

MERLIN GERIN
PUBLIC DISTRIBUTION PRODUCTS

OPERATING AND MAINTENANCE MANUAL

FOR

'SAIF'

SWITCHED AND INSULATED FUSEGEAR

WITH LOAD SHEDDING FACILITY

WARNING

ALL WORK ON THIS EQUIPMENT THAT MAY BE LIVE MUST BE CARRIED OUT IN COMPLETE COMPLIANCE WITH THE ELECTRICITY AT WORK REGULATIONS AND ALL SAFETY PROCEDURES MUST BE OBSERVED. IN PARTICULAR DUTY HOLDERS AND, PERSONS WORKING ON THIS ASSEMBLY OR ADJACENT TO IT, SHOULD NOTE THAT THE DEGREE OF PROTECTION IPXXB PROVIDED BY THIS ASSEMBLY (DOORS OPEN FOR OUTDOOR ASSEMBLIES) MAY NOT SAFEGUARD AGAINST THE POSSIBILITY OF SMALL DIAMETER OBJECTS E.G. CABLE STRANDS COMING INTO CONTACT WITH HAZARDOUS LIVE PARTS. IF WORK IS CARRIED OUT WITH ANY PART OF THE EQUIPMENT LIVE A RISK ASSESSMENT SHOULD BE CONDUCTED AND APPROPRIATE PROCEDURES SHOULD BE EMPLOYED.

DOCUMENT REFERENCE: **SALVF-LS** REVISION: **1**

DATE OF ISSUE: **27.09.2004**

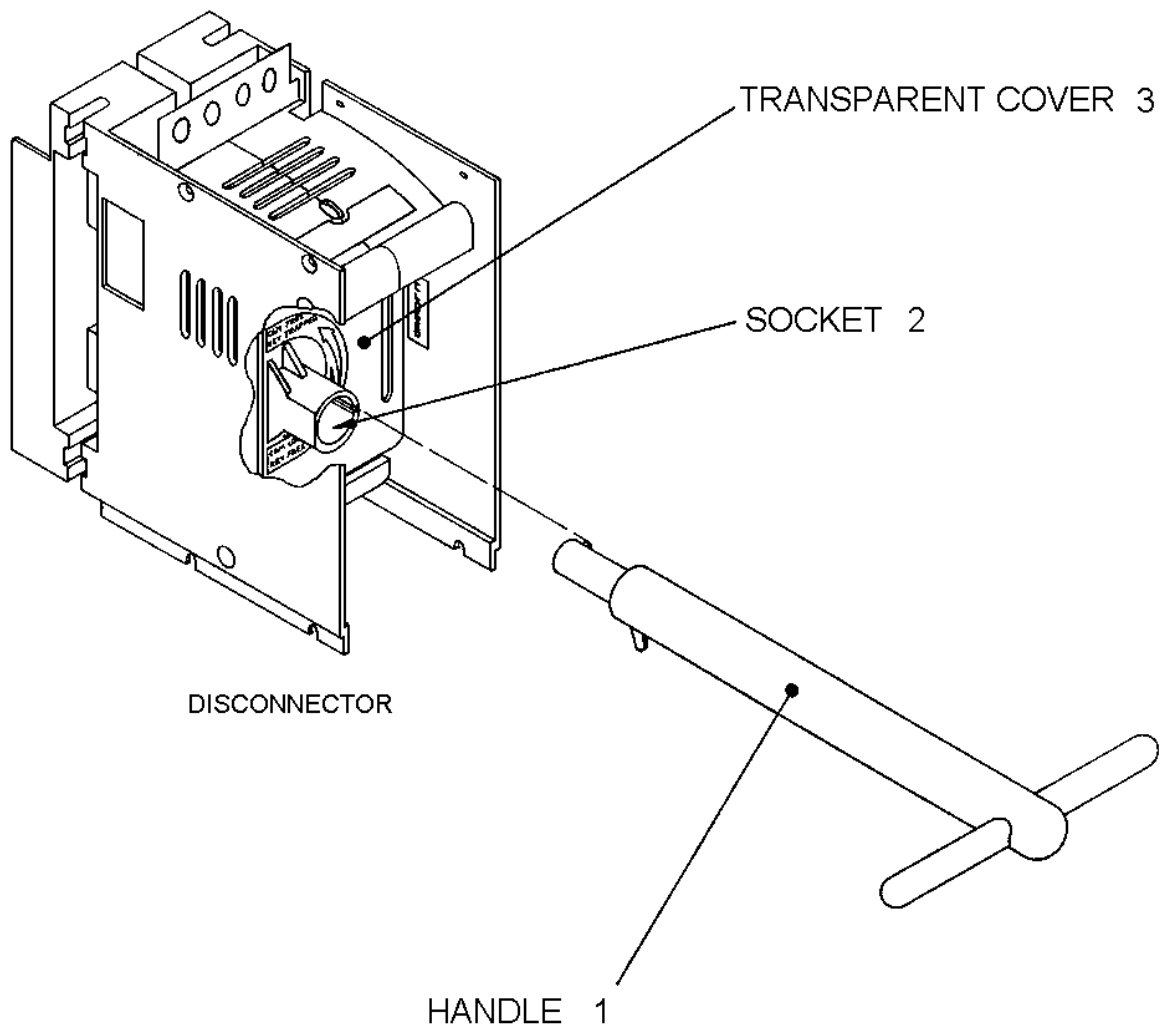
The successful operation of all switchgear and fusegear depends largely upon systematic inspection at regular intervals and the maintenance of all parts in a satisfactory condition. If the equipment described in this manual receives the recommended attention, it will give many years of reliable service.

Schneider Electric
Merlin Gerin Public Distribution Products
Eastfield, Scarborough, YO11 3DA, England
Tel: +44 (0) 1723 502800 Fax: +44 (0) 1723 502860
Web address: <http://www.schneider.co.uk>

	CONTENTS	PAGE
1	<u>OPERATION OF SAIF DISCONNECTOR</u>	
1.1	The disconnector	1.2
1.2	Closing a disconnector OFF-LOAD	1.2
1.3	Opening a disconnector OFF-LOAD	1.4
1.4	Disconnector INSPECTION position	1.4
1.5	Disconnector neutral link operation	1.7
1.6	Disconnector locking-off facilities	1.7
1.7	Routine test access	1.9
2	<u>OPERATION OF SAIF FUSEWAYS</u>	
2.1	The SAIF fuseway & mechanism	2.2
2.2	Switching ON & OFF	2.2
2.3	Removing & replacing fuse carriers	2.5
2.4	Fuse replacement 800, 630 & 400 BS types	2.5
2.5	Fuse replacement DIN types	2.7
2.6	Fuseway locking-off facilities	2.10
2.7	Routine test access	2.10
3	<u>INSPECTION & MAINTENANCE</u>	
3.1	General maintenance policy	3.1
3.2	Frequency of maintenance	3.1
3.3	Routine inspection	3.5
3.4	Examination & service of disconnectors	3.8
3.5	Examination & service of fuseways	3.8
3.6	Examination & service of enclosures	3.9
3.7	Fuseway replacement	3.12
3.8	Fuseway C.T change	3.14
3.9	Disconnector replacement	3.15
3.10	General overhaul	3.17
3.11	Post fault maintenance	3.18
4	<u>SPARES</u>	4.1
5	<u>KEY TO ILLUSTRATIONS</u>	5.1
6	<u>SUPPLIMENTARY INFORMATION</u>	
6.1	Load shedding contactor circuits	6.1
6.2	Operation of busbar selector links	6.1

FIG 1.1A

OPERATION OF SAIF DISCONNECTOR



1 OPERATION OF SAIF DISCONNECTOR

1.1 The Disconnecter

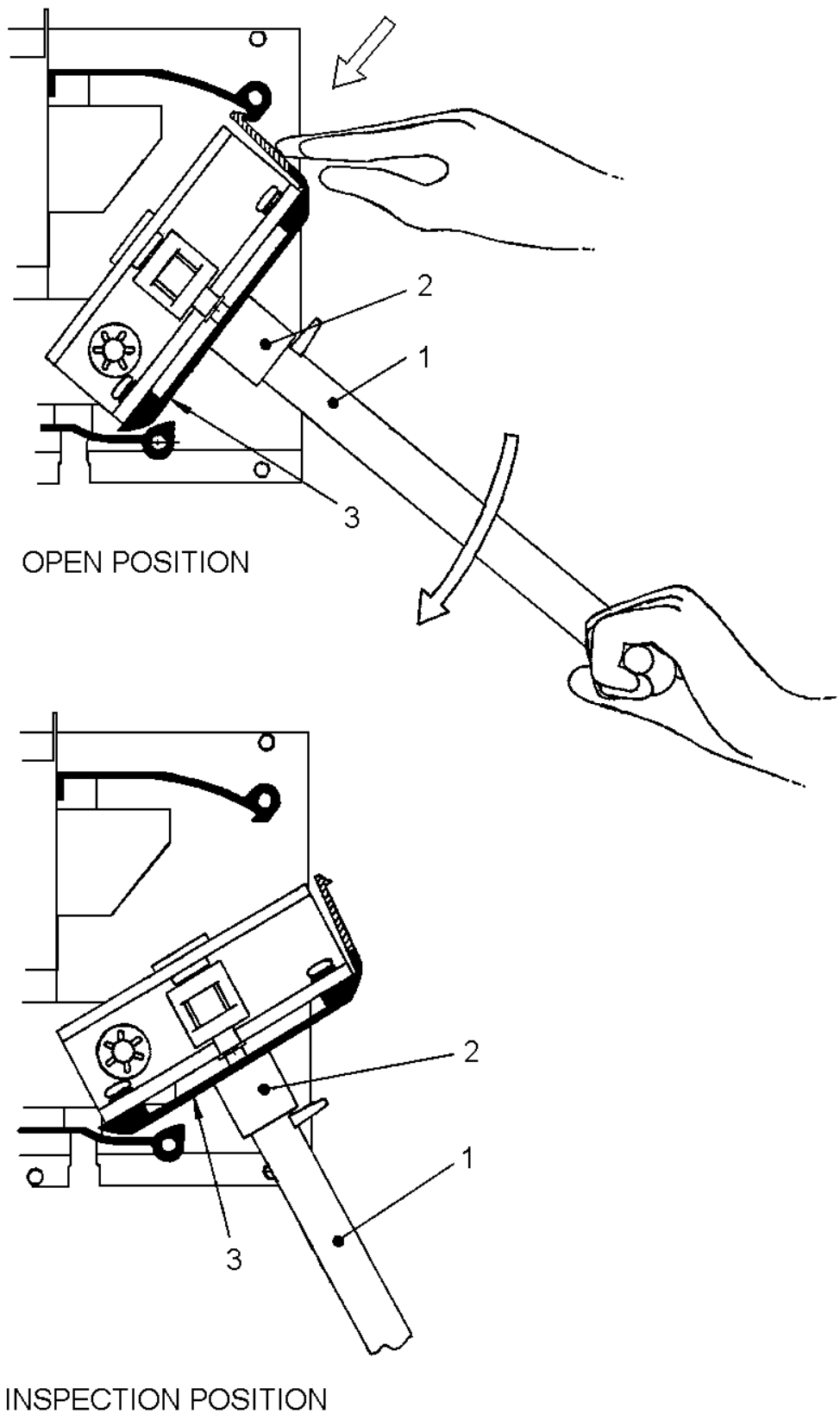
- 1.11 Essentially a hinged link off-load isolator of an insulated and interlocked design, the SAIF disconnecter comprises three single phase units and a bolted neutral link, in identical moulded supports. They can be arranged in a integrated vertical format or in an horizontal format.
- 1.12 Operation is by means of a special insulated tool (1), with interlocks to ensure that it can only be removed when the disconnecter is properly closed and full contact pressure applied, or when the disconnecter is fully and positively locked open. At any intermediate position, the tool is locked into the disconnecter and cannot be rotated.
- 1.13 Initial contact pressure is provided by springs, replaced in the closed position by clamping forces from a mechanical cam arrangement.
- 1.14 In addition to the OPEN and CLOSED positions the disconnecter has an INSPECTION position for examination and servicing only, which gives access to its contacts. This should NOT be undertaken with the equipment LIVE and involves an outage of the whole equipment.

1.2 Closing a Disconnecter Off-Load

- 1.21 Insert the operating handle (1) into the socket (2) in the disconnecter's transparent cover (3). Interlock pins and cutouts will ensure that the handle cannot be inserted in the wrong position.
- 1.22 Rotate the handle anti-clockwise through 180° to free the disconnecter and trap the handle.
- 1.23 Push up on the handle to pivot the front cover (3) back and up, closing the contacts to connect one phase to the transformer.
- 1.24 Rotate the handle clockwise through 180° to lock the disconnecter closed and release the handle.
- 1.25 Remove the handle.

FIG 1.4A

DISCONNECTOR INSPECTION POSITION



1.3 Opening a Disconnecter Off-Load

- 1.31 Insert the operating handle (1) into the socket (2) in the disconnecter's transparent cover (3). Interlock pins and cutouts ensure that the handle cannot be inserted in the wrong position.
- 1.32 Rotate the handle anti-clockwise through 180° to release the contact pressure.
- 1.33 Pull down on the handle to pivot the front cover (3) forward and down, opening the contacts to isolate one phase from the transformer.
- 1.34 Rotate the handle clockwise through 180° to lock the disconnecter open and release the handle.

1.4 Disconnecter Inspection position

- 1.41 MAKE THE TRANSFORMER DEAD FROM THE PRIMARY SIDE. Ensure there are no supplies from any interconnectors and that the equipment is completely dead.
- 1.42 With the disconnecter in the OPEN position, insert the operating handle (1) into the socket (2) in the disconnecter's transparent cover (3). Interlock pins and cutouts will ensure that the handle cannot be inserted in the wrong position.
- 1.43 Rotate the handle anti-clockwise through 180° to free the disconnecter cam and trap the handle. Keep holding it with one hand.
- 1.44 Maintain gentle pressure pulling down on the operating handle (1). At the same time with your free hand press down on top of the disconnectors transparent cover (3), this will release the safety catches allowing the disconnecter to open fully.
- 1.45 Turn the handle 180° clockwise to tighten the cam, lock the disconnecter in the INSPECTION position and release the handle.
- 1.46 Reverse the above to return the disconnecter to the OFF position, but it is not necessary to press down on the top of the disconnecter cover (3) as the safety catches automatically re-latch themselves upon closing the disconnecter.

FIG 1.5A

NEUTRAL LINK DISCONNECTOR

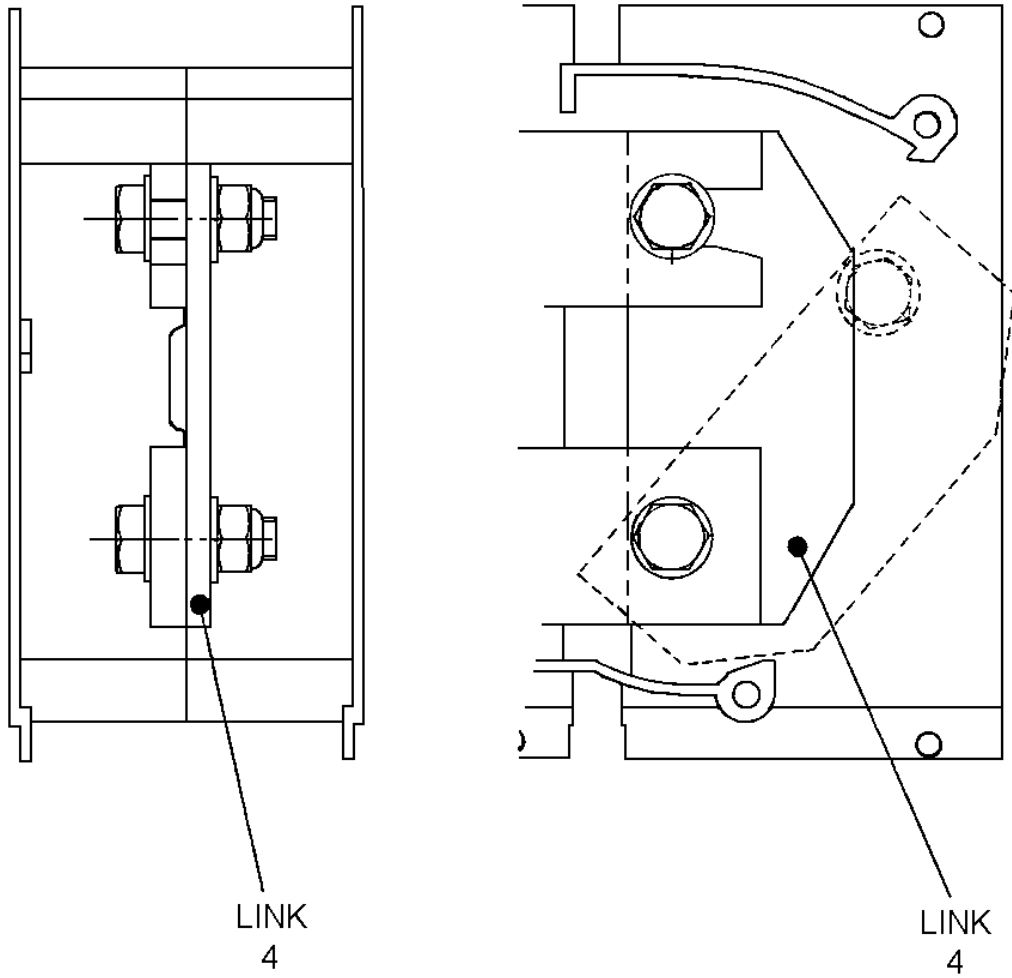
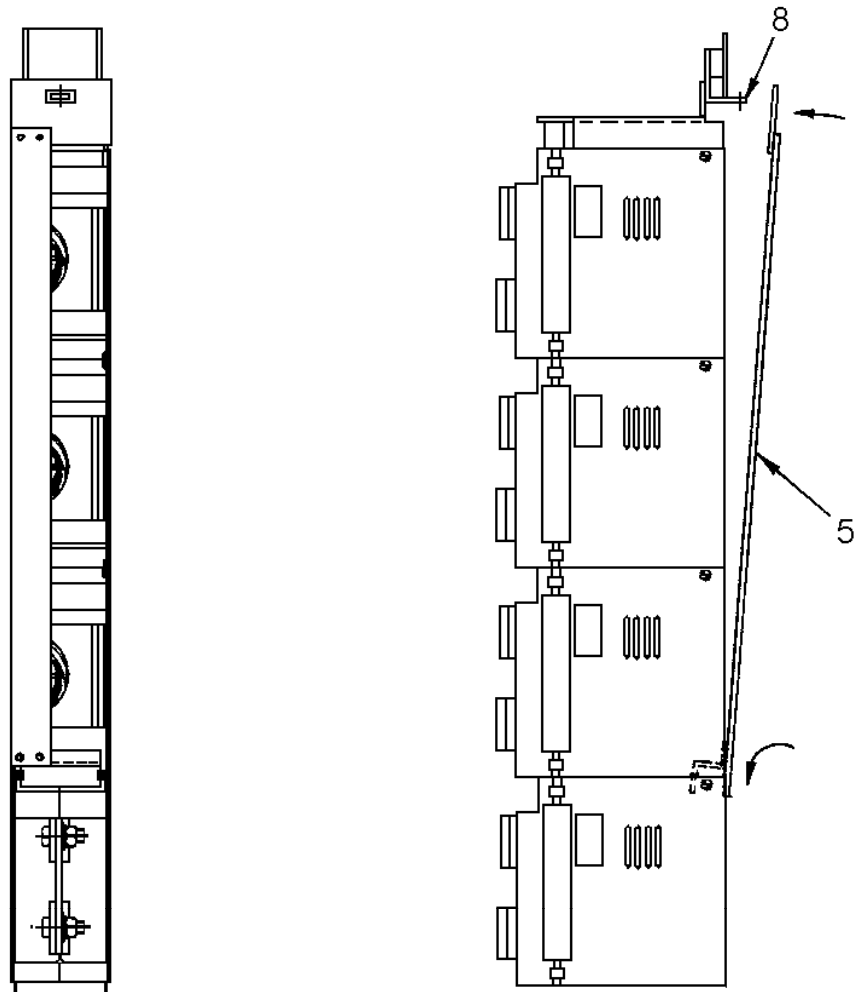
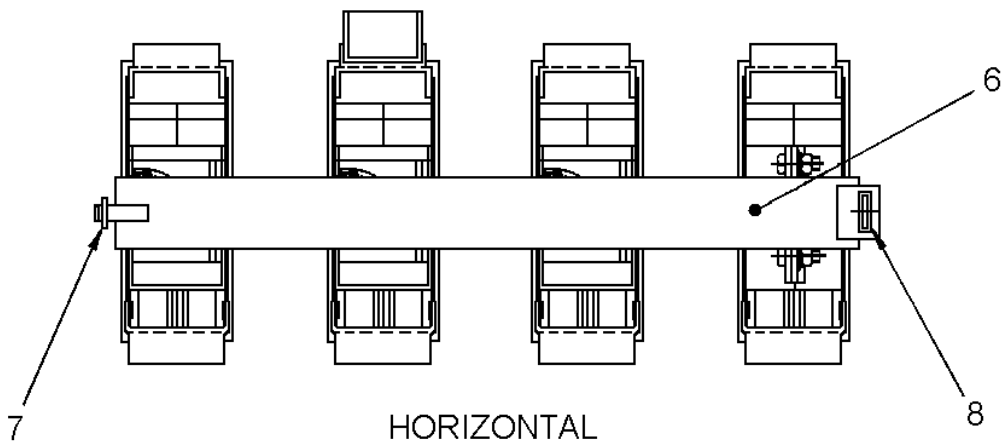


FIG 1.6A

DISCONNECTOR LOCKING OFF DEVICES



VERTICAL



HORIZONTAL

1.5 Disconnecter Neutral Link Operation

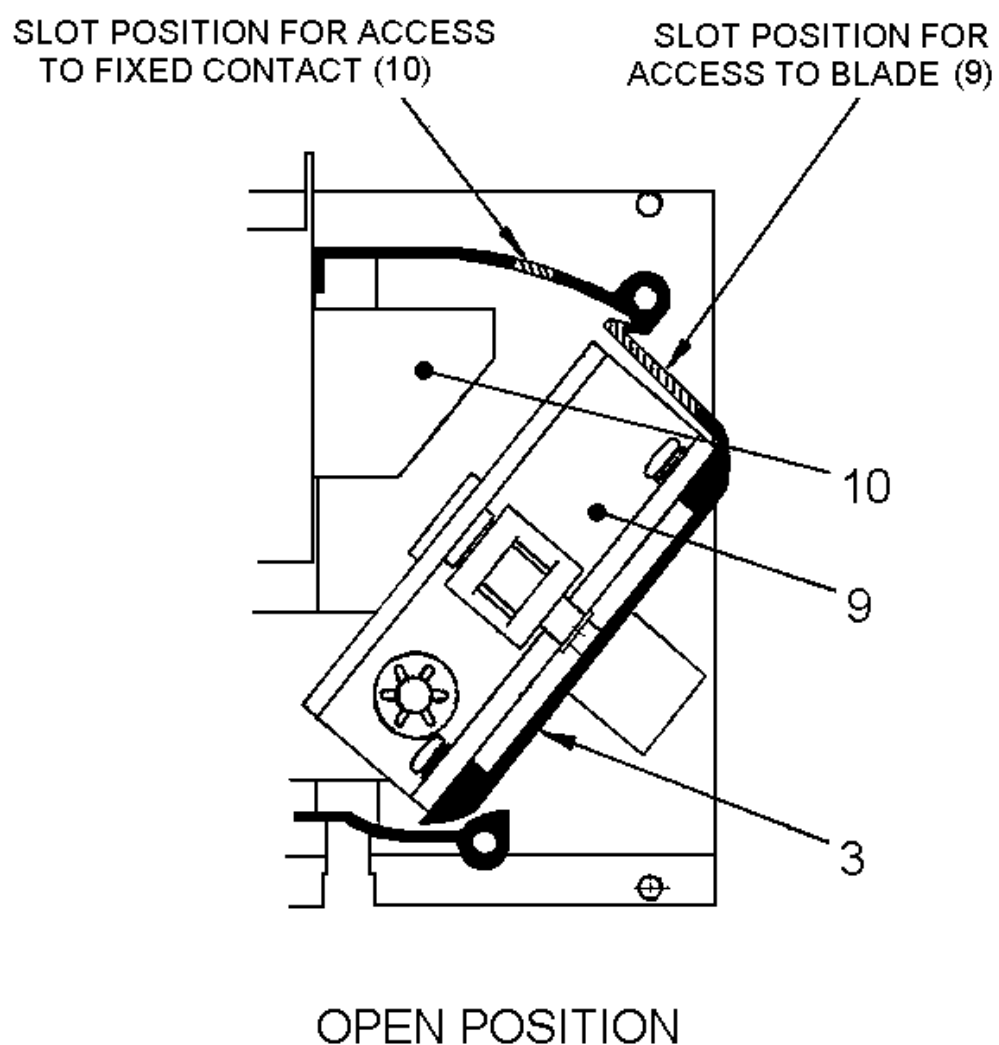
- 1.51 To disconnect the neutral link (4) of a SAIF disconnector assembly, first open the three phase disconnectors as described in 1.3 above.
- 1.52 Using a spanner, unscrew the top and bottom screws of the disconnector. Pull back on the upper screw to pivot the link backwards and downwards. Tightening the lower screw will then hold the link open.
- 1.53 To close the neutral link, slacken the lower screw, push the link to the closed position and tighten both top and bottom screws.

1.6 Disconnecter Locking-Off Facilities

- 1.61 Two types of locking-off device enable SAIF disconnectors in vertical or horizontal format to be locked off, whether OPEN or CLOSED, so that it is impossible to insert the operating handle.
- 1.62 On vertical arranged disconnectors, hook the lower end of the device (5) behind the nuts on the sidewall at the bottom of the blue phase module, which secure it to the neutral module. Fit the metal upper end of the device over the padlock eye beneath the circuit label. Fit a padlock to the padlock eye.
- 1.63 On horizontally arranged disconnectors, hook one end of the device (6) through the slotted plate (7) at the left hand side of the left hand disconnector. Pass the other, metal end of the device over the padlock eye (8) to the right hand side of the right hand end disconnector. Fit a padlock to the padlock eye.

FIG 1.7A

DISCONNECTOR ROUTINE TEST ACCESS



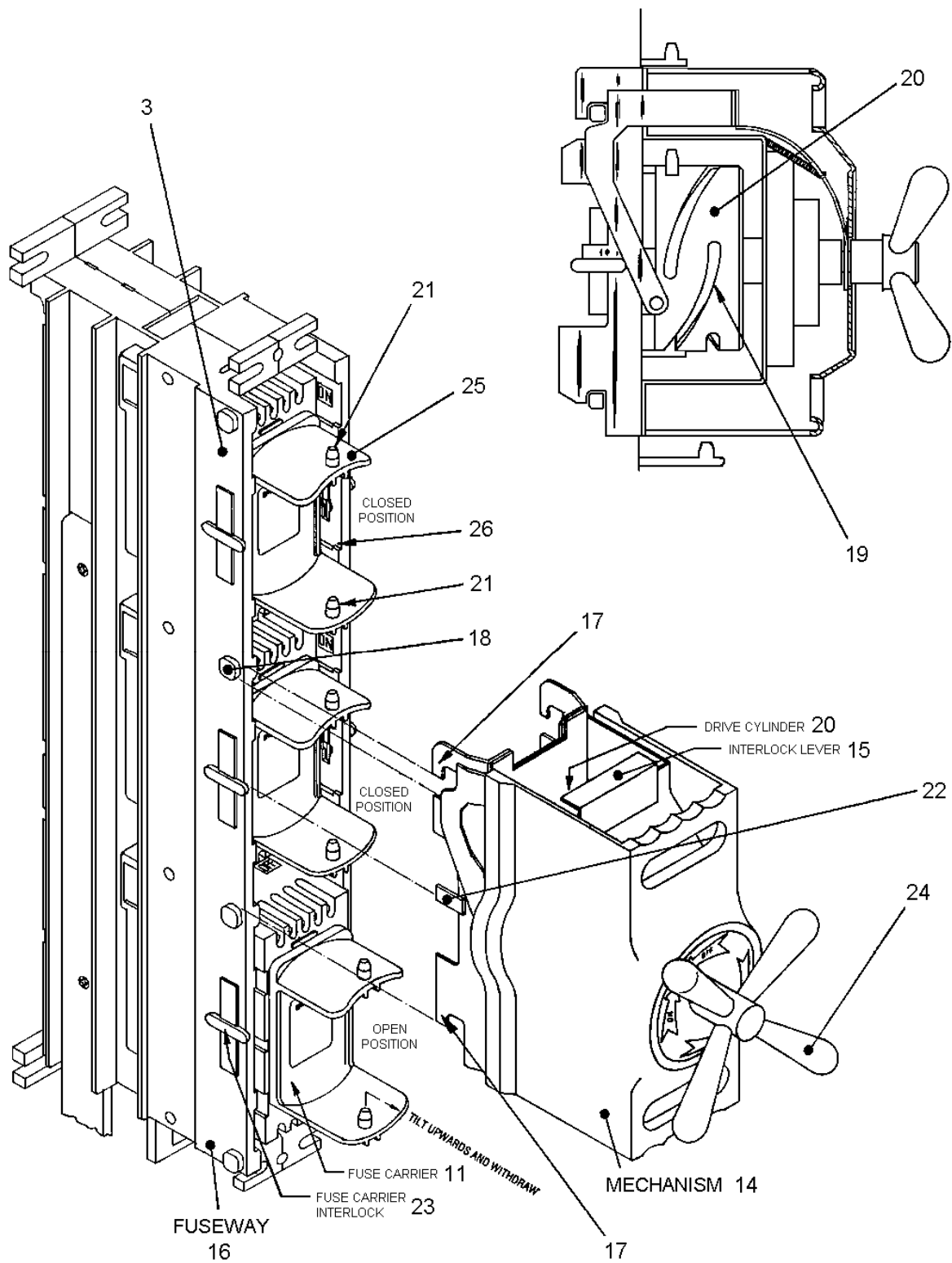
1.7 Routine Test Access

- 1.71 Whilst fully complying with the requirements of IP2X protection to IEC 529, the design of SAIF disconnectors permits a wide variety of routine monitoring tests to be carried out, using standard lamps or voltmeter probes.
- 1.72 With a disconnector in the OPEN but not the INSPECTION position (that is, with IP2X protection preserved), access to the blade ends (9) through slots in the top of the disconnector cover (3) permit phase to phase tests on the incoming supply. Access to the fixed contact (10) is through a small slot in the disconnector moulding above the fixed contact (10).
- 1.73 Testing on the busbar side (10) of an OPEN disconnector is possible through slots in the top of the fixed moulding or more readily, by using the topside of a fuseway, as discussed in 2.72 and 2.73.

NOTE:- With the horizontal configuration of disconnector the busbars may be connected to the bottom terminals that is, blade ends (9) of the disconnector.

FIG 2.1

OPERATION OF SAIF FUSEWAY



2 OPERATION OF SAIF FUSEWAYS

2.1 The SAIF Fuseway and Mechanism

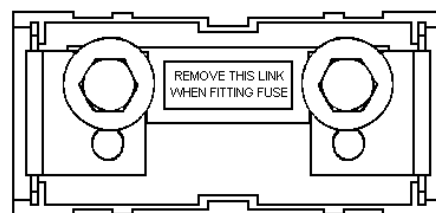
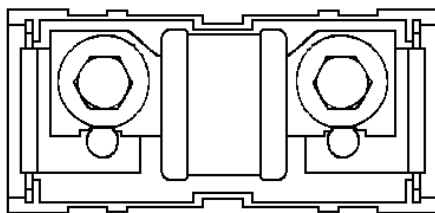
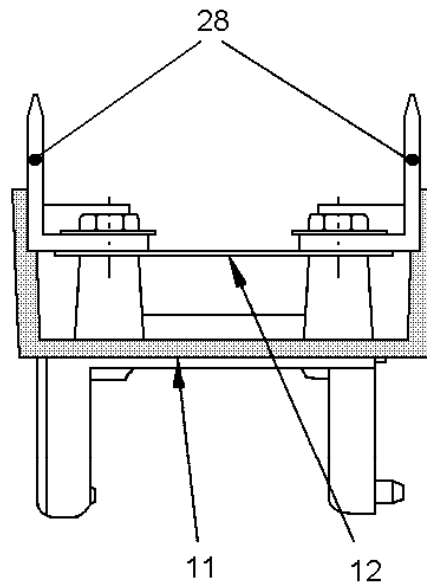
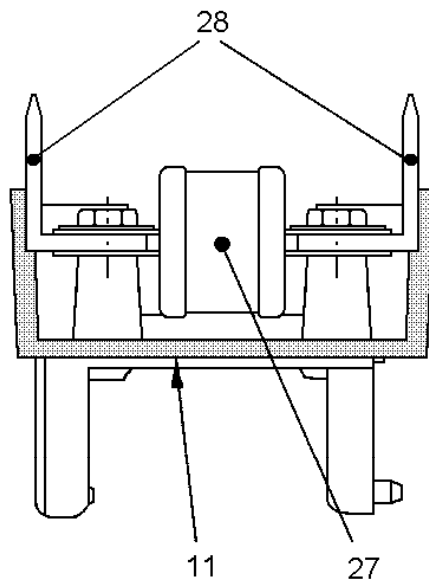
- 2.11 The 'SAIF' switchable and insulated fuseway is switched by means of a portable, independent manual spring mechanism (8) which gives it a single-phase, on - or off-load switching capability to category AC22 of BS5419. Fuse carriers (9) can only be switched between the ON and OFF positions by means of the mechanism: interlocks prevent manual operation.
- 2.12 The mechanism operates in a rotary fashion, each opening (anti-clockwise) or closing (clockwise) operation taking it through a quarter of a circle. The mechanism never needs to be reset and can be operated any number of times in succession in either direction, as when switching on or off all the circuits on a fuseboard; or successively in opposite directions, as in an OFF-ON-OFF sequence.
- 2.13 Fuse carriers must NOT be switched ON unless they have a fuse (27) or dummy link (12) (fitted for delivery) fastened between their contacts. Attempting to operate them empty can lead to incomplete contact engagement and jam the mechanism and carrier in an inoperable condition.

2.2 Switching ON and OFF

- 2.21 Note the position of the fuse carrier (11) in the fuseway. If it is OFF, a green label reading OFF will be visible on top of the fuse carrier. If it is ON, a red label reading ON will be visible on the fuseway sidewall (13). See the safety note at paragraph 2.13 above.
- 2.22 Hold the mechanism (14) by its top and bottom handles, so that the interlock lever (15) is at the top. Pull back the interlock lever with the fingers of your upper hand (see diagram).
- 2.23 Move the mechanism forward and down onto the fuseway (16) so that the locating hooks (17) engage the locating bosses (18). At the same time, the drive slots (19) in the drive cylinder (20) will engage the drive dowels (21) on the fuse carrier (11).
- 2.24 As the mechanism settles onto the locating bosses, interlock lugs (22) will depress the fuse carrier interlocks (23) on the fuseway sidewall (13). The position of the carrier is now determined by the position of the drive cylinder.

FIG 2.4A

VIEW OF FUSE AND CONTACTS (630 & 400 BS TYPE)
DUMMY LINK IN POSITION

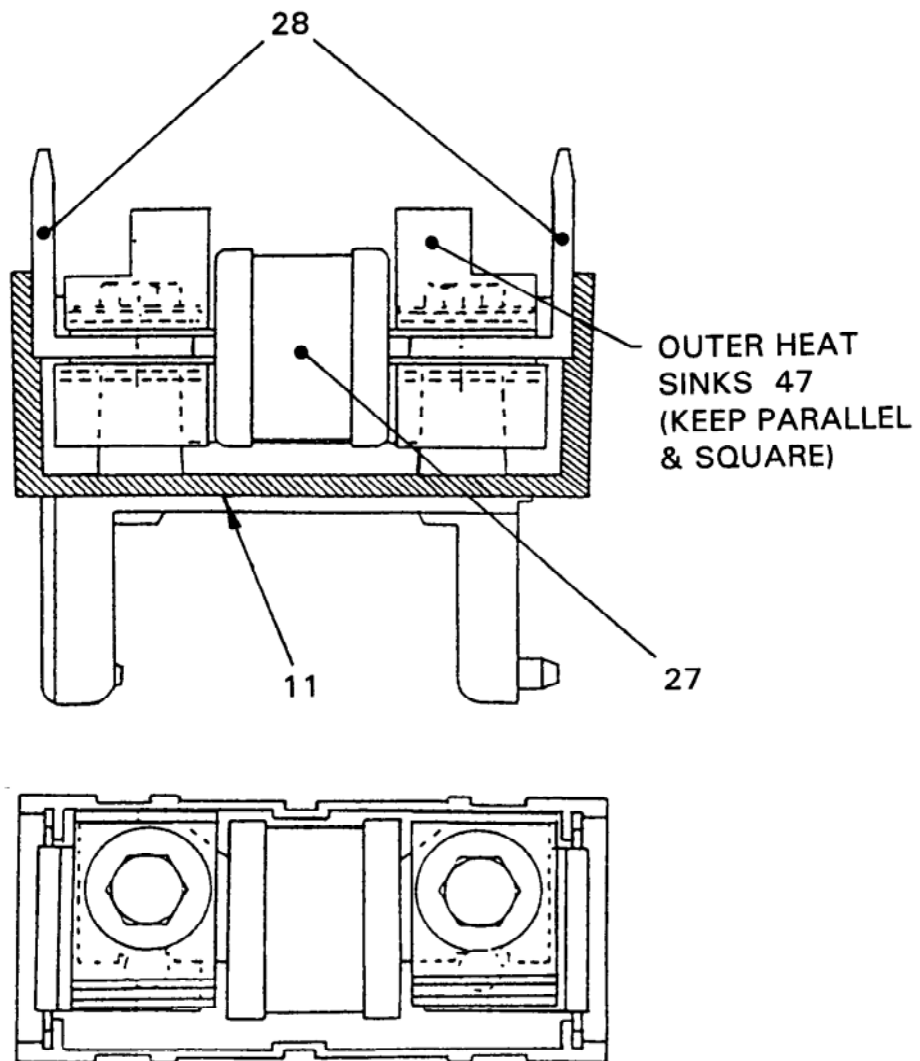


VIEW OF FUSE IN POSITION

VIEW OF DUMMY LINK IN POSITION

FIG 2.4B

VIEW OF FUSE AND CONTACTS (800 BS TYPE)



- 2.25 Release the interlock lever (15). As it springs away from you, it will lock the mechanism (14) onto the locating bosses (18), and release the mechanism drive.
- 2.26 Rotate the mechanism capstan handle (24), either clockwise to drive a fuse carrier into the ON position, or anti-clockwise to pull it into the OFF position. Either operation involves a 90° turn. If you do not turn the handle strongly or far enough, the mechanism will not operate and the handle will settle back safely to its original position. If you do operate it strongly and far enough, the mechanism will pass its spring charged/de-latch position and the springs will take over to drive or pull the fuse carrier with sufficient force to make a fault current or break a load current.
- 2.27 With the switching operation complete, pull back the interlock lever (15) and lift the mechanism (14) clear. It does not need to be reset for the next operation.

2.3 Removing and Replacing Fuse Carriers

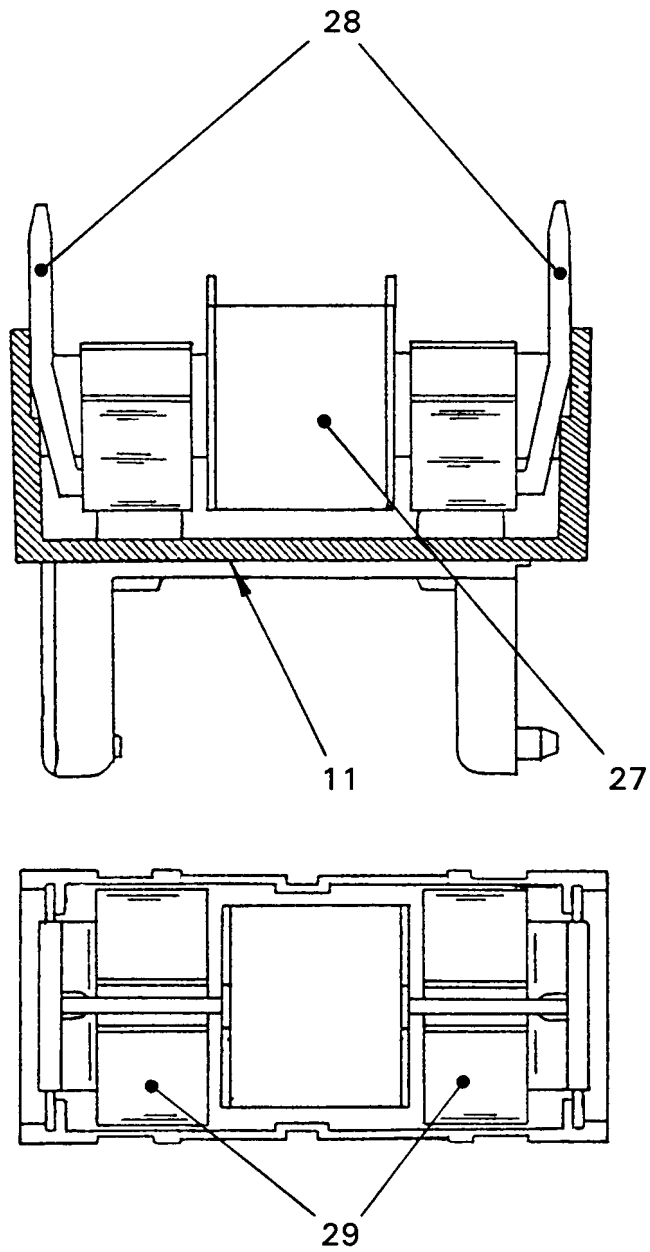
- 2.31 A SAIF fuse carrier (11) can only be removed from the fuseway (16) if it is in the OFF position, as indicated by a green label reading OFF being visible on top of the carrier. If it is ON, as indicated by a red label reading ON being visible on the sidewall (13), the fuse carrier must be switched to OFF using the mechanism (14) as described in 2.2 above.
- 2.32 With the fuse carrier OFF, tilt the orange-coloured front drive arms (25) upwards by approximately 6mm (1/4 in) and lift and gently pull the carrier (11) away from the fuseway (16), to remove it.
- 2.33 To replace a fuse carrier (11) in the fuseway (16), hold the carrier by its upper orange front drive arm (25), slightly above its final position and push it gently into the fuseway. It should slide along, and drop by 3mm behind, the securing lips (26) on the sidewall (13).
- 2.34 When a fuse carrier (11) is replaced in the fuseway (16) it is automatically in the OFF position and cannot be switched to the ON position except by use of the operating mechanism (14).

2.4 Fuse Replacement 800, 630 and 400 BS Type

Note : 800 BS & 630 BS SAIF fuse carriers accept 'J' type fuse links (92mm centres) to BS 88 Part 5 ratings up to 630A and 800A respectively.

FIG 2.5A

VIEW OF FUSE AND CONTACTS (DIN TYPE)



400 BS SAIF fuse carriers accept 'J' type fuse links (82mm centres) to BS 88 Part 5 ratings up to 400A.

- 2.41 Remove the fuse carrier (11) from the fuseway (16) as described in 2.3.
- 2.42 Lay the carrier on a workbench or other firm, level surface with the moving contacts (28) uppermost and, using a 19mm ring spanner or socket for the 800 & 630 BS Type or 17 ring spanner or socket for the 400 BS Type, unfasten and remove the two fixing screws and their disc spring washers.
- 2.43 Lift out the fuse (27) or dummy link (12) and moving contacts (28), withdraw the contacts from the fuse tags (with the 800 BS Type the outer heat sinks (47) are also removed) and discard the fuse or dummy link.
- 2.44 Place the moving contact (28) between the fuse tags of the new fuse and place the assembly in the fuse carrier. Note that the contacts fit into recesses in the top and bottom of the carrier moulding. Note also that with the 630 BS Type, with the fuse barrel in the centre of the carrier, the fuse tags must lie to the side of the carrier adjacent to the tapped fixing bosses. For the 800 BS Type re-position the outer heat sinks (47) onto the moving contacts (28).
- 2.45 Refit the two fixing screws, complete with their disc spring washers, and tighten to a torque of 40Nm 800 & 630 BS Type/24 Nm 400 BS Type, or until the disc spring washers are flattened and increased resistance is felt. Note with the 800 BS Type that the outer heat sinks (47) should be kept parallel and square to the moving contact (28) during tightening.

2.5 Fuse Replacement DIN Type

- 2.51 Remove the fuse carrier (11) from the fuseway (16) as described in 2.3.
- 2.52 Using a fuse puller pull out the fuse (27) from between the sprung fuse blade contacts (29) noting that it is necessary to angle one end of the fuse to clear the slot in the centre of the moving contact (28). Discard the fuse.
- 2.53 Fit the new fuse in the moving contacts (28) sliding one end of the fuse in first and pushing the fuse fully into the sprung fuse blade contacts (29).

FIG 2.6A

SAIF FUSEWAY LOCKING OFF FACILITIES

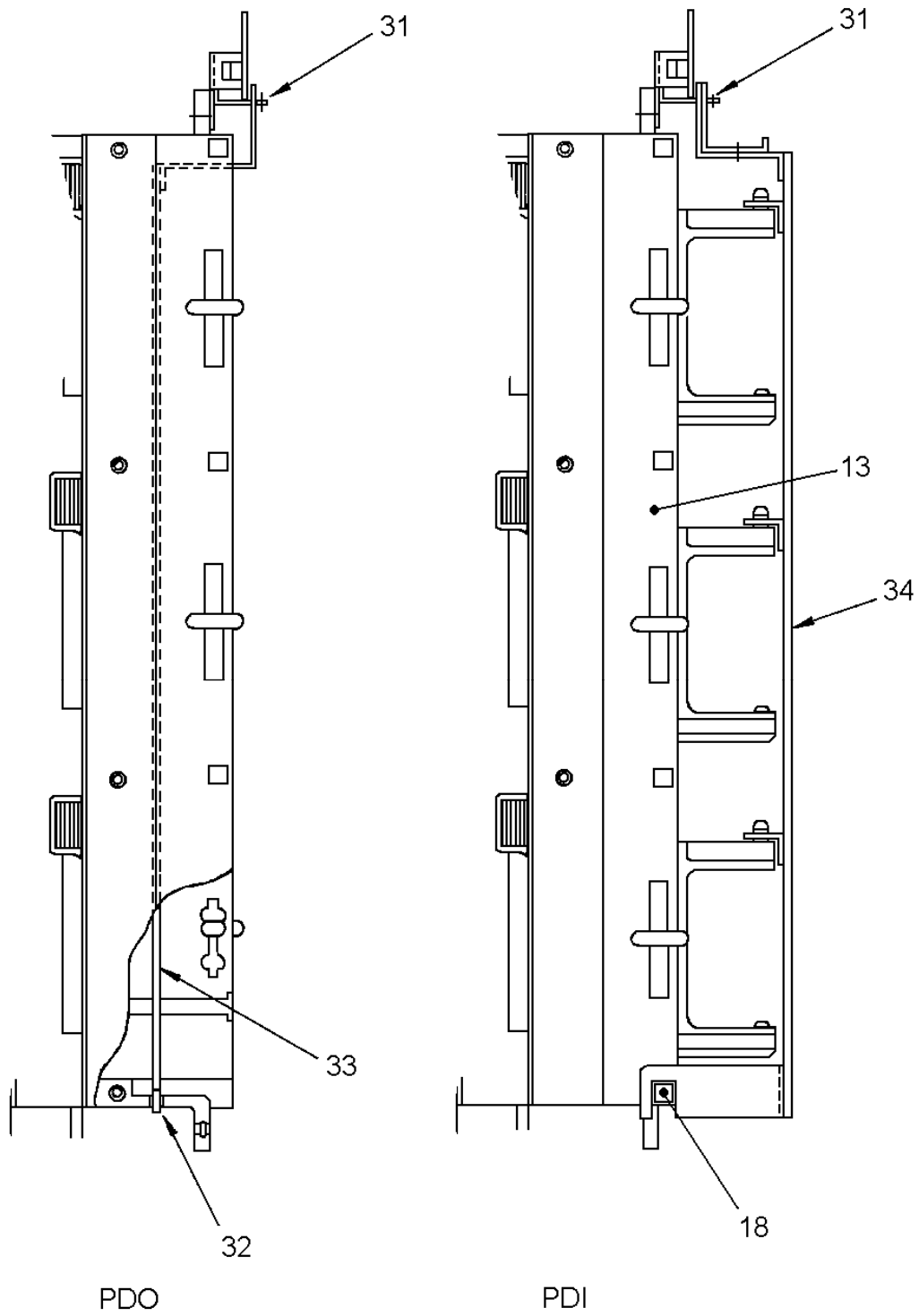
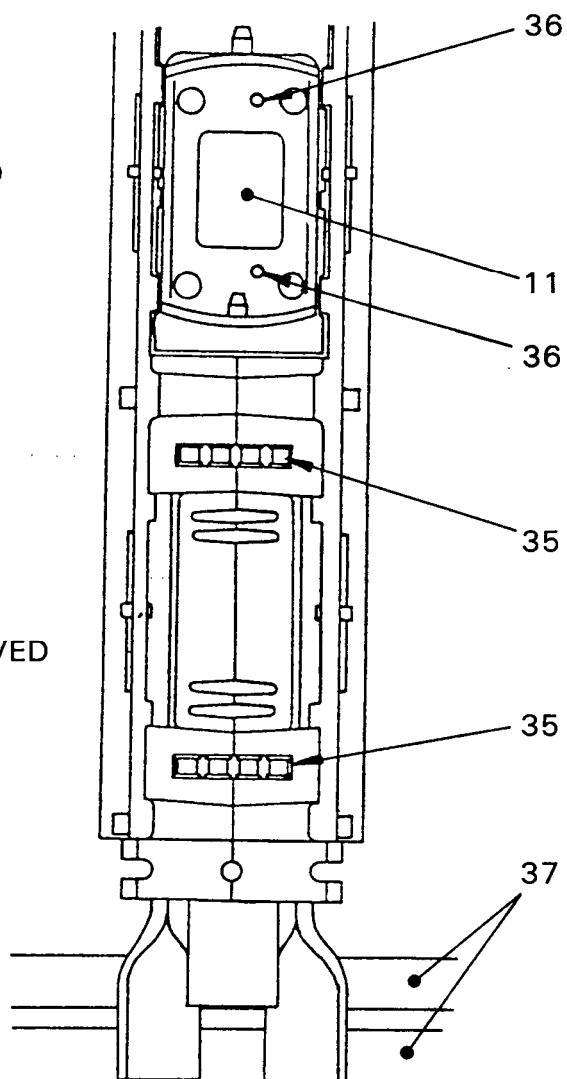


FIG 2.7A

ROUTINE TEST ACCESS

FUSE CARRIER FITTED
(CLOSED)

FUSE CARRIER REMOVED



2.6 Locking-Off Facilities

- 2.61 Two types of locking-off device enable SAIF fuseways to be locked off, when empty so that no fuse carriers can be inserted, or locked off with fuse carriers in place so that the carriers can be neither switched OFF if ON, switched ON if OFF, or removed.
- 2.62 To lock a SAIF fuseway with the fuse carriers removed, insert a locking-off device type PDO (33) so that its lower end engages in the slot (32) in the floor of the fuseway moulding and the slot in the cranked upper metal end of the device passes over the padlock eye (31) beneath the circuit label. Fit a padlock to the padlock eye.
- 2.63 To lock off a SAIF fuseway with the fuse carriers in position, place a locking-off device type PDI (34) so that its retaining hooks engage the lowermost set of locating bosses (18) on the outsides of the fuseway sidewalls (13) and the slot in the cranked upper metal end of the device passes over the padlock eye (31) beneath the circuit label. Fit a padlock to the padlock eye.
- 2.64 In both cases, the circuit is released by unlocking the padlock and lifting off the device.

2.7 Routine Test Access

- 2.71 Whilst fully complying with the requirements of IP2X protection to IEC 529, the design of SAIF fuseways allows a wide variety of routine monitoring tests to be carried out, using standard test lamps or voltmeter probes.
- 2.72 When a fuse carrier is removed, the fixed busbar and feeder contacts (35) are accessible through their respective slots in the back of the relevant compartment in the fuseway.
- 2.73 When a fuse carrier (11) is in place and switched to ON, two circular openings (36) in the front face of the carrier body contain contacts connected to the two ends of the fuse, for checks to see if the fuse has ruptured.
- 2.74 Using the lower contact in 2.72 or 2.73 and the neutral busbar (37) at the bottom allows phase to neutral testing of the outgoing circuit.
- 2.75 Using the contacts described in 2.72 and 2.73 on different phases allows phase to phase testing of outgoing circuits.

3 INSPECTION AND MAINTENANCE

3.1 General Maintenance Policy

3.11 This document is to be used as a guide to the maintenance of SAIF type low voltage assemblies. It should be read in conjunction with BS6423: 1983, the current British Standard code of practice for the maintenance of electrical switchgear and controlgear for voltages up to and including 650V, which sets out recommendations for safe conditions during maintenance work and guidelines for maintenance procedures.

3.12 It is assumed throughout that the precautions necessary to render the apparatus safe to work on, including the isolation of normally live parts as required, have been taken. However, reminders are included where this is felt appropriate.

3.2 Frequency of Maintenance

3.21 Different environments, loadings, types of load and frequency of operation will all affect the maintenance requirements of low voltage fuses, isolators, on-load switching devices and boards, so that the following recommendations are for guidance only.

3.22 Almost a decade of in-service experience has shown the SAIF range of equipment to suffer very little contact burning on either the on-load switched fuseway/fuse carrier contacts or the off-load switched disconnecter contacts. In the case of fuseways and fuse carriers, this is because the use of an independent manual switching mechanism and spring-loaded fixed contacts prevents any hesitation in operation or loose connections in service. In the case of disconnectors, the impossibility of removing the operating handle until the cam mechanism has firmly locked the blades closed or open also prevents arcing or overheating in service.

The following recommendations are based on:

(i) **Indoor Equipment** installed indoors in dry, well-ventilated substations or switchrooms, with atmospheres which are not unduly corrosive, and employed on normal distribution duties.

(ii) **Outdoor Equipment** installed outdoors where the atmospheric conditions of the site are reasonably clean and the equipment is not subject to excessive pollutions, such as occurs in some industrial or coastal areas, and employed on normal distribution duties.

It is recommended that the following intervals are considered but may be reduced to cater for any adverse conditions. Operational experience will determine how much more or less attention particular installations require.

3.23 Due to the unique operational features of SAIF distribution equipment and the desirability of minimising interruptions to the public electricity supply, conventional definitions of:-

- (i) inspection and operation check,
- (ii) servicing and
- (iii) examination and overhaul

are not precisely applicable. In the case of units supplying bulk consumers, it may be possible to schedule substation outages with the customers' own maintenance programmes. Where a number and variety of consumers are served by an installation, however, an escalating programme as follows is suggested.

3.24 **Routine inspection**, essentially visual and involving no operations or system outages, should be undertaken as frequently as possible and in any case at least once every 12 months. For specific details see 3.3.

3.25 **Examination and Service**, should be undertaken at least every five years, during which:

(i) **Disconnectors** are opened for examination and lubrication. This involves an outage of the whole equipment. For specific details see 3.4.

(ii) **Fuseways** have their fuse carriers removed for examination and lubrication of the contacts, and also an examination of the fuses. This involves an outage of the particular feeder circuits. For specific details see 3.5.

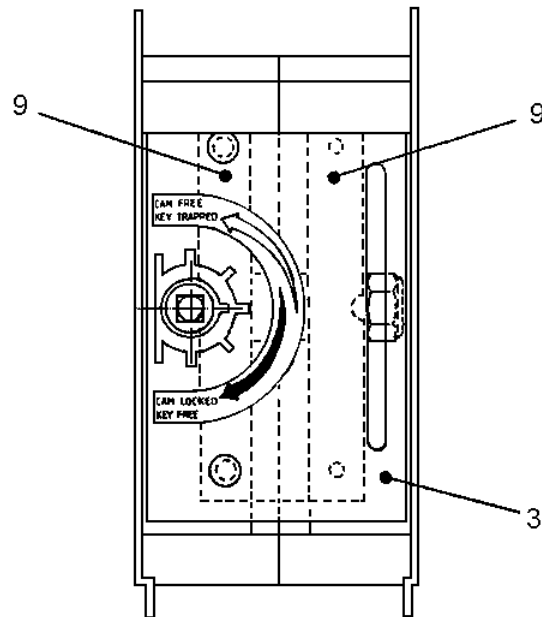
(iii) **Enclosures**, exterior and accessible interior parts are cleaned. This does not involve any outage of the equipment. For specific details see 3.6.

Where interrupting the supply could cause major problems, the period between services may be extended, but we would recommend extreme caution and very careful inspection between services.

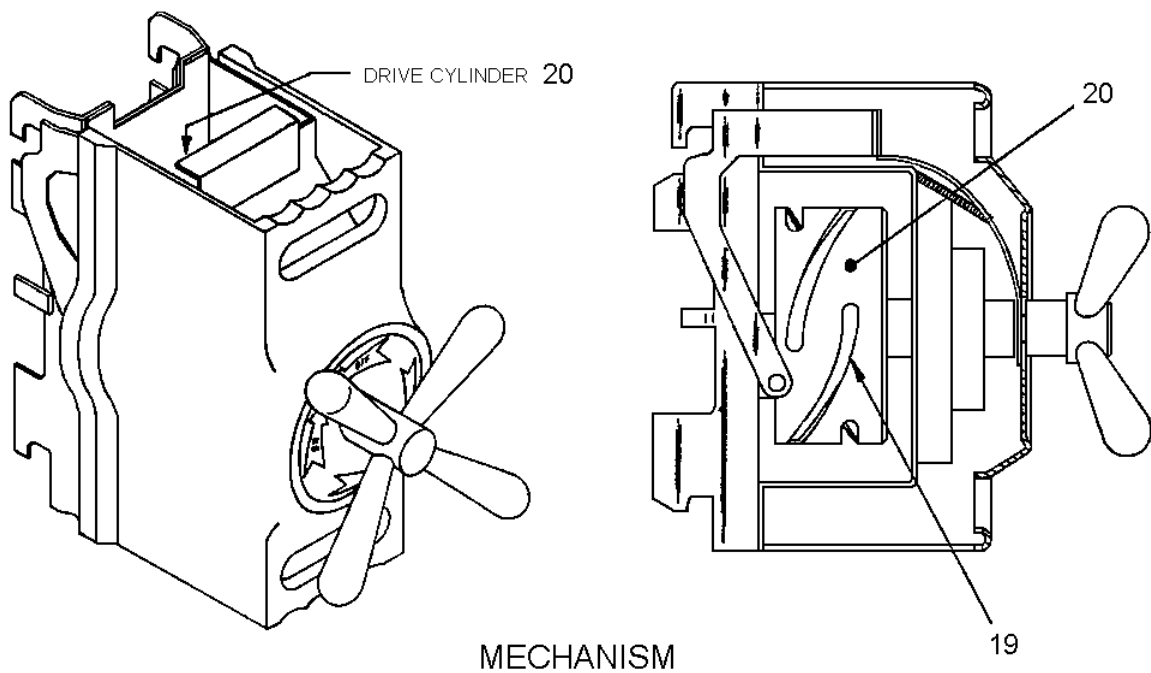
- 3.26** **Fuseway replacement** which may be indicated by the findings of an examination and service, this preferably involves making the whole low voltage assembly dead. Where it is essential a fuseway may be replaced with the busbars and adjacent fuseways live, but the guidance note at the start of section 3.7 should be observed. For specific details see 3.7.
- 3.27** **Disconnecter replacement**, involves making the whole low voltage assembly dead, and can usefully be combined with transformer and/or medium voltage switchgear maintenance. For specific details see 3.9.
- 3.28** **General overhaul** involves making the whole low voltage assembly dead and partially dismantling it to give access to busbar and riser supports and other normally inaccessible components. Such an overhaul need only be undertaken when indicated by inspection, servicing or testing, or every fifteen years, whichever is the sooner. For specific details see 3.10.

FIG 3.3A

ROUTINE INSPECTION



DISCONNECTOR



MECHANISM

3.3 Routine Inspection

- 3.31 On entering the substation or opening the enclosure doors, listen for any sizzling noise due to electrical discharge or rattling of loose components; sniff for any unusual smell which may indicate an electrical discharge or overheating; have a general look round.
- 3.32 Check that the room is clean, dry and well-ventilated and that external ventilation grilles are clear. Clear any rubbish, provided that this does not involve interfering with the equipment.
- 3.33 As far as is reasonably practicable, look for signs of corrosion, damaged external insulation, loose earth connections and any other visible signs of abnormality.
- 3.34 Check as applicable, that any operating mechanism, operating handle, locking off devices, spare fuses, spare fuse carriers or other equipment which should be there are present, accessible and in good conditions.
- 3.35 Look at the closed disconnecter links (9) through their transparent covers (3) for signs of overheating or damaged insulation. If any is found, a disconnecter replacement (see 3.9) will be necessary.
- 3.36 Clean and inspect the operating mechanism and lightly grease the slots (19) in the drive cylinder (20).

FIG 3.4A

EXAMINATION AND SERVICE: DISCONNECTOR

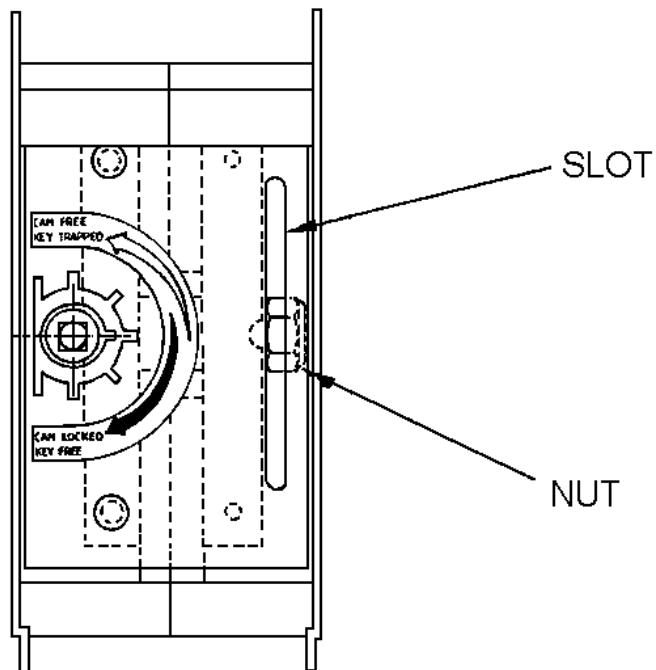
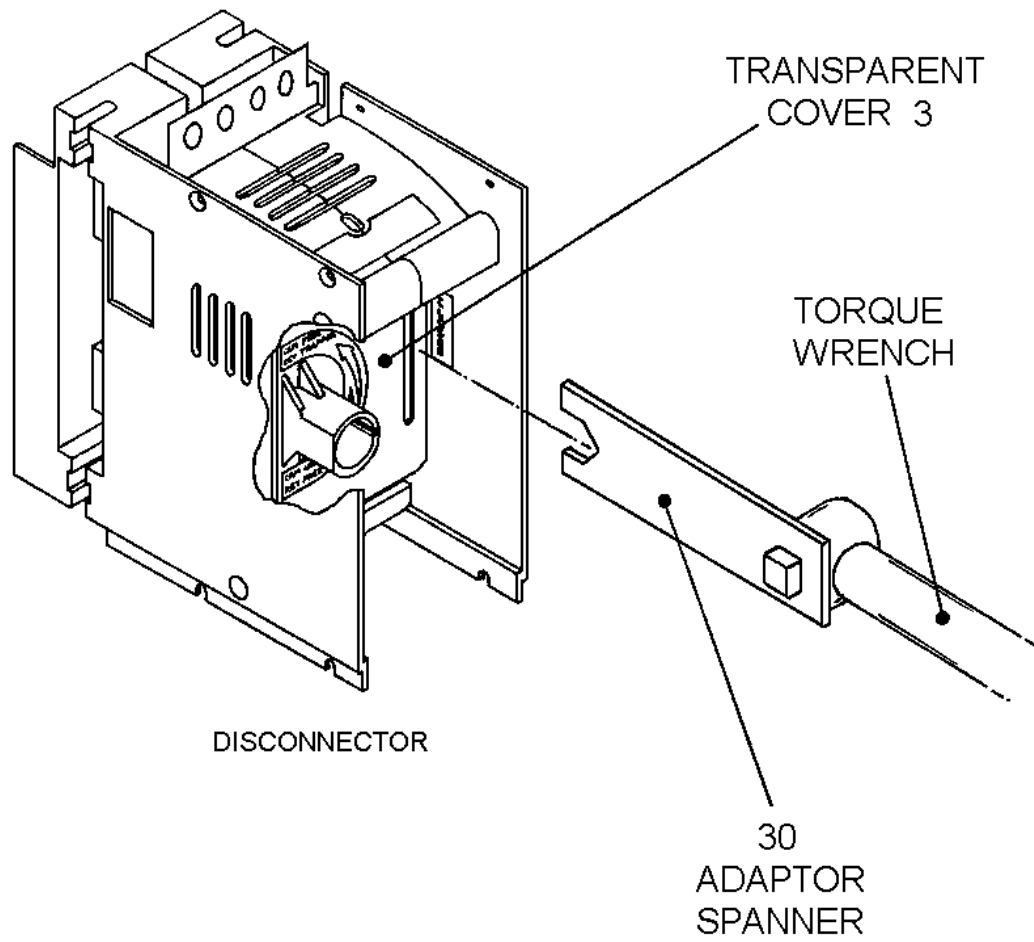
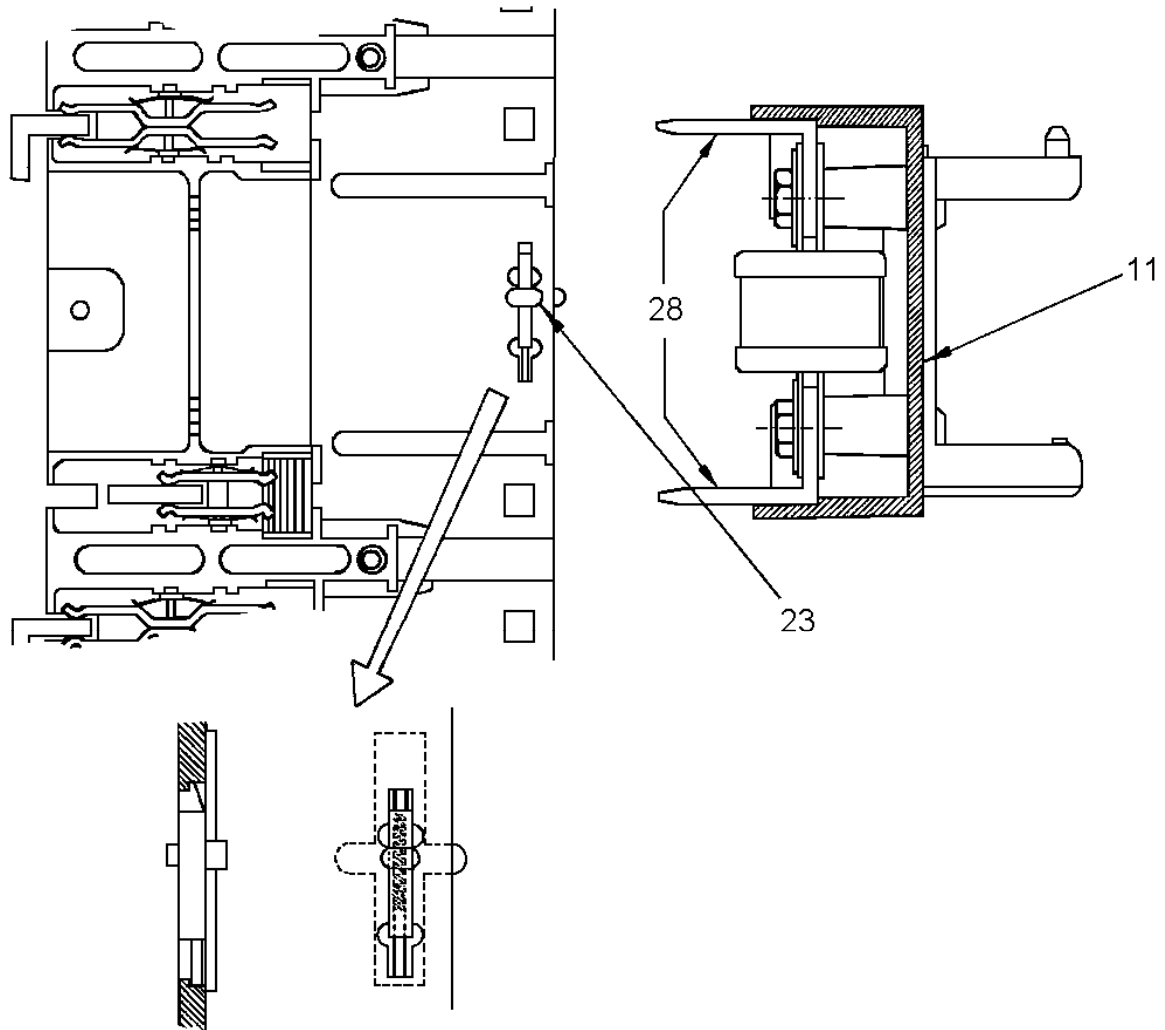


FIG 3.5A

EXAMINATION AND SERVICE: FUSEWAY



3.4 Examination and Service of disconnectors

3.41 MAKE THE TRANSFORMER DEAD FROM THE PRIMARY SIDE. Ensure there are no supplies from interconnectors and that the equipment is completely dead. Operate the disconnectors to the OPEN and then the INSPECTION position, as described in 1.3 and 1.4.

3.42 Clean any hardened or discoloured grease from the disconnector contacts using a suitable solvent, such as one based on electronics grade trichloroethane. Silver plating on the contacts may be tarnished black. this is not serious, but may be cleaned up using silver polish.

A small amount of pitting is not significant, but if there are signs of serious damage due to overheating the complete single phase disconnector should be replaced as described in 3.9.

Re-grease the contacts with Electrolube Ltd's 'EMPL' grease before returning the disconnector to the OPEN and then the CLOSED position, as described in 1.4 and 1.2.

3.43 Check the contact pressure of the closed disconnector by slipping the special adapter spanner (30) (Part No. 20590000C01*R, supplied separately upon request) through the slot in the transparent cover (3), fitting a torque wrench set to 12Nm and tightening (if possible). This is equivalent to a torque of 16Nm applied directly on the nut.

NOTE: THIS MUST NOT BE DONE WITH THE SUPPLY LIVE.

Repeat for all phases of the disconnector.

MAKE THE TRANSFORMER, AND THUS THE WHOLE BOARD, LIVE AGAIN.

3.5 Examination and Service of fuseways

3.51 Open and remove each fuse carrier (11) in turn as described in 2.2 and 2.3. Clean the carrier contacts (28) of any hardened or discoloured grease and polish if required, as described above for the disconnector contacts.

Again, serious signs of overheating, severe pitting or large beads or ridges on the contact surface indicate that the fuse carrier should be replaced by another. However, the damaged contacts can be replaced, either on site or later in the workshop.

The procedure for replacing the contacts is exactly the same as for fuse replacement (see 2.4), except that the contacts rather than the fuse are replaced.

If severe fuse carrier contact is found, an urgent fuseway replacement (see 3.7) is probably necessary.

- 3.52 Examine the moulded insulation for deterioration, cracks or breakage's. If there are any, scrap the fuse carrier and replace it with another, recovering the fuse and contacts if they are in good condition

Check the condition of the fuse and replace if it shows signs of deterioration.

Re-grease the contact surfaces with Electrolube Ltd's 'EMPL' grease.

- 3.53 Check the fuse carrier interlocks (23) in the fuseway sidewalls for free vertical movement and spring return. If any is unsatisfactory, force its top out of the slot in the sidewall. Push a replacement interlock assembly (part No. 40E00074S0100) into the slot, with the spring plunger downwards, and force it home, taking care that the plunger and spring do not fall out. Check the visible condition of the fuseway for cracks or damage. If any are found, a fuseway replacement (see 3.7) is required.

Replaced the fuse carrier in the fuseway as described in 2.3 and, if required, close it to ON as described in 2.2.

- 3.54 Check fuse continuity at every fuse carrier as described in 2.73.

3.6 Examination and Service of enclosures

- 3.61 Clean any loose dirt from the equipment exterior and accessible parts of the interior. DO NOT use cotton waste or cleaning cloths having loose fibres, loose particles or metallic threads. DO NOT use brushes or blower nozzles contaminated with metallic material. DO NOT let tools, loose parts, metal filings, dust or dirt fall into the equipment. DO NOT use cleaning fluids other than those specified in 3.42 above.

FIG 3.7A

FUSEWAY REMOVAL

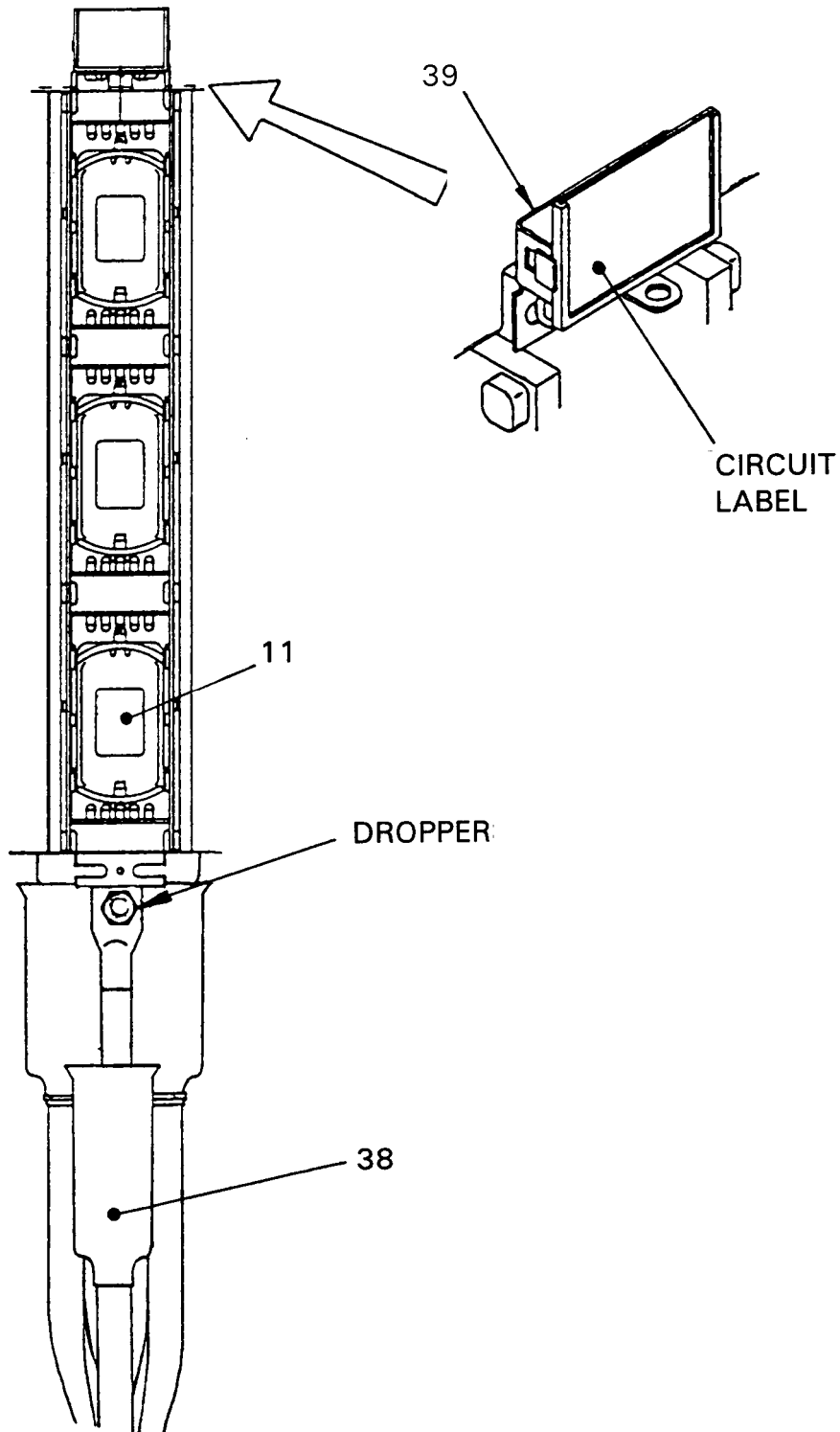
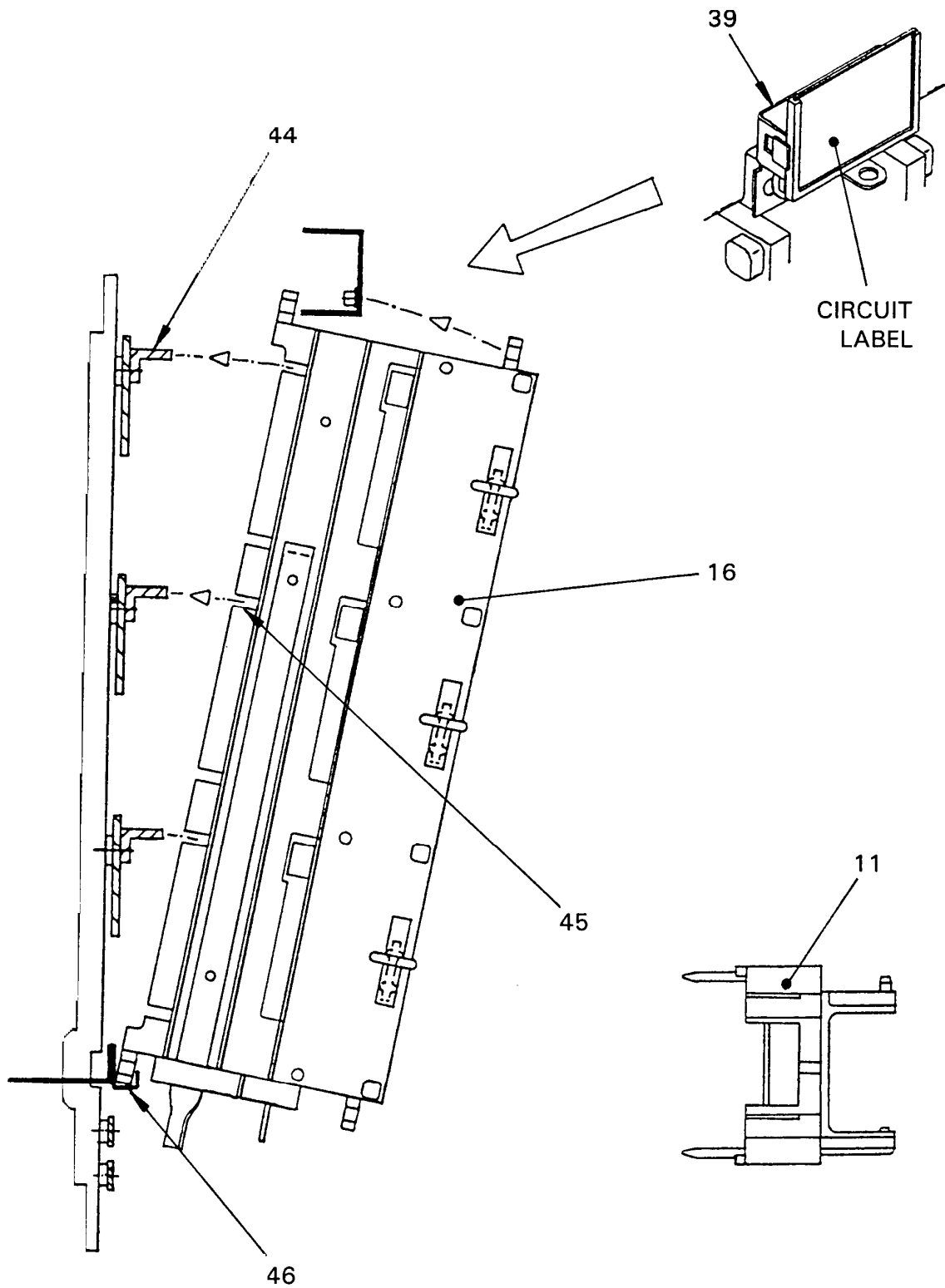


FIG 3.7B

FUSEWAY REPLACEMENT



3.7 Fuseway Replacement

- 3.71 In the event that fuse carrier contact damage is found, or fuseway cracking observed, during a servicing operation, it is recommended that the fuseway concerned be removed and scrapped. Then replaced as described below.

Any outgoing SAIF fuseway can be removed as a complete, triple pole, unit as follows.

NOTE As busbars will be exposed, preferably fuseways should only be replaced with the equipment dead, where it is essential fuseways are replaced with busbars and adjacent fuseways live, the responsible person must ensure the work is carried out in strict compliance with 'The Electricity at Work Regulations', applicable safety procedure and that individuals carrying out the work are suitably trained and skilled.

- 3.72 Switch OFF and remove the fuse carriers (11) as described in 2.2 and 2.3. Slide the insulating boots (38) down the cable tails to reveal the cable end sockets or shear head connectors. Unfasten the screws which secure the cable end sockets or shear head connectors to the three phase droppers.

Remove the two M8 screws and washers at the top of the fuseway and keep them. Lift off the label bracket (39).

Pull the top of the fuseway forward by about 80mm, this should unplug the way from the busbars.

Lift the way out of its support bracket, pull the bottom end forward and lower the whole way to clear the top support.

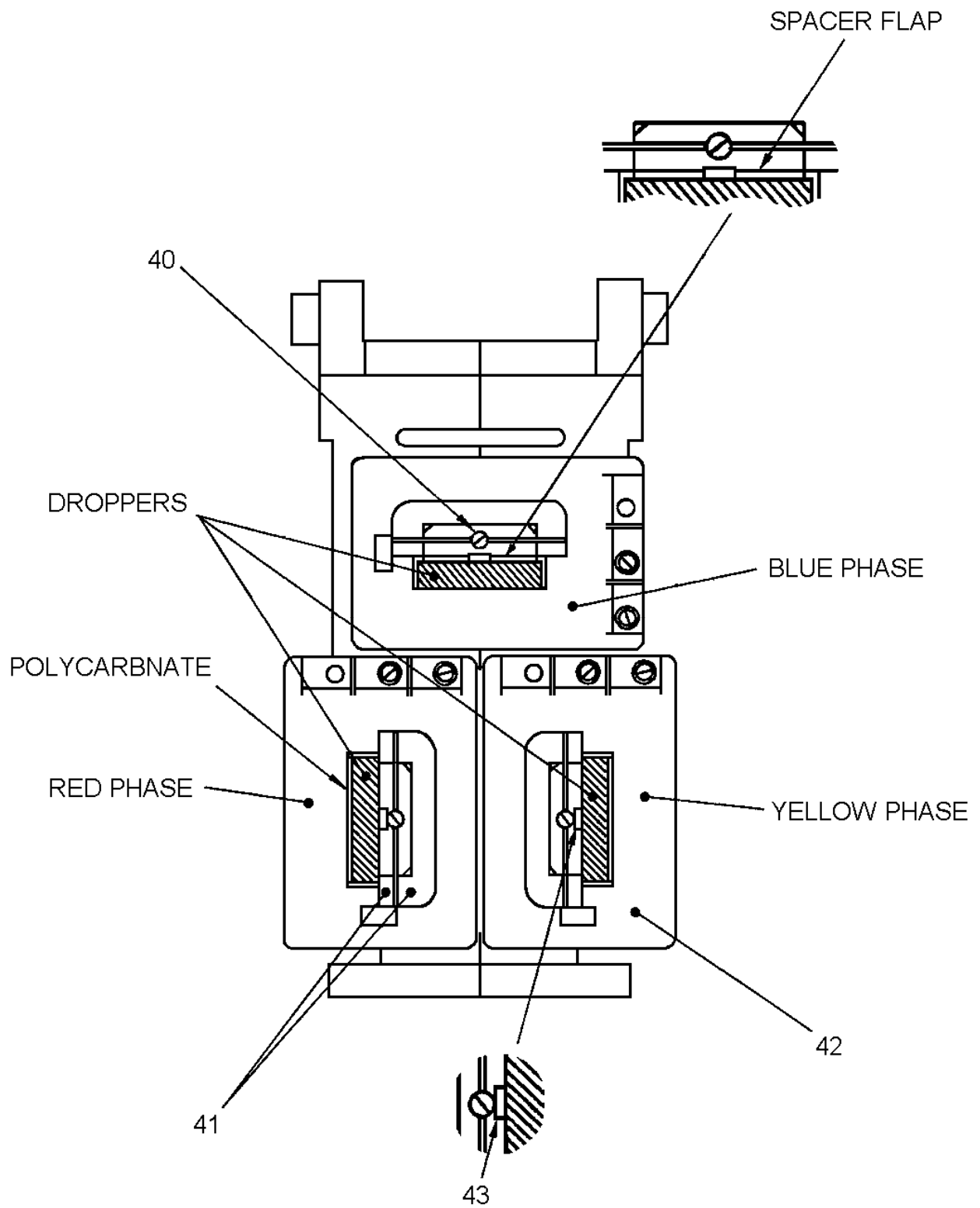
Tilt the top forward, lift the way clear of the cable tails and remove it.

- 3.73 Lift up the replacement fuseway and with the top end leaning forward towards you, position it's top rear fixing lugs behind the top support channel. Rest the lower end in the support bracket (46).

Push the upper end of the fuseway backwards, to overcome the spring pressure on the busbar isolating contacts (45), which must open to engage the busbars (44). Some minor movement of the complete fuseway upward may be required during this operation in order to align and engage the busbar isolating contacts with the busbars.

FIG 3.8A

CURRENT TRANSFORMER CHANGE



VIEW ON BASE OF FUSEWAY

Replace the screws and washers removed in 3.72, taking care to locate the circuit label fixing bracket (39) between the washers and the fuseway moulding.

- 3.74 Reconnect the cable end sockets to the three phase droppers or re-make the cable connections using new shear head connectors as applicable.

3.8 Fuseway CT Changes

- 3.81 The current transformers (CT's) on the outgoing cable cores may be changed as follows.

Remove the fuse carriers from the relevant way as described in 2.3. Disconnect the tails from the relevant CT or CTs.

- 3.82 To change the blue phase CT only, disconnect the cable end socket or shear head connector.

Unfasten and remove the brass screw (40) from between the two CT wedges (41). Take out the wedges. Slide off the old CT (42).

Place the new CT in the same position as the old one. Replace the wedges with the spacer flap on the back wedge trapped between the wedge and the dropper.

A protrusion (43) on the dropper stops the whole assembly sliding down.

Replace and tighten the brass screw (40).

Reconnect the cable end socket or re-make the cable connection using a new shear head connector as applicable.

- 3.83 To change the red or yellow phase CT, remove the fuseway as described in 3.72.

Unfasten and remove the relevant cable end sockets or shear head connector as applicable.

Unfasten and remove the brass screw (40) from between the two CT wedges (41). Take out the wedges. Slide off the old CT.

Place the new CT in the same position as the old one. Replace the wedges. Note that the back wedge on red or yellow phase has the spacer flap snapped off, to compensate an intervening thickness of polycarbonate.

A protrusion (43) on the dropper stops the whole assembly sliding down.

Replace and tighten the brass screws (40).

Replace the fuseway as described in 3.73.

- 3.83 Reconnect the cable end sockets to the droppers or re-make the cable connections using new shear head connectors as applicable.

3.9 Disconnecter Replacement

- 3.91 **MAKE THE TRANSFORMER DEAD FROM THE PRIMARY SIDE.** Ensure there are no supplies from interconnectors and that the equipment is completely dead. Remove the disconnector as follows.

- 3.92 On vertical configurations, disconnectors must be removed as complete three phase and neutral assemblies.

Where rear access is available remove the roof by opening the pillar door(s) then release the two M12 fixings located under the top front cross member in each corner. Lift the roof approximately 25mm and push it backwards until the two pins at the back edge clear their location holes, then lift off the roof.

To remove the top cover or ventilation cover remove the fixing screws securing the cover in place and then lift the cover off. The backplate can be removed by removing the fixing screws which secure the backplate in position, the backplate can then be lifted off giving access to the rear of the busbar assembly.

Alternatively, where rear access is not available, and depending on the particular arrangement, remove the shrouds over the incoming cable terminals and/or sufficient adjacent SAIF fuseways each side of the disconnector to gain access to the disconnector terminals. Removal of the SAIF fuseways is described in 3.72. To remove the clear incoming cable screens remove the M8 screws at the top and M8 nuts at the bottom of the screens, then lift the screens off.

Working from above or alongside remove the M10 fixings which secure the disconnectors to the transformer and busbar connections.

Disconnect the current transformer (CT) wiring from the terminal block.

Working from the front, remove the pairs of M8 fixings at the top and bottom of the disconnectors assembly.

Withdraw the complete assembly from the front.

3.93 The individual phases can now be separated by removing the screws through their sidewalls.

3.94 With the faulty phase or phases replaced, refit the assembly in the reverse of the above procedure.

3.95 With the disconnector replaced, check the contact pressure as detailed in 3.43 then make the transformer live again.

3.96 On horizontal configurations a single disconnector can be removed on its own. To do this:

Remove the roof and top cover or ventilation cover as described in 3.92.

Working from above, remove the horizontal connections which are attached to the disconnector top stem and the transformer bushing.

Access to the disconnector lower stem is now possible, remove the M10 fixings securing the busbar connection to the stem.

Disconnect the current transformer (CT) wiring from the terminal block.

Remove the circuit label holders from any relevant fuseway to gain access to the M8 fixings which retain the disconnector to the panel.

Remove the four M8 screws, two at the top and two at the bottom and withdraw the disconnector.

3.97 With the faulty phase or phases replaced, refit the assembly in the reverse of the above procedure.

3.98 With the disconnector replaced, check the contact pressure as detailed in 3.43 then make the transformer live again.

3.10 General Overhaul

- 3.10.1 **MAKE THE TRANSFORMER DEAD FROM THE PRIMARY SIDE.**
Ensure there are no supplies from interconnectors and that the equipment is completely dead.
- 3.10.2 Carry out all the inspection, servicing and overhaul procedures as described in 3.3 and 3.4. Carry out the procedures in 3.5 and 3.6 as required.
- 3.10.3 Unfasten and remove any front covers/screens as necessary for access.
- 3.10.4 Clean and inspect all insulation, looking for burning, cracks or other defects. Replace as necessary.
- 3.10.5 Clean all busbars, risers, droppers and other copperwork. Check their fastenings for tightness. Examine the busbar and other copperwork supports. Check all main and secondary earth connections for continuity and tightness of fastenings.
- 3.10.6 Inspect the cable tails and droppers for overheating of connections or discoloration.
- 3.10.7 Clean and clear any dirt or rubbish, especially if metallic.
- 3.10.8 Check that external ventilation grilles are clear and if fitted with expamet filter elements these should be treated with filtrafoil adhesive as instructed on the container.
- 3.10.9 With all fuse carriers removed and any outgoing disconnectors open, close the incoming disconnectors to connect the busbars and connections to the low voltage windings of the (still unenergised) transformer. Remove the neutral earth link between the earth bar and neutral busbar. Test the resistance between phases and phase to earth. Values will vary between different equipment depending upon the content and site location. Values in excess of 20 megohms can be expected, but values above 1 megohm is acceptable.
- Comparison of annually recorded insulation values, where available, will indicate any deterioration in the insulation.
- 3.10.10 Refit all covers and make alive.

3.11 Post Fault Maintenance

- 3.11.1 If a fuse ruptures due to an overload or a fault, replace the fuse as described in 2.4 and examine the contacts and body of the carrier for signs of damage. If the moving contacts are damaged, then corresponding damage of the fixed contacts within the fuseway is also likely and the fuseway should be replaced as described in 3.7.
- 3.11.2 If possible, check the cable terminations for signs of loosened contacts or damaged insulation. Repair or replace as necessary.
- 3.11.3 Any fault occurring in the equipment will require a thorough overhaul or replacement of the complete assembly, with special attention being paid to the effects of arcing, heat or smoke damage.

4 **SPARES**

4.1 The following list of spare parts does not list every individual small component, but only those assemblies which are supplied separately on request. This policy is based on almost 10 years of service experience with the SAIF range and on a recognition of the fact that transport, administration, loss of supply and on-site installation costs will often make the substitution of complete assemblies more cost effective than the replacement of individual components.

4.2 SAIF disconnectors will normally only be supplied as complete, single phase units:

SAIF disconnector, type 3000S	5504A00200
SAIF disconnector, type 3000T	5504A00100
SAIF disconnector neutral, type 1500	5504N01300
SAIF disconnector, type 2000S	5504800100
SAIF disconnector, type 2000T	5504700100
SAIF disconnector neutral, type 1000	5504N00200
SAIF disconnector, type 1000S	5504600100
SAIF disconnector, type 1000T	5504500200
SAIF disconnector neutral, type 500	5504N00100

4.3 SAIF fuseways will normally only be supplied as complete, three phase units including fuse carriers (excluding fuse links):

SAIF fuseway, type 800 BS MKII	5504400000
SAIF fuseway, type 630 BS MKII	5504301400
SAIF fuseway, type 400 BS MKII	5504200700
SAIF fuseway, type 630 DIN MKII	5504300300
SAIF fuseway, type 400 DIN MKII	5504200300

4.4 SAIF fuse carriers will normally only be supplied in packs containing three carriers (excluding fuse links):

SAIF fuse carrier, type 800 BS	5580007400
SAIF fuse carrier, type 630 BS	5580000500
SAIF fuse carrier, type 400 BS	5580000400
SAIF fuse carrier, type 630 DIN	5580000300
SAIF fuse carrier, type 400 DIN	5580000200

- 4.5 SAIF fuse carriers moving contacts (blades) will normally only be supplied in packs containing one pair of blades:

SAIF fuse carrier blades, type 800 & 630 BS	20543003C01*W
SAIF fuse carrier blades, type 400 BS	20542003C01*W

NOTE: Because of the construction of DIN type fuse carriers, blades are not supplied separately.

- 4.6 SAIF accessories:

Insulated disconnecter operating handle	40E00081S01*0
Vertical disconnecter locking-off device	5580000800
Horizontal disconnecter locking-off device	5580001000
Disconnecter torque setting spanner	20590000C01*R
SAIF fuseway switching mechanism MKII	5580000400
SAIF fuseway padlocking device, type PDO	5580000600
SAIF fuseway padlocking device, type PDI	5580000700

5 KEY TO ILLUSTRATIONS

1. Insulated disconnecter operating handle
2. Insulated disconnecter operating socket
3. Insulated disconnecter transparent cover
4. Disconnector neutral link
5. Vertical disconnector locking-off device
6. Horizontal disconnector locking-off device
7. Slotted plate engaged by (6)
8. Padlock eye
9. Disconnector blades
10. Disconnector fixed contact
11. SAIF fuse carrier
12. Dummy fuse link
13. Fuseway sidewall
14. SAIF fuse carrier spring mechanism
15. Interlock lever on (14)
16. Fuseway
17. Locating hooks on (14)
18. Locating bosses on (13)
19. Drive slots in (20)
20. Drive cylinder in (14)
21. Drive dowels on (11)
22. Interlock lugs on (14)
23. Fuse carrier interlocks on (13)
24. Mechanism capstan handle on (14)
25. Front drive arms on (11)
26. Securing lips on (13) to hold in (11)
27. Fuse link
28. Moving contacts in (11)
29. Sprung DIN fuse blade contacts
30. Disconnector contact setting spanner
31. Padlock eye beneath circuit label
32. Slot in floor of fuseway moulding
33. SAIF fuseway locking off device type PDO
34. SAIF fuseway locking off device type PDI
35. Fixed contacts accessible through slots in back of (16)
36. Test apertures in front of (11)
37. Neutral busbars
38. Insulating boot for cable core
39. Circuit label fixing bracket
40. Brass screw between (41)
41. Two insulated wedges to secure (42)
42. Current transformers
43. Copper dropper protrusion to support (41)
44. Busbars

- 45. Busbar isolating contacts on (16)
- 46. Fuseway support bracket
- 47. Outer heat sinks on 800 BS carrier

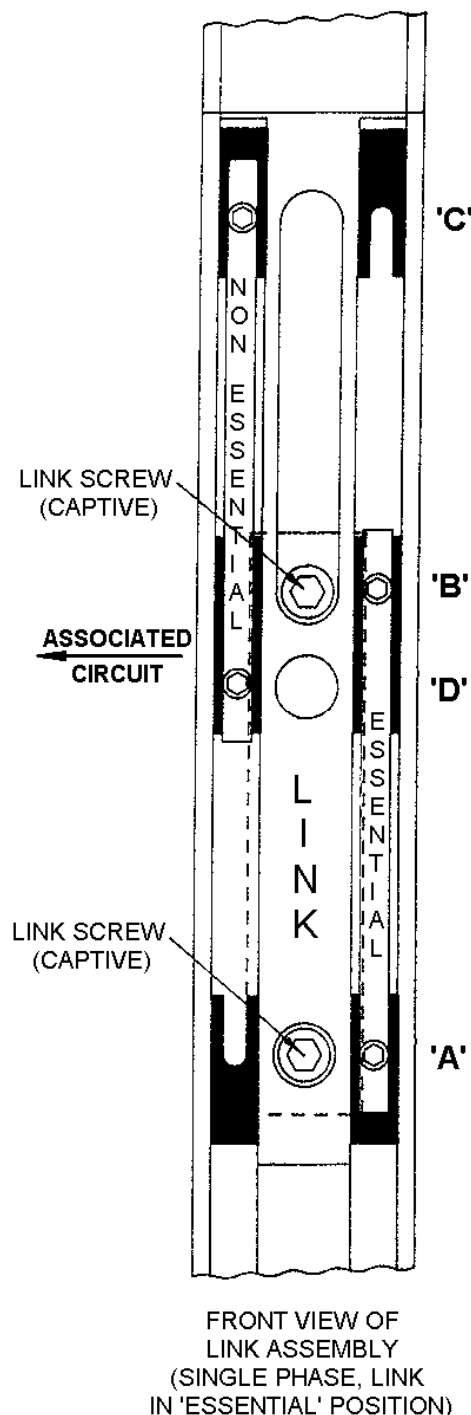
6 Additional Information

6.1 Load Shedding Contactor Circuits

- 6.1.1 The load shedding circuit comprises:
- 1) a suitable rated load shedding contactor, load shedding relay and contactor control relay, which are housed within a compartment on the left of the incoming disconnector.
 - 2) a set of control circuit supply fuses and selector switch located on the left hand side of the pillar instrument panel.
 - 3) a pair of terminal blocks located below the contactor/relay compartment for termination of the 48V DC load shed signal wires.
- 6.1.2 The operation of the load shedding circuit is controlled by the selector switch on the instrument panel which gives the functions:
- 1) AUTO, contactor controlled by remote load shed signal.
 - 2) OFF, contactor permanently off irrespective of load shed signal
 - 3) ON, contactor permanently on irrespective of load shed signal.
- 6.1.3 When the control selector switch is in the AUTO position, shedding of the non-essential circuits is initiated by the application of a 48V DC supply to the load shedding relay via the terminal block, which operates the contactor control relay and de-energises the load shedding contactor. On removal of the 48V DC signal the load shedding contactor will be re-energised and hence re-connect the non-essential circuits.
- 6.1.4 In the event of the requirement for removal of the screen covering the contactor/relay compartment for inspection purposes, care must be taken to ensure that neither set of busbars (either essential or non essential) are live by opening each phase of the incoming disconnector (off-load operation only), this should include the isolation of any generator supplies connected to the essential busbars via the generator cable connections and any interconnectors (where applicable).

6.2 Operation of Busbar Selector Links

- 6.2.1 The designation of each phase of each outgoing fuseway circuit can be changed from essential to non-essential and vice versa by means of the busbar selector links which are operated by the orange coloured 'T' bar handle.
- 6.2.2 For details of the operation of busbar selector links see the drawing detailed below.



OPERATION OF BUSBAR SELECTOR LINKS

THE UNIT IS SUPPLIED WITH ALL FEEDER CIRCUITS CONNECTED TO THE 'ESSENTIAL' BUSBAR.
BUSBAR SELECTOR LINKS FOR EACH FEEDER CIRCUIT ARE SITUATED ON THE RIGHT HAND SIDE OF THE CIRCUIT.

TO SELECT THE 'NON ESSENTIAL' BUSBAR :-

- 1) ENSURE CIRCUIT TO BE CHANGED TO 'NON ESSENTIAL' BUSBAR IS IN THE 'OFF' POSITION/FUSE CARRIER REMOVED.
- 2) INSERT THE ORANGE COLOURED 'T' BAR OPERATING HANDLE THROUGH THE HOLE AT 'A' LOCATING THE HEXAGON END INTO THE LINK SCREW.
- 3) TURN HANDLE ANTI-CLOCKWISE TO REMOVE PRESSURE FROM THE SCREW.
- 4) REMOVE OPERATING HANDLE.
- 5) INSERT AND LOCATE OPERATING HANDLE INTO SCREW AT 'B'.
- 6) TURN HANDLE ANTI-CLOCKWISE TO REMOVE PRESSURE FROM SCREW.
- 7) WITH HANDLE STILL LOCATED AT 'B' LIFT THE LINK (VIA THE HANDLE) AS FAR AS IT WILL GO (TO POSITION 'C'). TURN HANDLE CLOCKWISE UNTIL SCREW IS TIGHT.
- 8) REMOVE OPERATING HANDLE.
- 9) INSERT AND LOCATE OPERATING HANDLE INTO SCREW AT 'D'.
- 10) TURN HANDLE CLOCKWISE UNTIL SCREW IS TIGHT.
- 11) REMOVE OPERATING HANDLE AND RE-ENERGISE CIRCUIT.

TO CHANGE FROM 'NON ESSENTIAL' TO 'ESSENTIAL' BUSBARS :-

- 1) ENSURE THE CIRCUIT TO BE CHANGED IS IN THE 'OFF' POSITION/FUSE CARRIER REMOVED.
- 2) INSERT AND LOCATE THE OPERATING HANDLE INTO SCREW AT 'D'.
- 3) TURN HANDLE ANTI-CLOCKWISE TO REMOVE PRESSURE FROM SCREW.
- 4) REMOVE OPERATING HANDLE.
- 5) INSERT AND LOCATE HANDLE INTO SCREW AT 'C'.
- 6) TURN HANDLE ANTI-CLOCKWISE TO REMOVE PRESSURE FROM SCREW.
- 7) WITH HANDLE STILL LOCATED AT 'C' ALLOW THE LINK TO DROP AS FAR AS POSSIBLE (TO POSITION 'B'). TURN HANDLE CLOCKWISE UNTIL SCREW IS TIGHT.
- 8) REMOVE OPERATING HANDLE.
- 9) INSERT AND LOCATE OPERATING HANDLE INTO SCREW AT 'A'.
- 10) TURN HANDLE CLOCKWISE UNTIL SCREW IS TIGHT.
- 11) REMOVE OPERATING HANDLE AND RE-ENERGISE CIRCUIT.