Siemens
3AF Breaker
Adjustments
1.0 TRIP LATCH ADJUSTMENT, PRELIMINARY

This adjustment sets trip latch in position to ensure it ability to support the breaker bell crank under torque loads imposed by the tripping springs. This adjustment is usually required during the mechanisms initial assembly. Set adjusting screw to establish indicated dimension between latch paddle and trip latch support frame. Secure adjustment by fastening jam nut.
2.0 TRIP LATCH FINAL ADJUSTMENT

Final trip latch adjustment is made after breaker assembly is complete and prior to electrical testing.

Using the adjusting screw as shown in Figure 1, increase latch roller wipe (counter-clockwise screw rotation) or decrease roller wipe (clockwise rotation) to achieve the roller wipe indicated above.

When properly adjusted, solenoid stroke will be approximately 15mm (0.39 to 0.59 inches), and the breaker will have tripped prior to reaching the limit of solenoid travel. Approximately 1 to 2mm of plunger overtravel must occur after the breaker trips.

---

Contact At On Latch
Stroke
1-2mm Overtravel
(.04-.08 inches)
3.0 RADIUS ARM AND SHOCK ABSORBER ADJUSTMENT

FIGURE 3A
Closed Position

FIGURE 3B
Open Position

Closed & Latched Reference Position

Open, Radius Arm Displaced 58° From Reference Position

Trip Latch

Radius Arm Lever & Roller

Shock Absorber

Closed Position

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3.0 RADIUS ARM AND SHOCK ABSORBER ADJUSTMENT CONT.

The breaker shaft displacement, between open and closed positions, is controlled by the shock absorber which arrests motion and maintains the open breaker shaft position against the torsional force of the tripping springs. The reference position from which angular displacements are to be measured is the closed position as shown above in Figure 3A.

A prerequisite to this adjustment is the preliminary trip latch setting as described in Item 1.0. The breaker shaft, trip latch support and tripping springs must be installed. The coupling rod's lower connection pin must be in place to permit "maintenance closing".

The enclosure wall adjacent to either end of radius arm must be calibrated to 58° of arc with the breaker shaft axis as center. A magnetically secured gage or protractor is most suitable for this purpose. An adjustable pointer must be fitted to the breaker shaft.

The breaker shaft may be manipulated by use of the maintenance closing lever. The arm should be rotated to the closed position against the torsional load of the opening springs. The close position is attained when the trip latch falls behind the radius arm lever and roller.

In the closed position, adjust pointer to align with zero position on the gage (protractor). With pressure on the maintenance closing handle lift roller of trip latch and carefully release latch. Ease breaker shaft in the direction that the opening springs want to take it. Allow 58° of displacement to occur, and then hold the radius arm steady until the shock absorber is brought into contact and its piston compressed to support the radius arm. Relax pressure on maintenance closing lever.

Breaker shaft displacement may now be adjusted to the required angle by manipulating the heavy upper nut on the shock absorber. After achieving a satisfactory adjustment, lock shock absorber setting by holding the upper nut and running the lower nut upward to compress and secure the assembly. Tighten to 80 to 100 ft. lbs.
4.0 TRIP FREE MECHANISM ADJUSTMENTS

Trip Free Latch

Trip Lever Extension Lock Nut and Adjusting Screw

Closing Cam
Drive Bar Lever Roller

Trip Lever

Adjustment

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<td>1.488 ± 0.01</td>
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<tr>
<td>B</td>
<td>212.5 ± 0.5</td>
<td>8.366 ± 0.03</td>
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<tr>
<td>C</td>
<td>20 ± 0.5</td>
<td>0.787 ± 0.02</td>
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</tbody>
</table>

*Note: These are preliminary adjustments to be completed during breaker assembly.

Trip free coupling rod required adjustments "A", "B" and "C" be completed prior to this sub assembly's insertion in the mechanism, see table.

Final adjustment of the trip free coupling rod requires that the trip latch final adjustment, Item 2, be completed as prerequisite.

With closing springs charged, a clearance should be noted between the surface of the closing cam and the roller of the coupling rod lever. This clearance can be achieved by adjusting rod end at the terminus of the coupling rod. One turn of the rod end will alter this clearance by 0.035 inches. The clearance should be the minimum necessary to permit free rotation of the roller.

"The trip lever extension lock nut and adjusting screw" may be adjusted only after completing the trip latch final adjustment described on sheet 2. With the breaker in the "open" position, the "trip lever adjusting screw" is set to allow minimum play between the adjusting screw and pin extending from the "trip free latch", less than 0.01. 

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4.0 TRIP FREE MECHANISM ADJUSTMENTS CONT.

Free lock nut and adjust screw to remove free play from the "trip lever extension" When properly adjusted the trip lever will be drawn forward until it just touches the laterally extended trip latch pin, see inset. Any motion of the trip latch should cause immediate displacement of the coupling rods trip free latch.

Visually check to be certain the trip latch pin over hangs the trip lever by 1 to 2mm as shown above.

Trip Latch Pin

13.5 ± .05
5.0 CIRCUIT BREAKER RACKING INTERLOCK

The racking interlock requires that the actuating pushrod be adjusted such that the lower flag can be displaced as shown from the rear inside surface of the enclosure. This adjustment is achieved through the rod eye and adjusting nut which support the actuating pushrod. After installation and adjustment the racking interlock lever and pushrod must move freely.

The 35.5mm dimension may be adjusted to cause more or less sensitive spring release and trip free operation. Small changes in this dimension are effective. Limit variation to ±1.

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6.0 CLOSING SOLENOIDRequires no adjustment.

Stroke should be 10 to 15mm (0.39 to 0.59 inches) when properly adjusted. Closing spring release should occur 1 to 2mm before the solenoid reaches the end of its stroke. (See sheet 2 for opening solenoid and trip latch setting).

7.0 MECHANICAL SPRING RELEASE BLOCKING DEVICE

The 3AF breaker employs a closing spring release blocking device to prohibit spring release in a closed breaker.

The blocking lever is normally spring returned to an inactive position. Whenever the breaker is closed, a spring coupling the drive lever to the spring blocking lever draws the blocking lever into an active position over the tail of the closing spring release latch to block latch rotation.

The dimensional relationship between blocking device should be checked to the values shown below.

- Contact At On Latch Lever
- StROKE
- Close

Spring Release Latch Blocking Lever
- Einschaltklinke Spring Release Latch
- >0.08 Ins.
8.0 CHARGING MECHANISM FOR CLOSING SPRINGS

The action of driving pawl, closing cam, and withdrawal cam is as follows. Assuming the closing spring is discharged, approximately 25 revolutions of the manual crank handle will bring the driving pawl into contact with the spring and closing cam. The pawl "dogs" into the closing cam hub and forces it and the spring crank into rotation causing the closing springs to acquire progressively more tension.

This process continues until the spring crank reaches top dead center. Continued crank rotation brings the crank beyond top dead center and the closing spring rapidly advances the closing cam beyond the driving pawl. After a short interval of angular displacement, motion of the closing cam is quickly arrested by a cam appendage and roller which contact the closing spring release latch.

Continued rotation of the driving pawl brings the "tail" of the driving pawl against the withdrawal cam. The withdrawal cam rotates the engaged end of the driving pawl free of the closing cam hub. The withdrawal cam must be set so that the following conditions are met.

- Driving pawl withdrawal must not begin until the closing spring cam has passed over top dead center.
- Withdrawal must be completed before the leading edge of the driving pawl over takes the bearing surface in the hub of the closing cam.
- Clearance while passing the bearing surface of the closing cam hub must be set to the clearances indicated, 0.5 to 0.8 mm (0.02 to 0.032 inches)

Check that motor cutoff switches; LS21, LS22, LS3, LS9, LS41, have successfully changed state.

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9.0 AUXILIARY SWITCH ADJUSTMENT AND MOTOR CUTOFF SWITCH ADJUSTMENT

Auxiliary switch function is achieved by presetting the operator pushrod to a predetermined dimension. The required dimension is shown to the left in the accompanying sketch. Proper adjustment of the auxiliary switch may be confirmed by observing action of the movable contact thru a transparent inspection window. The sketch to the left shows this contact in a neutral position. As the breaker closes this contact and its diametrically opposed mate rotate clockwise to be fully straddled by the stationary contacts located at the 45 and 135 degree positions.

In the open position, the movable contact is rotated counterclockwise to straddle completely the stationary contact located at 45° and 225°. Correct adjustment of the connecting rod places the movable contacts in a fully straddled position with the breaker opened and closed.

A pre-formed connecting rod has been introduced on more recent models of this circuit breaker. Connecting rod adjustments are not provided nor are they required. However, proper function should be visually confirmed by observing contact function through the inspection windows.

MOTOR CUTOFF SWITCH ADJUSTMENT

The motor cutoff switch functions to remove power from the spring charging motor at the instant the springs achieve a full charge. The system consists of a crank with tang and cam or striker forged into the crank which stretches the closing spring. As full spring extension occurs, the spring crank passes over "top dead center" and advances rapidly until arrested by the spring release latching. During this period of rapid motion the striker displaces the tang and crank counter-clockwise depressing the pushrod and hinged "flap." The hinged "flap" forces the operating button or several adjacent switches downward causing all the switch contacts to change state. Proper adjustment ensures all switch operating buttons are sufficiently depressed to cause switch operation without excessive motion which may jam switches. Adjustment is achieved by slight bending of the tang encircled above.
9.0 AUXILIARY SWITCH ADJUSTMENT AND MOTOR CUTOFF SWITCH ADJUSTMENT

Auxiliary switch function is achieved by presetting the operator pushrod to a predetermined dimension. The required dimension is shown in the accompanying sketch. Proper adjustment of the auxiliary switch may be confirmed by observing action of the movable contact through a transparent inspection window.

The sketch to the left shows this contact in a normal position. As the switch closes this contact and its diametrically opposed mate rotate clockwise to be fully straddled by the stationary contacts located at the -65 and 135 degree positions. In the open position, the movable contact is rotated counterclockwise to straddle completely the stationary contacts located at 65° and 225°. Correct adjustment of the connecting rod places the movable contacts in a fully straddled position with the breaker opened and closed.

A pre-formed connecting rod has been introduced on more recent models of this circuit breaker. Connecting rod adjustments are not provided nor are they required. However, proper function should be visually confirmed by observing contact function through the inspection windows.

In the open position, the movable contact is rotated counterclockwise to straddle completely the stationary contacts located at 45° and 225°. Correct adjustment of the connecting rod places the movable contacts in a fully straddled position with the breaker opened and closed. A transparent viewing window allows for inspection.
10.0 SECONDARY RELEASE AND UNDervoltage DEVICE MECHANISM

Prior to performing the adjustments which follow, observe the following preliminaries:

- Undervoltage Releases -- The locking feature must be released (placed in position "B") and rated voltage applied. Do this before proceeding. When adjustments are completed the locking release should be returned to the locked position, "A."

- Secondary releases are not to be energized during their adjustment.

Adjustment proceeds with the breaker in the open position. Release striker by pressing the "tripping pin." Striker will become extended and bear against the "striker adjusting screw."

Turn the "striker adjusting screw" clockwise (access hole in rear of the enclosure) until the striker latches. Continue screw rotation an additional ⅛ turn and secure striker screw by means of the lock nut.

Set "stop screw" as shown with indicated clearance over arming lever.
11.0 CONTACT STROKE AND FORCE ADJUSTMENTS

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<td>C1 11x1 (0.43 - 0.04)</td>
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</table>

Interrupter stroke is to be set at values as shown in the table above. The control of vacuum tube stroke is achieved by adjusting the "rod end" (eye) which terminates the insulated coupling rod at the end nearest the vacuum tube.

With the breaker open, remove pin joining the eye of the insulated coupling rod to the lever at the base of each pole assembly. The interrupter will close immediately under the influence of atmospheric pressure.

Check now for the presence of a small white erosion mark located in the center of the keyway just where the movable stem enters the body of the vacuum tube. This white mark must be viewed from the "stud" (primary connection) side of the vacuum breaker. With the tubes contacts closed this mark must always be visible.

Contact stroke displacements must be measured or gaged between a fixed point on the movable contact structure and some fixed reference on the lower pole support.

In the procedure shown below, the bottom surface of the terminal clamp and lower surface of an access window in the lower pole support have been chosen as points of measurements.

With atmospheric pressure holding the vacuum tube closed, measure this distance from the bottom surface of the terminal clamp, record this value as \( x_1 \). Move the lever backward to align the appropriate hole with the "eye" on the insulated coupler. Insert pin and measure the distance from the bottom surface of the terminal clamp to the stationary reference, record this value as \( x_2 \).

The difference between \( x_1 \) and \( x_2 \) (\( x_1 - x_2 \)), represents vacuum tube stroke, and the value recorded must agree with information shown in the table of "Contact Force and Travel Data". Iterative adjustment of the isolated coupler "eye" may be required to achieve the required \( x_1 - x_2 \) dimension.

Contact force measurement is crucial to breaker performance at rated close, latch and momentary currents. It is best measured by means of specialise fixtures and load cells as noted below.

Forced Pole Support Types
- 4FT 212-264-014
- 4FT 210-854-022

Cast Pole Support Types
- 4FT 210-854-014
- 4FT 210-854-022

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11.0 CONTACT STROKE AND FORCE ADJUSTMENTS CONT.

An alternate means of measuring contact force consists of measuring contact pressure spring deflection beyond installed lengths.

Required performance data may be found in the table of "Contact Force and Travel Data".

Measurements will proceed with the breaker closed, and for safety must be blocked in this position as the work proceeds. Use blocking device 2FT 211-165-014.

LOAD CELL METHOD

1. Attach load cell device and install continuity tester to the upper and lower breaker terminal.
2. Tighten adjusting nut on load cell until continuity is lost.
3. Read force at the point of continuity loss and record the value.
4. Check table for appropriate value.
5. Force measurement must be repeated on each pole.
6. Remove blocking device after completing measurements on each pole.

CONTACT PRESSURE SPRING DEFLECTION PROCEDURE (Excess Stroke)

Check table for correct contact pressure spring color code.

With breaker open measure dimension $X_1$ in each of three phase positions. Distance inside opposing spring collars.

Close breaker and install blocking device 2FT 211-165-014.

Measure $X_2$ and record for each respective phase position.

The difference between $X_1$ and $X_2$ must meet the appropriate values listed in the table and be recorded.

Remove blocking device and open breaker.
## CONTACT FORCE AND TRAVEL DATA 00-857-024-004

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**OVERTRAVEL SPRING CODE**

1. LOWER SPRING HANGER--ONE, HOLE

- **Blue**: 409-00171-001 18-658-104-054
- **Orange**: 409-00068-001 18-658-104-050
- **Yellow**: 409-00128
- **Cray**: 409-00067
- **Green**: 409-00568
- **Red**: 409-00754
- **Brown**: 409-01081-001 18-658-104-049
The following settings and adjustments apply to the 5kV Interim Vehicle, and must be performed in addition to those described in drawing series 18-740-886-402 for the vacuum breaker.

Many adjustments must be performed in the assembly fixture, 75-533-949, final settings, in general, require pinning after achieving fixture settings.

ASSEMBLY DRAWING REFERENCE 18-742-988-503(T)
18-658-486-535

I. GUIDE BAR SETTING

The assembled breaker must be inserted into fixture and centered before guide bar settings are established. The breaker's vertical posts shall be spaced 0.987±0.03 on each side from the inclined panel checking guide bars. The fixture guide bars are spaced at a 22.687 calibrated dimension. It is suggested that spacers be developed to assist the centering operation. This procedure is critical, as the MSV breaker passes the cubic entrance with minimum design clearances.

Once centered, the guide bar (with loosened fasteners) should be clamped to the inboard surface of the fixture's guide bar slot. Care in performing this operation will facilitate primary alignment.

Securely torque guide bar fasteners to 150 ± 20 foot pounds, and proceed to primary stud alignment.

After completing primary stud alignment, use holes in base plate and drill two 0.190 ± .003 diameter holes thru guide bar and then pin bar in two places with roll pins, Item #48.

II. PRIMARY STUD ALIGNMENT

Align primary studs to drawing dimensions to tolerance of ± 0.040.

- Top Stud Elevation: 38.00 inches
- Lower Stud Elevation: 26.00 inches
- Center Stud Lateral Displacement of Guide Bar Reference: 3.50 inches
- Phase Spacing: 7.00 inches

III. CAM SHUTTER SETTING

Fixture cam shutter to fixture dimensions.

- Lateral Displacement from Guide Bar Reference to Outer Surface of Guide: 14.34 ± 0.06 inches
- Shutter cam profile makes a transition from an inclined surface to a horizontal surface 0.94 ± 0.06 inches toward the panel end of the breaker ahead of the plunger reference.
- Drill two 0.190 holes using guide holes in cam and its supporting angle.
- Drive two roll pins through supporting angle into base, and two pins thru cam into supporting angle; use roll pins, Item #10.

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IV. SECONDARY DISCONNECT SETTING

Align and set to fixture dimensions:
- Bottom secondary contact elevation to contact centerline: 6.437 ± .060 inches
- Lateral displacement from guide bar reference to crest of secondary contacts: 7.25 ± .060 inches
- Fore and aft alignment, crest of contacts must lie toward panel end of breaker ahead of plunger reference: 0.69 ± .060 inches

After completing final adjustment drill (2) 0.190 ± .003 holes using guide holes in secondary mounting plate. Drive two roll pins through this plate into vertical breaker channels, use item #48.

V. GROUNDING FINGER SETTING

Align and set to fixture dimensions:
- Rearward extension of grounding fingers from plunger reference: 17.00 ± 0.125 inches
- Lateral displacement from guide bar reference to center of fingers: 8.88 ± .06 inches

VI. CONTINUOUS CURRENT INTERLOCK

Install interlock bar by mounting with specified fasteners through prepared holes in base. Elevation: 2.75 ± .06 inches.

1200 Amp Breaker Extension, vertical portion nearest guide bar.
2000 Amp Breaker, Extension Outboard, vertical portion set at greatest distance from the guide bar.
VII. REMOTE AUXILIARY SWITCH OPERATING YOKE ADJUSTMENT

The yoke (1) which operates the cubicle mounted auxiliary switch is set in the fixture to an elevation of 17.18 ± 0.03 inches. A prerequisite to this adjustment requires that the operating arm (2) be set to a 30° angle, as shown, with the breaker opened. This arm must be fastened securely, the shaft drilled 0.190 ± 0.003 inches to an 0.250 depth and the arm pinned using an 0.188 X 0.75 long spring pin.

The yoke is set to the 17.18 ± 0.03 elevation by manipulating nut (22). After achieving the correct setting, these nuts should be securely tightened after applying Locktite thread adhesive.

During this adjustment, check that the yoke moves freely between nylon guide strips (3). Washers are used to space the nylon strips, their number may have to be adjusted in order to ensure free movement.

Check the lateral extension of the yoke ends at 5.91-6.00 inches of the reference line.

FIXTURE REFERENCE
VIII. RACKING INTERLOCK ADJUSTMENT

Initial adjustment begins by setting the rail plunger linkage. Plunger (1) free height is not adjustable, being established by design at 1.75 ± .06 inches.

The bridging link (2) must be set in an essentially horizontal position. Using the adjusting eye (3) directly above the plunger, set the bridging link at 3.00 ± .03 inches above the base surface. Securely lock with jam nut.
VIII. RACKING INTERLOCK ADJUSTMENT (continued)

During these adjustments, the closing spring discharge tube (3) should be blocked or clamped so that its upper end is flush with the guide bushing on the inside of the mechanism enclosure.

Adjust pushrod (4) until the washer and retaining ring associated with the "floating tip" (6) of the push rod lies flush with guide bushing and end of the spring discharge tube. When properly adjusted, the floating tip should be immediately displaced upward as the "racking release handle" (7) is raised.

The pushrod and floating tip must demonstrate free movement, responding to the "Racking Release Handle," and returning freely to its initial state upon release of the handle.

Close the breaker and observe that the floating tip clears breaker shaft cam by 1-2mm (.04 to 0.08 inches). With the breaker closed, this cam must block racking release. A closed breaker must not open when the racking release handle is lifted.

The mechanism internal to the breaker enclosure may now be adjusted. This adjustment is to be accomplished through the racking "interlock adjusting screw" (see Figure 2). Block the lever which engages the floating tip of the pushrod, Figure #1, by inserting a 2mm (.080-inch) shim between the lever and flat washer attached to the floating tip. This action stimulates the effect of lifting the "racking release lever" on a closed breaker. Be sure the breaker is open while performing this adjustment.

---

**Figure 2 Racking Interlock**

Components Internal to Breaker's Operating Mechanism
VIII. RACKING INTERLOCK ADJUSTMENT (concluded)

Advance "racking interlock adjusting screw" to raise trip pushrod and cam. Continue this action until the pushrod cam contacts and bears against the trip latch lever. See Figure 2. Lock adjustment with jam nut. Remove blocking, charge and close breaker. Attempt to raise racking release lever and check that pushrod is blocked by the breaker shaft cam. Open breaker and recharge closing springs. Raise rail plunger to an elevation of 2.06 inches by lifting the "breaker racking release handle." Hold the handle in this position and close the breaker. The breaker must operate "trip free" and not close.

IX. SPRING DUMP ADJUSTMENT

Refer to Figure 3. With breaker in the "open" position, displace spring dump tube (1) upward approximately 0.88 inches until free movement is lost. The pushrod shown in Figure 2 will begin to bind in its guiding eye bolt. Clamp the spring dump tube in this position.
IX. SPRING DUMP ADJUSTMENT (continued)

Run the "2nd fixed collar" (2) up to the horizontal brace, and set firmly with two set screws.

Establish roller free height by setting the free height adjusting screw, (3). Bottom surface of the roller must be set at a maximum of 2.56 inches from floor or reference plain.

Check to make certain that the cylindrical pivot (4) is loose and that the "1st fixed collar (5) and group of bellville washers are free to adjust. (Suggest temporarily moving these items up the pushrod and lightly setting them in place.)

Free clamp on spring dump tube and allow the tube to move downward until the spring dump tube is flush to the guide bushing on the inside of the mechanism enclosure. Clamp spring dump tube in this position. Adjust the cylindrical pivot to dimension "X" as shown in Figure 3 and tighten firmly in place. Note: be sure to rotate cylinder pivot toward rear of breaker to ensure slot is positioned to enable full angular motion. A good initial estimate for dimension "X" is 4.0 inches.

Free collars and bellville washers allowing this group of parts to bear on the cylindrical pivot. Press downward on the collar (5) compressing the bellville washers and securely set the collar in place with two set screws. The bottom collar nearest the cylinder is to remain free.

Charge the breakers closing springs, and raise roller to a height of 2.0 inches. The charging springs should be released automatically.

If spring release does not occur, dimension "X" must be iteratively increased in small increments followed by retesting the first fixed collar until automatic spring discharge is consistently achieved.

X. ELECTRICAL INTERLOCK - RACKING RELEASE SYSTEM

After completing all "racking release adjustment," the interlock shown above must be set.

With "racking release handle" in its fully depressed position, free switch and rotate bushing through the wall of the wiring enclosure. The switch operator will bear against the actuator pad. Continue rotating until switch operates, distinctly heard click, and then beyond this point by at least one full turn. Orient body of switch as shown, and secure with jam nut.
15KV INTERIM VEHICLE ADJUSTMENTS

The following settings and adjustments apply to the 15KV Interim Vehicle, and must be performed in addition to those described in drawing series 16-740-886-401 for the vacuum breaker.

Many adjustments must be performed in the assembly fixture, 75-535-760-05, final settings in general require pinning after achieving fixture settings.

1. GUIDE BAR SETTING

The assembled breaker must be inserted into fixture and centered before guide bar settings are established. The breaker vertical channels shall be spaced 1.188 - 0.030 from fixture guide bars which run the depth of the fixture at an elevation of approximately 26 inches. It is suggested that spacers be developed to assist the centering operation.

Once centered the guide bar (with loosened fasteners should be clamped to the inboard surface of the fixture guide bar slot. Care in performing this operation will facilitate primary alignment.

Securely torque guide bar fasteners to 150 ± 20 foot pounds, and proceed to primary stud alignment.

After completing primary stud alignment, use holes in base plate and drill two 0.190 ± .003 diameter holes thru guide bar and then pin bar in two places with roll pin item # 10.

2. PRIMARY STUD ALIGNMENT

Align primary studs to drawing dimensions to tolerance of ± 0.060.

- Top Stud Elevation: 43.00 inches
- Lower Stud Elevation: 31.00 inches
- Center Stud Lateral Displacement of Guide Bar Reference: 3.50 inches
- Phase Spacing: 10.00 inches

3. CAM SHUTTER SETTING

Fixtures cam shutter to fixture dimensions

- Fore and Aft Displacement of Apex in Slot: Rearward
- From Front Surface of Reference Plunger: 4.250 ± .03 inches
- Drill four 0.190 holes using guide hole in cam and its supporting angle. Drive two roll pins through supporting angle into base, and two pins thru cam into supporting angle, use roll pin, item # 10.
15KV INTERIM VEHICLE ADJUSTMENTS

The following settings and adjustments apply to the 15KV Interim Vehicle, and must be performed in addition to those described in drawing series 18-740-866-402 for the vacuum breaker.

Many adjustments must be performed in the assembly fixture, 75-535-760-05, final settings in general require pinning after achieving fixture settings.

1. GUIDE BAR SETTING

The assembled breaker must be inserted into fixture and centered before guide bar settings are established. The breakers vertical channels shall be spread 1.188 - 0.030 from fixture guide bars which run the depth of the fixture at an elevation of approximately 24 inches. It is suggested that spreaders be developed to assist the centering operation.

Once centered the guide bar (with loosed fasteners should be clamped to the inboard surface of the fixtures guide bar slots. Care in performing this operation will facilitate primary alignment.

Securely torque guide bar fasteners to 150 + 20 foot pounds, and proceed to primary stud alignment.

After completing primary stud alignment, use holes in base plate and drill two 0.190 + .001 diameter holes thru guide bar and then pin bar in two places with roll pins item 0 10.

II. PRIMARY STUD ALIGNMENT

Align primary studs to drawing dimensions to tolerance of ± 0.060.
- Top stud elevation: 43.00 inches
- Lower Stud Elevation: 31.00 inches
- Center Stud Lateral
- Displacement of Guide Bar Reference: 3.50 inches
- Phase Spacing: 10.00 inches

III. CAM SHUTTER SETTING

Fixtures can shutter to fixture dimensions
- Fore and Aft Displacement of Apex in Slot Detail rearward
- From Front Surface of Reference Plunger: 4.250 ± .03 inches
- Drill four 0.190 holes using guide holes in cam and its supporting angle. Drive two roll pins through supporting angle into base, and two pins thru cam into supporting angle, use roll pins, item 0 10.
IV. SECONDARY DISCONNECT SETTING

Align and Set to Fixture Dimensions

- Bottom secondary contact elevation to contact centerline: 6.837 ± .060 inches
- Lateral displacement from guide bar reference to crest of secondary contacts: 12.25 ± .060 inches
- Fore and aft alignment, crest of contacts must lie toward panel end of breaker ahead of plunger reference: 0.812 ± .060 inches

After completing final adjustment drill (2) 0.190 ± .003 holes using guide holes in secondary mounting plate. Drive two roll pins through this plate into vertical breaker channels, use item # 10.

V. GROUNDING FINGER SETTING

Align and set to Fixture Dimensions

- Rearward extension of grounding fingers from plunger reference: 17.625 ± .125 inches
- Lateral displacement from guide bar reference to center of fingers: 12.25 ± .06 inches

VI. CONTINUOUS CURRENT INTERLOCK

Install interlock bar by mounting with specified fasteners through prepared holes in base. Side nearest center of breaker should be 8.5 inches (Ref) laterally displaced from guide bar. Elevation 2.50 ± .06 inches.

1200 Amp Breaker Extension Nearest Guide Rail
2000 Amp Breaker, Extension Outboard.
VII. REMOTE AUXILIARY SWITCH OPERATING YOKE ADJUSTMENT

The "yoke" which operates auxiliary mounted auxiliary switches is set in the fixture to appropriate elevation. The required elevation dimension is 17.18 ± .03 inches with breaker open.

Adjustment is made by dismounting and rotating the adjustment yoke as shown to the left.

The dimension "A" provides an initial setting and will ensure rapid convergence to the desired setting with a minimum of iterative yoke adjustments.

One complete turn of the yoke alters the elevation dimension 0.013 inches.

<table>
<thead>
<tr>
<th>DIMENSION</th>
<th>A</th>
</tr>
</thead>
<tbody>
<tr>
<td>15KV, 500MVA, 2KA</td>
<td>14.27</td>
</tr>
<tr>
<td>15KV, 500MVA, 1.2KA</td>
<td>13.49</td>
</tr>
<tr>
<td>15KV, 750 MVA</td>
<td>13.00</td>
</tr>
</tbody>
</table>

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Breaker Shaft Extension Open Position

Adjustment Yoke End

Close 1.875

Open 17.18 ± .03

17.18 + .03
VIII. RACKING INTERLOCK ADJUSTMENT

Initial adjustment begins by setting the rail plunger linkage. Plunger free height is not adjustable, being established by design at 1.75 ± .06 inches.

The bridging link must be set in an essentially horizontal position. Using the adjusting eye directly above the plunger, set the bridging link at 3.00 ± .03 inches above the base surface. Securely lock with jam nut.

The required length of the push rod must now be established. This length is dependent on the type of breaker being manufactured, and to facilitate adjustment, set during assembly at the values shown below.

<table>
<thead>
<tr>
<th>BREAKER TYPE</th>
<th>&quot;A&quot; PROP.</th>
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</thead>
<tbody>
<tr>
<td>15kV 600MVA 2000A</td>
<td>12.93</td>
</tr>
<tr>
<td>15kV 500MVA 1200A</td>
<td>12.14</td>
</tr>
<tr>
<td>8.75kV/15kV 500</td>
<td>11.67</td>
</tr>
</tbody>
</table>

DIMENSIONS "A" FIGURE 1

The required length of the push rod must now be established. This length is dependent on the type of breaker being manufactured, and to facilitate adjustment, set during assembly at the values shown below.

FIGURE 1 LINKAGE DETAIL

Closure spring discharge tube
Push rod
Aux. Sw. Bullet incub. —
Adjustment eye
Bearing surface
Fully withdrawn
Reference line
1.75 ± .06 Free height
11.75
VIII. RACKING INTERLOCK ADJUSTMENT (CONT.)

During these adjustments, the closing spring discharge tube should be blocked or clamped so that its upper end is flush with the guide bushing on the inside of the mechanism enclosure.

Adjust pushrod until the washer and retaining ring associated with the "floating tip" of the push rod lies flush with guide bushing and end of the spring dump tube. When properly adjusted, the floating tip should be immediately displaced upward as the "racking release handle" is raised.

The pushrod and floating tip must demonstrate free movement, responding to the "Racking Release Handle", and returning freely to its initial state upon release of the handle.

Close the breaker and observe that the floating tip clears breaker shaft cam by 1-2mm (.04 to 0.08 in.). With the breaker closed this cam must block racking release. A closed breaker must not open when the racking release handle is lifted.

The mechanism internal to the breaker enclosure may now be adjusted. This adjustment is to be accomplished through the racking "interlock adjusting screw" see Figure 2. Block the lever which engages the floating tip of the pushrod. Figure #1, by inserting a 2mm (.080 inch) shim between the lever and flat washer attached to the floating tip. This action simulates the affect of lifting the "racking release lever" on a closed breaker. Be sure the breaker is open while performing this adjustment.

FIGURE 2 RACKING INTERLOCK

COMPONENTS INTERNAL TO BREAKERS OPERATING MECHANISM
VIII. RACKING INTERLOCK ADJUSTMENT (CONT.)

Advance "racking interlock adjusting screw" to raise the trip pushrod and cam. Continue this action until the pushrod cam contacts and bears against the trip latch lever. See Figure 2. Lock adjustment with jam nut. Remove blocking, charge and close breaker. Attempt to raise racking release lever and check that pushrod is blocked by the breaker shaft cam. Open breaker and recharge closing springs. Raise rail plunger to an elevation of 2.06 inches by lifting the "breaker racking release handle". Hold the handle in this position and close the breaker. The breaker must operate "trip free" and not close.

IX. SPRING DUMP ADJUSTMENT

Refer to Figure 3, displace spring dump tube upwards approximately 0.875 inches until free movement is lost. The pushrod shown in Figure 2 will bind in its guiding eye bolt. Clamp the spring dump tube in this position.

---

FIGURE 3 SPRING DUMP MECHANISM
IX. SPRING DUMP ADJUSTMENT (CONT.)

Run the "2nd fixed collar" up to the horizontal brace, and set firmly with two set screws.

Establish roller free height by setting the free height adjusting screws. Bottom surface of the roller must be set at a maximum of 2.56 inches from floor or reference plain.

Check to make certain that the cylinder pivot is loose and that the "1st fixed collar" and group of bellville washers are free to adjust. (Suggest temporarily moving these items up the pushrod and lightly setting them in place).

Free clamp on spring dump tube and allow the tube to move downward until the spring dump tube is flush to the guide bushing on the inside of the mechanism enclosure. Clamp spring dump tube in this position. Adjust the cylinder pivot to dimension "X" as shown in Figure 2 and tighten firmly in place. Note: be sure to rotate cylinder pivot toward rear of breaker to ensure slot is positioned to enable full angular motion.

Free collars and bellville washers allowing this group of parts to bear on the "cylinder pivot". Press downward on the upper collar, 1st fixed collar of Figure 1, and securely set it in place with two set screws. The bottom collar nearest the cylinder is to remain free.

Check the breakers closing springs, and raise roller to a height of 2.9 inches. The charging springs should automatically be released.

If spring release does not occur dimension "X" must be iteratively increased in small increments followed by resetting the first fixed collar until automatic spring discharge is consistently achieved.

X. FRONT BARRIER

Install and set to fixture dimensions.

After completing adjustment drill two 0.190 ± .001 holes through each hinge and crossbrace. Drive two roll pins through each hinge and crossbrace.
XI. PADLOCK PROVISION ADJUSTMENT

Having completed racking interlock and spring release adjustments, install lower front cover.

Mount padlocking angle with fasteners just set to a snug condition. Set breaker release handle to point where breaker is trip free and the plunger is not more than 2.25 inches from floor.

Tap padlocking angle into the position where its hole aligns with the hole in the racking release lever.

Mark this position release handle and tighten securely the padlocking angle hardware.
After completing all "racking release adjustment", the interlock shown above must be set.

With "racking release handle" in its fully depressed position, free switch and rotate bushing through the wall of the wiring enclosure. The switch operator will bear against the actuator pad. Continue rotating until switch operates, distinctly heard click, and then beyond this point by at least one full turn. Orient body of switch as shown, and secure with jam nut.
H-2 VACUUM CIRCUIT BREAKER VEHICLE ADJUSTMENTS

The following settings and adjustments apply to the H-2 Circuit Breaker, and must be performed in addition to those described in drawing series 18-740-886-402 for the vacuum breaker.

Generally, adjustments must be performed in the assembly fixtures 34-325-088-601 and 34-325-089-601. Final settings in selected areas require pinning after achieving fixtured settings.

I. BACKING BLOCK SETTING

The backing block, Item 2 of 18-672-780-521, is set in the assembly fixture, 34-325-088-601. A dimension of 7.937 ± 0.01 is set from the panel surface of the block to the pole support plate mounting surface. The backing blocks on each side of the vehicle must be set to this dimension and securely fastened.

After fixturing, two holes, 0.187/0.192 dia., are to be drilled through the side frame and backing block. Two 0.187 spring pins are to be driven into these holes to ensure backing block security.

II. LATERAL ALIGNMENT WHEEL

Four (4) lateral alignment wheels are to be set in the assembly fixture 34-325-089-601. Two (2) wheels on the right-hand side of the vehicle, as observed from the panel, are to be set at 0.375 inches from the vehicle's side frame. A line tangent to the periphery of these wheels must be perpendicular to the circuit breaker's pole support mounting surface with 0.010 inches.

Two (2) remaining alignment wheels on the opposite side of the vehicle shall be set on a line of peripheral tangency parallel to that of the right-hand wheels and displaced 29.75-0.03 inch parallelism to the opposite wheel is required within 0.010 inches. After completing each setting, secure two mounting bolts at each wheel support bracket.

After fixturing each set of wheels, the wheel mounting brackets and supporting angle shall each be thru drilled, 0.187/0.192 diameter, in two places, and 0.187 spring pins driven in place to ensure wheel alignment accuracy.

III. PRIMARY STUD ALIGNMENT

- Lateral displacement from right-hand lateral alignment wheels external periphery 0.065 ± 0.030

- Lateral phase spacing 10.812 ± 0.030

- Vertical phase spacing 12.500 ± 0.030

- Vertical phase alignment relative to track roller bearing surface.
  - Lower Primary Vertical Center Line 0.312 ± 0.030
  - Upper Primary Vertical Center Line 12.188 ± 0.030
IV. SECONDARY DISCONNECT SETTING

Align and Set to Fixture Dimensions
- Outboard secondary bayonet elevation to track roller bearing surface: 10.648 ± 0.030.
- Lateral displacement from right-hand alignment wheels external periphery: 4.500 ± 0.030.
- Fore and aft alignment, active side of molded connector housing is displaced 9.750 ± 0.030 from racking block surface.

Secure bracket mounting hardware. Check that screws mounting connector housings have been freed one turn to allow the contact housings to "float" into final alignment upon meeting their mating contacts.

V. GROUNDING FINGER SETTING

Align and set to Fixture Dimensions
- Rearward extension of grounding bar from racking block reference: 11.931 ± 0.030.
- Lateral displacement from alignment wheel periphery to near side of ground bar: 2.062 ± 0.03.

IV. CONTINUOUS CURRENT INTERLOCK

Install interlock bar(s) by mounting with specified fasteners through prepared holes in base. See 16-740-568-529(T) for mounting appropriate to the circuit breaker's rating. Interference block locations are established vertically from the track roller bearing surface and laterally from the right-hand alignment wheel's outboard periphery.

- Vertical Extension
  - Long Blocks, 18-456-017-079, -12.00 ± 0.06 inches
  - Short Blocks, 18-458-017-080 -11.25 ± 0.06 inches
- Lateral positions to near surface of each block:
  - 1st Pos. 14.813 ± 0.058
  - 2nd 15.563
  - 3rd 16.313
  - 4th 17.063
  - 5th 17.813
  - 6th 18.563
  - 7th 19.313
  - 8th 20.063

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VII. RACKING INTERLOCK AND SPRING DISCHARGE SYSTEM ADJUSTMENT

Racking interlock adjustment is performed by carefully presetting the trip free components, and then proving the required performance by functional tests. Adjustments prerequisite to the functional tests include the following:

The actuator should be installed as shown in Figure 1. The actuator's smaller diameter should be passed through the foot of the shorter lever and cotter pinned in place.

Free the "racking interlock adjusting screw," and raise the long lever to elevate the "pushrod." The pushrod should be raised until the "trip pushrod cam" just contacts without displacing the "trip latch lever." Capture the long lever in this position by advancing the "racking interlock adjusting screw" until it bears on the short lever. Secure jam nut.
The actuator may now be preset. The trip free roller shall be gaged at 1.534 from the vehicle's side frame. Dimension "A."

The actuator, shown in Figure 3, may now be set by freeing the "actuator adjustment nut." Once freed, the actuator is screw up or down until the edge of its large diameter is flush with the inside surface of the mechanism enclosure. After completing this setting, the "actuator adjustment nut" should be secured.

Having completed these adjustments, proceed to perform functional tests.

CLOSE FUNCTION: "A" dimension set at 1.034. Charge breaker and close, breaker must consistently complete each close operation.

TRIP FREE FUNCTION: "A" dimension set at 1.279. Charge breaker and initiate close operation. The breaker must be "trip free." That is, the closing springs must discharge with no displacement of the breaker shaft.

SPRING DISCHARGE: Charge closing springs and move the roller to an "A" dimension of 0.909. The closing springs must discharge before this dimension is reached.

TRIP FREE SYSTEM (RACKING INTERLOCK)

ACTUATOR ADJUSTED FLUSH TO THIS SURFACE

ACTUATOR

ACTUATOR ADJUSTMENT NUT

TRIP PUSHROD CAM

TRIP LATCH LEVER

PUSHROD

FIGURE 3

TRIP FREE SYSTEM (RACKING INTERLOCK)
VIII. CLOSE SIGNAL LEVER LATERAL ALIGNMENT

The close signal lever's lateral alignment is established by the fixture guided installation of a "U"-shaped bracket, 18-658-111-170.

An alignment tool, 18-743-350-501, is applied as shown in the figure below. The "U" bracket is positioned in depth and height by the alignment tool.

Once in position, an 0.219 diameter hole is prepared using a hole in the "U" bracket as a guide. An 0.25-20 self-threading fastener is then applied to secure the bracket in one place. After confirming position and freedom of lever motion, a second 0.219 diameter hole is prepared and the second fastener secures the bracket in final position. See 18-840-291-802 if further detail is required.

AL/\(\text{ALIGNMENT TOOL} \quad 18-743-350-501\)
VI. REMOTE AUXILIARY (MOC) SWITCH ADJUSTMENT (OPTIONAL FEATURE)

The mechanism which operates cubicle-mounted auxiliary ("MOC") switches is set in the fixture to appropriate elevation. The required elevation dimension is 8.03 ± 0.03 inches with breaker open relative to the track roller bearing surface.

Adjustment is made by dismounting and rotating the adjustable rod end as shown to the left.

X. CELL (TOC) SWITCH STRIKER ADJUSTMENT (OPTIONAL ITEM)

The cell switch striker is defined as Item 8 of truck assembly Drawing 18-477-760-521. The striker consists of an annular bracket which is set to the dimensions given below in the referenced fixtures:

- Vertical position is set by the truck frame weldment.
- Depth is to be taken at 6.50 ± 0.03 off racking block reference surfaces.
- Lateral position is taken at 12.94 ± 0.03 inches from the outboard periphery of the right-hand alignment wheels. The adjustments of Article II are prerequisite to this setting.
1.0 TRIP LATCH ADJUSTMENT, PRELIMINARY

This adjustment sets a trip latch in position to ensure its ability to support the breaker bell crank under torque loads imposed by the tripping springs. This adjustment is usually required during the mechanism initial assembly. Set adjusting screw to establish indicated dimension between latch paddle and trip latch support frame. Secure adjustment by fastening jam nut.