INSTRUCTIONS

For Field Assembly and Installation

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INTRODUCTION

⚠ CAUTION

The equipment covered by this publication must be selected for a specific application and it must be installed, operated, and maintained by qualified persons who are thoroughly trained and who understand any hazards that may be involved. This publication is written only for such qualified persons and is not intended to be a substitute for adequate training and experience in safety procedures for this type of equipment.

General

The following instructions are for field assembly (erection) and installation of S&C Mark V Center-Break Style Circuit-Switchers, with aluminum-sheathed steel weldment bases, rated 345 kv, 1600 amperes or 2000 amperes continuous. See Figure 1.

The S&C Mark V Circuit-Switcher employs an in-series circuit-breaking interrupter and a circuit-making and isolating disconnect, making it especially suited for switching of transformers, lines, and cables. The Mark V Circuit-Switcher is suitable for frequent operation over a long period of time with minimal maintenance; is capable of closing and carrying fault currents as well as load currents; and utilizes interrupters economically tailored for specific applications by employing the precise number of interrupting gaps required. These interrupters are unaffected if subjected to sustained system voltage for extended periods, as a a result of being left open with the disconnect blades closed for any reason.

Each pole-unit of the S&C Mark V Circuit-Switcher includes a brain which provides built-in positive sequence control . . . and a fully enclosed stored-energy source dedicated solely to operation of the interrupter which is in the circuit at all times. Close-and-trip mechanisms are fully enclosed and protected, too. There are no external linkages, lever arms, cams, shunts, etc. that must be coordinated with a disconnect blade to accomplish circuit interruption. Positively sequenced operation is assured regardless of severe weather conditions such as high winds, rain, sleet, or snow.

The fault-closing contacts utilized on Center-Break Style Mark V Circuit-Switchers consist of a rugged stainless-steel tongue contact and a tempered silicon-bronze jaw contact. This contact arrangement assures long operating life and contributes to Center-Break Style Mark V Circuit-Switcher's high fault-closing capability. Dissimilar metals prevent contact welding.

The current-carrying contacts utilized on Center-Break Style Mark V Circuit-Switchers consist of a multifinger, spring-loaded, silver-plated, hard-drawn copper, reverse-loop jaw contact that grips hard (but only when needed during short-circuit current surges) against a silver-inlaid, high-conductivity cast copper tongue contact. Confining all arcing to the fault-closing contacts, plus the built-in blade-wiping action, assures clean current-carrying contacts, low-resistance current path.

Mark V Circuit-Switcher features a base-integrated power train with drive-shaft mechanism that efficiently transmits and controls energy at high operating

Supersedes Instruction Sheet 711-530 dated 6-30-86

INTRODUCTION — Continued

speed . . . and permanently maintains close interphase simultaneity. The drive train utilizes 186-degree vertical-shaft rotation to provide full toggle action at both ends of closing and opening strokes for smooth, shock-free acceleration and deceleration. Peak mechanical advantage is developed at stroke ends for power opening and closing without hesitation under 1½-inch ice formation, as discussed below under "Power Operation."

Power Operation

High-speed, high-torque power operation of S&C Mark V Center-Break Style Circuit-Switchers is required to provide a two-time duty-cycle fault-closing rating of 40,000 amperes rms three-phase symmetrical, 102,000 amperes peak (see "Basis of Fault-Closing Ratings" on page 3).

Power operation of Mark V Center-Break Style Circuit-Switchers also provides opening and closing without hesitation under 1½-inch ice formation; close interphase simultaneity; long life of fault-closing contacts under normal operating duties; and avoidance of excessive switching transients due to prolonged or unstable prestrike arcing. Mark V Circuit-Switchers are provided with high-speed, high-torque power operation by means of S&C Switch Operators—Type CS-1A.

High-speed tripping of power-operated Mark V Circuit-Switchers is furnished by the S&C Shunt-Trip Device. This optional accessory (Circuit-Switcher Catalog Number Suffix "-T1" or "-T2") provides high-

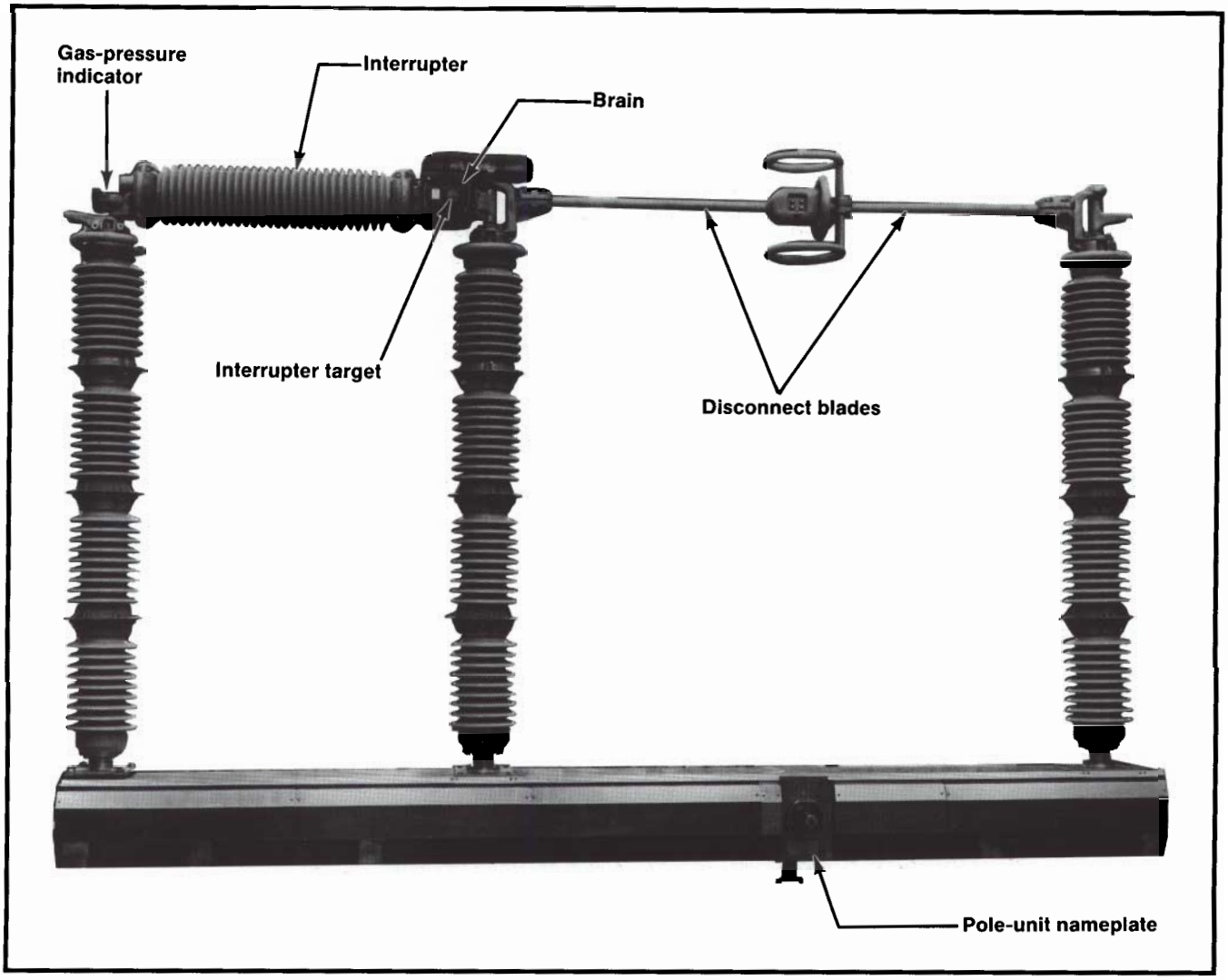

Figure 1. One pole-unit of S&C Mark V Three-Pole Center-Break Style Circuit-Switcher, with aluminum-sheathed steel weldment base, rated 345 kv nominal, 1600 amperes continuous.

speed (8-cycle) circuit interruption. The S&C Switch Operator—Type CS-1A is required if the shunt-trip device is specified.

Basis of Fault-Closing Ratings

The two-time duty-cycle fault-closing rating set forth above applies to Center-Break Style Mark V Circuit-Switchers when powered by S&C Switch Operators—Type CS-1A, and is based on performance as follows:

1. The Circuit-Switcher is capable of two fault-closing operations consisting of closing against and carrying for 10 cycles its rated fault-closing current, after which it can carry and interrupt its rated continuous current and is capable of power operation—either opening or closing.
2. After each occasion consisting of either one or two fault-closing operations at its rated fault-closing current, the Circuit-Switcher must be inspected and any necessary repair or replacement of the fault-closing contacts made to restore the device to its original condition.

Mounting of Circuit-Switchers

The high operating speed which makes possible many of the Mark V Circuit-Switcher's superior performance features when power operated brings about high acceleration and deceleration rates, resulting in high dynamic forces—for which S&C Mounting Pedestals were specifically designed, and are thus highly recommended. Alternately, Circuit-Switchers can be installed on the user's steel pedestals or supporting structures—which must meet specific static and dynamic deflection limits shown in S&C data sheets, so that the dynamic forces will be absorbed by the pedestals and not transferred to adjoining bus or other apparatus (e.g., bushings).

Use of flexible-conductor connections at Circuit-Switcher's terminal pads will compensate for inherent insulator-column deflection. The weight of the bus plus any associated ice load exerts a vertical force on the Circuit-Switcher terminal pads. This vertical force must not exceed 400 pounds on the terminal pad at the interrupter end, or 300 pounds on the terminal pad at the disconnect-blade end. Furthermore, bus connections to the terminal pads on the disconnect-blade end must be sufficiently rigid to preclude wind-induced oscillation of the terminal pads.

Seismic Withstand Capability

S&C Mark V Circuit-Switchers, when installed with the recommended S&C Mounting Pedestals and anchor bolts, are capable of withstanding seismic loading of 0.2 g ground acceleration in any direction, as well as performing as intended during such loading and afterward. Higher seismic withstand capabilities can be furnished on special application.

Inspection Schedule and Procedures

To assure Circuit-Switcher's continued proper performance, it should be inspected in accordance with S&C's recommended schedule and procedures contained in S&C Instruction Sheet 711-590.

Since the Type CS-1A Switch Operator is provided with a convenient means for decoupling it from the Circuit-Switcher, elective exercising of the operator may be performed at any time without requiring an outage or switching to an alternate source. Moreover, when the switch operator is in the decoupled position, the shunt-trip device—when this option is furnished—is rendered inoperative, thereby permitting checkout of the system protective scheme.

BEFORE STARTING INSTALLATION

Checking the Shipment

An S&C erection drawing will be found in a water-resistant envelope attached to the interrupter container on one of the three Circuit-Switcher pole-units. Study the erection drawing carefully and check the bill of material to be sure all parts are at hand.

The Circuit-Switcher shipment should include the following items, as shown in Figure 2:

1. Three pole-units, each mounted on a skid. The live parts—which are attached directly to the insulator-mounting flanges—are factory-assembled and adjusted and *should not be interchanged during their removal for installation of the insulators.*
2. A crate which contains miscellaneous power-train components, interphase couplings, mounting hardware, and a temporary adapter for hand operation of the individual pole-units—all individually identified.
3. The vertical operating shaft, flanged interphase shafts, and the temporary lifting angles, which are bundled and shipped uncrated. Perforated panels, to enclose the underside of the pole-unit bases after the installation has been completed, are shipped in a separate crate.
4. Insulators, if furnished, shipped in separate crates.
5. S&C Mounting Pedestals (if specified) consisting of a set of six, of square steel tube construction.
6. An S&C Switch Operator—Type CS-1A (as specified).
7. Any accessories specified, such as shunt-trip device.

Interrupter Target

Circuit-Switchers are usually shipped with the interrupters in the open position. Therefore, the interrupter target, located on the side of each brain housing (see Figure 1), will appear yellow. During the step-by-step instructions which follow, the disconnect blades will be moved to the fully open position. This will close the interrupter and charge and latch the stored-energy source within the brain, and the target will appear gray (normal).

⚠ CAUTION

When in service, Circuit-Switcher interrupters should *never* be open when the blades are in the closed position. To close the interrupters, Circuit-Switcher must be completely opened and then reclosed.

Gas-Pressure Indicator

Circuit-Switchers have sealed interrupters containing gas under pressure. Loss of gas pressure may result in improper interrupting action. Low gas pressure is signaled by a red target in the gas-pressure indicator at the terminal end of each interrupter. A gray target indicates normal pressure.

SHUNT-TRIP DEVICE

If the optional shunt-trip device has been specified, a shunt-trip solenoid housing will be attached to the side of each pole-unit base near the center insulator support, and a shunt-trip linkage will be attached to the brain. The Circuit-Switcher shipment will also include, in separate cartons, insulator units and hardware for the three shunt-trip insulated operating shafts. The cartons containing these insulator units should be opened to inspect for shipping damage, *but the units should be left in their boxes until installation* to prevent damage at the job site.

Installation of the shunt-trip insulated operating shafts should be performed following Step 27. Conduit and control wiring from the switch operator to the shunt-trip solenoid housings—to be furnished by the user—may be installed any time after the Circuit-Switcher pole-units have been permanently mounted in place. Conduit size should be one inch minimum. Control wiring for the shunt-trip solenoids should be left disconnected at the switch operator end until Step 32 has been completed. Refer to S&C Instruction Sheet 711-600 for recommended wire sizes for the control wiring.

DO NOT INTERMIX COMPONENTS FROM DIFFERENT INSTALLATIONS

S&C maintains an historical record—by serial number—of every Circuit-Switcher produced. This record lists information pertinent to each installation, such as application, date of shipment, and any service performed by S&C factory service specialists. This record is invaluable when questions arise relative to modifications or replacements. It is important, therefore, that the various components belonging to a specific Circuit-Switcher installation *not* be intermixed with components belonging to a different installation.

For this reason, each Circuit-Switcher is serially numbered. This serial number is stamped on the nameplate affixed to each individual pole-unit base and also on the nameplate affixed to the switch operator.

To facilitate identification during erection, the serial number, the sales-order number, and the erection-drawing (ED) number are marked on each Circuit-Switcher pole-unit base; on the switch operator shipping crate, and on all crates, boxes, and bundles for the other components associated with the installation. In addition, each Circuit-Switcher pole-unit base, as well as the pole-unit skid, is marked "Pole 1," "Pole 2," or "Pole 3," corresponding to the mounting position of the pole-unit on the erection drawing. These pole-unit numbers are not necessarily phase designations.

INSTALLATION

⚠ CAUTION

Do not remove the interrupter containers until the installation has been completed.

PIERCING SET SCREWS

To assure the integrity of the operating mechanism, it is imperative that careful attention be given to the correct installation of the piercing set screws provided on the vertical operating-shaft couplings. Before installing an operating shaft in any coupling, make certain that the cutting tips of the piercing set screws do not protrude through the body of the coupling. Tighten each piercing set screw as directed in the step-by-step instructions that follow, but in each case, *only* after the associated clamp bolts have been torqued to final tightness.

Step 1

Without removing the Circuit-Switcher pole-units from their skids, arrange them in the position and order in which they will be raised onto their mounting pedestals, as shown on the erection drawing. Each pole-unit base is numbered, corresponding to its position as indicated on the erection drawing. (The pole-unit numbers are not necessarily phase designations.) Moreover, the three pole-units carry the same serial number located on the nameplate of each pole-unit base. In the event that more than three pole-units are available, care should be taken to be sure that the serial numbers are matched for each Circuit-Switcher installation. The switch operator also carries the Circuit-Switcher serial number on its nameplate to aid in making certain that the operator is used with the correct Circuit-Switcher.

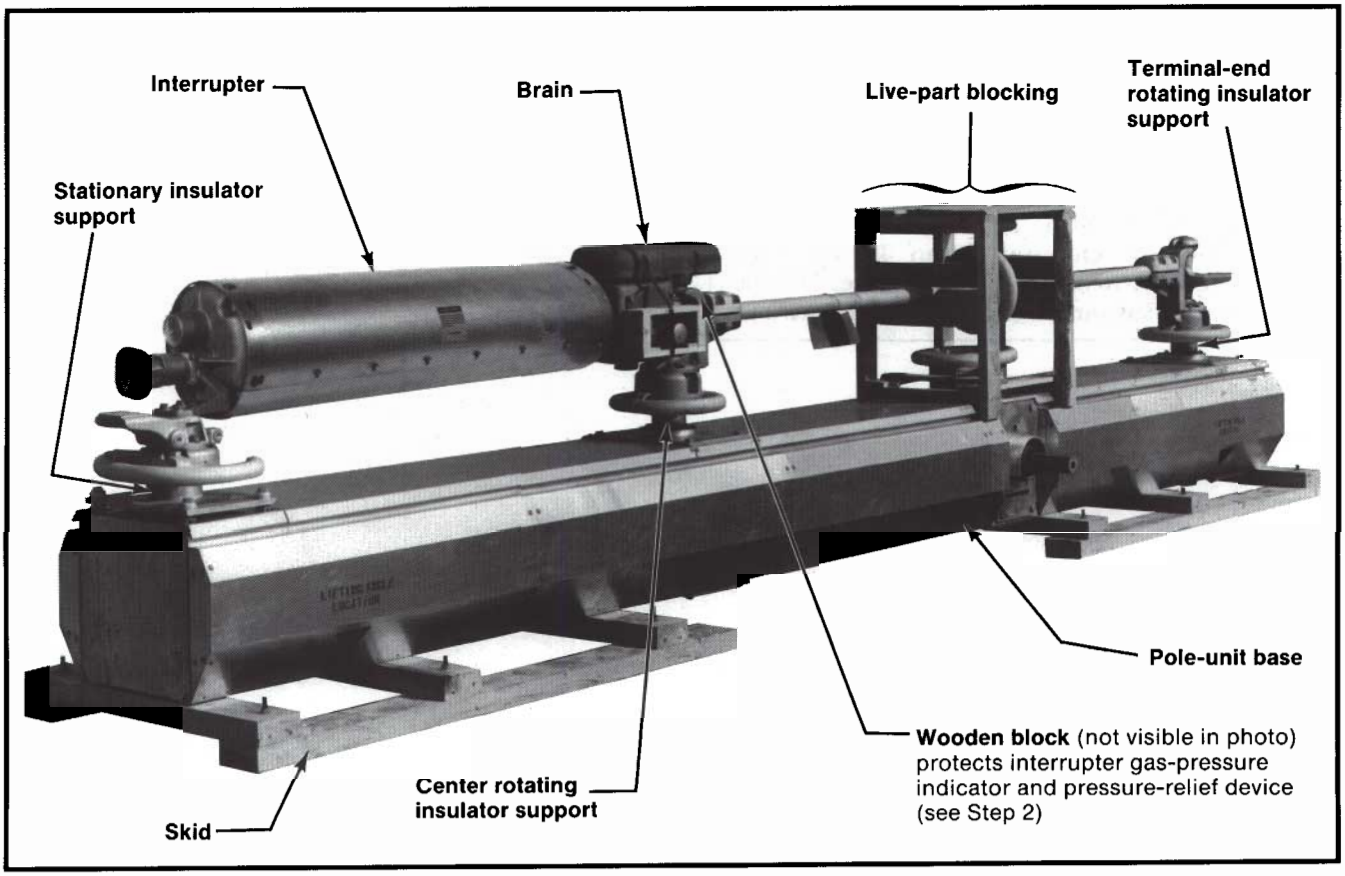

Figure 2. Pole-unit as shipped (1600-ampere rating shown).

Each skid should rest firmly and be reasonably level. Shoring under the skids may be necessary if the ground is uneven. Sufficient space must be provided to permit full blade opening of each pole-unit without interference with the adjacent pole-unit or pedestal. The blades will open to the left, as viewed from the interrupter end.

Repeat Steps 2 through 8 for each of the three Circuit-Switcher pole-units.

Step 2

Leaving the skid attached to the pole-unit base, remove the blocking members which support the live parts during shipping. See Figure 2. Remove also from the base any component parts, such as corona shields or shunt-trip insulated operating shafts (if applicable).

Do not remove the wooden block fastened to the blade-hinge assembly at the center insulator support until the live parts have been attached to their supporting insulators. This block is intended to prevent a freely swinging blade from damaging the adjacent interrupter's gas-pressure indicator or pressure-relief device during hoisting. Inspect for any obvious shipping damage before continuing installation.

Step 3

Attach one of the interphase couplings to the drive-shaft hub on the side opposite the direction of blade opening. Then bolt the temporary hand-operation adapter to the coupling in a manner so as to permit 186-degree rotation of the adapter in a counterclockwise direction. See Figure 3. (Use this same temporary

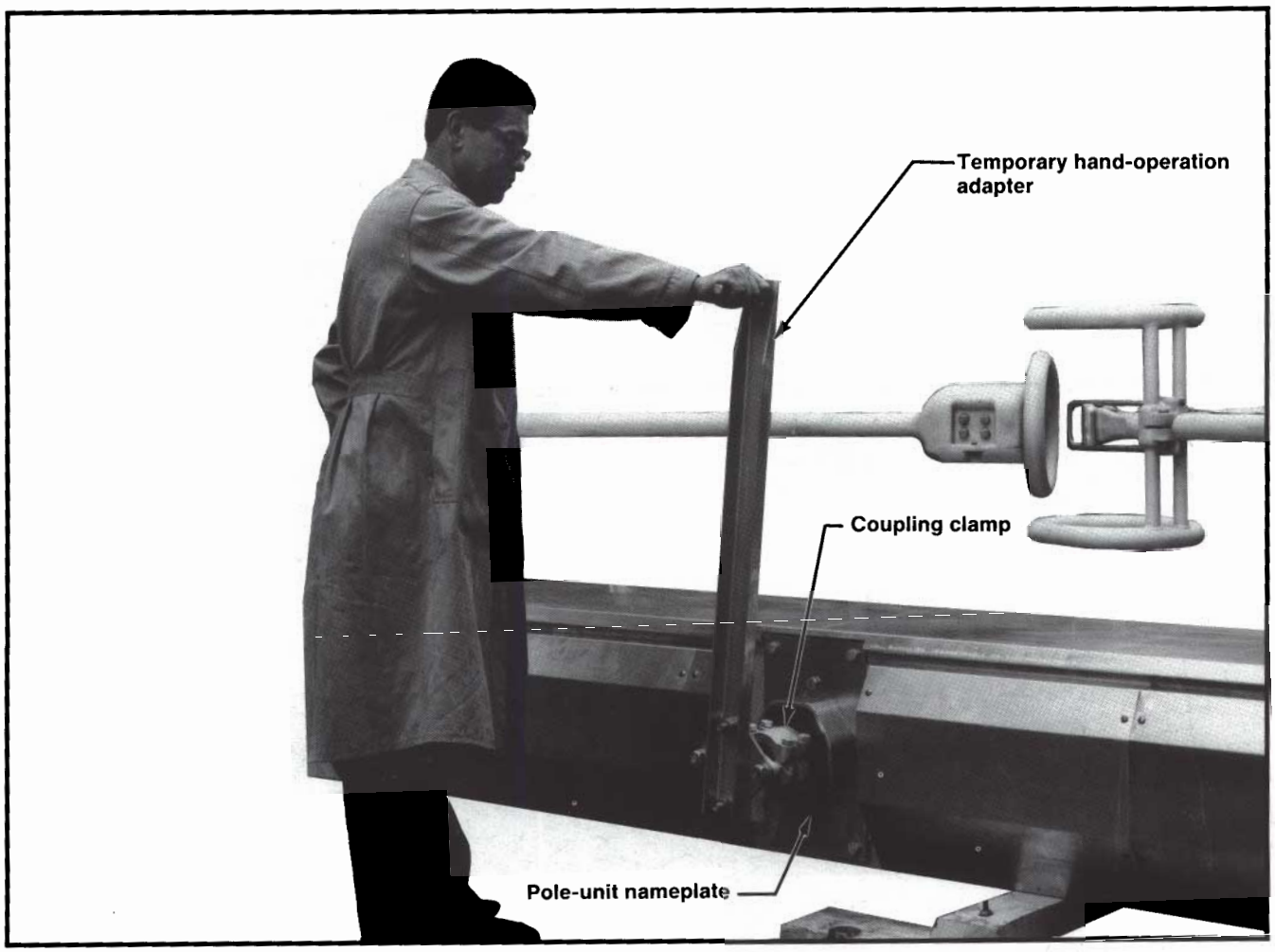

Figure 3. Operating a pole-unit with the temporary hand-operation adapter.

hand-operation adapter and interphase coupling when checking and adjusting the other two pole-units.)

Step 4

With the hand-operation adapter, open and close the pole-unit several times to obtain the "feel" and observe the operation of Circuit-Switcher as adjusted by the factory.

Note that:

(a) During the opening operation, an initial peaking of effort will be required as the drive-shaft crank leaves its closed, toggle position. Rotation should progress smoothly but with a noticeable increase in effort as the blades pass beyond their half-open position. It is at this position that the stored-energy source within the brain begins to charge as the interrupter closes.

As the opening rotation continues, this stored-energy source charges and latches, and a final peaking of effort again will be required as the drive-shaft crank goes into toggle against its open stop. Both blades will now be in their fully open positions at an angle slightly greater than 90 degrees from the pole-unit base. With the blades in the fully open position, the interrupter will be closed, as indicated by the gray interrupter target on the side of the brain. See Figure 1.

(b) During the opening sequence, the interrupter target on the side of the brain housing changes from gray to yellow when the interrupter is opened, then back to gray, indicating the normally closed position of the interrupter. In addition, the interrupter target remains gray when the Circuit-Switcher is closed, indicating that the interrupter is closed.

(c) As the Circuit-Switcher moves toward the closed position, rotation should progress smoothly with the fault-closing tongue contact in proper mesh with the fault-closing jaw contact and with the current-carrying tongue contact entering the current-carrying jaw contact evenly. See Figure 17. This same engagement should be attained after the live parts have been removed and reassembled on the insulator stacks.

Step 5

Remove—as a complete assembly—the brain, interrupter, and associated disconnect blade from the insulator-mounting supports, following the procedure described below. Use care, during this procedure, to avoid damage to the corona shields at each live-part mounting position.

(a) Attach lifting slings in the manner shown in Figure 4. Be sure that the slings do not interfere with the interrupter target on the side of the brain, the gas-pressure indicator, the pressure-relief device, or the shunt-trip operating shaft (if applicable).

(b) Loosen the adjusting screws at both blade-adjustment discs. Figure 5 illustrates a terminal-end blade-adjusting screw.

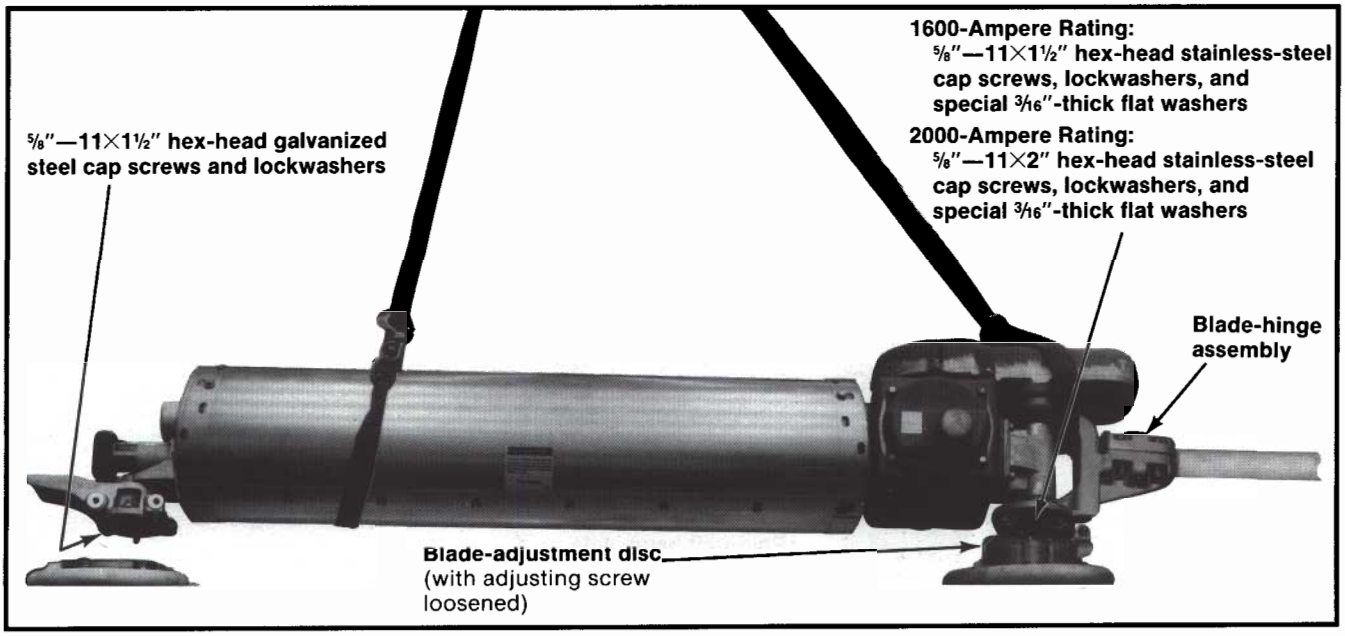

Figure 4. Removing brain, interrupter, and blade assembly.

(c) Remove the cap screws fastening the blade-hinge assembly to the blade-adjustment disc on the center insulator support, and the cap screws fastening the interrupter terminal end to the stationary insulator support. (For the 1600-ampere rating, a spacer casting is used under the interrupter terminal pad. See Figure 6. Disassembly and later reassembly will be simplified by handling the spacer as a separate item, i.e., unbolting the spacer from the terminal pad as well as from the insulator support.)

(d) Use a fall line to prevent the disconnect blade from swinging. Then hoist the brain-and-interrupter assembly and set it aside on a clean surface. Do not permit the assembly to rest on the shunt-trip shaft extending from the brain (if applicable).

Retain the stainless-steel hardware for reuse; discard the galvanized cap screws used to fasten the terminal end to the insulator support.

Step 6

Remove the remaining live parts from the rotating insulator supports. First, remove the disconnect-blade assembly at the terminal-end rotating insulator support; retain the stainless-steel cap screws for reuse. Then remove both blade-adjustment discs; discard the galvanized cap screws.

Make sure that the pole-unit power train is in its fully open position. (The erection drawing shows the direction of blade-opening rotation.) Then remove the temporary hand-operation adapter.

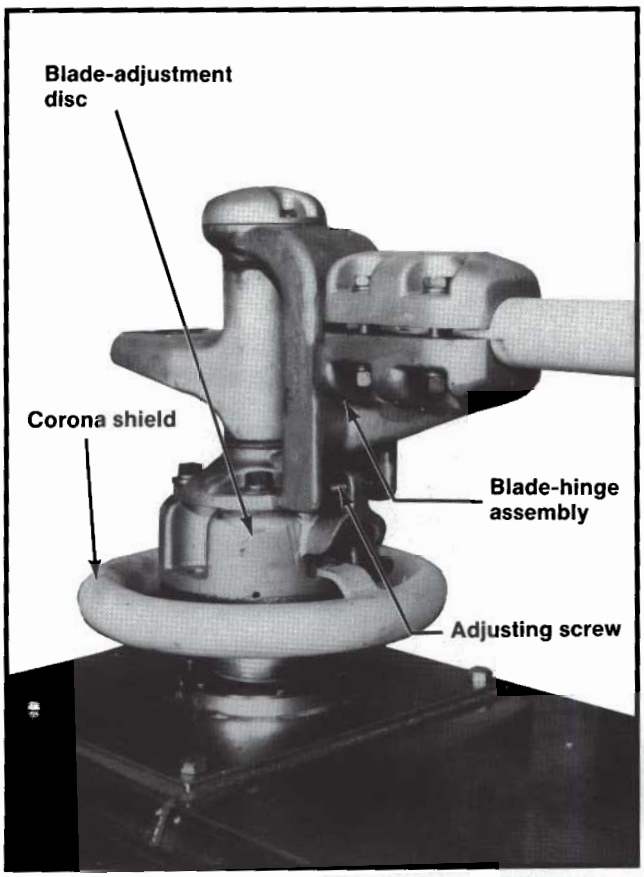

Figure 5. Terminal detail, disconnect end (1600-ampere rating shown).

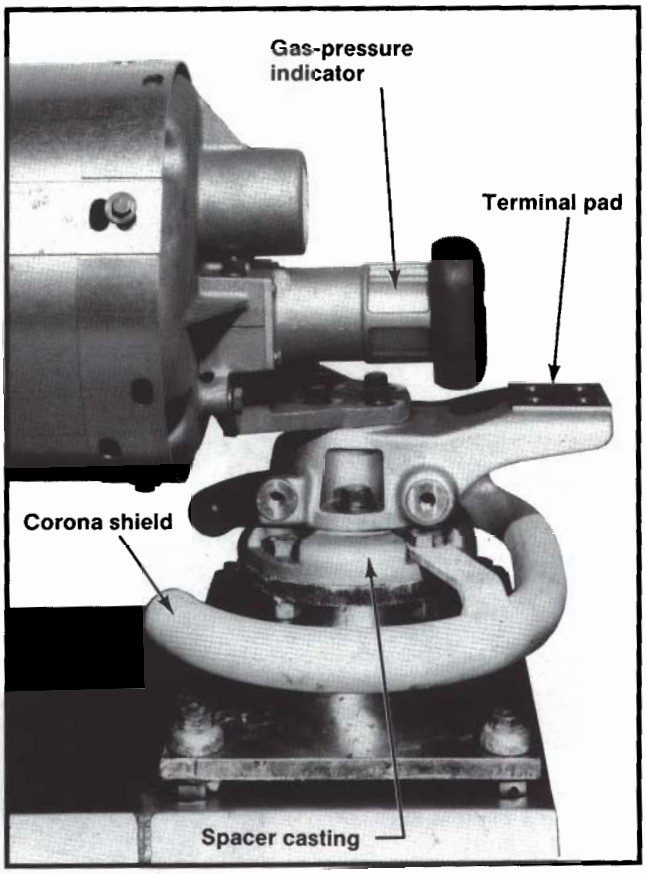

Figure 6. Terminal detail, interrupter end (1600-ampere rating shown).

INSTALLATION — Continued

Step 7

Install the mounting pedestals. Make sure that the pedestal to which the switch operator is to be mounted is positioned as shown on the erection drawing. Adjust the bottom set of anchor-bolt nuts at each pedestal to *generally* plumb and level the pedestal. The upper set of anchor-bolt nuts should only be loosely attached at this time. Figure 7 illustrates a typical pedestal mounting detail.

Step 8

Bolt the lifting angles to the base at the locations indicated. Attach the lifting slings as shown in Figure 8. Unbolt the skids and raise the base assemblies to the mounting pedestals in the position shown on the erection drawing. Note that the hex shaft extending beneath one of the bases is for connection to the switch operator.

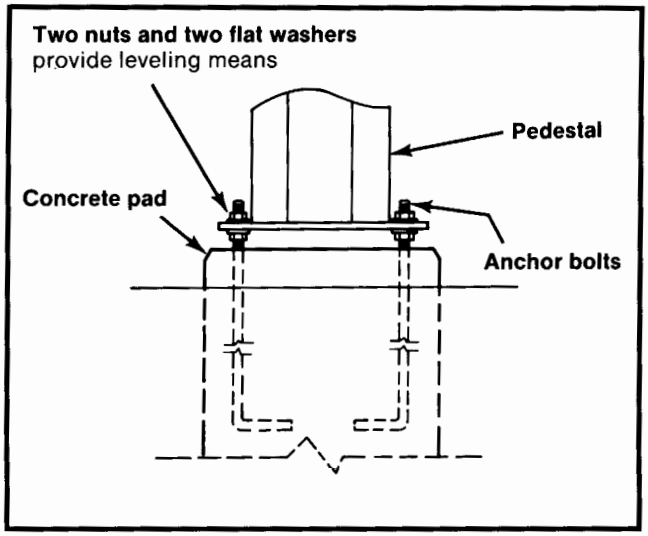

Figure 7. Pedestal mounting detail.

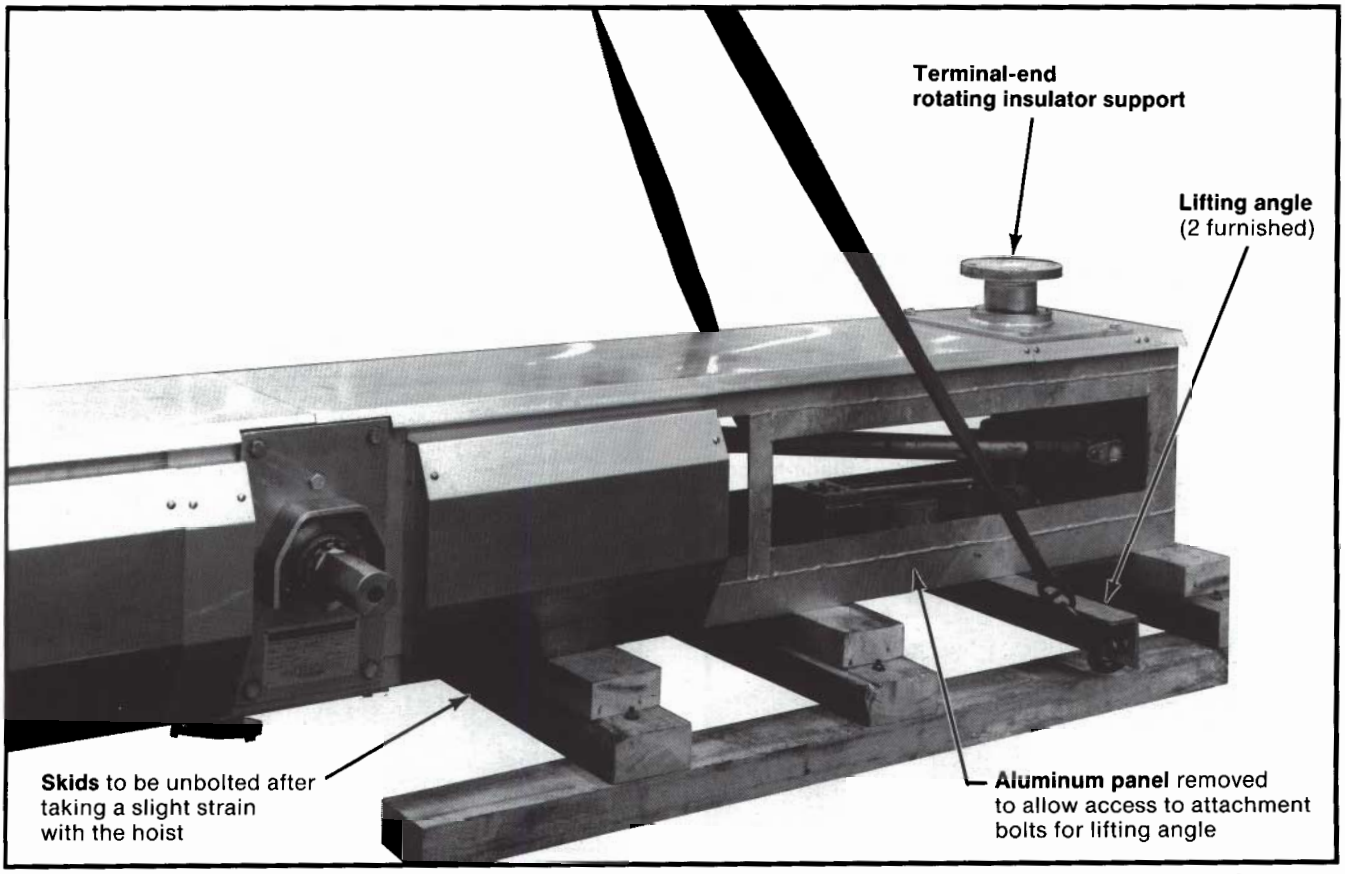

Figure 8. Pole-unit base assembly ready for hoisting to mounting position. Slings similarly attached to opposite end.

Make sure that the upper set of mounting-pedestal anchor-bolt nuts is *loosely* attached. Then *securely bolt* the pole-unit base to its associated mounting pedestals. Adjust the lower set of anchor-bolt nuts to level the center insulator support. Then securely tighten the upper set of anchor-bolt nuts. Note that it is not the pole-unit base itself that is to be leveled—only the insulator support. Remove the lifting angles.

Step 9

Mount the switch operator★ as shown on the erection drawing.

Step 10

Attach flexible couplings to the drive-shaft hubs of the three pole-units as specified on the erection drawing.

For each interphase shaft, attach an extension weldment to one of the pole-unit drive-shaft couplings. See Figure 9. Typically, both extension weldments are attached to the center pole-unit. Note that, on the base containing the gearbox, one side must first be fitted with a flange-mounted hub. See Figure 9. Attach this flange-mounted hub such that its hex "flats" are aligned with the flats of the hex on the adjacent pole-unit hub.

Step 11

Install each interphase shaft with its circular mounting flange toward the circular flange on the extension weldment.

Slide the interphase shaft over the tubular projection on the extension weldment to temporarily support that end of the shaft. (It may be necessary to loosen the clamp bolts on the drive-shaft hub to permit this to be done.) See Figure 9. Then attach the opposite end of the interphase shaft to the flexible coupling on the adjacent pole-unit. See Figure 10. Tighten all clamp bolts.

Step 12

Make sure that the drive-shaft crank in each of the three Circuit-Switcher pole-unit bases is resting against its open stop. See Figure 18. Then locate a pair of holes in each interphase-shaft flange which line up with a

★ If more than one switch operator is available, be sure to select the one intended for the Circuit-Switcher installation being made. Make certain that the Circuit-Switcher serial number, located on the Circuit-Switcher nameplate *on the switch operator*, agrees with the serial number on the nameplate of each pole-unit.

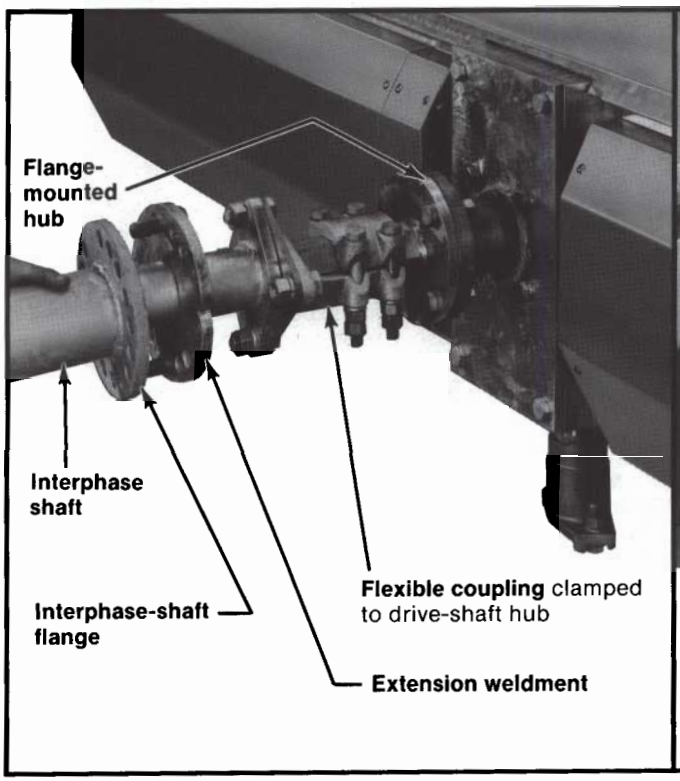

Figure 9. Interphase-shaft coupling detail, typical of center pole-unit.

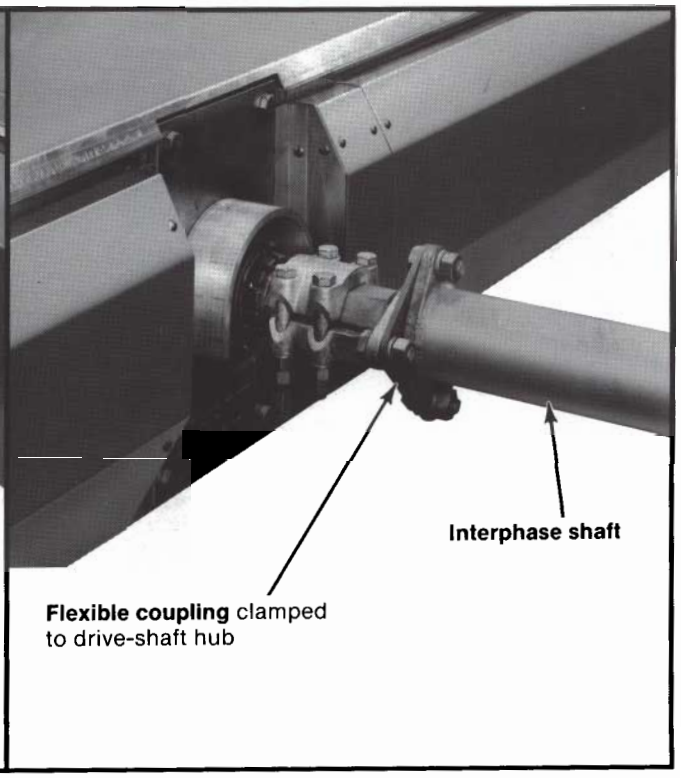

Figure 10. Interphase-shaft coupling detail, typical of outer pole-unit.

matching pair of holes in the mating extension weldment and bolt together tightly. The matching holes should be as nearly diametrically opposite as possible. See Figure 9.

Step 13

After the interphase shafts have been securely bolted in place (tightness of both clamps and flange bolts is very important), recheck the position of the drive-shaft cranks in each of the three Circuit-Switcher pole-unit bases. Each should be resting firmly against its stop. See Figure 18.

If this is not the case, remove the flange bolts installed as described in Step 12 to permit movement of the drive-shaft crank independent of the interphase shaft. After the proper stop position of each drive-shaft crank has been attained, reinstall the flange bolts in the manner described in Step 12.

Step 14

Refer to S&C Type CS-1A Switch Operator Instruction Sheet 719-500, which has been placed inside the door of the switch operator, and proceed as outlined therein in the "INSTALLATION" and "MANUAL OPERATION" sections.

⚠ CAUTION

Electrical operation of the switch operator should not be attempted until its travel-limit discs have been properly adjusted as described in S&C Instruction Sheet 719-500.

Step 15

Manually operate the switch operator to bring it to the same position (fully open or fully closed) as the Circuit-Switcher. Make certain that the cutting tips of

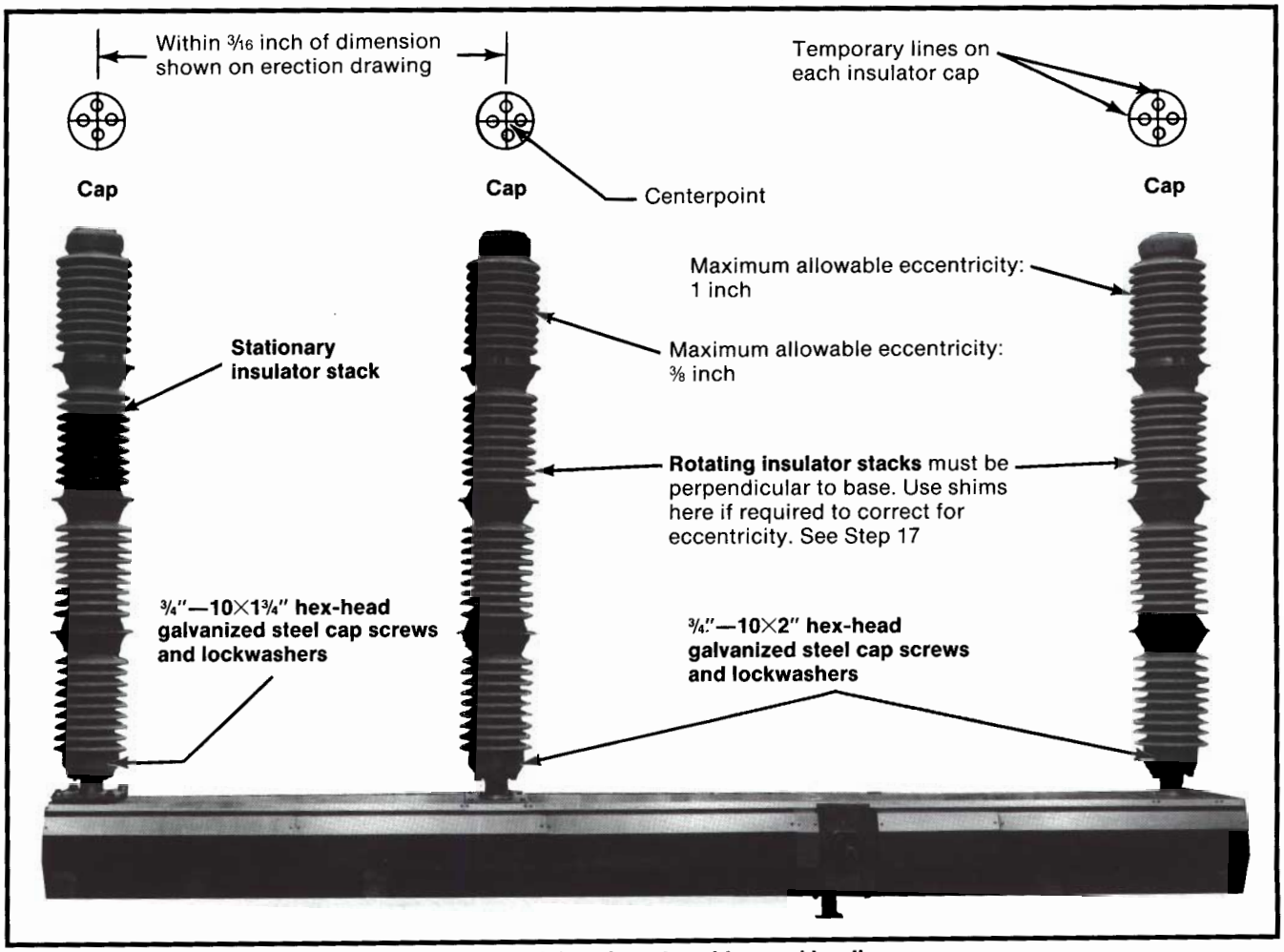

Figure 11. Critical dimension and alignment to be attained by using shims and leveling screws.

the piercing set screws do not protrude through the body of the universal or flexible coupling attached to the output shaft of the switch operator. Tighten the clamp bolts equally so that the clamp pulls down evenly. Then tighten the associated piercing set screws, piercing the shaft, and continue turning until a firm resistance is felt.

Then, for each pole-unit, repeat Steps 16 through 23.

Step 16

Assemble the three insulator stacks, with rain shields (where applicable), in accordance with the insulator manufacturer's instructions. (Hardware for assembling the individual insulators to make up the stacks are included with the insulator shipment.) Securely tighten all cap screws.

Attach the insulator stacks to the pole-unit insulator supports with the galvanized hardware (furnished) as shown in Figure 11. Securely tighten all cap screws.

It is recommended that scaffolding or other means be provided to permit erection and adjustment of the pole-units without introducing strains which could distort or otherwise interfere with their proper operation. It is especially important that insulator alignment measurements be made *without placing any weight or strain on the insulator stacks.*

Step 17

Check each rotating insulator stack for eccentricity as follows:

(a) Locate the centerpoint of each insulator stack by accurately drawing, on the top of the insulator cap, temporary lines which bisect and connect opposite bolt holes. See Figure 11.

(b) For use as a reference, extend a fixed object over the centerpoint at the top of each insulator stack. (The fixed object may be, for example, a piece of wood extending from the stationary insulator stack, rigidly held in position; or taut cord strung between the stationary insulator and the scaffolding.)

(c) Crank the manual operating handle on the switch operator to rotate the insulator stacks through their full travel. (The full open-close rotational travel of each rotating insulator stack is approximately 95 degrees.) Verify that the centerpoint of each insulator cap does not move more than as specified in Figure 11 and, at the same time, observe the arc of this movement. Any excess eccentricity must be corrected by shimming the insulator stack(s)—the higher up in the stack that the shims are placed, the less the degree of correction. Shimming material is included with the insulator hardware in a cloth sack attached to the pole-unit base.

Torque to final tightness all insulator-stack cap screws, including those fastening the insulator stacks to the insulator supports.

When adjustments have been made to eliminate eccentricity, the perpendicularity of the rotating insulator stacks with respect to their supports will be within acceptable limits.

Step 18

The stationary insulator stack should be checked for alignment with the rotating insulator stacks by stretching a cord taut across the top of the insulator caps so that it crosses the centerpoint of all three insulator stacks. Then measure the center-to-center distance between the stationary insulator stack and the center rotating insulator stack. See Figure 11. This distance must be within 3/16 inch of the dimension shown on the erection drawing.

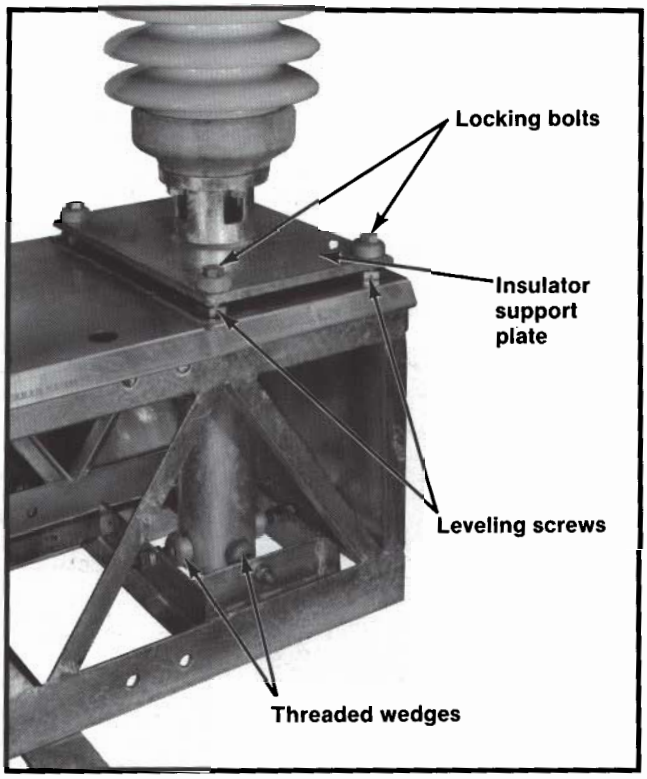

Figure 12. Leveling screws for alignment of stationary insulator stack. See Step 19.

INSTALLATION — Continued

Step 19

Adjust for the necessary centerline distance and the stack alignment, as described in Step 18, as follows:

Remove the sculptured panel from one side of the base, below the stationary insulator stack. Refer to Figure 12. Loosen the four threaded wedges within the base enclosure. Then loosen the four locking bolts located at the corners of the insulator-support plate (the associated locking nuts are accessible inside the base). Turn the leveling screws (the leveling screws are threaded into the insulator-support plate).

To avoid changing the relative height of the insulator stack, *do not use more than three of the four leveling screws* for this adjustment.

Retighten the four locking bolts. Then retighten the four threaded wedges.

Replace the sculptured panel after completing adjustment.

Note: Alignment of the insulator stacks, as directed in Steps 17, 18, 19, is essential to obtain correct latching of the brains and to obtain close interphase simultaneity during opening.

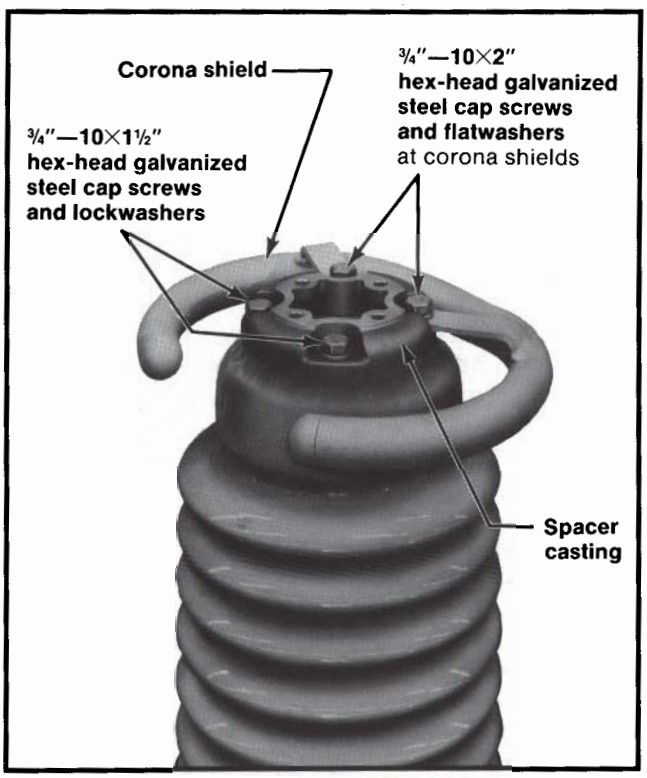

Figure 13. Spacer casting hardware requirements for stationary insulator stack (1600-ampere rating).

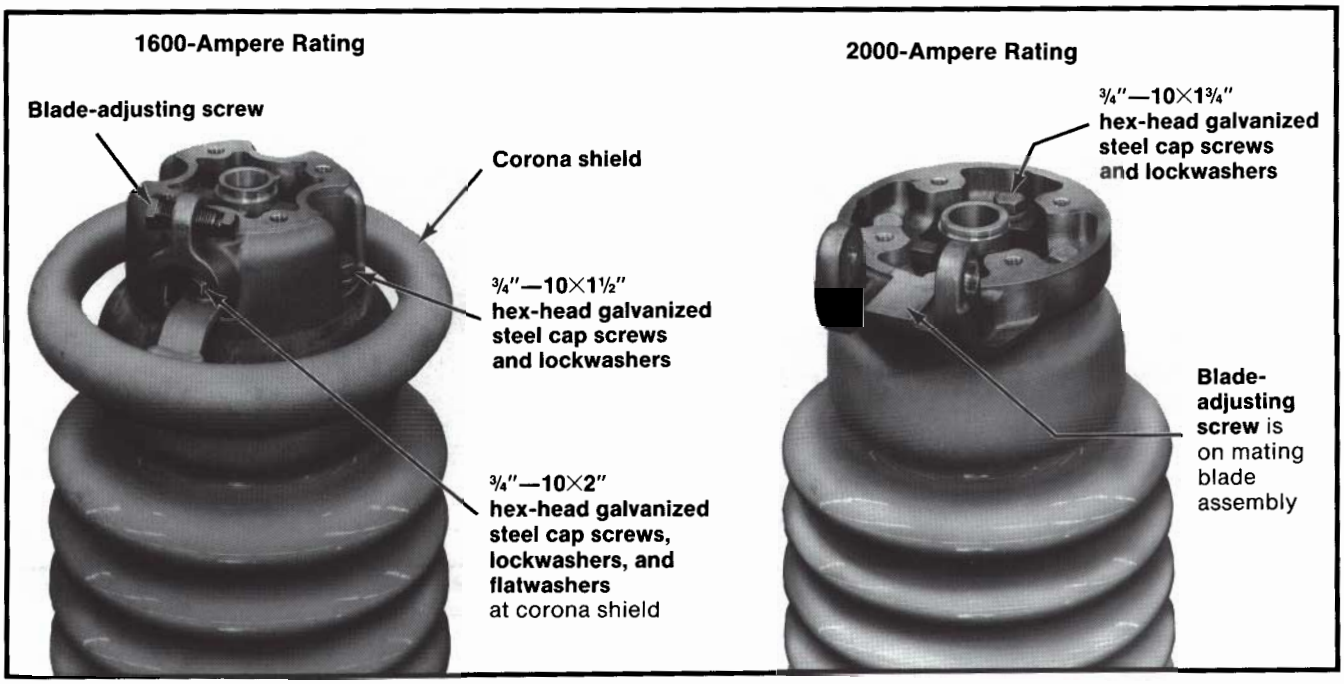

Figure 14. Blade-adjustment discs.

Step 20

So that the live parts may be installed in their proper relationship to the rotating insulator stacks, establish a point of reference by cranking the manual operating handle on the switch operator to fully close the Circuit-Switcher.

For the 1600-ampere rating, mount a spacer casting and corona shield on the stationary insulator stack, using the galvanized hardware indicated in Figure 13. See also Figure 6 for orientation.

Mount a blade-adjustment disc on each rotating insulator stack, using the galvanized hardware specified in Figure 14. Note in particular the placement of the corona shield which is installed with the blade-adjustment disc on 1600-ampere Circuit-Switchers.

For the 2000-ampere rating, place the corona shield over the blade-adjustment disc so that it rests loosely on the insulator porcelain. The corona shield will be attached to the blade-hinge assembly in Step 22.

The cap screws for mounting the blade-adjustment discs and spacer castings *must be torqued to final tightness. This is important because access to the cap screws will be restricted later.*

Make sure that the cap screws are the correct length. Screws longer than those specified may bottom in the mounting holes in the insulator caps without effectively tightening against the blade-adjustment discs.

Step 21

With slings attached as described in Step 5(a), hoist the assembly of disconnect blade, brain, and interrupter. Mount the assembly onto the insulator stacks using the hardware indicated in Figure 4. Be sure to place the assembly on the same pole-unit from which it was originally removed. Torque the stainless-steel cap screws to final tightness.

Extreme care should be exercised to prevent the lifting slings from interfering with the interrupter target, the gas-pressure indicator, or the pressure-relief device.

Step 22

Crank the manual operating handle on the switch operator to fully open the Circuit-Switcher. Then mount the terminal-end disconnect-blade assembly on its rotating insulator stack. See Figure 15. Torque the stainless-steel cap screws to final tightness.

For 2000-ampere Circuit-Switchers, fasten the corona shields to the blade-hinge assemblies, using four each ⅜″—16×1″ hex-head stainless-steel cap screws and lockwashers.

Step 23

Remove the wooden block fastened to the blade-hinge assembly at the center insulator support.

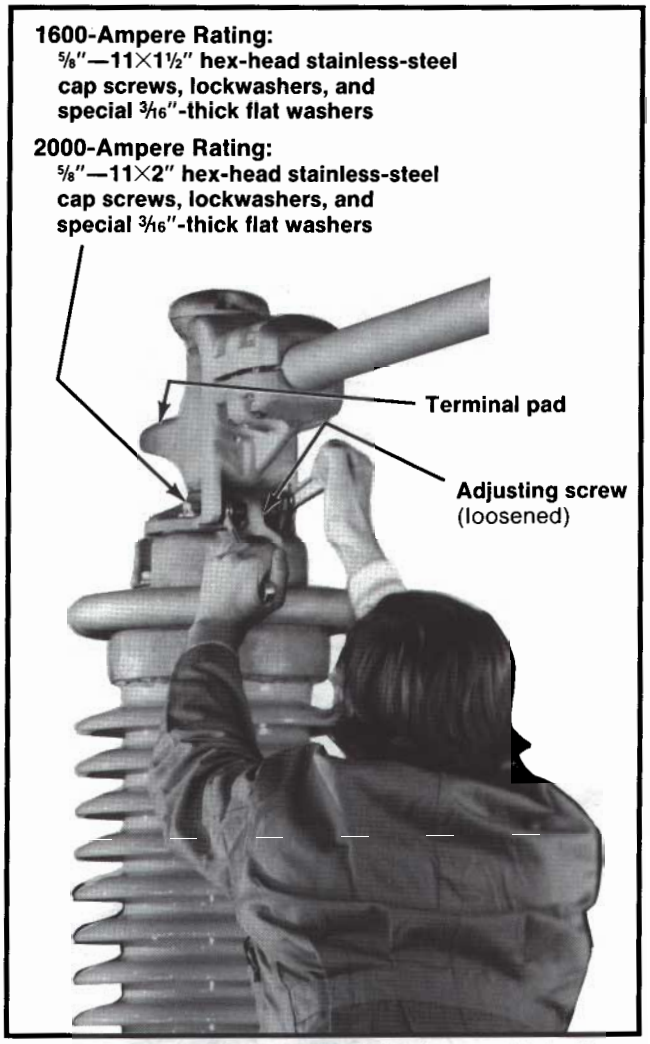

Figure 15. Assembling disconnect-blade assembly to blade-adjustment disc on terminal-end rotating insulator stack.

INSTALLATION — Continued

Step 24

Crank the manual operating handle on the switch operator to fully close the Circuit-Switcher.

In this position, note the guide mark on each tongue-contact blade. See Figure 16 or 17. This mark should be in line with the edge of the corona shield (for 1600-ampere ratings) or the edge of the jaw-contact housing (for 2000-ampere ratings) to ensure proper blade engagement.

If any guide mark does not line up as specified, loosen the blade clamp that holds the tongue-contact blade assembly and move that blade assembly in or out as required.

Torque the blade-clamp bolts to final tightness.

Step 25

For Circuit-Switchers rated 1600 amperes, adjust the position of the tip of each fault-closing tongue contact for ⅛-inch to 3/16-inch clearance from the inside of the jaw-contact housing, as shown in Figure 16 (inset), by loosening the fault-closing tongue-contact support and sliding it along the blade. The bottom cover of the jaw-contact housing must be removed to check this measurement.

Step 26

Open and reclose the Circuit-Switcher to check blade entry. The current-carrying tongue contacts should enter the current-carrying jaw contacts evenly with no tendency to clash against either side. See Figure 17.

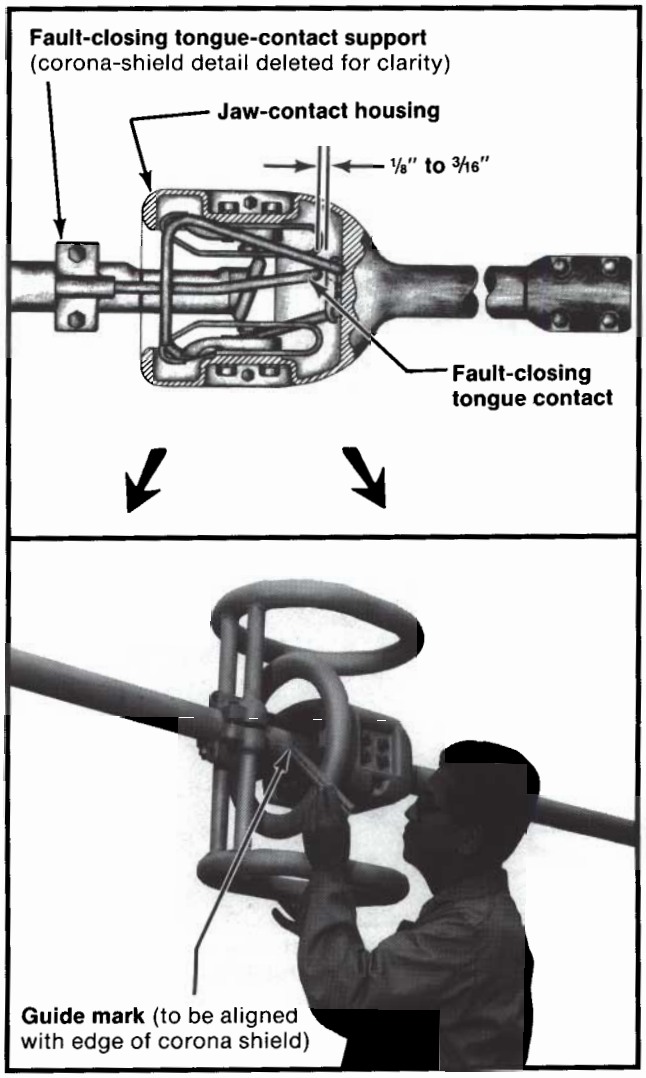

Figure 16. Checking for proper blade engagement (1600-ampere rating shown).

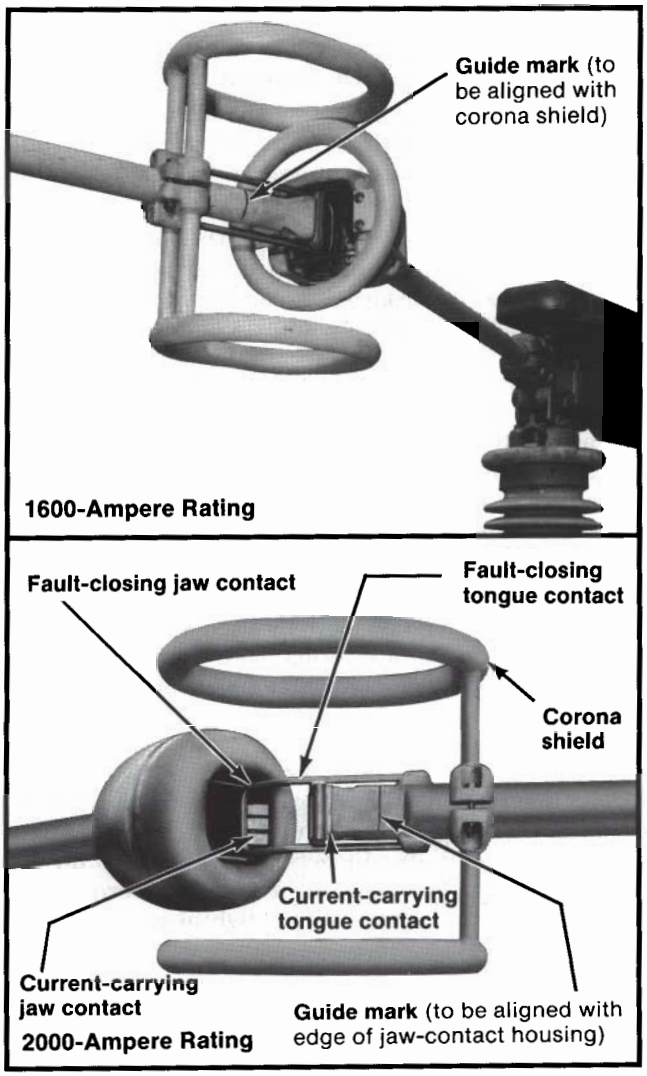

Figure 17. Blade-contact detail (blades partially opened).

Should adjustment be necessary, it may be accomplished with the blade-adjustment disc *at the terminal-end rotating stack only.* See Figure 15. Do not disturb the blade-adjustment disc of the center rotating stack because this can impair the latching and tripping action of the brain.

Under no conditions should adjustment be attempted on the power train in the base.

Step 27

Open and reclose the Circuit-Switcher. For each pole-unit, examine both the drive-shaft crank in the base and the blade crank-arm at the top of the brain to verify that each rests against its respective stop in the open and closed positions. See Figure 18 and Figure 19. *Do not attempt to adjust these stops.* The stops are factory-set to provide the travel necessary to achieve full latching of the brain as well as tripping simultaneity. The blade crank-arm may be viewed through the window in the top of the linkage cover. Do not remove the linkage cover itself. If the blade crank-arm at the top of the brain fails to meet its stop, in either the fully open or fully closed position, the most likely cause is misalignment of the stationary insulator stack. Adjust as follows:

(a) Loosen the cap screws which fasten the interrupter at the terminal end and, with the power train held securely against the drive-shaft crank stop, move the interrupter sideways (within the confines of the mounting holes) until the blade crank-arm stop makes firm contact with the blade crank-arm. See Figure 19.

Torque to final tightness the cap screws which fasten the interrupter at the terminal end.

(b) If the above method does not provide sufficient movement, adjustment of the stationary insulator stack is required. In this case, loosen the cap screws which fasten the interrupter at the terminal end (to relieve the strain) and adjust the stationary stack to align it with the rotating stacks. See Step 19. Then repeat the adjustment described in (a) above.

SHUNT-TRIP DEVICE

If the optional shunt-trip device has been specified, the insulated operating shafts should be installed at this time. The necessary conduit—with control wiring of recommended size—should be in place, although the control wiring for the shunt-trip solenoids should be left disconnected at the switch operator end until Step 32 has been completed. Refer to S&C Instruction Sheet 711-600 for instructions on insulated operating shaft installation.

After the insulated operating shaft has been installed, fully disengage the retractable bracket which secures the shunt-trip operating shaft extending from each brain. See S&C Instruction Sheet 711-600, Figure 3.

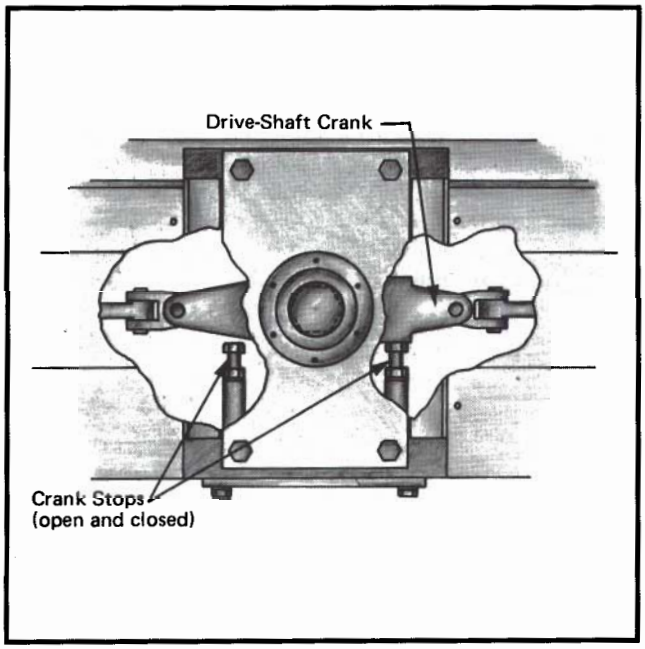

Figure 18. Checking drive-shaft crank.

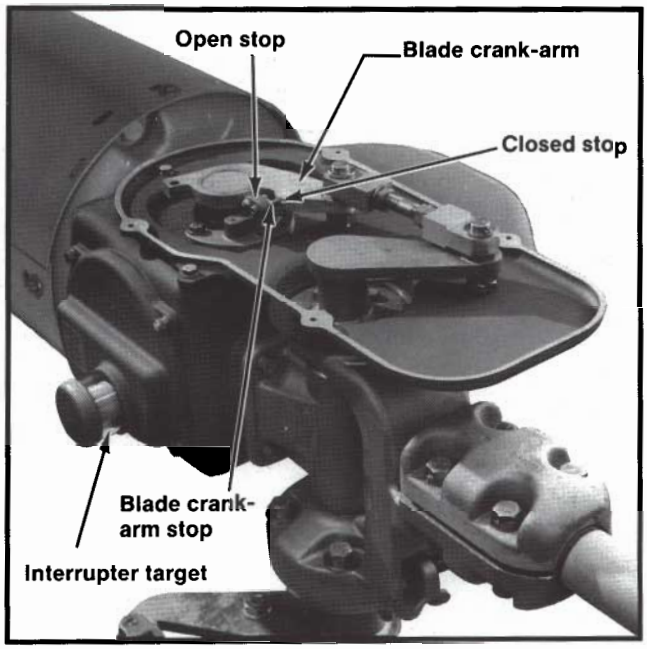

Figure 19. Brain-linkage detail. Linkage cover removed *only* for photographic clarity.

FINAL CHECKS AND ADJUSTMENTS

Step 28

Connect high-voltage conductors to their respective Circuit-Switcher terminal pads.

⚠ CAUTION

Conductors must be de-energized and grounded in accordance with standard system operating practice. Then proceed with the final checks and adjustments described in the following steps.

Step 29

Using the manual operating handle on the switch operator, open and close the Circuit-Switcher to check the three-pole group operation. The feeling of toggle action and the increase in opening effort as the stored-energy sources within the brains are charged will be similar to that experienced with single-pole operation.

Step 30

Check interrupter action by observing the target on the side of each brain. During the opening sequence, each target changes from gray to yellow when the interrupter opens, then back to gray, indicating the normally closed position of the interrupter. In addition, the interrupter target remains gray when the Circuit-Switcher is closed, indicating that the interrupter is closed.

Step 31

Refer to S&C Instruction Sheet 719-500 and adjust the switch operator for electrical operation as described in the "ADJUSTMENTS" section.

Step 32

Operate the Circuit-Switcher several times with the switch operator and observe the action. Operation should appear smooth, in both the opening and closing directions, with the drive-shaft crank of each pole-unit coming to rest in a positive-toggle position.

SHUNT-TRIP DEVICE

If the optional shunt-trip device has been specified, the control wiring for the shunt-trip solenoids should be connected to the terminal block in the switch operator at this time. See S&C Instruction Sheet 711-600.

Step 33

Opening of the interrupters of the three pole-units under switch operator power should be simultaneous within 1.5 cycles (0.025 second). Check for this simultaneity by slowly opening the Circuit-Switcher (by manually cranking the switch operator). Listen for the tripping action of the individual interrupters, and observe the interrupter targets. Note the point at which the first interrupter trips. From this point, no more than 40 degrees of rotation of the manual operating handle should be required before the other two interrupters trip. If this condition exists, the desired simultaneity has been attained.

Step 34

If simultaneity within the limits specified in Step 33 is not attained, recheck the blade crank-arm at the top of each brain with Circuit-Switcher in both the fully open and fully closed positions. If any blade crank-arm fails to meet its respective stop in either position, adjust as directed in Step 27. In the event that the blade crank-arms are correctly adjusted and the specified simultaneity is not attained, instructions for corrective adjustment will be provided by an S&C factory service specialist.

Step 35

After all adjustments are completed, close the bottoms of the bases with the perforated panels and fastening springs provided. The fastening springs are to be installed by hand—no tools are required. Recheck all bolted fastenings for tightness. This is important in maintaining optimum performance.

Step 36

Remove the container from each interrupter as follows:

(a) Remove and discard the ⅜"—16 zinc-plated serrated hex nuts which run the length of the container.

(b) Remove and discard the ⅜"—16×⅞" and two ⅜"—16×1" zinc-plated hex-head cap screws and flat washers which attach the *upper* container-half to the coupling end casting of the interrupter. Also remove and discard the ⅜"—16×⅞" and two ⅜"—16×1" zinc-plated hex-head cap screws and flat washers which attach the upper container-half to the indicator end casting of the interrupter.

(c) Pry the container-halves apart with a screwdriver. The upper container-half can now be removed and discarded—slotted holes are provided so that a rope or lifting sling can be attached and the container-half more conveniently lowered to the ground.

(d) Now remove and discard the ⅜"—16×⅞" hex-head cap screw and flat washer which attach the *lower* container-half to the coupling end casting of the interrupter, and the ⅜"—16×⅞" hex-head cap screw and flat washer which attach the lower container-half to the indicator end casting of the interrupter. Then discard this container-half.

(e) Finally, remove and discard the foam-core inner liner wrapped around the interrupter.

Now remove the shield for the pressure-relief device.