

KNIFE SWITCHES, FUSES, FUSE MOUNTINGS AND ENCLOSURES

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1. GENERAL

1.1 Scope

1.11 This section covers requirements and adjusting procedures for knife switches, fuses and fuse mountings. It does not apply to high tension circuits supplying transformers from which the power service for the office is taken as these circuits are maintained by the power company.

1.2 Precautions

1.21 Power should be disconnected whenever possible from switches, fuses, clips or connections before they are worked on. If the potential cannot be removed, protect adjacent parts of opposite polarity with insulating materials such as RM-583101 1/64" Gray Fiber Sheet to prevent accidental contact.

1.22 Before beginning work on any live switch or fuse equipment, refer to the section in handbook 0 which covers cooperation with the customer, precautions and safeguards to prevent service interruptions and general protection of working equipment and personnel.

1.23 Link fuses shall be covered with barriers at all times.

1.24 Before touching any fuse or switch to check temperature, determine the potential on the part.

1.25 When working around live parts it is advisable to use only one hand and to stand on insulated material.

1.3 Inspection

1.31 Inspect each cabinet, switch and fuse mounting for defects that are readily apparent. Normally this is a visual inspection for damage, defects of finish and a check of fuse clip or switch clip alignment.

1.4 Description

1.41 Cartridge type fuses covered herein are of two general types. Some having ferrule contacts and some having knife blade contacts. Fuses rated 60 amperes and below are ferrule type and fuses rated 61-600 amperes are knife blade type. These fuses may mount in open clips or in insulated holders, such as the SAF-TO-FUSE or PULFUZSW units shown in Figures 1 and 2, respectively.

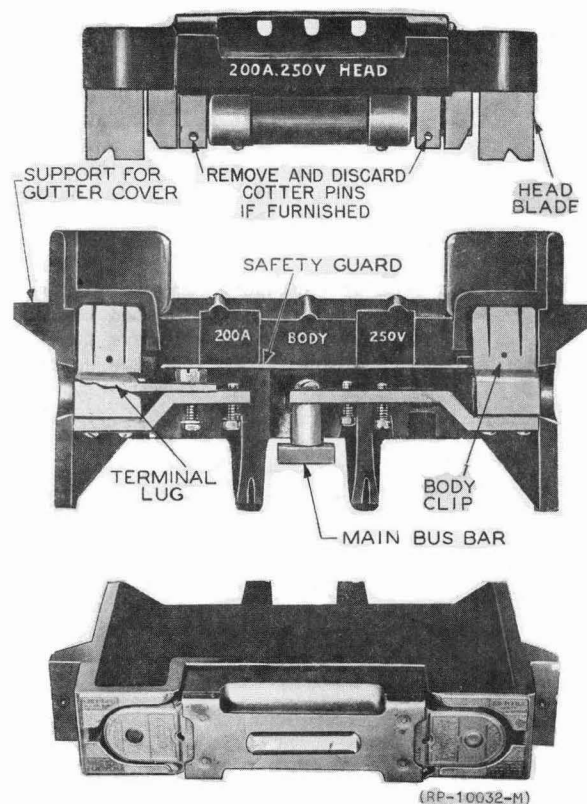


FIG. 1 SAF-TO-FUSE UNIT (BULLDOG ELECTRIC PRODUCTS CO.)

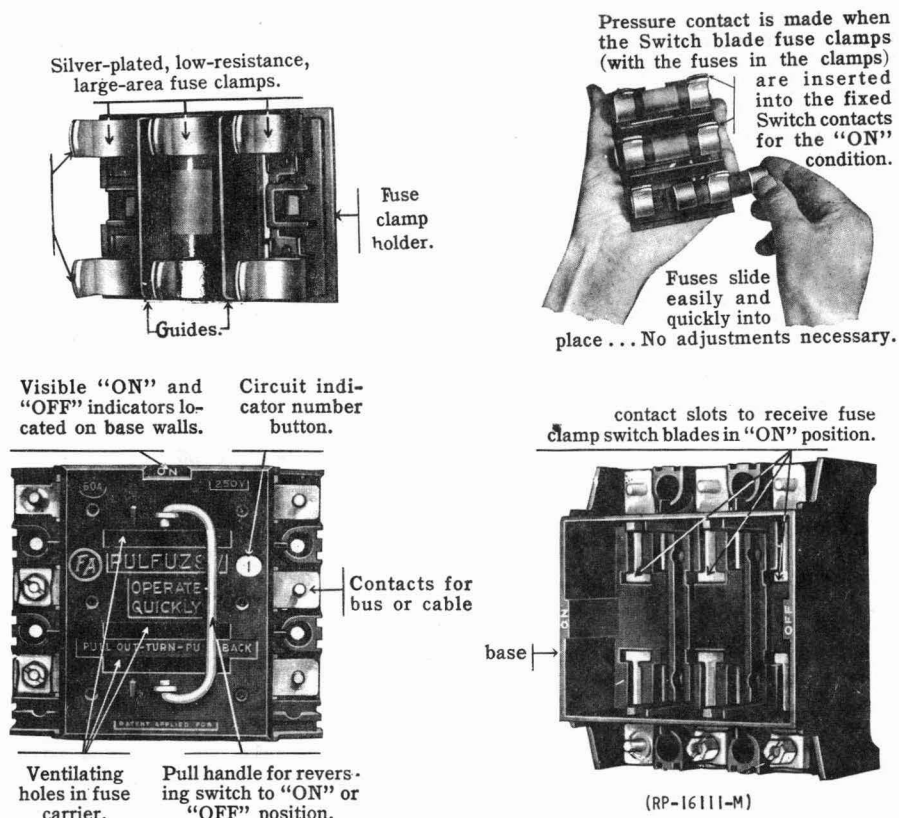


FIG. 2 PULFUZSW (FRANK ADAMS)

1.42 Link type fuses are furnished in rating of 600-1500 amperes. Over 1500 amperes, parallel combinations of these fuses are used. Barriers are provided for link fuses.

1.43 SAF-TO-FUSE and PULFUZSW units are provided with fuse test holes through the dead front, or head, of each unit. This permits testing of the fuse without removing it from the circuit, by the insertion of test leads in these holes. (See Figures 2 and 3).

1.44 Cabinets or enclosures may be wall-mounted, floor-mounted, or attached to bus duct. These cabinets may have fuses only or combination switch and fuse units.

2. INSTALLING EQUIPMENT

2.1 Tools and Test Equipment

Code	Description
R-3022	Gauge, Feeler, .0015"
R-2559	Lamp, Test, Power
ITE-4442	Volt-Ohmmeter

2.2 Supplies

Code	Description
R-3154	Sheeting, Protective
KS-14666	Cloth, Cleaning
RM-583101	Fiber, Sheet, Gray 1/64"
KS-16328	Oil
R-3163	Paper, Abrasive
R-3266	NO-OX-ID "A" Compound
R-3429	Trichloroethane
RM-591127	Tape, Fraction, 3/4"
RM-647651	Petrolatum

3. MOUNTING

- 3.1 All mounting screws and nuts shall be tight.
- 3.11 Tighten all mounting screws or nuts that may have loosened on the panel, in a fuse box, or on a mounting assembly.
- 3.2 Crossbars (multipole switches) shall be securely fastened to the blades or blade blocks.

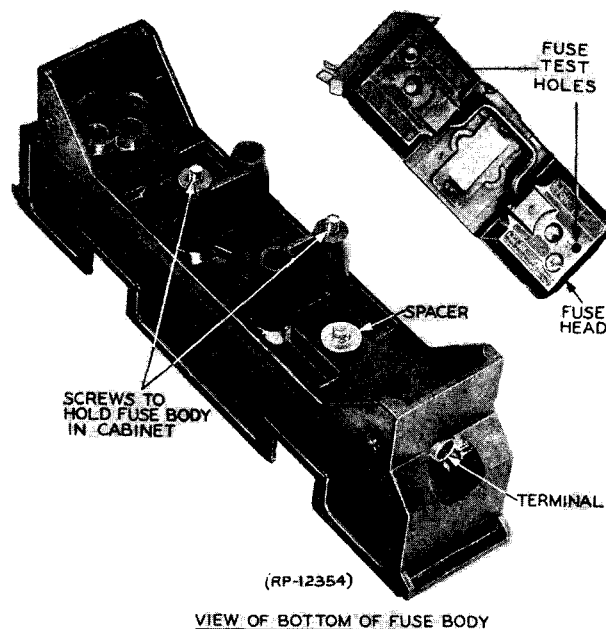
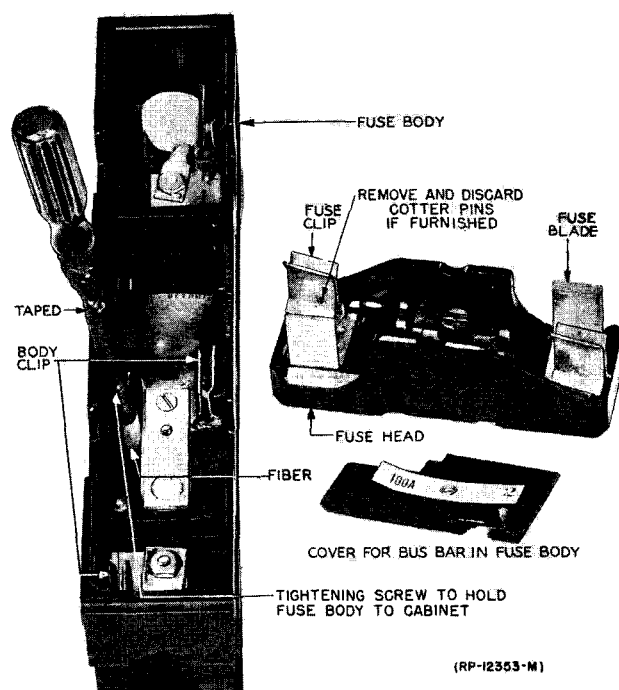


FIG. 3 ADDING A SAF-TO-FUSE UNIT TO A POWER SERVICE CABINET (PAR. 4.1)

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| <p>3.3 Except where a linkage is used between a separately mounted operating handle and the switch blades, the handle shall be securely fastened to the blade, bladeblock, or crossbar.</p> <p>3.31 Tighten all loose handles by setting up the holding screws with a screwdriver. Straight handles may be tightened by turning the handle itself, holding the mounting screw or bolt from turning if necessary.</p> <p>3.4 All cabinets shall be secured in the position designated on the job drawings.</p> <p>3.41 Refer to Handbook 30 for method of installing. It will be necessary to remove trim on the front of wall-mounted cabinets in order to install mounting bolts.</p> <p>3.5 All metal details and raceway covers shall be secured in position when cabling is completed.</p> <p>4. <u>ADDING SAF-TO-FUSE UNITS OR FILLER UNITS</u></p> <p>4.1 <u>SAF-TO-FUSE UNIT</u></p> | <p>4.11 Remove the power service from the cabinet, if at all possible. If absolutely necessary to proceed with power on, observe the procedure indicated in Figure 3.</p> <p><u>CAUTION:</u> The screwdriver blade must be well-taped and covered with fiber to insulate the mounting screw and screwdriver blade from the copper detail. The copper is hot as soon as the SAF-TO-Fuse unit is placed in position in the cabinet.</p> <p>4.12 SAF-TO-FUSE units may be received on the job having cotter pins in the drilled holes of the fuse clips in the unit head. Remove and discard these pins.</p> <p>4.13 Fuses shall be held securely in both fuse clips. Fuses having ferrule type clips with end stops shall have clearance between the end stops and one or both ferrules of the fuse. Readjust the spacing between the clips if necessary.</p> <p>4.14 Fuse clips at both ends of a fuse should be in alignment.</p> <p>4.141 If not, loosen the mounting screws, adjust position, and then retighten mounting screws. A blown fuse inserted in the clips may be of assistance in aligning the clips.</p> |
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4.2 Filler Unit

- 4.21 Remove trim (front) from the cabinet by loosening the trim clamps.
- 4.22 Remove the screws bolding the steel housing frame and lift off the frame.
- 4.23 Install the insulating barriers furnished with the filler plate. These stand on edge and are held in place by screws that go entirely through them and into the tapped holes in the back mounting plate.
- 4.24 Clip one edge of the filler over the edge of the mounting plate and spring out the other end to clip over the opposite edge of the mounting plate. Exercise extreme care if the cabinet is alive.
- 4.25 Replace the steel housing frame and screws holding it in place.
- 4.26 Replace the trim (front) on the cabinet and tighten the clamps, holding it in place with a screwdriver.

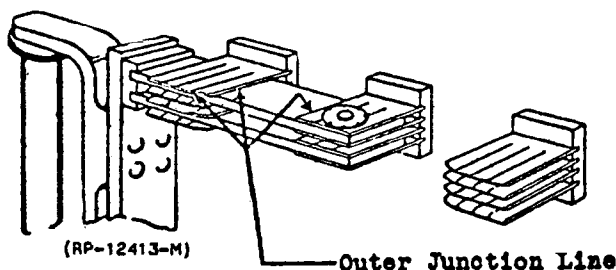


FIG. 4 ILLUSTRATING JUNCTION LINE BETWEEN SWITCH BLADE AND CLIP (PAR. 6.22)

- 5.12 Silver plated surfaces shall not be sanded but cleaned only by wiping with a KS-14666 Cleaning Cloth moistened with R-3429 Trichloroethane.

- 5.2 Clean the contact surfaces of all new power fuses (except fuses with silver plated ferrules or blades) with abrasive paper to remove any dirt, lacquer or oxide that may be present. Wipe with a clean cloth. See Paragraph 8.

6. CONTACT AREA

6.1 Fuses

- 6.11 Ferrule type fuses shall be visually checked to see that a minimum of approximately 75% of the fuse head is making contact in each fuse clip. These fuses should also resist rotational movement. This can be checked by using the fingers. These requirements must be met so that the fuse can carry the current for the particular installation without excessive heating.

- 6.111 Clips may be shaped with long-nose pliers to the curvature of the associated fuse. Phosphor bronze clips sometimes fail to maintain satisfactory contact. These should be replaced if necessary.

- 6.12 Knife blade type fuse clips, with the fuse inserted, shall refuse a .0015" feeler gauge around at least 50% of the accessible outer junction line. Use R-3022 feeler gauge. This requirement applies to each junction line. The majority of these are KS units and are factory adjusted.

- 6.13 The blades of dead front fuse units or other arrangements where contact area cannot be checked readily do not have any contact area requirement but shall have a reasonable tight fit in their clips, sufficient to carry the current for the particular installation, without excessive heating.

- 6.14 Knife blade type clips shall be slightly converging, that is, slightly closer together at the edge where the blade enters.

6.2 Switches

- 6.21 Switch blades of switches rated less than 30 amperes shall have a reasonably tight fit in the clips, sufficient to carry the applied load.

5. CLEANING

- 5.1 All contact surfaces of switch blades, clips, switches and fuse clips shall be clean, smooth and free of rough edges.
- 5.11 Use a fine flat file to remove nicks and obvious high spots, otherwise use abrasive paper as necessary. Exercise care so as to remove only a minimum amount of metal. After sanding, remove dust with a cloth either dry or moistened with R-3429 Trichloroethane. Use R-3429 sparingly.

- 6.22 Switch clips of switches rated 30 amperes and above shall refuse a .0015" feeler gauge around at least the following percentages of the accessible outer junction line, with the switch in the closed position. See Figure 4. Use R-3022 feeler gauge.

<u>Capacity</u>	<u>Minimum</u>
30-60 Amps. (Inclusive)	50%
100 Amps. and Over -	
Copper Contacts	90%
Silver Contacts	50%

- 6.23 Clips shall be straight and converging, that is, slightly closer together at the rounded edge where the blade enters.
- 6.231 When necessary to adjust, squeeze the blades of the clip slightly with pliers at the point where the blades make contact until the distance between the clip or fingers of the clips is slightly less than the thickness of the blade.
- 6.24 Blades shall be straight. Multi-blade switches shall have their blades approximately parallel.
- 6.241 Replace any bent or damaged switches.
- 6.25 Corresponding clips of the same pole and fingers of the same clips shall be in the same horizontal or vertical plane.
- 6.26 Blades at the hinge shall make positive contact but shall not bind excessively.
- 6.261 Where possible, contact pressure may be adjusted in the hinge by tightening or loosening the hinge bolt. Avoid getting the hinge bolt too tight as it may result in galling the metal surface involved.

7. FUSE CONTACT PROTECTION

- 7.1 Coat fuse ferrules, blades and contact area of their associated clips with a thin film of NO-OX-ID "A" Compound. This requirement does not apply to plug fuses and sockets, alarm-type fuses and holders and glass fuses and holders.

8. LUBRICATION

- 8.1 Coat contact surfaces of all switch blades and switch clips with a thin film of RM-647651 Petrolatum. Work the lubricant into the hinge by applying to exposed surfaces and operate the switch several times. Do not use oil on hinge clips.

- 8.2 Where a linkage is used between a separately mounted operating handle and the switch blades (dead front knife switch) oil the linkage joints sparingly with KS-16328 oil. The joints should first be cleaned to remove any dust or dirt. After applying oil, wipe off excess with a clean cloth.

9. DESIGNATION

- 9.1 Cabinets, switches, and fuses shall be designated in accordance with the information in Section 30, Handbook 39.

10. DUMMY FUSES

- 10.1 All exposed unused fuse positions on power distribution boards and cabinets must be equipped with dummy fuses. For the 35 type fuse holder, use a 63A dummy and for the 70 type fuse holder, use the 72A dummy.
- 10.2 Concealed fuse positions which are not wired do not require a dummy fuse, except as necessary to retain the fuse head. i.e. 72A dummy required to retain the cap in the 18A fuse holder. These positions will require a dummy fuse when equipment has been disconnected and the circuit becomes "W.O." (Wiring Only).

11. SPARE FUSES

- 11.1 Spare fuses are usually furnished in the specification for use by the operating company to cover new circuits or different sizes. Spare fuses are furnished in accordance with those normally installed and working and in accordance with the frequency a particular size is used. Spare fuse holders are usually mounted on the power board, end guard, wall or column where they are readily available when needed.
- 11.2 Unplated power type fuses such as cart-ridge with ferrule contacts or knife blade contacts as well as link type fuses shall be cleaned with abrasive paper until all of the contact area is bright and then coated with a thin film of NO-OX-ID "A" Compound.

- 11.3 When plated fuses are furnished (usually silver plating) they shall not be sanded or otherwise abraded but wiped clean with a KS-14666 Cleaning Cloth and coated with a thin film of NO-OX-ID "A" Compound.

11.4 All fuses should then be placed in the holders in such a manner as to allow for the capacity to be easily seen, when ever this is possible.

11.5 All spare power fuses shall be turned over to the Operating Company by listing them and signing them over on an RGM form or equivalent.

12. 70 TYPE FUSES

12.1 The following table lists all 70 Type fuses, their current carrying capabilities and color identification:

TABLE A

70 TYPE FUSES			
Code Number	Rated Capacity In Amperes (For 10 minutes) SEE NOTE 1	Color Of Bead	Note
70A	1 1/3	White	
70B	2	Orange	
70C	3	Blue	
70D	5	Green	
70D5*	5	Green with bk st	2
70E	.180	Yellow	
70F	1/4	Violet	
70G	1/2	Red	
70H	3/4	Brown	
70K	1/4	Violet with White Stripes	3
70P	1/10	Grey with White Stripes	4
70R	.150	Red with White Stripes	

NOTE 1: The continuous rated current is equal to 80% of the rated capacity current.

NOTE 2: The ASTERISK is PART OF THE FUSE DESIGNATION. The 70D5* contains a copper clad steel spring while the 70D contains a copper cadmium alloy spring. The 70D5* features an improvement in the reliability of the alarm function but is electrically and physically equivalent and may be used interchangeably. The designation pin for both fuses is solid green.

NOTE 3: The 70K is a slow-blown fuse and contains a 12 ohm resistor.

NOTE 4: The 70P is a slow-blown fuse and contains a 36 ohm resistor.

13. 74 TYPE FUSES

13.1 The 74 type fuse is similar in appearance to the 70 type except it has no indicating bead or alarming facility. Its first application is in the 1A processor circuits of the No. 4 ESS Toll Switching System and features the ability to operate quickly, quick enough to protect certain electronic devices.

13.2 They are designed to fit in the 18A and 20A modular fuse holders as well as other similar holders with a redesigned P-12F160 fuse cap. The 18A holder must be limited to 5 amperes, however.

13.3 Maximum voltage rating is 60.

TABLE B

74 TYPE FUSES	
Code Number	Rated Capacity In Amperes (NOTE 1)
74A	1 1/4
74B	3
74C	5
74D	10
74E	15
74F	20
NOTE 1: The continuous rated current is equal to 80% of the rated capacity current.	

Manager, Product Engineering

Reason for Reissue:

- (1) To bring section into agreement with BSP 026-371-501 concerning the cleaning and protecting of spare fuses.
- (2) To clarify the cleaning and protecting of fuses and fuse clips.