Vacuum Circuit Breaker

McGRAW-EDISON POWER SYSTEMS

Type VACG - 38 kV Installation and Maintenance Instructions

S290-13-1

CONTENTS

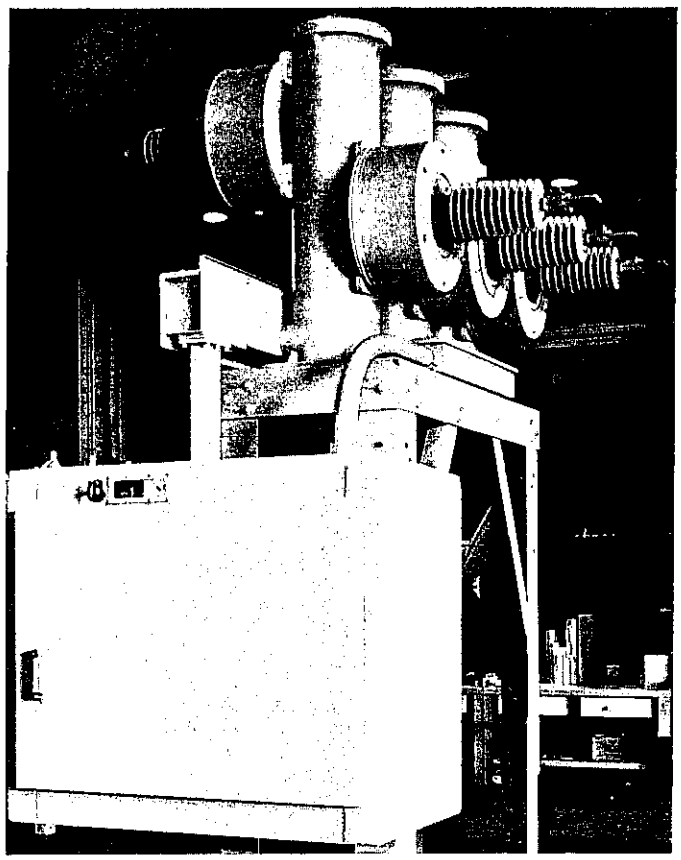


Figure 1.
Type VACG vacuum circuit breaker.

GENERAL

Service information S290-13-1 pertains specifically to McGraw-Edison Type VACG-38 kV vacuum/gas insulated circuit breakers. Circuit interruption is accomplished in a vacuum interrupter contained in a pressurized SF_6 atmosphere. Detailed outline, control drawings and connection diagrams are issued for and accompany each breaker. Bushing current transformers are covered separately in Service Information on OE Bushing Current Transformers. Separate instruction books are also furnished for relays and auxiliary switches as required for each application. All drawings, diagrams, pertinent instructions and packing lists are shipped protected in the mechanism cabinet. Retain all pertinent instructions for permanent breaker identification.

The VACG vacuum circuit breaker is a three-pole electrically operated unit. The operating mechanism is a motor-driven, hydraulically-charged, compression-spring, stored energy type MO-1. It is mechanically and electrically trip free. Auxiliary provisions include an external trip device, a mechanical position indicator, trip counter, and facilities for proper mounting and electrical grounding.

Standard NEMA terminal designations are as indicated on the outline drawing. Facing the mechanism cabinet and from front to rear, terminals are numbered 1, 3 and 5 on the left, 2, 4 and 6 on the right, (Figure 2).

The VACG vacuum breaker should only be installed on circuits which operate within the voltages or currents given on the nameplate. Short circuit conditions imposed on the breaker must not exceed the breaker rating.

SHIPMENT AND INSPECTION

Except in special cases, each VACG breaker is shipped completely assembled with bushings and operating mechanism in place. Accessory items are shipped in marked packages.

Each breaker is shipped with the contacts blocked closed by a red bolt inserted in the mechanism. The mechanism is shipped unlatched so that opening spring pressure is on the rod. Refer to instructions later in this book for removing this rod.

Immediately upon receipt of the breaker:

1. Inspect the exterior of breaker for evidence of shortage, rough handling or damage in transit.
2. Observe the SF_6 pressure gauge and if more than 2 psi below the fill line on the

These instructions do not claim to cover all details or variations in the equipment, procedure, or process described, nor to provide directions for meeting every possible contingency during installation, operation, or maintenance. When additional information is desired to satisfy a problem not covered sufficiently for the user's purpose, please contact your McGraw-Edison Power Systems sales engineer.

SF_6 Fill Chart, as indicated by temperature, notify the service department. The fill chart is located on the inside of the mechanism cabinet door.

3. Open the mechanism cabinet door and inspect the interior of the compartment for evidence of rough handling or damage in transit.
4. Close and latch the mechanism cabinet door to prevent entrance of dirt and moisture.
5. Inspect the high voltage area for evidence of external damage. Vacuum interrupters and linkages are set at the factory and do not require further adjustment.

Should initial inspection reveal evidence of rough handling or damage in transit, or shortage, notify and file a claim with the carrier at once. Also, notify the Service Department, Mcgraw-Edison Power Systems, Canonsburg, Pennsylvania 15317.

UNLOADING AND POSITIONING

Type VACG breakers must be unloaded and moved by hoisting only. Slings for hoisting must have adequate lifting capacity. Slide the 1 inch pipe lifting rod, located in the control compartment, into lifting lug holes provided at the top of each single pole. Rod must extend from phase next to the mechanism to the middle phase. Center rod equally between the two phases. The sling should be attached to the rod outside the lifting lugs, (Figure 2).

With slings properly secured, lift breaker straight up. Exercise caution so as not to damage bushings during handling.

STORAGE

If the VACG breaker is not to be placed in the service-ready condition immediately upon receipt, it is considered to be in storage. To prepare a breaker for storage:

1. Open the mechanism compartment.
2. Remove all packing material that might possibly collect moisture from compartment, including desicants.
   A. Do not remove blocking or bracing at this time.
   B. Open all boxes, inspect contents and reseal.
   C. Store all boxes indoors in a dry place.
   D. Inspect the interior of compartment to be sure it is clear and free from foreign materials.
   E. Close mechanism compartment.
3. Inspect bushings thoroughly.
   A. Make sure all bushings are clean, dry and in good condition.
4. Ensure all openings are sealed.
5. Energize compartment heaters with temporary electrical source until permanent connections can be made.

INSTALLATION

1. Level and anchor the breaker.
   A. Prepare a flat slab or concrete piers to meet foundation requirements of drawings submitted for breaker.
   B. Level and bolt breaker solidly in position at points designated on outline drawing.
      (1.) Shims should be located as required to ensure leveling and an even load distribution.
2. Ground the breaker.
   A. Clean ground pad.
   B. Two ground pads per NEMA Standard are furnished on breaker (Figure 2).
   C. Install grounding connector.
3. Open compartment door (being careful not to damage gasket).
4. Remove all packing materials from the mechanism compartment.
5. The interrupter housings were pressurized with SF_6 at the factory. Confirm proper operating pressure, refer to SF_6 maintenance.
6. Check all external fasteners for tightness, refer to torque table. **Do not overtighten**.
7. Remove operator blocking:
   A. Position maintenance closing wrench as illustrated (Figure 3).
   B. Apply force toward closing position to relieve pressure on blocking pin.
   C. Remove blocking bolt.
   D. Slowly relieve force on maintenance closing wrench allowing breaker to reach fully open position.

WARNING

Do not leave maintenance positioning wrench on jack shaft in either open or closed position.

   E. Close the mechanism compartment.

ELECTRICAL CONNECTIONS

1. Make line, auxiliary and control connections as overall installation progresses and as indicated on drawings.
   NOTE: It is recommended that main (load) connections not impose more than 100 lb. maximum pull on the bushings in any direction. Forces may be caused by expansion, contraction, wind loading or foundation movement.
2. To operate the breaker during installation, if a permanent source is not available, a temporary AC and DC source must be made available.
3. Energize cabinet heaters.

VACUUM INTERRUPTER TEST

After completing all electrical and mechanical connections for the type VACG-38 kV vacuum breaker in accordance with the installation instructions, electrically test and establish the vacuum by performing a simple a-c high voltage potential test on each interrupter.

RADIATION WARNING

Refer to Vacuum Interrupter Test in the Maintenance Section for the proper procedure and observe all safety precautions during the tests to ensure personnel safety.

GENERAL DESCRIPTION

The McGraw-Edison type VACG vacuum/gas insulated power circuit breaker is a three-pole unit suitable for outdoor application. It is comprised of three (3) single pole assemblies (Figure 4) [bushings, current transformers and vacuum interrupters]. A pull rod housing (Figure 6), joins the single pole assemblies with the mechanism housing (Figure 8) containing the operating mechanism and controls.

SINGLE POLE

The single pole assemblies are the high voltage area of the breaker. Each single pole contains the source bushing, line bushing, current transformers, vacuum interrupter, SF_6 insulating gas, transfer means, stand-off insulators, supporting casting and portions of the operating mechanism required to operate the interrupters.

The single pole assemblies are joined together with a main frame and pull rod assembly. The single or multiple ratio bushing current transformers are attached to the supporting casting with all leads terminating at the terminal blocks in the mechanism housing.

MECHANISM HOUSING

The mechanism housing contains all control devices and the operator. The type MO-1 operator consists of a motor-driven, hydraulically-charged, compression-spring stored energy mechanism which is electrically and mechanically trip-free. The contact position indication and manual trip functions are externally accessible. A means of manually charging the closing springs in case of charging power failure or for maintenance purposes is provided. Access to the MO-1 operator is by means of a hinged gasketed door with padlock provisions.

Trip operations are registered on an internal counter which is externally visible. Contact position is indicated by an externally visible flag. A pull-type external manual trip handle is provided. As an option, this device can be furnished with a permissive control device to prevent electrical reclosure. The permissive control device must be manually reset to permit reclosure. Various convenient locations are provided for terminal blocks.

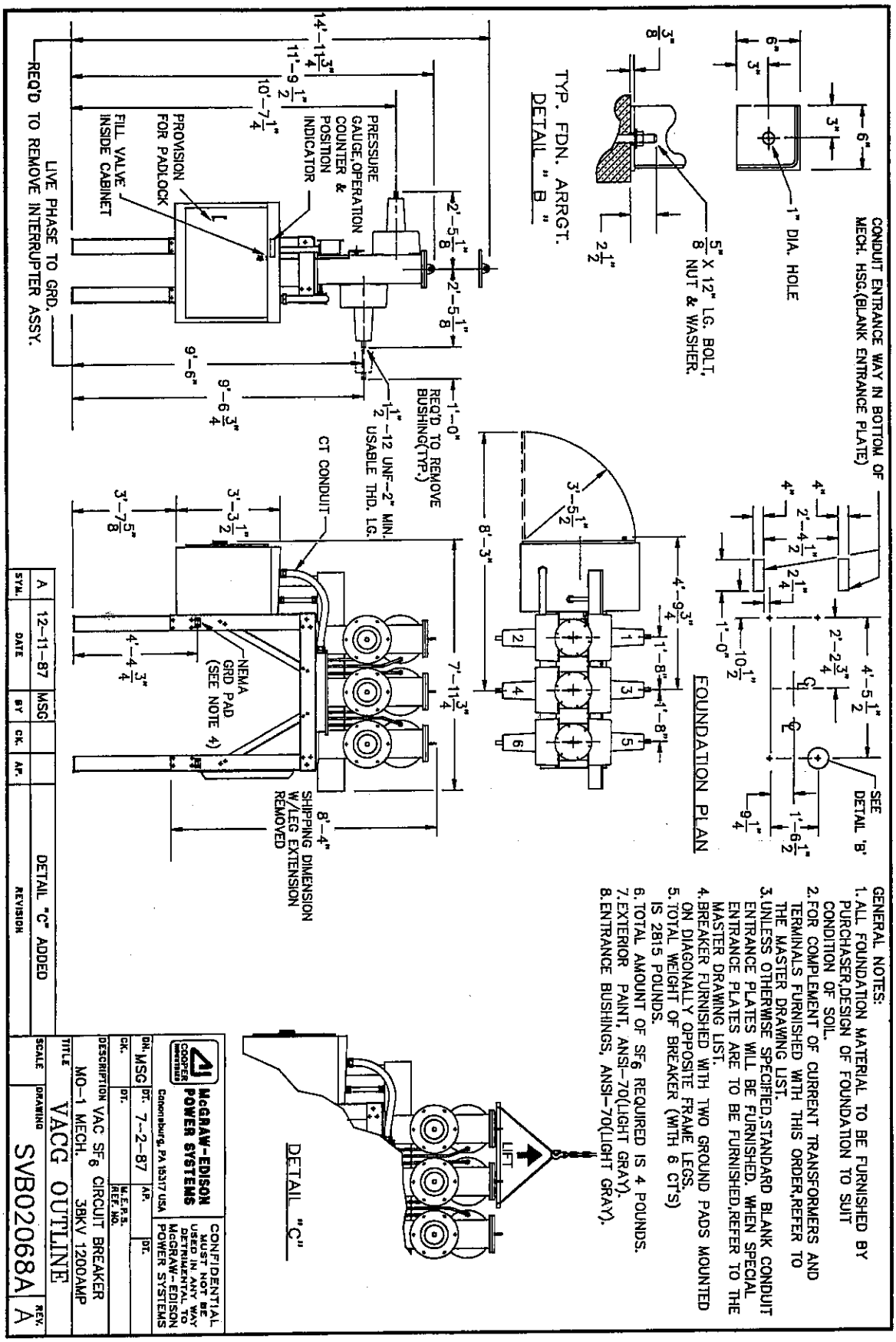

CONDUIT ENTRANCE WAY IN BOTTOM OF MECH. HSG.(BLANK ENTRANCE PLATE)
1" DIA. HOLE
5/8" X 12" LG. BOLT, NUT & WASHER.
TYP. FDN. ARRGT. DETAIL "B"
FOUNDATION PLAN
SEE DETAIL 'B'
GENERAL NOTES:
1. ALL FOUNDATION MATERIAL TO BE FURNISHED BY PURCHASER,DESIGN OF FOUNDATION TO SUIT CONDITION OF SOIL.
2. FOR COMPLEMENT OF CURRENT TRANSFORMERS AND TERMINALS FURNISHED WITH THIS ORDER,REFER TO THE MASTER DRAWING LIST.
3. UNLESS OTHERWISE SPECIFIED,STANDARD BLANK CONDUIT ENTRANCE PLATES WILL BE FURNISHED. WHEN SPECIAL ENTRANCE PLATES ARE TO BE FURNISHED,REFER TO THE MASTER DRAWING LIST.
4. BREAKER FURNISHED WITH TWO GROUND PADS MOUNTED ON DIAGONALLY OPPOSITE FRAME LEGS.
5. TOTAL WEIGHT OF BREAKER (WITH 6 CT's) IS 2815 POUNDS.
6. TOTAL AMOUNT OF SF6 REQUIRED IS 4 POUNDS.
7. EXTERIOR PAINT, ANSI-70(LIGHT GRAY).
8. ENTRANCE BUSHINGS, ANSI-70(LIGHT GRAY).
PRESSURE GAUGE,OPERATION COUNTER & POSITION INDICATOR
PROVISION FOR PADLOCK
FILL VALVE INSIDE CABINET
LIVE PHASE TO GRD. REQ'D TO REMOVE INTERRUPTER ASSY.
REQ'D TO REMOVE BUSHING(TYP.)
1"-12 UNF-2" MIN. USABLE THD. LG.
CT CONDUIT
NEMA GRD PAD (SEE NOTE 4)
SHIPPING DIMENSION W/LEG EXTENSION REMOVED
DETAIL "C"
LIFT
SYM. A
DATE 12-11-87
BY MSG
CK.
AP.
REVISION DETAIL "C" ADDED
McGRAW-EDISON POWER SYSTEMS
Canonsburg, PA 15317 USA
CONFIDENTIAL MUST NOT BE USED IN ANY WAY DETRIMENTAL TO McGRAW-EDISON POWER SYSTEMS
DR. MSG DT. 7-2-87 AP. DT.
CK. DT. M.E.P.S. REF. NO.
DESCRIPTION VAC SF6 CIRCUIT BREAKER MO-1 MECH. 38KV 1200AMP
TITLE VACG OUTLINE
SCALE DRAWING SVB02068A REV. A

Figure 2.

ROUTINE MAINTENANCE AND INSPECTION

General

The frequency of maintenance depends upon the degree of exposure to contaminating atmosphere and the severity of operating duty. Suggested practice is to inspect the breaker at 500 operation intervals or after a severe fault interruption near the breaker's maximum rating. All adjustments are set at the factory and none should be required unless the breaker has had severe wear or rough handling.

Cleanliness is the best assurance of trouble-free operation. If, due to either normal wear or severe duty, it is necessary to replace or adjust a breaker component, refer to the Adjustment and Parts Replacement section.

Materials

Cleaning solutions:

The preferred cleaning solutions are Stoddard solvent or naptha.

Insulating gas:

Sulfur Hexafluoride

WARNING

Preferred cleaning solutions are flammable. Avoid sparks and flames. Use in an area where there is adequate ventilation. Refer to appropriate OSHA material safety data sheet for specific material.

Lubricants:

Wipe all parts to be lubricated with clean lint-free rags. Lubricate non-current-carrying moving parts such as operating linkages, pins, needle bearings and gear teeth with a light film of Humble Oil and Refining Lidok 000 grease, Dow Corning FS-1292 for contacts and Dow Corning 55M for O-rings.

Wipe off excess grease with clean lint free rags.

WARNING

De-energize the circuit breaker and ground all terminals before performing any maintenance or inspection work. Unless stated otherwise in the procedure all maintenance and inspection should be performed with the breaker open and the closing spring discharged. Contact position indicator must read – OPEN. Closing spring position indicator must read – DISCHARGED.

Inspection

1. Contact Wear
   A. To check contact wear, the contacts must be closed and the closing spring charged. Loosen fasteners and remove cover on pull rod assembly (Figure 6). The breaker must be closed. Check the gap between the trunion and adjuster on all three drive levers. If the gap is less than 1/16 inch, vacuum interrupter should be replaced, contact wear gauge, SVA01240A001.
2. Wiring Checks
   A. Terminal strip – check that all connections and mounting screws are tight and there are no cracks in the strip.

Bushings

1. Bushings should be cleaned at regular intervals where abnormal conditions prevail such as salt deposits or any accumulation of foreign substances.
2. Bushing should be checked for cracks or chips.
3. If a bushing must be replaced, refer to Bushings in the Parts Replacements section.

   NOTE: If any change in – or addition to – bushing current transformers is required, make the change or addition at the same time the bushing is replaced.

Bushing Current Transformers

Check the bushing current transformer visually to make sure the leads are intact.

NOTE: If a change in – or addition to – bushing current transformers is required, refer to Bushing Current Transformers in the Parts Replacement Section and Service Information on the Type OE Bushing Current Transformers.

SAFETY PRECAUTION

Current transformer secondaries not connected to relays, instruments or meters must be short-circuited and grounded at the terminal blocks in the low voltage compartment.

Breaker Resistance

With the breaker in the closed position, conduct a bushing stud to bushing stud resistance test on each of the three breaker poles (Figure 2).

NOTE: Resistance test results indicate the current-carrying condition of the breaker, not its ability to interrupt faults.

The electrical resistance, stud to stud, should measure 100 microhms or less. If resistance test values are above the specified value, the cause must be determined and corrected.

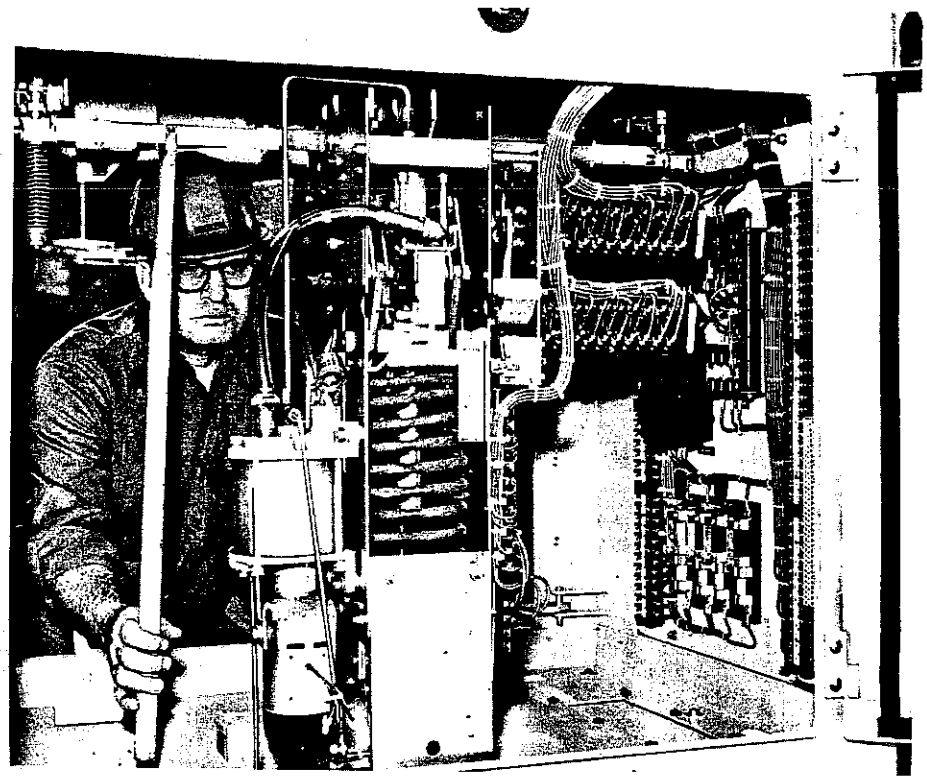


Figure 3.
Maintenance positioning, rotation of jackshaft permits ease of contact adjustment during maintenance or interrupter change out.

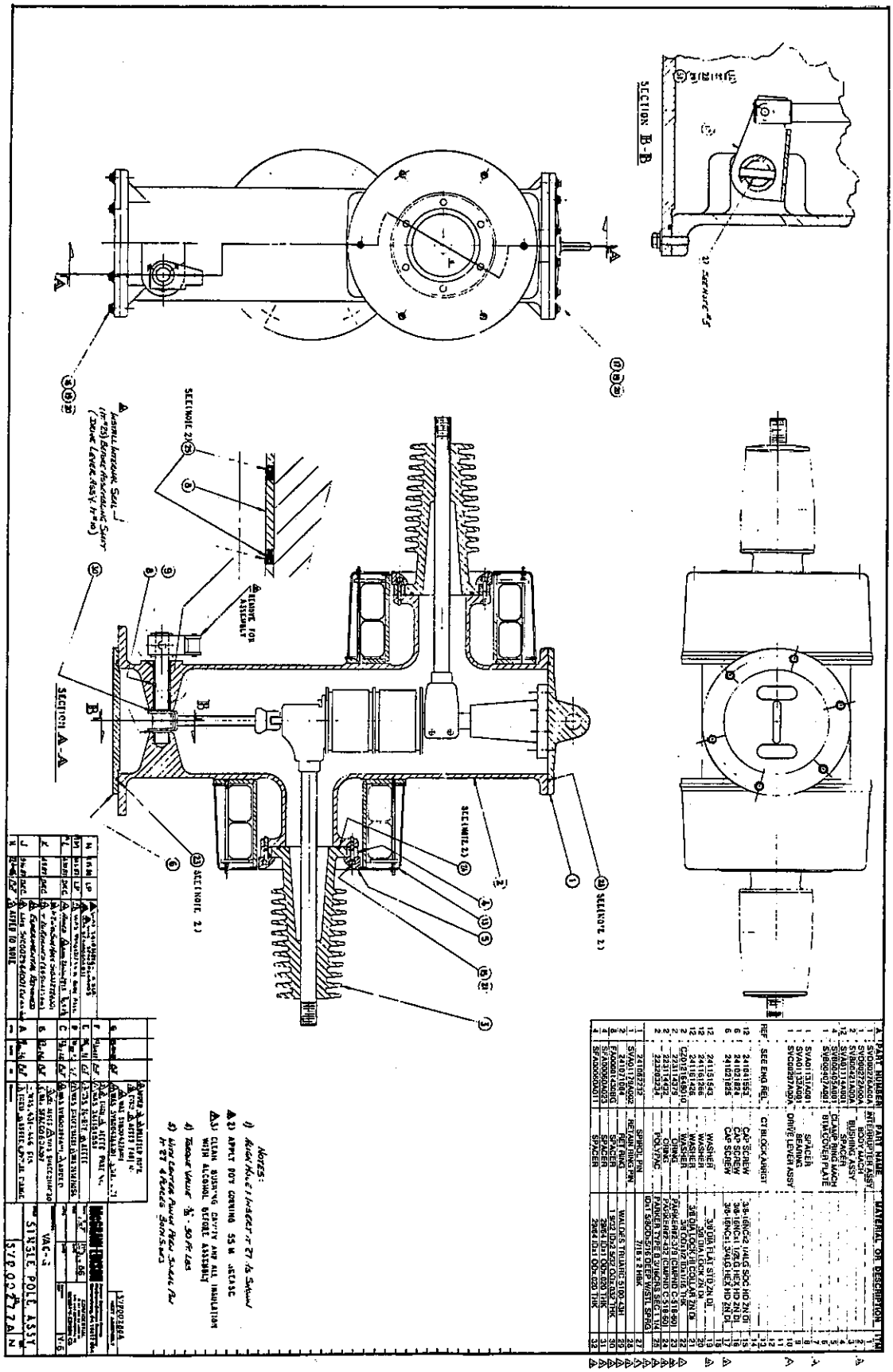


Figure 4.

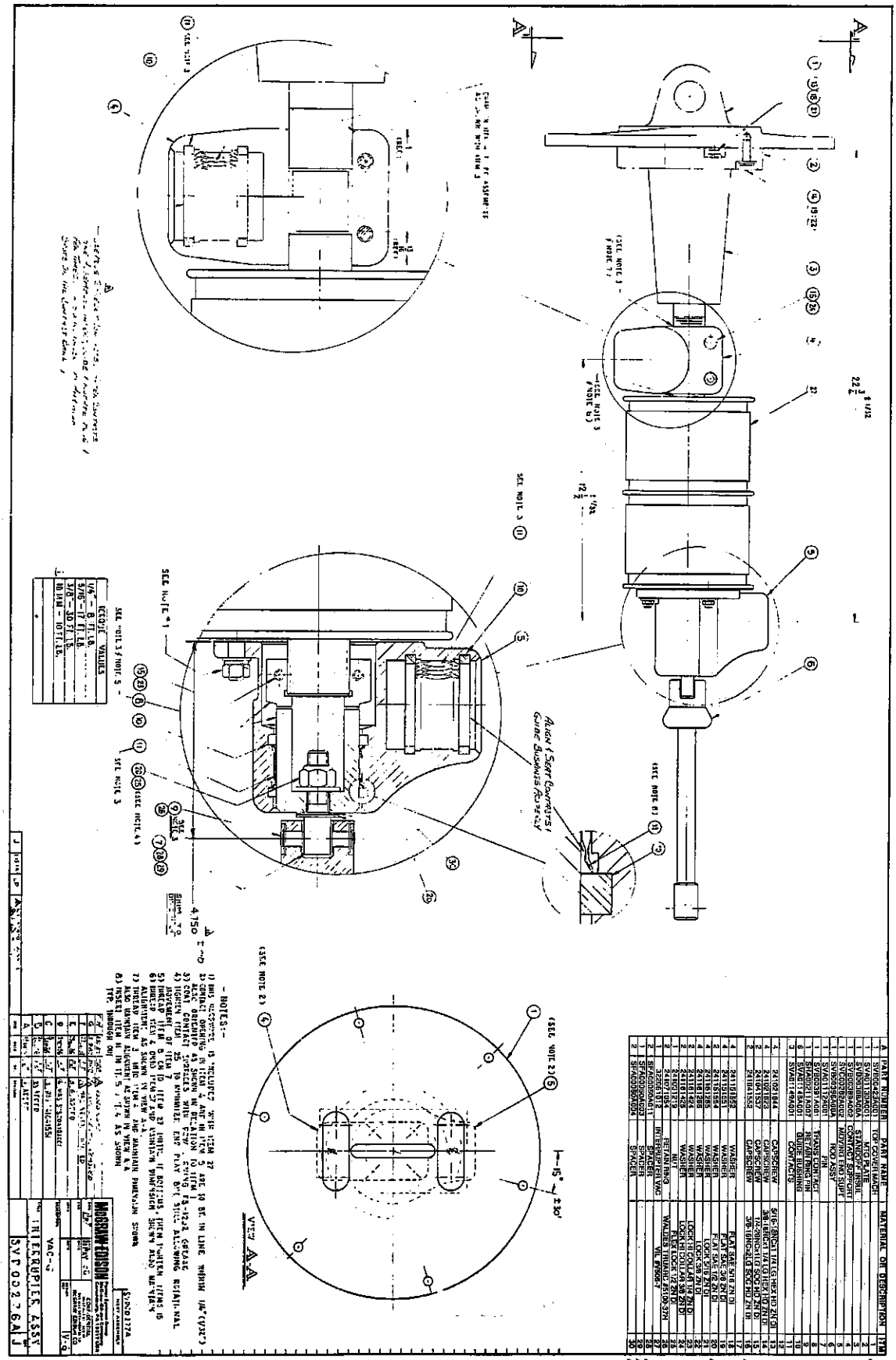


Figure 5.

Mechanical

Check that all external fasteners are tight. After the first 500 operations, all fasteners should be retorqued to standard values as follows:

¼-20	8 ft. lb.
5/16-18	17 ft. lb.
⅜-16	30 ft. lb.
½-13	75 ft. lb.
* M 10 x 1.5 6H	10 ft. lb.

* Caution: Do not exceed recommended torque values for interrupter mounting nuts, (Figure 5).

Operating Mechanism

NOTE: Also see Service Information on the type MO-1 Operating Mechanism.

1. Listen for excessive noise or bearing rumble in motor.
2. Check linkage for sign of wear.
3. Check for hydraulic leaks.
4. Check hydraulic fluid level in sump.
   A. Check with closing spring discharged.
   B. Dip stick connected to fill-hole plug indicates fluid level.
   C. An empty hydraulic system requires approximately 1-½ pints of fluid to fill the sump.
   D. Add hydraulic fluid through fill-hole with one of the recommended hydraulic fluids to proper level.
      NOTE: Recommended fluids are:
      - Shell Oil Co. Aeroshell Fluid No. 4
      - Chevron USA Inc. Aviation Hydraulic Fluid A
      - Texaco Inc. type Aircraft BB
      - Exxon type J-13
      - Any hydraulic fluid meeting MIL-H-5606-A

Vacuum Interrupter Test

RADIATION WARNING

X-radiation can result when voltage in excess of rated maximum voltage is applied across the open-contact gap in a vacuum interrupter. Such radiation can become a health hazard on long exposure at close range. When performing high-voltage tests on vacuum interrupters, personnel safety can be insured by noting the following information and taking the necessary precautions.

RADIATION WARNING contd.

1. American National Standard C37.09-1979 "A-C High Voltage Circuit Breakers" allows tests after delivery which include application of 75% of rated low-frequency withstand voltage across open contacts of the interrupters. This voltage (50-60 hertz) is tabulated below.
2. At test voltages listed in Column C and D, radiation is negligible when interrupters are mounted in their respective operating structures, installed in their normal apparatus enclosure and have contacts open.
3. Testing at voltages higher than those listed in Columns C and D may cause radiation emission injurious to personnel. If testing is to be performed at voltages above those listed in Column C and D, additional radiation shielding is required.
4. Vacuum interrupter testing above 50 kV ac rms is not recommended.

CAUTION

5. If direct-current dielectric tests (15 minute dc) are to be conducted on an underground system with apparatus connected, be sure vacuum interrupter contacts are closed.
6. Normal electrical safety precautions should be observed.

Apparatus Type Designation	Interrupter Rated Maximum Voltage (kv ac rms)	75% of Rated Low-Frequency Withstand Voltage (kv ac rms) (1 min. dry)	Recommended DC Withstand Voltage (kv-dc)* (1 min. dry)
Column A	Column B	Column C	Column D
VACG-38 kv	38.0	60	70

* To prevent possible interrupter damage, d-c test source should be limited to 100 milliamps maximum.

To electrically test and establish the integrity of the vacuum, the interrupter should be given a simple a-c high voltage potential test. **Breaker contacts must be in the open position.** The vacuum condition is satisfactory provided the interrupter withstands 50 kV for one minute for a 38 kV breaker.

A. Connect a high potential voltage source across the open interrupter contacts; bushing to bushing connection is recommended.
B. Gradually increase the test voltage to 50 kV (rms).
C. Maintain the peak test voltage for one minute.
D. Gradually decrease the test voltage to zero.
E. The test is a failure if the interrupter fails to withstand the voltage.
F. If the vacuum interrupter fails the high potential test, the interrupter assembly should be replaced in accordance with the section on Replacing the Vacuum Interrupter Assembly.
   NOTE: Ground breaker (bushing and vacuum interrupter) after high potential testing to remove any residual electrical charge.

PARTS REPLACEMENT

Bushings

1. To replace a bushing the breaker should be open, isolated from the system with the closing springs discharged.
   NOTE: If any change in – or addition to – bushing current transformers is desired, make the change or addition at the same time the bushing is replaced.
2. Remove SF_6 gas from the breaker.
3. Referring to (Figure 4), loosen (6) six capscrews and remove clamp rings and spacers. This frees the bushing, allowing you to carefully slide the bushing contact stud from the contact cluster.
4. Clean mating surface of the support casting before assembling new bushing.
5. Make sure new O-Ring is in position and lubricated, before assembling bushing.
6. Carefully slide bushing stud into contact cluster.
7. Clamp rings, spacers and six (6) capscrews should be assembled around the bushing-flange. Align the bushing and tighten alternate capscrews in small increments to apply uniform clamping pressure to the bushing mounting flange.

Bushing Current Transformers

Refer to and follow Service Information on Type OE Bushing Current Transformer.

1. To replace a bushing current transformer, the breaker should be open, isolated from the system with the closing springs discharged.
2. Referring to [(Figure 4-SVD00277A) and (Figure 7-SVD00278A)].
3. Disconnect and identify leads in the current transformer junction box.

4. Loosen and remove six (6) flexlock nuts. Remove Current Transformer cover by sliding it off the studs. Remaining flexlocks must be loosened and removed along with clamp plate.
5. To install a new bushing transformer, simply reverse steps 2, 3 and 4. Refer to Figure 7 for proper position of insulating rings.
6. Reconnect leads in the current transfomer junction box. Check ratio.

Vacuum Interrupter Assembly

Vacuum interrupters are supplied as a component or a factory assembled replacement unit. The assembly is aligned, adjusted and the contacts properly seated to ease and simplify field installation. Instructions for removal and installation of the assembly are provided with each kit, see replacement parts list

Sulfur Hexafluoride Maintenance

The SF_6 pressure gauge must be monitored on a periodic basis. If the pressure is below the SF_6 fill chart pressure and at or above the recharge line, as indicated by temperature, the system should be topped off from an SF_6 supply, being certain the supply lines have been purged. Initiate leak detection to determine the severity or the rate of loss. In the the case of non-detection a suitable monitoring schedule must be initiated. The properties of the gas used in the breaker conform to commercial-grade SF_6 gas with a maximum dewpoint of $-45°$ C or a moisture content of 63 ppm.

To top off from a cylinder:

1. Determine the correct fill pressure for the ambient temperature, refer to the SF_6 fill chart in the control compartment.
2. Install a tee and relief valve assembly on the regulator valve on the SF_6 gas cylinder with the relief valve set to relieve at 50 psig.
3. Connect the fill hose to the regulator valve tee and to the fill valve on the circuit breaker, leaving the breaker valve connection loose.
4. Open the gas cylinder valve and set the regulator to the selected operating pressure.

WARNING

Supplying unregulated SF_6 gas directly to the circuit breaker fill valve can cause severe overpressure in the single pole housings. This condition may result in the rupture of one or more of the housings and possible serious injury to the operator.

5. Slightly open the regulator valve, letting the SF_6 gas flow purge the line.
6. Tighten the breaker valve connection.
7. Open the breaker valve to allow the SF_6 to slowly expand and flow into the breaker.
8. Continue filling until fill pressure is attained.
9. Monitor for loss of pressure.

If the pressure is below the recharge line on the SF_6 chart, as indicated by temperature, the circuit breaker must be removed from service and the reason for the pressure loss determined. Once determined and corrected the system must be evacuated and recharged. The following procedure applies to a recharge and a total refill as the result of a component replacement. To recharge or refill:

1. Determine the correct fill pressure for the ambient temperature, refer to the SF_6 fill chart in the control compartment.
2. Install a tee and relief valve assembly on the regulator valve on the SF_6 gas cylinder with the relief valve set to relieve at 50 psig.
3. Connect the vacuum line and the fill line from the SF_6 cylinder regulator valve tee through a second tee to the fill valve on the circuit breaker.
4. Open the vacuum valve and the fill valve, leaving the regulator valve closed, draw a vacuum to 400 microns.
5. Close the vacuum valve. Observe whether or not the breaker vacuum is maintained. Correct any observed leakage prior to recharging the breaker with SF_6.
6. Open the gas cylinder valve and set the regulator to the selected operating pressure.

WARNING

Supplying unregulated SF_6 gas directly to the circuit breaker fill valve can cause severe overpressure in the single pole housings. This condition may result in the rupture of one or more of the housings and possible serious injury to the operator.

7. Slightly open the regulator valve to allow the SF_6 to expand and flow into the breaker.
8. Continue filling until fill pressure is attained.
9. Close the fill valve on the breaker and make a leak test on the circuit breaker.
10. Return the breaker to service.

Vacuum Interrupter Assembly Replacement

WARNING

The operating mechanism must be tripped and the closing spring discharged.

CAUTION

Before any work is attempted in the high voltage area, be sure the breaker is "dead"; isolating air brake disconnect switches on either side of the breaker should be locked in the open position.

1. The vacuum interrupter assembly unit is removed as follows:
   (Refer to Diagram Figure 4 and Figure 5.)
   A. Remove bushings – loosen fasteners and remove, carefully slide contact lugs from contact clusters.
   B. Lower cover plate must be removed (Figure 4).
   C. Disassemble retaining rings and pin from drive lever assembly. This will free the rod assembly (Figure 4).
   D. Fasteners holding the top cover must be removed.
   E. Interrupter assembly unit should be lifted up out of the casting housing (Use lift lug on the top cover.) (Figure 5).
   F. The new interrupter assembly unit should be installed in the same order in which the old interrupter was removed (Figure 4).
   G. Make necessary adjustments.
   H. Tighten all fasteners, and operate breaker several times with maintenance positioning wrench, to be sure of proper alignment.
   I. Fast close the breaker, make adjustments [(Figure 6) Linkage Assembly Instructions].
   J. Fast open the breaker, make final adjustments (Figure 6).
   K. Fill with SF_6 with approximately 4 pounds to 14.9 psig at 70°F. (refer to fill chart for temperature correction).

Replacement Parts List

1–Vacuum Interrupter Assembly Kit
SVC00304A00A
1–Bushing Kit
SVC00305A00A
1–Motor-Pump Assembly
SHD00353A00C

The following parts are supplied to meet the customer's specification. They may be ordered by name of part and giving the serial number and order number for the specific circuit breaker.

1–Trip Coil
1–Trip Coil Resistor
1–Close Coil
1–'X'-Relay
1–'Y'-Realy

Linkage Assembly Instructions

1. Assemble bellcrank (Item #3) to pivot (Item #4) and mount into base weldment (Item #1). Do not tighten hardware.
2. Apply silicon sealant (RTV) to interrupter casting (SVD00277A00A) outside of bolt circle as shown. Mount base weldment to castings and tighten. Align interrupter casting with operator vertical pull rod housing. Tighten the hardware, attaching casting to frame.
3. Assemble drive lever (SVC0297A00A) to drive shaft as shown using spirol pin (Item #55). Position spirol pin as shown.
4. Slide pull links (Items #6 and #7) through trunion in drive lever. Assemble contact springs (Item #26) using Items #42 and #53 and set to precompressed value.
5. Attach clevis (Item #16) to pull links using jam nut (Item #41).
6. Mount opening spring assembly (Item #24) to base weldment. Snug up hardware.
7. Adjust clevis (Item #16) so that pull links are horizontal with minimum linkage play in direction toward operator. Make certain drive lever is forced forward to close contacts. Insert pin (Item #21) and lock plate (Item #13).
8. Use bellcrank set gage to position bellcrank. Assemble rod end (Item #5) (4-1/2) additional turns on to adjuster rod (Item #6). Disengage bellcrank from set gage, rotate bellcrank back and insert pin (Item #20).
9. With vertical pull rod adjusted to preset dimension, pry operator toward open position and attach pull rod to bellcrank using pin (Item #20).
10. Manually close operator. Remove open spring blocking. Tighten hardware on opening spring bracket. Tighten hardware on pivot (Item #4), vertical pull rod housing to operator mounting brackets and cabinet to leg mounting.
11. Check closed position of bellcrank (Item #3) using bellcrank set gage. To change setting, block follow spring and manually open breaker. Adjust vertical pull rod end to correct. Close breaker and check closed position.
12. Check contact spring overtravel with overtravel gauge. To change overtravel, block open spring, then slow open breaker. Front horizontal rod adjusts all three phases. Disengage pin (Item #20) from rod end assembly (Item #5). Thread rod end in to increase overtravel (1/16 per turn). Slow close breaker to check overtravel setting. Remove blocking. Mechanism closing spring must be in the charged position.
13. Open breaker. Check precompression of opening and contact springs. Adjust with flex lock nut if necessary. Close and latch breaker.
14. Tighten all jam nuts while preventing pull rods from turning. Install pin lock plates (Items #9 and #13).

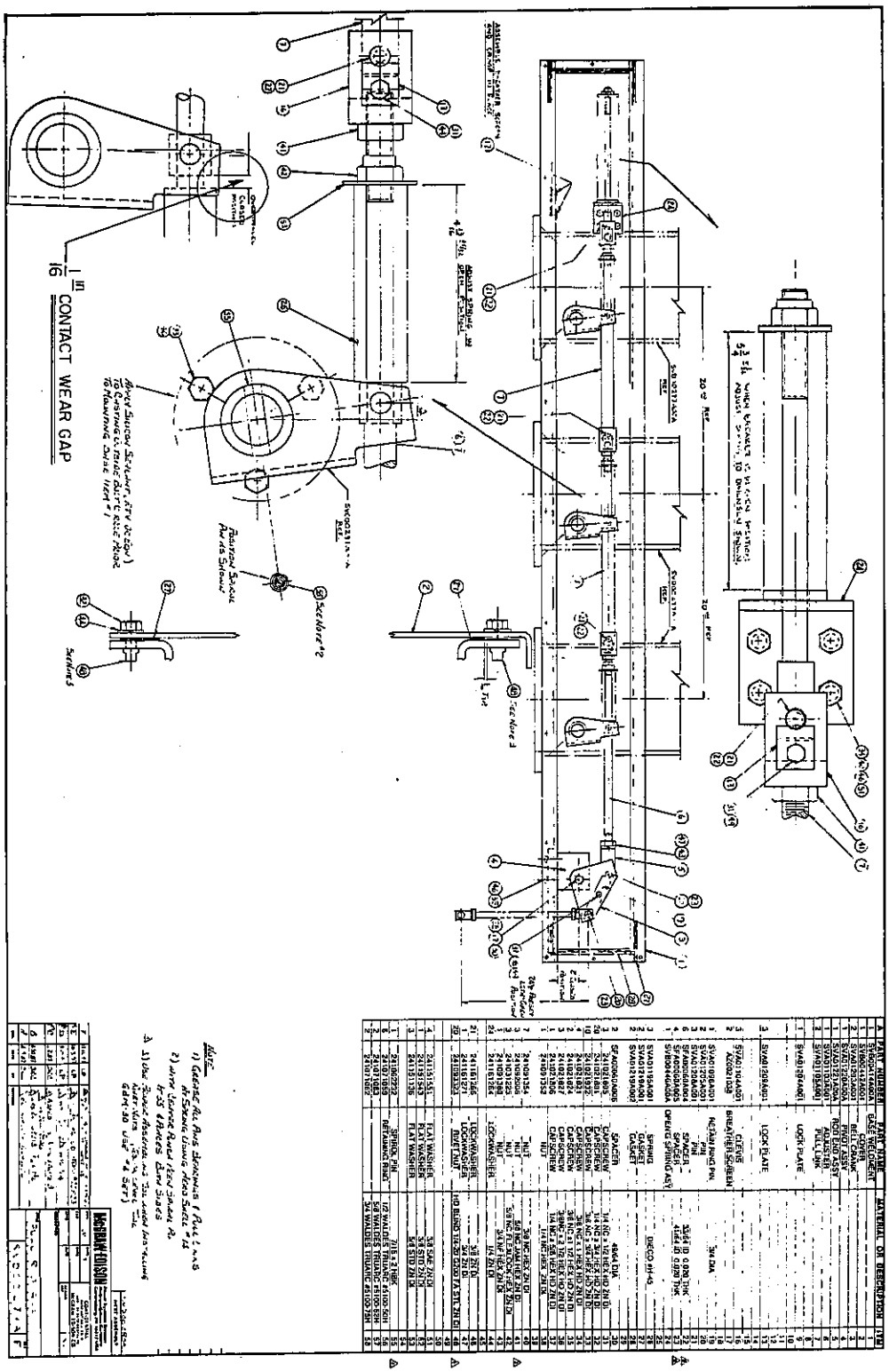


Figure 6.

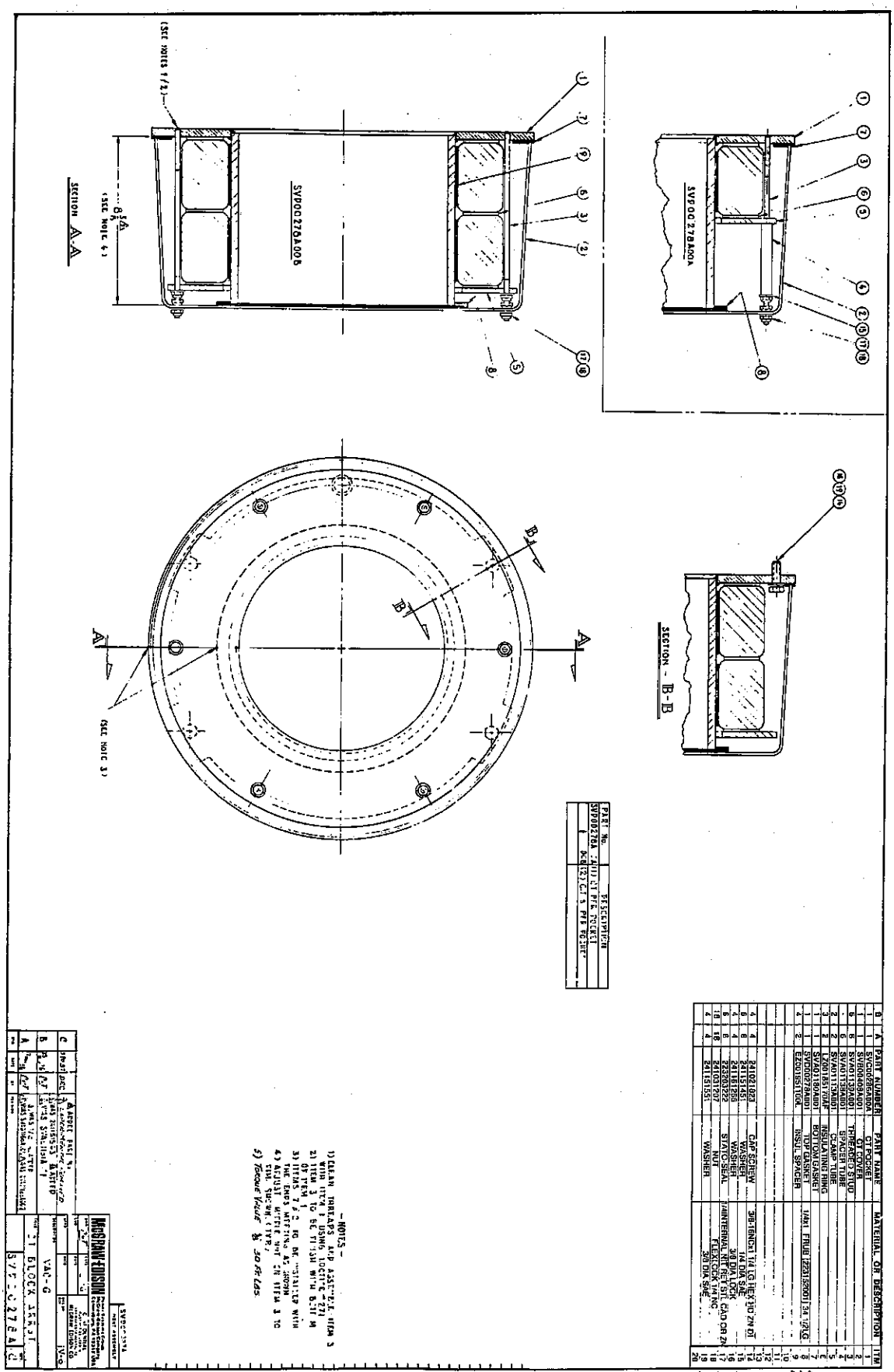
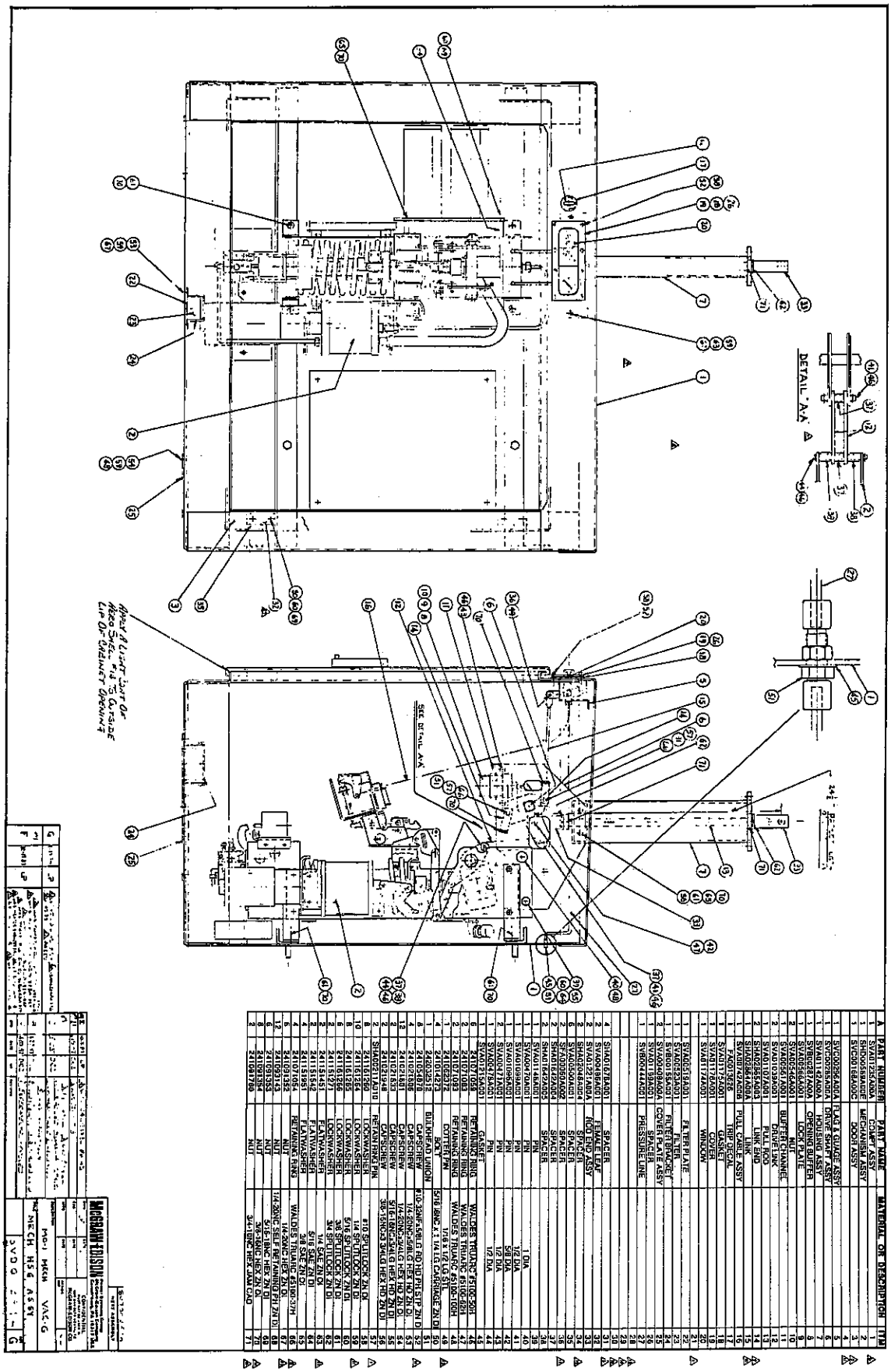


Figure 7.



A	PART NUMBER	PART NAME	MATERIAL OR DESCRIPTION	ITEM
1	SVA01235A00A	COMPT ASSY		1
1	SHD0058SA00E	MECHANISM ASSY		2
1	SVC0018A00C	DOOR ASSY		3
1	SVC0028SA00A	PLAT E GUIDE ASSY		4
1	SVC0028SA00A	DRIVE SHAFT ASSY		5
1	SVA01187A00A	HOUSING ASSY		6
1	SVB0028I7A00A	OPENING BUFFER		7
1	SVA0056A00A	LOCK PLATE		8
2	SVA0056A00A	BUFFER CHANNEL		9
1	SVA01107A001	DRIVE LINK		10
2	SVA01107A001	PULL ROD		11
2	SVA01039A001	LINK END		12
2	SHA02585A003	LINK		13
1	SVA01284A00A	PULL CHANNEL ASSY		14
1	SVA01175A001	TRIP DECAL		15
1	*FA0117SRE	GASKET		16
1	SVA01175A001	WINDOW		17
1	SVA01174A001	COVER		18
1	SVA01174A001	FILTER PLATE		19
1	SVA0523A001	FILTER		20
1	SVB0015A001	FILTER BRACKET		21
2	SVA00409A00A	COVER PLATE ASSY		22
1	SVA01146A001	SCREEN		23
1	SVB0041A001	PRESSURE LINE		24
				25
4	SHA01824A003	SPACER		29
2	SHA01824A003	SPACER		30
2	SVA0041A001	ROD END ASSY		31
2	SVA01125A00A	ROD END		32
6	SHA02585A004	SPACER		34
6	SVA00560A001	SPACER		35
2	SHA01824A003	SPACER		36
2	SHA01824A003	SPACER		37
1	SVA0070A001	PIN	1 DIA	38
1	SVA01146A001	PIN	1/2 DIA	39
1	SVA01146A001	PIN	1/2 DIA	40
1	SVA01039A001	PIN	5/8 DIA	41
2	SVA01315A001	PIN	1/2 DIA	42
1	SVA0041A001	PIN		43
1	SVA0041A001	GASKET		44
1	SVA0041A001	RETAINING RING	WALDES TRUARC #5100-50H	45
2	SVA01315A001	RETAINING RING	WALDES TRUARC #5100-62H	47
2	24107108A	RETAINING RING	WALDES TRUARC #5100-100H	48
1	24102823T2	PLUNGER PIN		49
4	24014273	BODY	5/16 18NC X 1 1/4 LG CARRIAGE ZN DI	50
1	24032521Z	BULKHEAD UNION	#10-32NF-5,#8 LG RD HD PH STP ZN DI	51
4	24104301B	CAPSCREW		52
2	24102163T	CAPSCREW	1/4-20NC-5G LG RST HD ZN DI	53
2	24102163T	CAPSCREW	1/4-20NC-5G LG RST HD ZN DI	54
2	24102163T	CAPSCREW	5/16-18NC-5G LG HEX HD ZN DI	55
2	24102194B	CAPSCREW	3/8-16NC-3G LG HEX HD ZN DI	56
2	SHA02214A01B	RETAINING PIN		57
10	24116126G	LOCKWASHER	#10 SPLITLOCK ZN DI	58
8	24116126I	LOCKWASHER	5/16 SPLITLOCK ZN DI	59
6	24116126I	LOCKWASHER	5/16 SPLITLOCK ZN DI	60
2	24116126J	LOCKWASHER	3/8 SPLITLOCK ZN DI	61
2	24115121J	LOCKWASHER	3/4 SPLITLOCK ZN DI	62
2	24115145J	FLATWASHER	1/4 SAE ZN DI	63
4	24115158J	FLATWASHER	5/16 SAE ZN DI	64
2	24115158J	FLATWASHER	5/16 SAE ZN DI	65
4	24107105A	WALDES TRUARC #5100-37N		66
6	24109138Z	RETAINING RING		67
6	24109138Z	NUT	1/4-20NC HEX ZN DI	67
2	24109114J	NUT	1/4-20NC SELF RETAINING PH ZN DI	68
8	24109138Z	NUT	5/16-18NC HEX ZN DI	69
2	24109138Z	NUT	3/8-16NC HEX ZN DI	70
2	24109138Z	NUT	3/4-10NC HEX JAM GAD	71
2	24106178D			

Figure 8.

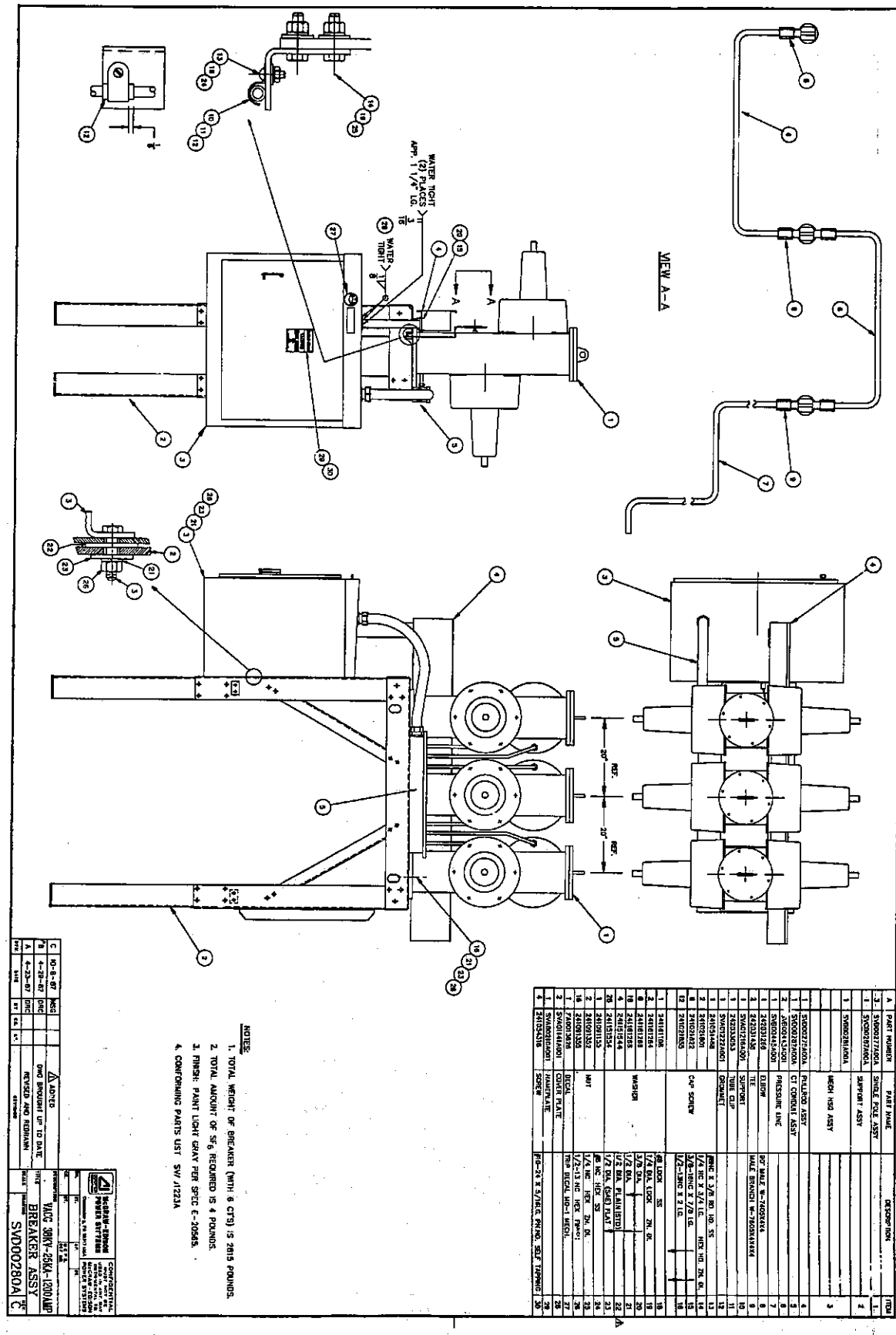


Figure 9.

McGRAW-EDISON POWER SYSTEMS
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