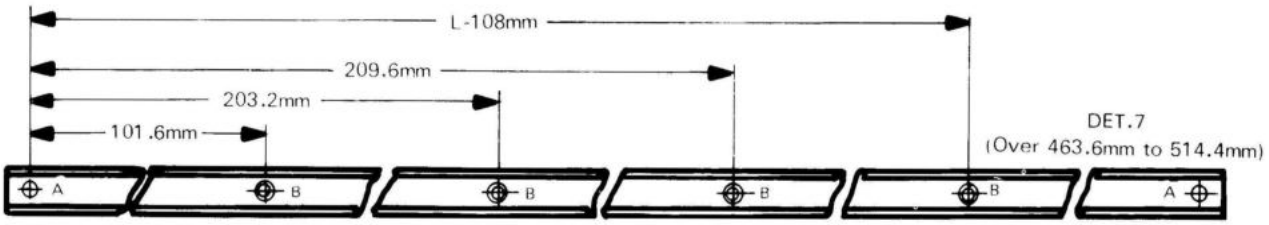


DET.5
(Over 311.2mm to 412.8mm)



FOR DESIGNATION STRIP DRILLINGS ON JACKFIELDS SEE DRG. EPA 2703

DET.6
(Over 412.8mm to 463.6mm)



DET.7
(Over 463.6mm to 514.4mm)

NOTES:

1. Dimensions not specified on Dets. 2-7 inclusive are as shown for Det.1.
2. Holes 'A' - DR. for No.4 Self-Tapping Type Pan Hd. Screws.
3. Holes 'B' - DR. and Csk. 4.4mm x 90° for No. 2 Self-Tapping Type 'B' Csk. Hd. Screws.
4. Remove all burrs and sharp edges.
5. See Sheet 5147 for size of fixing holes required in mounting panels.

D FIG.19a

DESIGNATION STRIP

RECOMMENDED DRILL SIZES

SIZE OF SCREW	PANEL THICKNESS	SHEET METAL	PLASTIC
		DRILL SIZE mm	DRILL SIZE mm
No.2	0.711	1.8	1.6
	0.914	1.85	1.6
	1.024	1.9	1.7
	1.291	1.95	1.8
	1.628	2.1	1.9
No.4	0.711	2.3	2.2
	0.914	2.3	2.2
	1.024	2.35	2.2
	1.291	2.4	2.3
	1.628	2.6	2.3

D FIG 19b

SECTION E COMPONENT CODING

ATTENUATORS, VARIABLE AND FIXED CODING

The coding of an Attenuator is intended to indicate its function. In this coding the first prefix letter indicates the design and manufacture, whether commercial or B.B.C. Subsequent prefix letters indicate the electrical network.

CODE	DEFINITION	
FIRST LETTER		
P	Variable Attenuator or Fader	GENERAL STYLE
F	Fixed Pad	
SECOND LETTER		
A	Ladder, balanced or unbalanced	TYPE OF NETWORK: Two or more of these letters may be used where more than one network of the same or different types are included in the one assembly.
B	Bridge, balanced or unbalanced	
F	Loaded potential divider	
H	H (balanced T) network	
L	L Network	
N	Potential divider, unloaded	
O	Square network	
P	Pi network	
T	T network	
U	Balanced L network	
Z	Series resistance, balanced or unbalanced	
FIRST FIGURE OR FIGURES	Design serial number of Network of the same configuration	
THIRD LETTER		
B	Painton type B	MECHANICAL ASSEMBLY: These letters are also allotted to assemblies by other manufacturers if they have the same form and basic dimensions as those quoted.
C	" " C	
D	" " D	
L	" " Plug-in	
M	" " BM	
N	" " M	
NN	" " MD	
Y	Yaxley or Oak type switch	
P	Plug-in Fixed Pad	
Q	Painton Quadrant type EM	

E FIG.1A

ATTENUATORS, VARIABLE AND FIXED CODING

CODE	DEFINITION
SECOND FIGURE	MECHANICAL DESIGN SERIAL NUMBER It is used to differentiate between units differing in minor details, e.g. form of contacts, tag blocks, auxiliary contacts.
SUFFIX LETTER	
S	Silver/silver-graphite } CONTACT MATERIAL
G	Gold Plated } CONTACT MATERIAL

Example: PB/16M2S is decoded to:-

P = Variable Attenuator of commercial design and manufacture.

B = Electrical characteristic, Bridge network.

16 = Design serial number 16 of the B class.

M = Mechanical Assembly.

2 = Design serial number of the PB/16M class (denoting certain details of spindle design, detent, switching, etc.)

S = Contact material, Silver

E FIG.1b

CABLES AND WIRES, CODING

COLOUR CODE

The colour range for PVC covered cables and wires conforms to British Standards Specification BS 6746, as follows:-

COLOUR		ABBREVIATION	
Blue	Primary Colours	B	
Orange		O	
Green		G	
Brown		BN	
Slate		S	(Specified as Grey in BS 6746)
White	Secondary Colours	W	
Red		R	
Black		BK	
Yellow		Y	
Violet		V	

SINGLE WIRE

When abbreviations are used for more than one colour, the combination should be hyphened, e.g., Blue and White should be shown thus B-W.

PAIR

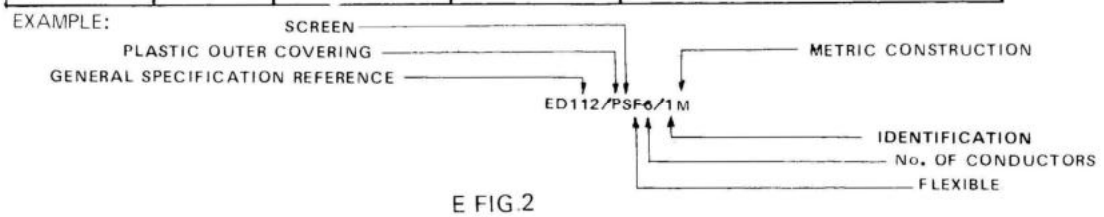
Colour abbreviations for a pair of wires each having a single colour, should be separated by a solidus, e.g., Orange and Red should be shown thus O/R.

SPECIFICATION CODE

Cables and wires manufactured to BBC requirements are covered by individual specifications. In each case, the code is prefixed by the Equipment Dept. General Specification reference ED112 which is followed by letters and numerals indicating brief details of construction:-

CODE				DEFINITION
OUTER COVERING	SCREEN OR RIBBON	FLEXIBILITY OR WIRE WRAP	No. OFF CONDUCTORS	
P				PLASTIC
R				RUBBER
	I			INDIVIDUAL PAIRS OR QUADS, SCREENED.
	R			RIBBON
	S			SCREENED OVERALL BRAID, LAPPED, OR METALLISED TAPE.
	U			UNSCREENED
		F		FLEXIBLE
		N		NON-FLEXIBLE
		WR		WIRE WRAP
			1.2 ETC.	NUMBER OF CONDUCTORS SEPARATELY INSULATED

EXAMPLE:

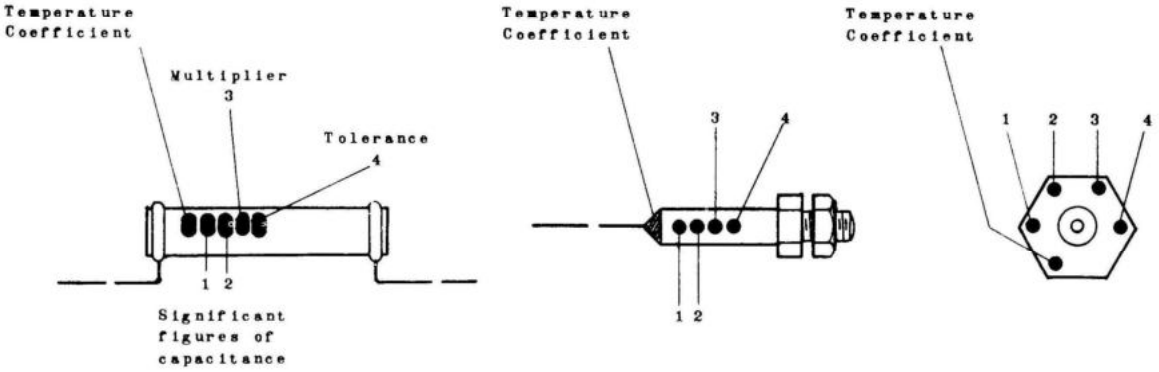


E FIG.2

CAPACITORS, CERAMIC, COLOUR CODE

5 UNIT CODE

Temperature Coefficient is indicated by the colour of the first Spot or End. Where no colour is shown for this the capacitor has a high permittivity dielectric. In the case of high permittivity Post Capacitors, the end filling is normally an Orange shade and should not be confused with the Standard Colour Code.



TUBULAR POST FEED-THROUGH

COLOUR	TEMPERATURE COEFFICIENT	CAPACITANCE IN pF		SELECTION TOLERANCE	
	SPOT OR END COLOUR P.P.M/°C	1st & 2nd COLOURS SIGNIFICANT FIGURE	3rd COLOUR MULTIPLIER	4th COLOUR 10pF or UNDER	OVER 10pF
BLACK	NPO (±0)	0	1	±2pF	±20%
BROWN	N030 (-30)	1	10	±0.1pF	±1%
RED	N080 (-80)	2	100		±2%
ORANGE	N150 (-150)	3	1000	±0.25pF	±2.5%
YELLOW	N220 (-220)	4	10,000		
GREEN	N330 (-330)	5		±0.5pF	±5%
BLUE	N470 (-470)	6			
VIOLET	N750 (-750)	7			
GREY		8	0.01		
WHITE	P100 (+100)	9	0.1	±1pF	±10%

EXAMPLE:

Temperature Coefficient - Spot or End colour, Violet - 750

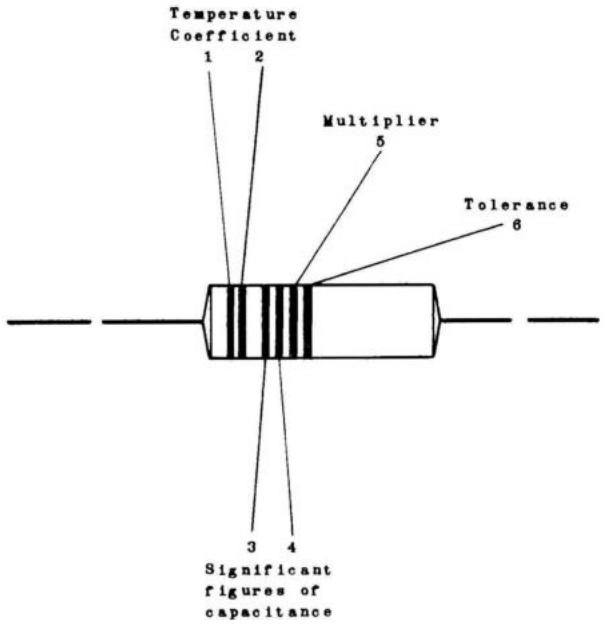
Capacitance - { 1st colour, Grey; 2nd colour, Red; 3rd colour, Black } 82pF

Tolerance - 4th colour, Black ±20%

E FIG.3

CAPACITORS, CERAMIC, COLOUR CODE

6 UNIT CODE



NOTE:
This colour code conforms to Defence Specification DEF-5133-1

EXAMPLE:

Temperature Coefficient P.P.M./°C
1st colour, Violet
2nd colour, Red
} −750

Capacitance
3rd colour, Brown
4th colour, Red
5th colour, Brown
} 120pF

Tolerance
6th colour, White ±10%

COLOUR (B.S. 381C NUMBER)		TEMPERATURE COEFFICIENT		CAPACITANCE IN pF		SELECTION TOLERANCE	
		1st COLOUR P.P.M./°C	2nd COLOUR MULTIPLIER	3rd & 4th COLOURS SIGNIFICANT FIGURE	5th COLOUR MULTIPLIER	6th COLOUR 10pF OR UNDER	6th COLOUR OVER 10pF
BLACK	–	0	1	0	1	±2pF	±20%
BROWN	412	−3	10	1	10		±1%
RED	538	−8	100	2	100		±2%
ORANGE	557	−1.5	1000	3	1000	±0.25pF	±2.5%
YELLOW	355	−2.2	10,000	4	10,000		
GREEN	221	−3.3		5		±0.5pF	±5%
BLUE	166	−4.7		6			
VIOLET	796	−7.5		7			
GREY	632	+3	0.01	8	0.01		
WHITE	–	+1	0.1	9	0.1	1pF	±10%

RELEVANT SPECIFICATIONS:-
DEFENCE SPECIFICATION DEF-5133-1
BRITISH STANDARDS BS.381C

E FIG 4

CAPACITORS, CERAMIC, TYPOGRAPHIC CODE

(ERIE RESISTOR LTD.)



TUBULAR DISC TUBULAR DISC

NORMAL OR HIGH NEGATIVE TYPES **HIGH PERMITTIVITY (Hi-k) TYPES**

CAPACITANCE TOLERANCE	TOLERANCE LETTER
±0.1 pF	B
±0.25 pF	C
±0.5 pF	D
±1 %	F
±2 %	G
±2.5 %	H
±5 %	J
±10 %	K
±20 %	M
-20 +40 %	N
-20 +80 %	P
* 0 +100 % (or G.M.V.)	R
-25 +25 %	S
-20 +100 %	T
-20 +50 %	U
-50 +50 %	V

NORMAL & HIGH NEG. TEMP. COEFF. (P.P.M./°C)	TEMP. LETTER
P470	W
P100	A
P030	B
NP0	C
N030	D
N047/N050	E
N080	F
N150	G
N220	H
N330	J
N470	K
N560	L
N650	M
N750	N
N1500	P
N2200	R
N3300	S
N4200	T
N4700	U
N5600	V

HIGH PERMITTIVITY (Hi-k) DIELECTRIC	DIELECTRIC LETTERS
K060011	AA
K120051	AC
K120061	AD
K120071	AE
K120081	AF
K170041	AG
K170051	AH
K170061	AJ
K250011	AK
K2600	AL
K3000	AM
K350011	AN
K350081	AO
K4000	AP
K4007	AR
K400011	AS
K4500	BA
K600041	AU
K6994	BB
K6998	BC
K7000	AV
K7001	AW
K7002	BD
K7004	AX
K750012	AY
K800011	AZ

EXAMPLES:

10JD = 10pF ±5% N030

470MAC = 470pF ±20% K120051

Values 1000 to 9900pF are indicated in pF by the use of multiplier 'K', which may take the place of the decimal point, i.e., 1K5PT = 1500pF -20 +80% N4200

Values 10,000pF and over are indicated in uF, i.e., .01PU = .01uF -20 +80% N4700

* G.M.V. DENOTES GUARANTEED MINIMUM VALUE

E FIG.5

CAPACITORS, LETTER & DIGIT CODE

VALUE CODE

CODE LETTER	MULTIPLIER F
p	10^{-12}
n	10^{-9}
μ	10^{-6}
m	10^{-3}

TOLERANCE CODE

CODE LETTER	MULTIPLIER ± %
B	0.1
C	0.25
D	0.5
F	1
G	2
J	5
K	10
M	20
N	30

GENERAL RULES:

1. In the case of the value code, the code letter replaces the decimal point.
2. Three characters only are used to code a value with two significant figures, (e.g. 5μ9 not 5μ90), except in the decade from 100 to 999 for any given multiplier.
3. Any additional code letter or digit (e.g. date code) appears after the tolerance code letter specified above, and is applied so as not to confuse the coding for value and tolerance.
4. The letter u is permissible in place of μ

EXAMPLES OF CAPACITOR LETTER AND DIGIT CODE

CODE MARKING	VALUE
p10	0.1pF
p332	0.332pF
3p32	3.32pF
10p	10pF
33p2	33.2pF
590p	590pF
1n5	1.5nF
59n	59nF

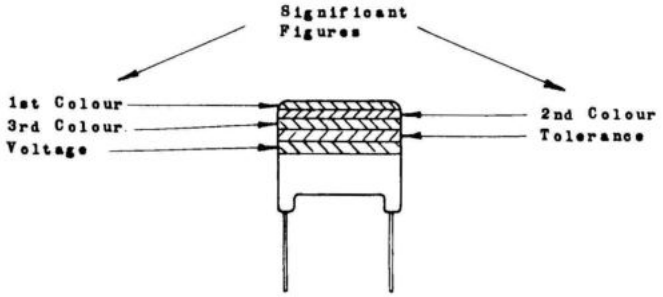
CODE MARKING	VALUE
1μ5	1.5μF
3μ32	3.32μF
10μ	10μF
33μ2	33.2μF
100μ	100μF
332μ	332μF
1m0	1mF
33m2	33.2mF

RELEVANT SPECIFICATION:
BRITISH STANDARDS B.S.1852

E FIG 6

CAPACITORS, POLYESTER, METALLISED, COLOUR CODE

5 UNIT CODE



COLOUR	CAPACITANCE IN uF		4th COLOUR TOLERANCE %	5th COLOUR VOLTAGE
	1st & 2nd COLOUR SIGNIFICANT FIGURES	3rd COLOUR MULTIPLIER		
BLACK	0	-	±20	-
BROWN	1	-	-	-
RED	2	-	-	250
ORANGE	3	0.001	-	-
YELLOW	4	0.01	-	400
GREEN	5	0.1	-	-
BLUE	6	-	-	-
VIOLET	7	-	-	-
GREY	8	-	-	-
WHITE	9	-	±10	-

EXAMPLE:

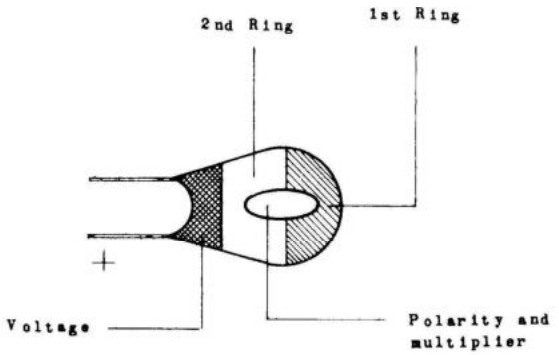
Capacitance - { 1st colour, Yellow; 2nd colour, Violet; 3rd colour, Orange } 0.047uF

Tolerance - 4th colour, Black, ±20%

Voltage - 5th colour, Red, 250V

E FIG.7

CAPACITORS, TANTALUM, SOLID, COLOUR CODE



NOTE:

The above sketch shows the position of the coloured spot which on colour coded versions serves both as multiplier and anode indicator. On types with printed values a white spot indicates the positive lead.

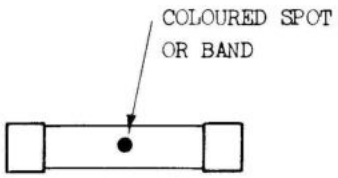
EXAMPLE:

6.8uF/25 volts = Blue, Grey, White, Grey

CAPACITANCE (uF)				VOLTS D.C. WKG.
COLOUR	1st RING	2nd RING	POLARITY AND MULTIPLIER	
BLACK	-	0	1	10
BROWN	1	1	10	
RED	2	2		
ORANGE	3	3		
YELLOW	4	4		6
GREEN	5	5		15
BLUE	6	6		
VIOLET	7	7		
GREY	8	8	0.01	25
WHITE	9	9	0.1	3
PINK				35

E FIG.8

FUSES, CARTRIDGE, COLOUR CODE



RATING (AMPS)	COLOUR
0.050	Salmon Pink
0.060	Black
0.100	Dark Admiralty Grey
0.150	Post Office Red
0.250	Dark Brown
0.500	Golden Yellow
0.750	Mid Brunswick Green
1	Azure Blue
1.5	Sky Blue
2	Dark Violet
3	White
5	Black & White
7	Light Orange
10	Light Orange & Black
12	Light Orange & Dark Admiralty Grey
15	Light Orange & Mid Brunswick Green
20	Light Orange & Dark Violet
25	Light Orange & White

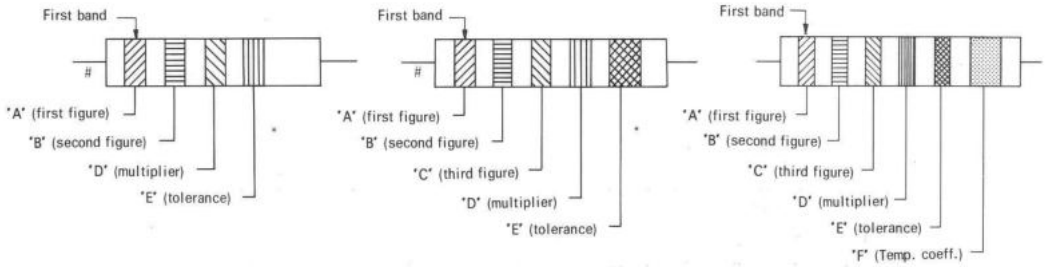
RELEVANT SPECIFICATION:
BRITISH STANDARDS BS 2950

E FIG 9

RESISTOR COLOUR CODE SYSTEMS



4 BAND SYSTEM **5 BAND SYSTEM** **6 BAND SYSTEM**



Colour	Significant figure 'A'	Significant figure 'B'	Significant figure 'C'	Multiplier 'D'	Tolerance 'E'	Temperature Coefficient 'F'
Silver	-	-	-	10^{-2}	± 10%	
Gold	-	-	-	10^{-1}	±5%	
Black	0	0	0	1	-	
Brown	1	1	1	10	± 1%	100 ppm
Red	2	2	2	10^2	± 2%	50 ppm
Orange	3	3	3	10^3	-	15 ppm
Yellow	4	4	4	10^4	-	25 ppm
Green	5	5	5	10^5	± 0.5%	
Blue	6	6	6	10^6	± 0.25%	
Violet	7	7	7	10^7	± 0.1%	
Grey	8	8	8	10^8	-	
White	9	9	9	10^9	-	
None	-	-	-	-	± 20%	

NOTES:

'A' THE FIRST SIGNIFICANT FIGURE BAND IS ALWAYS CLOSEST TO ONE END.

'E' THE TOLERANCE BAND IS SOMETIMES WIDER THAN THE VALUE BAND ON 4 AND 5 BAND CODING.

'F' THE TEMPERATURE COEFFICIENT BAND IS ALWAYS WIDER THAN THE VALUE AND TOLERANCE BANDS. IT IS POSITIONED AT THE END OPPOSITE TO THE FIRST SIGNIFICANT FIGURE.

E FIG.10

SECTION F MANUFACTURING SPECIFICATIONS

EQUIPMENT DEPARTMENT MANUFACTURING SPECIFICATIONS

F1 GENERAL SPECIFICATIONS

F1.1 General

The following list shows general specifications currently in use within the BBC and to which reference may be made on manufacturing drawings. Each Specification deals with a particular aspect of manufacturing processes, procedures or requirements in greater detail than can be incorporated within this Specification. The Specifications will be supplied on request to Equipment Department Drawing Office.

Spec. No.	Title
ED112	Cables & Wires, General Specification
ED12O	Technical Equipment, General specification
ED121	General Conditions of Contract
ED138	Anodised Finish
ED139	Requirements for the Manufacture of Printed Wiring Boards.
ED141	Requirements for the Gold Plating of Edge Contacts on Printed Wiring Boards
ED143	Wiring Techniques Utilising Solderless Wrapped Joints
ED155	Requirements for solder Resist and Component Placement Legends on Printed Wiring Boards.
ED22OO Series	Equipment Department Finishes, General Specification
ED3OO2	Insulating Tubing and Sleeving

SECTION G GUIDE TO ENGINEERING COMPONENTS CATALOGUE

ATTENUATORS
Audio
Video
Variable (Mtce.)

BATTERIES
1.5V-15V

BOXES
Diecast
Extruded
Plastic

CABLES
Camera (TV36)
Co-axial
Cords, Equipment
Cords, Mains
Equipment
Mains
Microphone
Power Supply
R.F.
Ribbon
Video
Wire

CABLE ACCESSORIES
Binding, Sleeves
Binding, Spiral
Cutter
Clamps
Grommets
Heat Shrink Sleeving
Insulating Sleeving
Insulating Tape
Lacing Cord
Markers
Solder Sleeves
Strippers
Ties
Tray

CAPACITORS
Ceramic
Ceramic (mtce.)
Clamps (mtce.)
Clips
Electrolytic
Electrolytic (mtce.)
Feed Through
Mica (mtce.)
Multi-Layer
Paper (mtce.)
Polycarbonate
Polyester
Polystyrene
Tantalum
Variable
Variable (mtce.)

CONNECTORS A.F.
Data
Jacks
Jack Moutings
Jackfield Blanking Peg
Plugs 'B Gauge'
Test Tablet
U-Link Adapters
U-Link Plugs
U-Link Sockets

CONNECTORS
'D'Series
Insulation Displacement
Multicon 2 Pole
Multicon 4-33 Pole (mtce)
Red Range
Ribbon Cable
Varicon
Varicon Hoods
Wander
10 Pole In-Line
11 Pole Heavy Duty
11 Pole Heavy Duty Terminals
202 & 203 Series

CONNECTORS MAINS
Adapter Plates
Covers, Insulating
'D' Mains
'Domestic' 13 Amp
EP-LNE Type
Flat Pin
Weatherproof
XLR-LNE Type
13 Amp

CONNECTORS PROGRAMME
Bayonet, O.B.
Camera
Edge
EP Type Audio
ISEP
Hypertac
Hyfen
Printed Circuit
XLR Type Audio
15 Pole In-Line
17 Pole
26/41 Pole (Bayonet)
32 Pole
32/64 Pole
39 Pole (TV36)
39 Pole (TV36) Accessories

CONNECTORS R.F.
S.M.B. Adapters
S.M.B. Plugs
S.M.B. Sockets
B.N.C. Adapters
B.N.C. Plugs
B.N.C. Sockets
B.N.C. Termination
T.N.C. Adapters
T.N.C. Plugs
T.N.C. Sockets
C Series Adapters
C Series Plugs
C Series Sockets
N Series Adapters
N Series Plugs
N Series Sockets
MUSA Series Adapters
MUSA Series Plugs
MUSA Series Sockets
83 Series Adapters

CONNECTORS R.F. (contd)	83 Series Plugs 83 Series Sockets Inter Series Adapters S.M.B. to B.N.C. S.M.B. to N B.N.C. to T.N.C. B.N.C. to C B.N.C. to N B.N.C. to MUSA B.N.C. to 83 T.N.C. to N C to N C to 83 'Domestic' Adapters Miniature Adapters Terminations
DELAY LINES	Video Video (DIL)
DESIGNATION STRIP	See Labels
ENCLOSURES	B.M.M.S. Illustration
ENCLOSURES, BAYFRAME	PN3/54-58 (Panel Main Frames)
ENCLOSURE, CASES	Console
ENCLOSURES, CHASSIS	CH1/64 CH1/65 CH1/82 PN1/27J-30J (Card Panels) Screen Plate (2U to 5U)
ENCLOSURES PANELS	PN1/31 (Dummy Panels) PN1/36 (Ventilation Panels) PN3/71 (Termination Panels) PN3A/50 (Termination Panels) PN3A/51 (Termination Panels) PN3A/52 (Termination Cover) PN3A/53 (Termination Covers) PN3A/54 (Termination Cover) PN3A/55 (Termination Cover) PN3A/57 (Termination Cover) PN3A/60 (Indexing Panels) PN3A/67 (Dummy Panels) PN3A/75 (Dummy Panels) PN3A/76-H (Dummy Panels) PN3A/77H (Dummy Panels) PN3A/79A (Termination Cover) PN3A/83 (Front Covers)
FASTENERS IMPERIAL	Bushes Coach Screws Nuts Screws Self-Tapping Screws Spacers Studding Wallplugs Washers Wing Nuts Wood Screws
FASTENERS METRIC	Anchor Nuts Bolts Bushes Caged Nuts Captive Screw Nuts Screws Spacers Studding Threadforming Screws Washers
FILTERS	Low-Pass, Pulse-Shaping Mains
FUSES	Circuit Breakers Fuselinks Fuselinks (mtce.) Fuseholders Fuseholders (mtce.) Insulating Covers
HEADPHONES	Headphones Headsets
JACKFIELDS	Audio (JF2) Video (JF3)
KNOBS	Aluminium Bembridge Hexagonal Collet Type
LABELS & DESIGNATION STRIP	Labels Labels, B.M.M.S. Handle Labels (mtce.) Labels, Test Tablet
LAMPS	Lamps Lamps (mtce.) Lampholders Lampholders (mtce.) Lamp Extractor (mtce.) L.E.D.'S Neon Neon (mtce.) Signal Light Box
LOUDSPEAKER	Public Address System

MATERIALS
- Extrusion
- Metals (see note)
- Rubber
- Service Aids
- Vero Board

METERS
- Adapter, Flush Fitting
- Ammeters
- Buzzers
- Continuity Testers
- Clocks
- Lamp Brackets
- Multi
- Peak Programme
- Volt

MICROPHONES
- Anglepoise Arm
- Capsules
- Cases
- Coded Equipment
- Inserts
- Pre-Amps
- Stands
- Tie Clips
- Windshields

RELAYS
- Contact Cleaner
- Coaxial
- Crystal Can
- D.I.L.
- Low Profile
- Miniature Enclosed
- Miniature Sealed
- R.F.
- Sockets
- Type 3000 (mtce.)

RESISTORS
- Metal Film
- Metal Oxide
- Networks
- Precision
- Variable (Pre-Set)
- Variable Potentiometers
- Variable (mtce.)
- Wirewound

SAFETY EQUIPMENT
- Ear Plugs
- Goggles
- Hearing Defenders
- Safety Earthing Wand

SEMICONDUCTORS
- 74 Series
- 74H & L Series T.T.L.
- 74LS Series T.T.L.
- Analogue I.C.'S
- C-MOS B Series
- C-MOS 74C Series
- Miscellaneous I.C.'S
- Transistors
- Diodes
- Package Details

SEMICONDUCTOR ACCESSORIES
- Heat Sinks
- I.C. Sockets
- Transistor Bushes
- Transistor Insulating Washer
- Transistor Mounting Pads

SWITCHES
- Dual-In-Line
- Illuminated
- Lever
- Micro
- Push Button
- Rotary
- Slide
- Toggle
- Toggle Caps

TAGS AND TERMINALS
- Solder Tags
- Tag Strips
- Terminals
- Terminal Blocks
- Terminal Block Cover
- Test Point

TOOLS
- Adhesive Gun
- Allen Keys
- Crimp Heads, BNC
- Cutters
- Drills, Masonry
- Feeler Guages
- Goggles
- Insertion/Withdrawal
- Hacksaw Blades
- Mirror, Inspection
- Pliers
- Screwdrivers
- Side Cutters
- Solder, etc.
- Soldering Irons & Accessories
- Spanners
- Wallet
- Wire Strippers

TRANSFORMERS
- A.F.
- Mains

WOUND COMPONENTS
- Chokes
- Inductor Parts
- Transformers