POWER DISTRIBUTION
IN 2000 TYPE EQUIPMENT AREAS

This E.I. describes the assembly of and positioning of various fittings and fixtures to provide aluminium or copper busbar power feeder service in -

(i) 2000 Type Exchanges.

(ii) Trunk Switching Equipment: Uniselector, Motor-Driven.

(iii) C.B. rack assemblies, and

(iv) Other equipment which is based on the standard 2000 type rack framework and its associated superstructures.

For the installation of busbars in battery rooms, in power rooms, and between floors see E.I. INTERNAL PLANT INSTALLATION Practice P 3015.'

INDEX — SEE PAGE NO.

1. GENERAL.

1.1 Components and Assembly. The main components and various methods of assembly used in the provision of busbar power distribution are shown in figures included in this instruction. Central Office Drawings No. C.E. 510, 511 and 512 also record this information. These drawings must be referred to when manufacturing details are required. The drawings show -

(i) The various types of clamps used in jointing of the busbar. (Drawing No. C.E. 510.)
(ii) The general assembly of fittings on power distribution to satisfy various power feeding arrangements. (Drawing No. C.E. 511.)
(iii) The provision of power feeder services on a standard 2000 rack framework. (Drawing No. C.E. 512.)

1.2 Capacity of Busbar. Power distribution systems using busbars are designed to provide rack feeds. The number of racks in each feed is determined from information in E.Is. dealing with the provision of Power.
The inter-rack busbars connect to a group fuse panel which in turn is linked with the sub-main distribution system.

1.3 Jointing Copper or Aluminium. This E.I. applies equally to jointing of copper or aluminium busbar, the same type and assembly of fittings being used for either.

1.4 Comparison of Copper and Aluminium. Aluminium has a higher specific resistance than copper and where used for the main power distribution leads a cross-section 1.6 times that of the equivalent copper busbar is required.
Manufacture and assembly construction require the same cross-section for both copper and aluminium rack and inter-rack busbars. The higher resistance of aluminium is compensated for by increasing the sizes of the main and sub-main runs or by the addition of extra leaves in the negative and positive feeds.
When aluminium busbars are used it may also be necessary to decrease the number of racks fed from the one group fuse.

1.5 Extensions to Existing Busbar Systems. Installations using one metal for busbars should be continued in that metal when extensions are made. This is necessary because of the electrolytic corrosion which may occur when two dissimilar metals are joined. This problem is being investigated and an E.I. will be issued covering the findings. All such joints must be sealed against the intrusion of moisture.

2. BUSBAR INSULATION AND COLOUR CODE.

2.1 The busbars in both the main distribution and in the subsidiary feeds must be insulated and painted as follows.

2.2 Insulation.

(i) The negative busbar must be insulated with either -

(a) book-binding cloth formed to the shape of the busbar, or
(b) P.V.C. sheath covering, or
(c) linen tape painted blue used at bends and other locations where (a) or (b) cannot be used, or
(d) synthetic rubber coating - at present under test (see Section 8).

(ii) Standard practice is not to insulate the positive busbar. Tests are now being made on insulating the positive lead with a synthetic rubber coating.

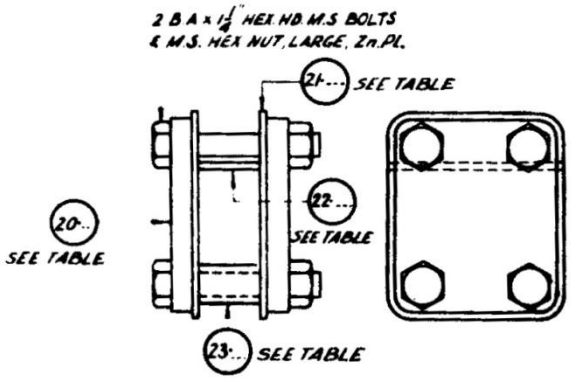
2.3 Colour Code.

(i) Where the negative lead is treated as in 2.2 (i)(a), or (c) it must be painted blue (British Standard Specification No. 381 colour 104 glossy).
(ii) If the positive lead is not insulated it must be painted bright red (British Standard Specification No. 381 colour 538).

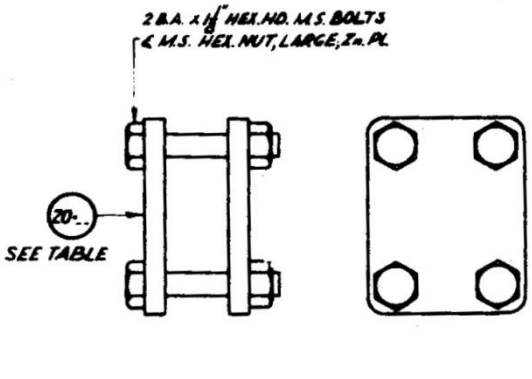
3. TYPES OF CLAMPS.

3.1 Busbar Jointing Clamps. Various shapes and sizes of clamps are used when jointing busbars.
When jointing the negative busbar it is necessary to use insulation pieces between the clamps and the busbar, the bolts clamping the two metallic plates together are sleeved with an insulation tube. This assembly arrangement prevents any contact with the metal clamp plate causing a leakage of electrical energy. The negative clamp plate also includes a tapped hole in one plate to permit insulation tests to be made.
The clamping of the positive busbar does not require the insertion of either the insulation piece, or the insulation tubes on the bolt.
Busbar jointing clamps are shown in Drawing No. C.E. 510, and are reproduced in this E.I. (See Figs. 1-6.) Fig. 7 shows the details referred to in the tables of Figs. 1-6.
In some cases when jointing aluminium busbars the dimensions of the clamps may need to be altered to allow for the larger busbars required, i.e. the clamp appropriate to the busbar size should be selected from the tables included in this E.I.

Examples of the use of these clamps are in Section 7.



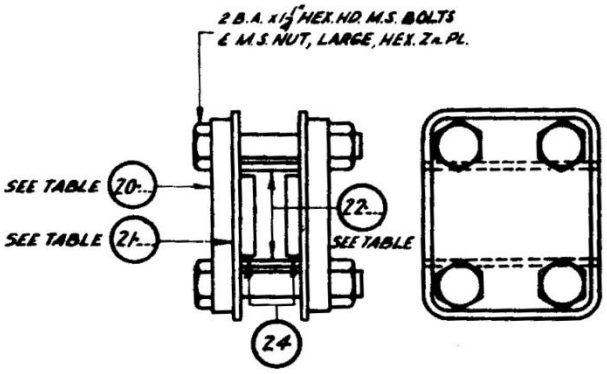
JOINTING CLAMP - NEGATIVE.



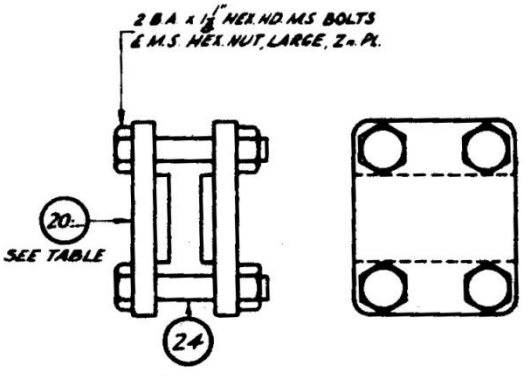
JOINTING CLAMP - POSITIVE.

ASSEMBLY	QUANTITY OFF DETAILS						
	PLATE 20-1	PLATE 20-3	PLATE 21-1	PLATE 21-3	PLATE 22-12	PLATE 22-02	TUBE 23-1
A1. NEGATIVE	2	—	2	—	1	—	2
A2. NEGATIVE.	—	2	—	2	—	1	2
A3. POSITIVE.	2	—	—	—	—	—	—

FIG. 1. BUSBAR JOINTING CLAMP – ASSEMBLY A.
(See Fig. 7 for details.)



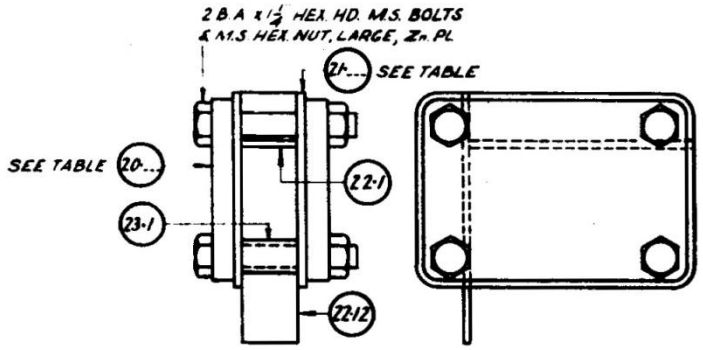
JOINTING CLAMP - NEGATIVE.



JOINTING CLAMP - POSITIVE.

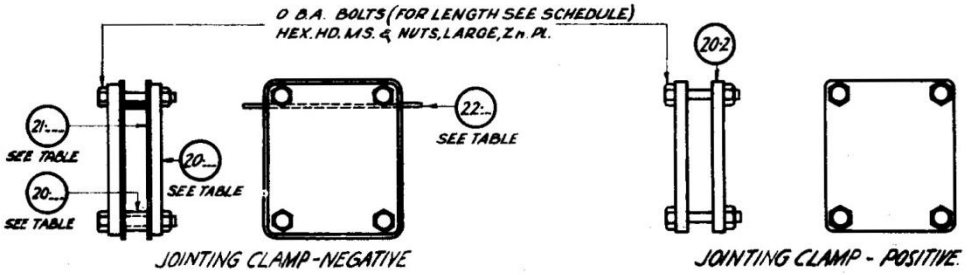
ASSEMBLY	QUANTITY OFF DETAILS			
	PLATE 20-1	PLATE 21-1	PLATE 22-12	PLATE 24
B1. NEGATIVE.	2	2	2	2
B2. POSITIVE.	1	–	–	1

FIG. 2. BUSBAR JOINING CLAMP – ASSEMBLY B.
(See Fig, 7 for details.)



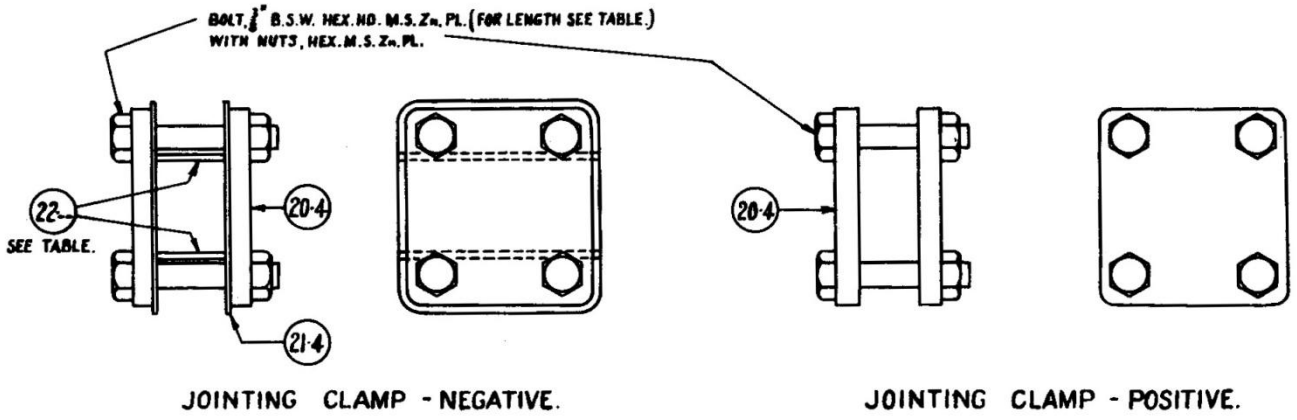
ASSEMBLY	QUANTITY OFF DETAILS.						
	PLATE 20-1	PLATE 20-3	PLATE 21-1	PLATE 21-3	PLATE 22-01	PLATE 22-12	TUBE 23-1
C1 NEGATIVE	–	2	–	2	1	1	1
C2 NEGATIVE	2	–	2	–	–	2	1

FIG. 3. BUSBAR JOINTING CLAMP – ASSEMBLY C.
(See Fig. 7 for details.)



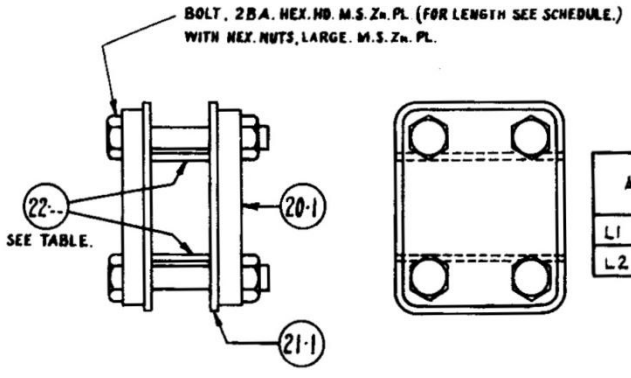
ASSEMBLY	QUANTITY OFF DETAILS.																
	PLATE 20-2	PLATE 20-5	PLATE 21-2	PLATE 21-6	PLATE 22-2	PLATE 22-3	PLATE 22-4	PLATE 22-8	PLATE 22-9	PLATE 22-10	PLATE 22-18	FLATE 22-14	TUBE 23-2	TUBE 23-3	TUBE 23-4	TUBE 23-5	BOLTS, O.B.A, HEX. HD. M.S. NUTS
D1 NEGATIVE	–	2	–	2	–	–	–	1	–	–	–	–	2	–	–	–	4 OFF, 1⅛" LONG.
D2 "	–	2	–	2	–	–	–	–	1	–	–	–	–	2	–	–	4 OFF, 1½" LONG.
D3 "	–	2	–	2	–	–	–	–	–	1	–	–	–	–	2	–	4 OFF, 1⅝" LONG.
D4 "	2	–	2	–	1	–	–	–	–	–	–	–	2	–	–	–	4 OFF, 1⅛" LONG.
D5 "	2	–	2	–	–	1	–	–	–	–	–	–	–	2	–	–	4 OFF, 1½" LONG.
D6 "	2	–	2	–	–	–	1	–	–	–	–	–	–	–	2	–	4 OFF, 1⅝" LONG.
D7 POSITIVE	2	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	4 OFF, 1½" LONG.
D8 "	2	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	4 OFF, 1¾" LONG.
D9 NEGATIVE	–	2	–	2	–	–	–	–	–	–	1	–	–	–	–	2	4 OFF, 2⅛" LONG.
D10 "	2	–	2	–	–	–	–	–	–	–	–	1	–	–	–	2	4 OFF, 2⅛" LONG
D11 POSITIVE.	2	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	4 OFF, 2¼" LONG

FIG. 4. BUSBAR JOINTING CLAMP – ASSEMBLY D.
(See Fig. 7 for details.)



ASSEMBLY	QUANTITY OFF DETAILS					
	20·4	21·4	22·5	22·6	22·7	BOLTS, 3/8" B.S.W, HEX. HD, M.S., Zn. PL.
K1 NEGATIVE	2	2	2			4 OFF 2" LONG.
K2 "	2	2		2		4 OFF 2 1/4" LONG
K3 "	2	2			2	4 OFF 2 1/2" LONG
K4 POSITIVE	2					4 OFF 1 3/4" LONG
K5 "	2					4 OFF 2" LONG
K6 "	2					4 OFF 2 1/4" LONG.

FIG. 5. BUSBAR JOINTING CLAMP – ASSEMBLY K.
(See Fig. 7 for details.)



ASSEMBLY	QUANTITY OFF DETAILS				
	PLATE DET. 20-1	INSULATOR DET. 21-1	INSULATOR DET. 22-12	INSULATOR DET. 22-11	BOLTS, 2 B.A. HEX. HD. M.S. Zn. PL.
L1 NEGATIVE	2	2	2		4 OFF 1 1/4" LONG
L2 "	2	2		2	4 OFF 1 1/2" LONG

FIG. 6. BUSBAR JOINTING CLAMP – ASSEMBLY L.
(See Fig. 7 for details.)

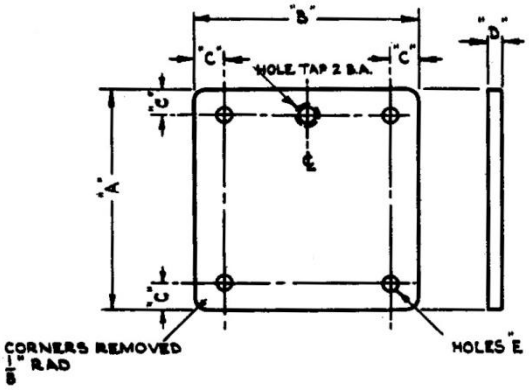
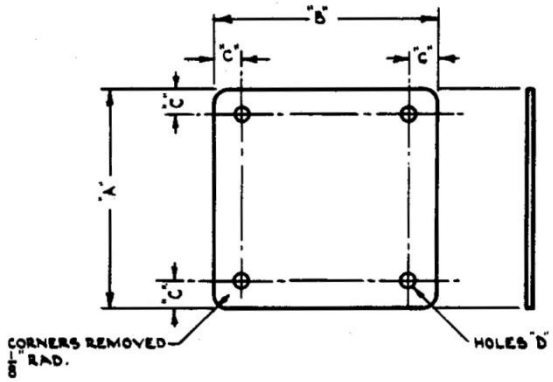


PLATE
MATERIAL. M.S.
FINISH : ZINC PLATE.

DETAIL Nº	DIMENSIONS IN INCHES. "A"	"B"	"C"	"D"	"E" DIA.
20·1	1·500	1·500	0·187	0·187	0·203
20·2	3·000	1·750	0·281	0·250	0·265
20·3	1·500	2·250	0·187	0·187	0·203
20·4	3·500	3·500	0·468	0·375	0·406
20·5	3·000	2·500	0·281	0·250	0·265

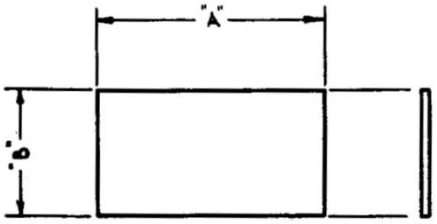
(a) Detail 20



PLATE, INSULATING
MATERIAL : PHENOL FIBRE. 1/16" THICK.
FINISH : CLEAN.

DETAIL Nº	DIMENSIONS IN INCHES. "A"	"B"	"C"	"D"
21·1	1·625	1·625	0·250	0·203
21·2	3·125	1·875	0·343	0·265
21·3	1·625	2·375	0·250	0·203
21·4	3·625	3·625	0·531	0·406
21·5	3·126	2·625	0·343	0·265

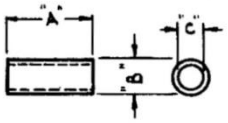
(b) Detail 21



PLATE, INSULATING.
MATERIAL : PHENOL FIBRE 1/16" THICK.
FINISH : CLEAN.

DETAIL Nº.	DIMENSIONS IN INCHES. "A"	"B"
22·01	2·25	0·5
22·02	2·75	0·5
22·03	2·75	0·625
22·04	2·75	0·75
22·05	4·125	0·5
22·06	4·125	0·75
22·07	4·125	1·00
22·08	3·5	0·5
22·09	3·5	0·625
22·10	3·5	0·75
22·11	2·00	0·75
22·12	2·00	0·5
22·13	3·5	1·5
22·14	2·75	1·5

c) Detail 22



TUBE
MATERIAL : EBONITE B.S.S. 234. QUALITY A
FINISH : CLEAN.

DETAIL Nº	DIMENSIONS IN INCHES. "A"	"B"	"C"
23·1	0·468	0·281	0·187
23·2	0·468	0·320	0·240
23·3	0·593	0·320	0·240
23·4	0·718	0·320	0·240
23·5	1·468	0·320	0·240

(d) Detail 23

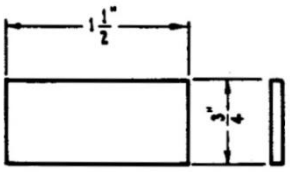


PLATE.
MATERIAL : COPPER H.D.C. H.C. 1/8" THICK.
FINISH : CLEAN.

(e) Detail 24

FIG. 7. DETAILS OF BUSBAR FITTINGS (REFERRED TO IN FIGS. 1-6).

3.2 Clamps for Inter-rack Busbars. The inter-rack busbars are anchored to the tie bar system. A set of fibre blocks is used to carry the negative and positive leads. Other metal clamps and associated bolts and nuts are used to lock the fibre block and the copper busbars to the tie bar system.

Fibre block clamps for inter-rack busbars are shown in Drawing C.E. 510, Sheet 2 and are reproduced here. (See Figs. 8 and 9. Details are shown in Fig. 10.)

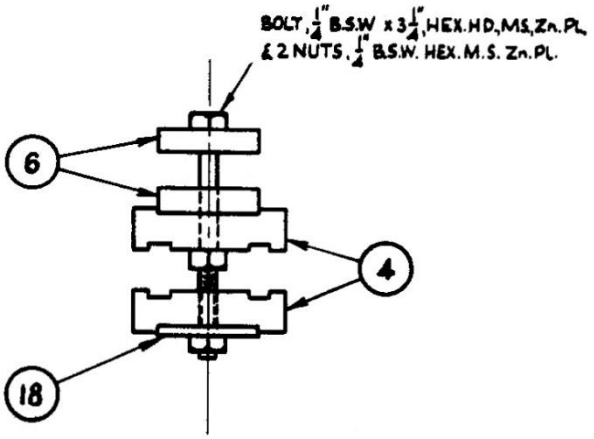
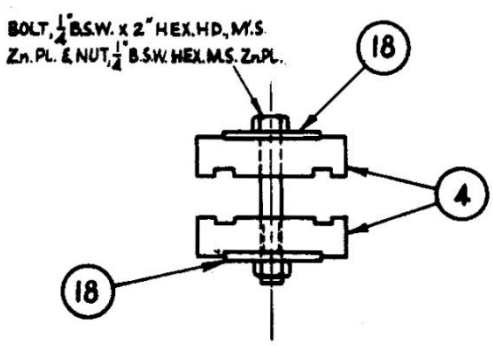
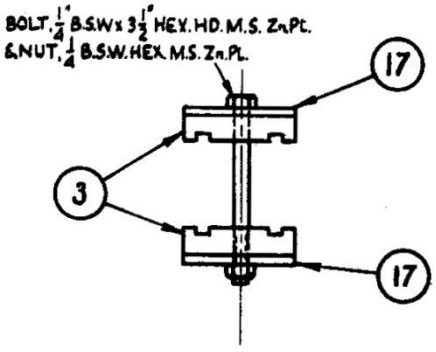


FIG. 8. FIBRE CLAMP FOR FIXING INTER-RACK BUSBARS TO TIE BARS.
(See Fig. 10 for details.)



(a) For Inter-Rack Busbars.



(b) For Rack Main Busbar.

FIG. 9. FIBRE CLAMPS.
(See Fig. 10 for details.)

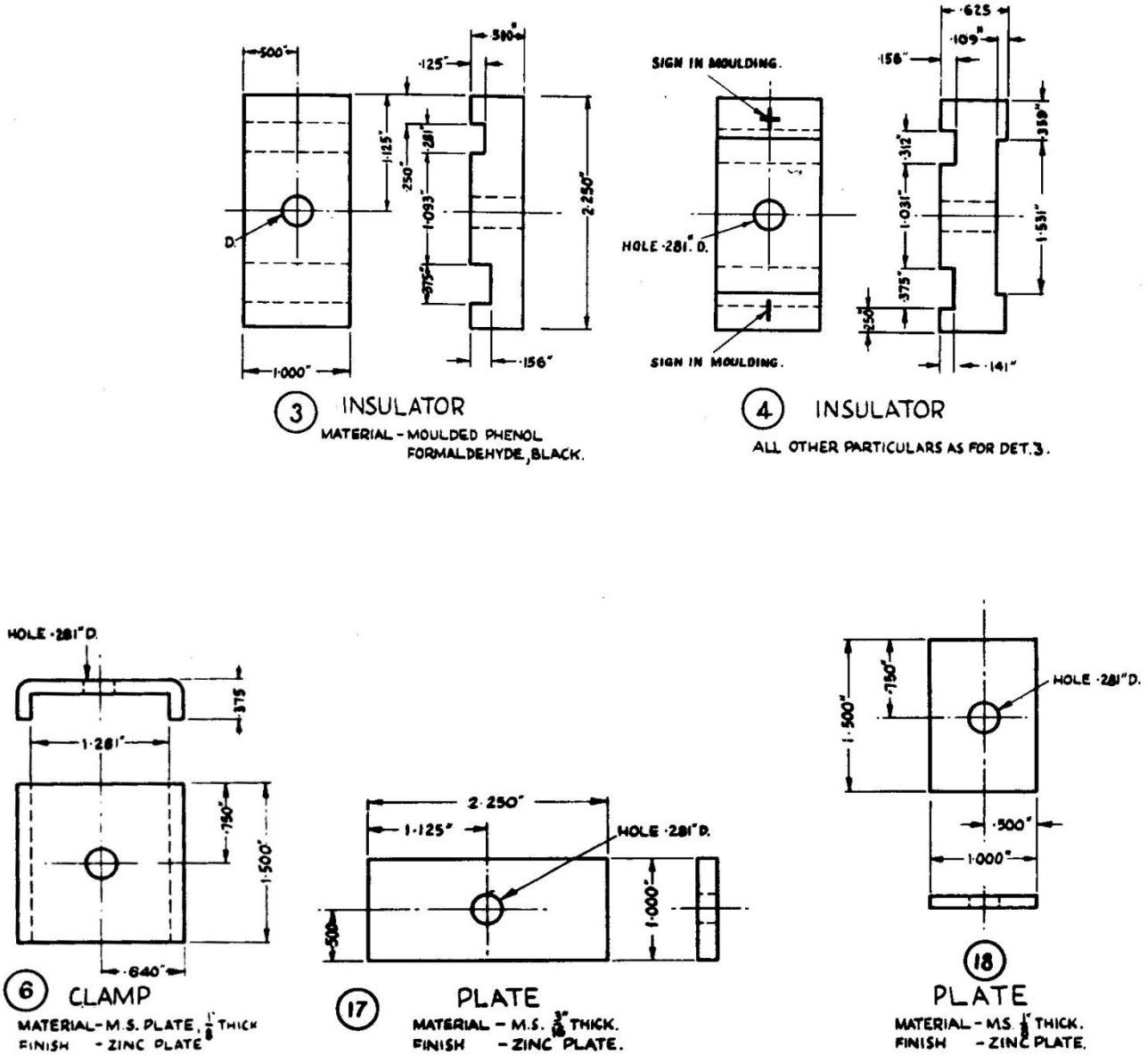
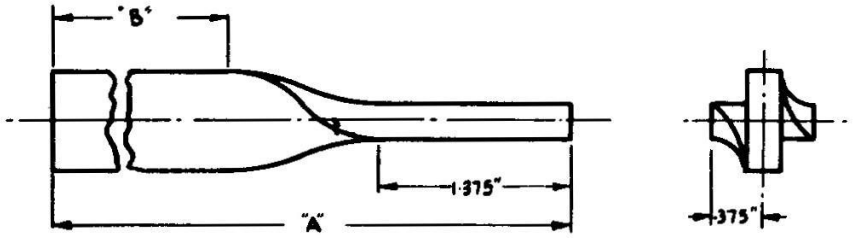


FIG. 10. DETAILS OF BUSBAR CLAMPS.

4. JOINTING BUSBARS.

4.1 Lap and Butt Joints. All joints in busbars must be of either the lap or butt types. The lap area of any joint is gauged by the dimensions of the clamp fitting.

4.2 Riser Joins. A small twisted section of copper shown in Fig. 11 is used to provide for riser joins between two levels of copper distribution busbars. Methods of fitting are in Figs. 23 and 25.

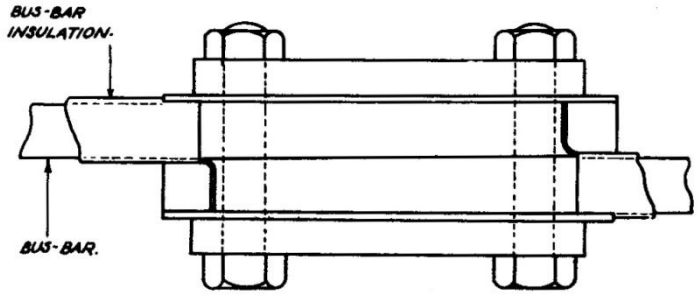


MATERIAL – HARD DRAWN COPPER, $\frac{3}{4}$" x $\frac{1}{4}$"
FINISH – CLEAN

RISER FOR JOINTING COPPER BUSBAR.

FIG. 11.

4.3 Jointing Negative Busbar. When jointing the negative busbar it is important to remove only the correct amount of the insulating material. This is necessary to enable a low resistance joint to be made without exposing the conducting material and hence introducing the danger of metallic contact. The method of jointing is in Fig. 12.

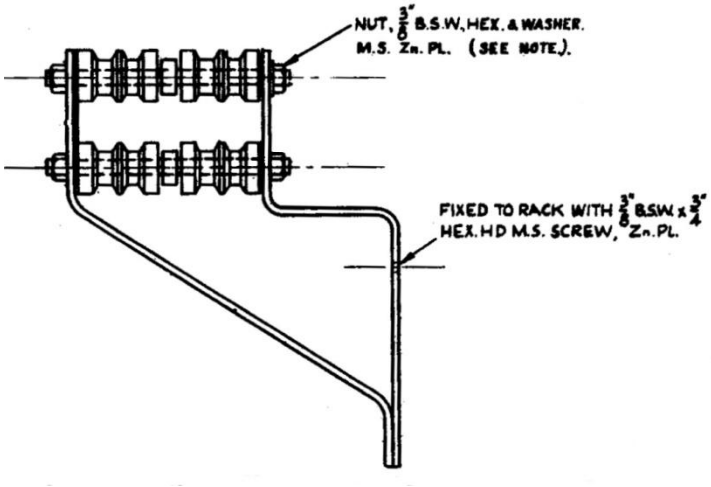


JOINTING NEGATIVE BUSBAR.

FIG. 12.

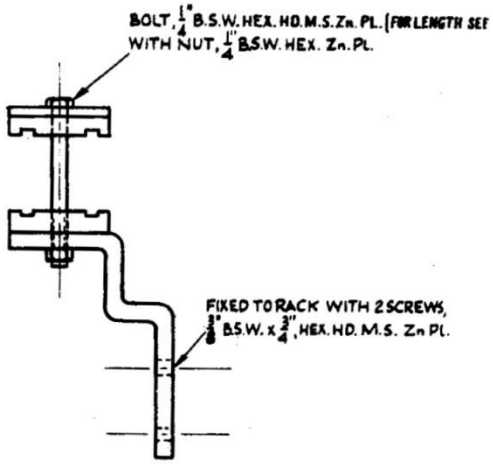
5. BRACKETS AND MOULDED INSULATION PIECES.

5.1 The Sub-main feeder system supplying the various rack feeds is supported on iron brackets and a series of moulded ceramic insulators support the busbar and provide for its correct spacing. The ceramic insulating pieces for the general assembly are in Figs. 13 and 14 and details are in Drawing C.E. 510.



SUPPORTING BRACKET FOR RACK MAIN BUSBAR.

FIG. 13.

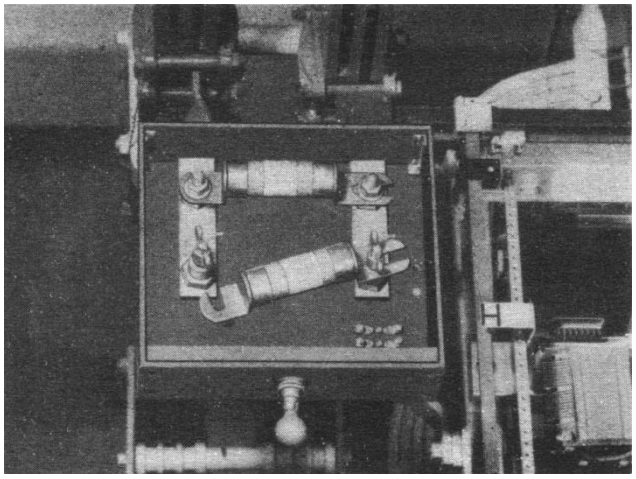


CLAMP AND SUPPORTING BRACKET FOR RACK MAIN BUSBARS.

FIG. 14.

6. ALARM PROTECTION.

6.1 The Sub-main distribution fuse box is also fitted with fuse alarm lamps and a protective fuse wired in parallel with %he main supply fuse. (See Fig. 15.)



SUB-MAIN DISTRIBUTION FUSE BOX.

FIG. 15.

6.2 The fuse aim lamp circuit is connected to the exchange alarm system.

7. GENERAL ASSEMBLY OF FITTINGS.

7.1 The general assembly of fittings on power distribution to satisfy various feeding arrangements are in Drawing C.E. 511, similar Figs. Are reproduced in this E.I. (See Figs. 16-21.)

Views of the joints and supports are shown in Figs. 23-31 and refer to the assemblies shown in Figs. 1-6.

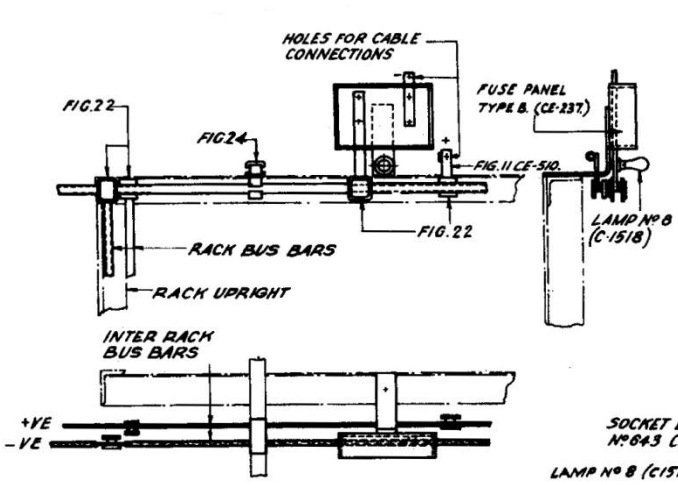


FIG. 16. SUB FUSE PANEL FOR ISOLATED RACKS.

The panel is mounted on rack distribution busbar and is linked to the Sub or Main Distribution busbar with power cable.

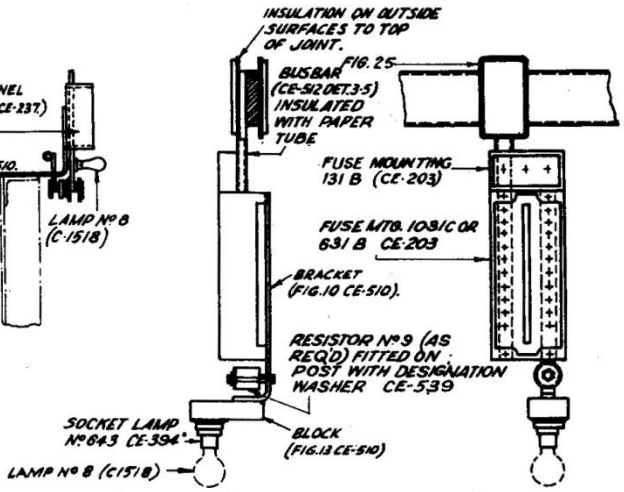


FIG. 17. FUSE ALARM – FUSE PANEL (A.E.R.)

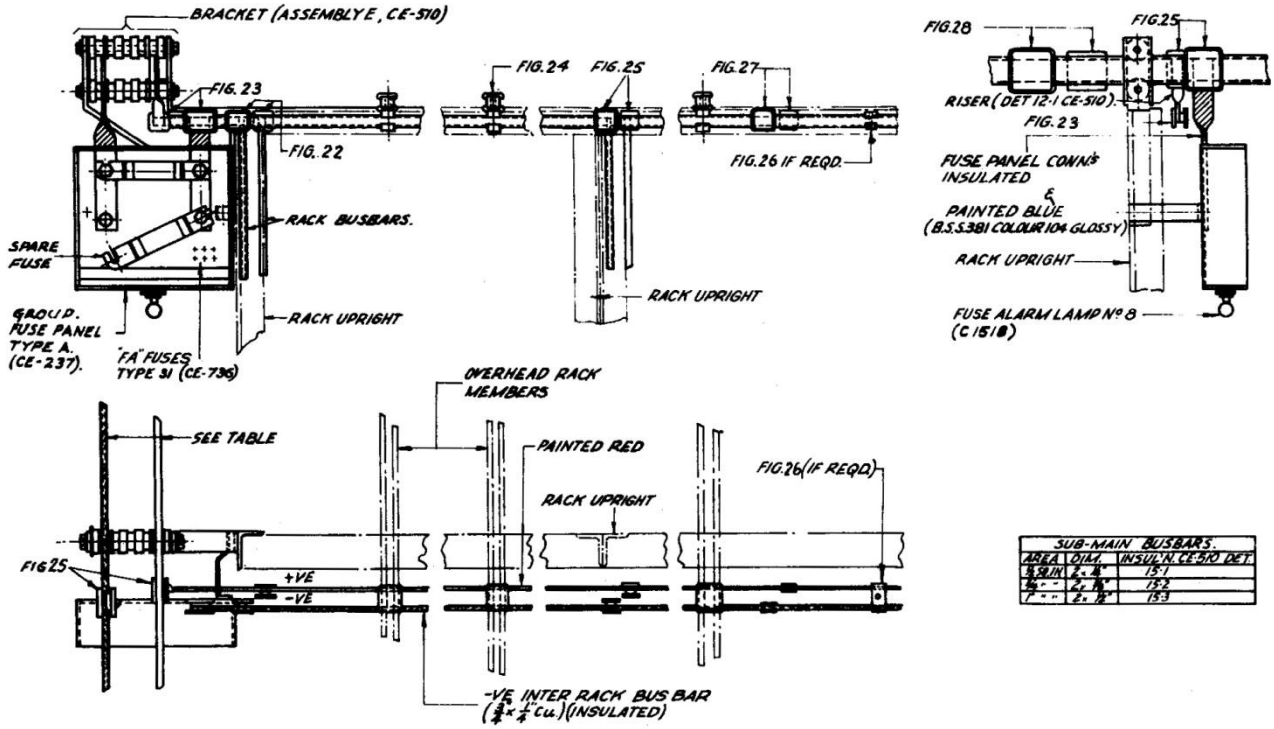
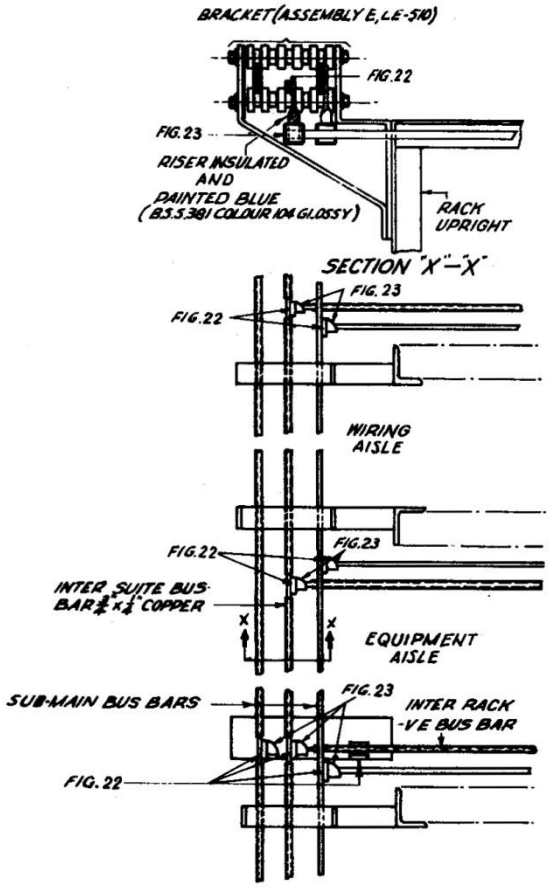
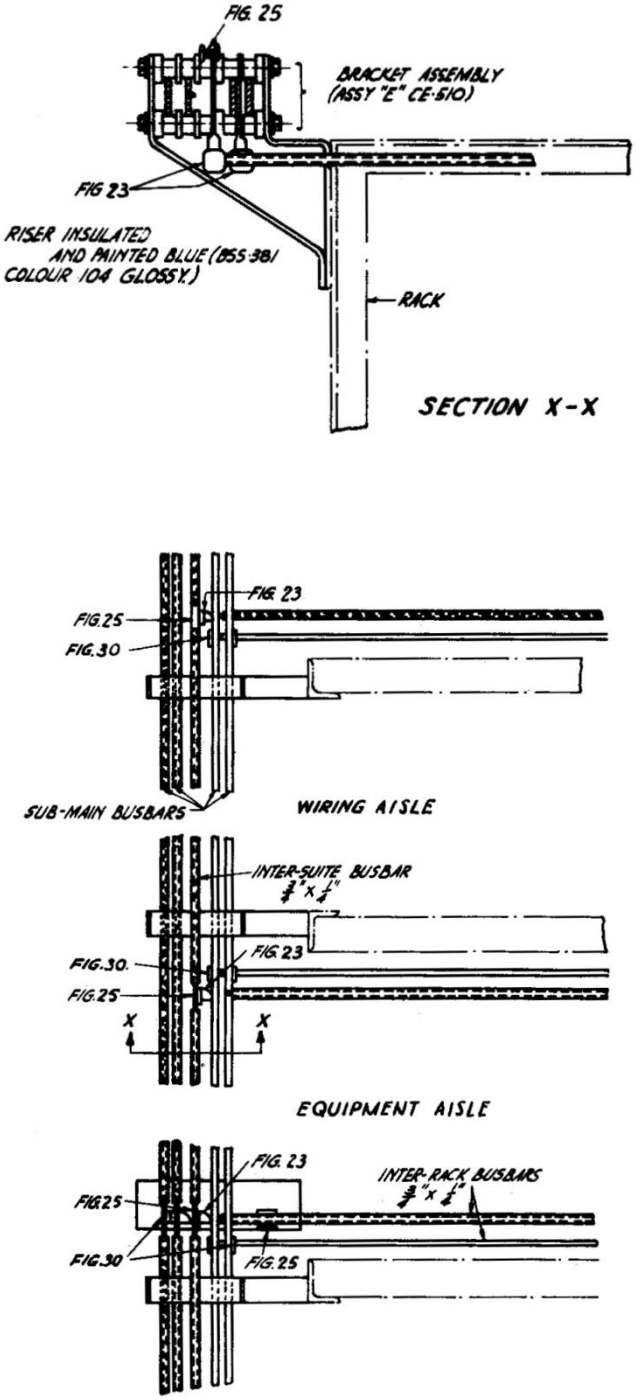


FIG. 18. POWER DISTRIBUTION FOR EXCHANGES HAVING GROUP FUSE DISTRIBUTION.



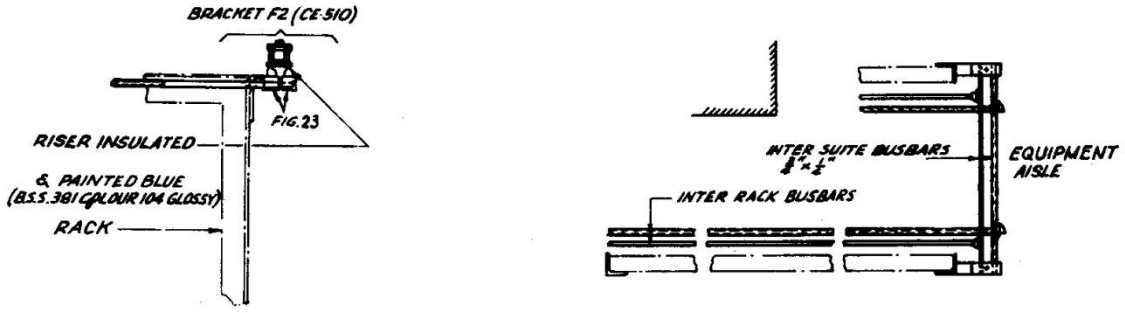
(a) One 2" × ½" busbar per pole.



(b) Two " × ½" busbar per pole.

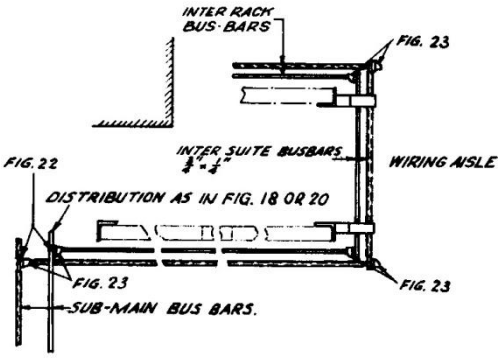
BUSBAR ARRANGEMENT WHERE A GROUP FUSE PANEL FEEDS MORE THAN ONE SUITE OF RACKS.

FIG. 19.



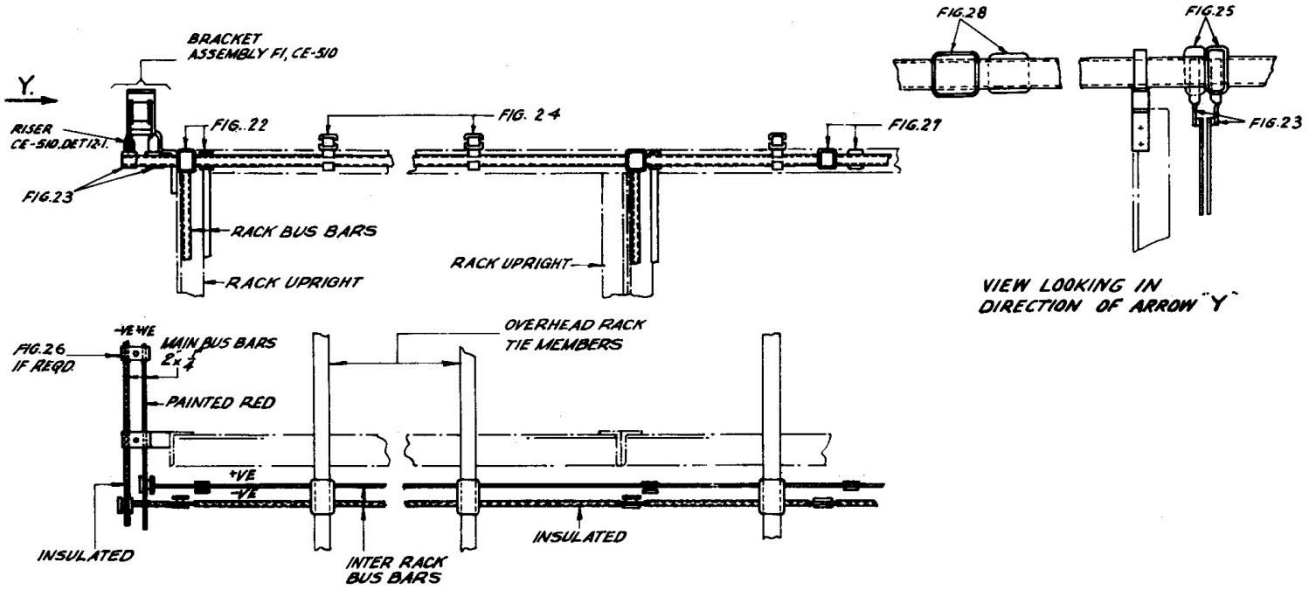
(a) Method of connection

(b) Across an equipment aisle.



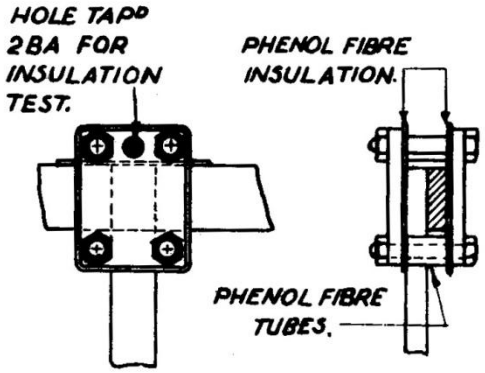
(a) Across a wiring aisle.

FIG. 20. LINKING TWO SUITES WHERE ONE SUITE CANNOT BE CONNECTED DIRECT TO THE SUB-MAIN BUSBAR SYSTEM.



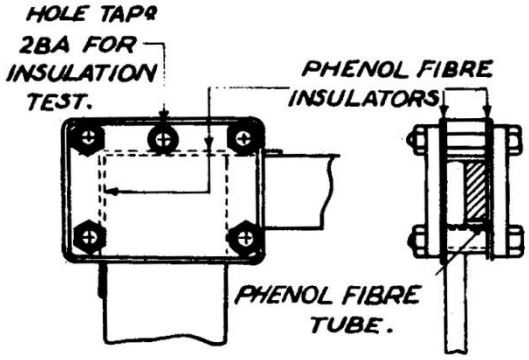
POWER DISTRIBUTION FOR EXCHANGES WITHOUT GROUP FUSE DISTRIBUTION.

FIG. 21.



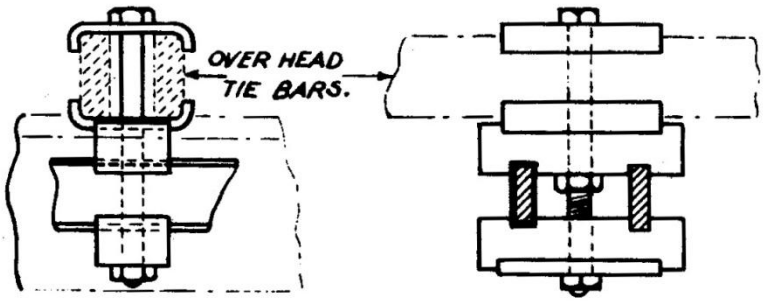
SIZE OF BUS BARS		CLAMP (CE-510).	
HORIZ.	VERT.	NEG.	POS.
¾" × ¼"	¾" × ¼"	ASS'Y. A1	
¾" × ¼"	½" × ¼"	" A1	ASS'Y A3.
¾" × ¼"	1½" × ¼"	" A2	
¾" × ¼"	1" × ¼"	"	

FIG. 22. TEE JOINT INTER RACK BUSBARS.



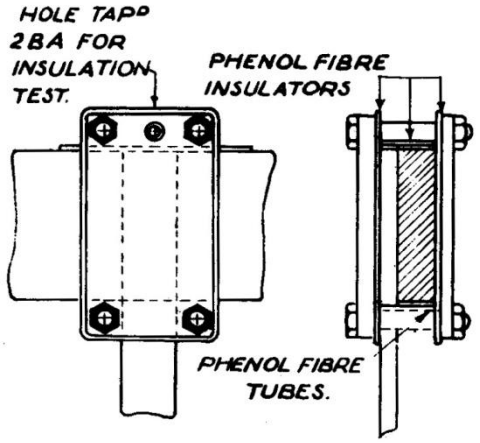
SIZE OF BUS BARS.		CLAMP (CE-510).	
HORIZ.	VERT.	NEG.	POS.
¾" × ¼"	1½" × ¼"	ASS'Y. C1.	ASS'Y.
¾" × ¼"	¾" × ¼"	" C2.	" A3.
¾" × ¼"	1" × ¼"	"	"
¾" × ¼"	½" × ¼"	" C2.	" A3.
2" × ¼"	2" × ¼"	"	- K4.
2" × ⅜"	2" × ⅜"	"	- K5.
2" × ½"	2" × ½"	"	- K6.

FIG. 23. ANGLE JOINT.



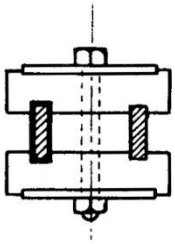
SIZE OF BUS-BARS	TIE BAR	CLAMP (CE810)
¾" X ¼"	1" X ⅜"	ASS'Y. G

FIG. 24. INTER-RACK BUSBAR SUPPORT.



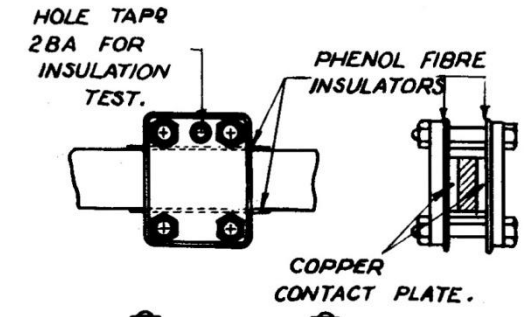
SIZE OF BUS-BARS		CLAMP (CE510)	
HORIZ.	VERT.	NEG.	POS.
2"x¼"	1½"x¼"	ASS'Y. D1	—
2"x⅜"	" "	" D2	—
2"x½"	" "	" D3	—
2"x¼"	¾"x¼"	" D4	ASS'Y. D7
2"x⅜"	" "	" D5	" D8
2"x½"	" "	" D6	
2"x¼"	½"x¼"	" D4	" D7
2"x⅜"	" "	" D5	" D8
2"x½"	" "	" D6	
2"x¼"	2"x¼"	—	" K4
2"x⅜"	2"x⅜"	" L1	" K5
2"x½"	2"x½"	" L2	" K6

FIG. 25. TEE JOINT (SUB-MAIN BUSBARS).



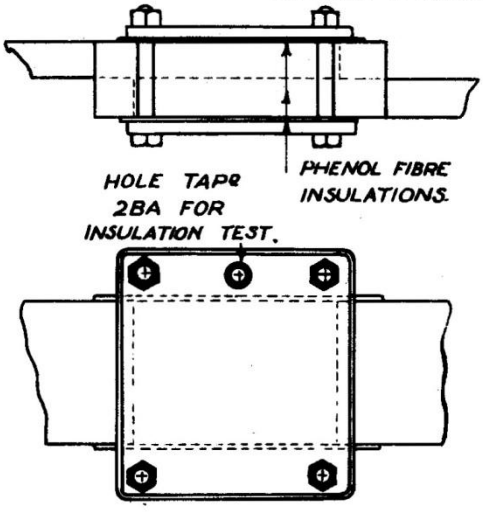
SIZE OF BUS-BARS	SPACER (CE510)
TWO ¾"x¼"	ASS'Y. H

FIG. 26. INTER-RACK BUSBAR SPACER.



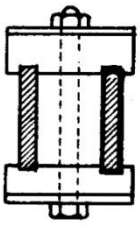
SIZE OF BUS-BARS	CLAMP (CE510)	
	NEG.	POS.
2¾"x¼"	ASS'Y. B1	ASS'Y. B2

FIG. 27. BUTT JOINT.



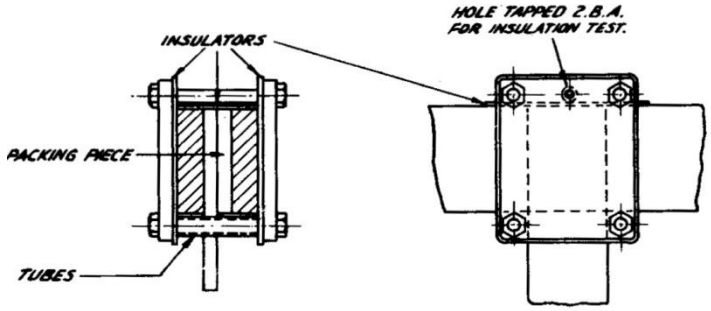
SIZE OF BUS-BARS	CLAMP (CE510)	
	NEG.	POS.
2"x¼"	ASS'Y. K1	ASS'Y. K4
2"x⅜"	" K2	" K5
2"x½"	" K3	" K6

FIG. 28. LAP JOINT (SUB-MAIN BUSBARS).



SIZE OF BUS-BARS	SPACER (CE 510)
TWO -2" X 1/4"	ASS'Y. J

FIG. 29. SUB-MAIN BUSBAR SPACER.



SIZE OF BUS BARS		CLAMP	
HORIZ.	VERT.	NEG.	POS.
2-2"×¼"	1½"×¼"	ASS'Y D9	
2-2"×¼"	¾"×¼"	ASS'Y D10	ASS'Y D11
2-2"×½"	½"×¼"		
2-2"×⅜"	1½"×¼"		
2-2"×⅜"	¾"×¼"		
2-2"×⅜"	½"×¼"		

FIG. 30. TEE JOINT (SUB-MAIN BUSBARS).

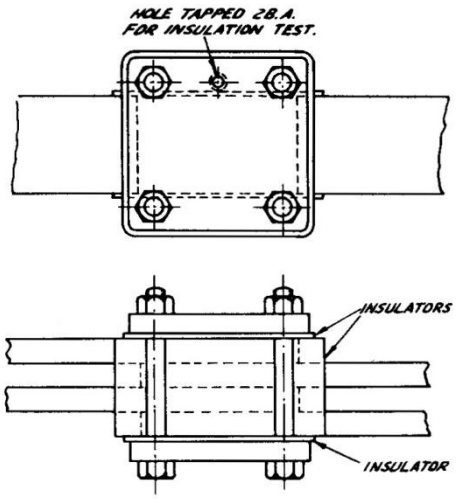


FIG. 31. LAP JOINT (SUB-MAIN BUSBARS).

8. SYNTHETIC RUBBER COATING OF BUSBAR.

8.1 This method of insulating busbars is still under test. A report must be sent to the Engineer-in=Chief at the end of six months trial.

8.2 Obtain supplies of busbar coated with synthetic rubber as follows:-

(i) When busbar is required at an installation make arrangements to withdraw from Store the required quantity of standard copper, or aluminium, busbar. Send the busbar to the depot of the contractor who is to coat the busbar.

(ii) After treatment send the busbar to the installation.

8.3 This will ensure that the minimum amount of damage is done to the busbar coating. In view of the damage that can occur on handling, supplies of coated busbar must not be held in store.

END.