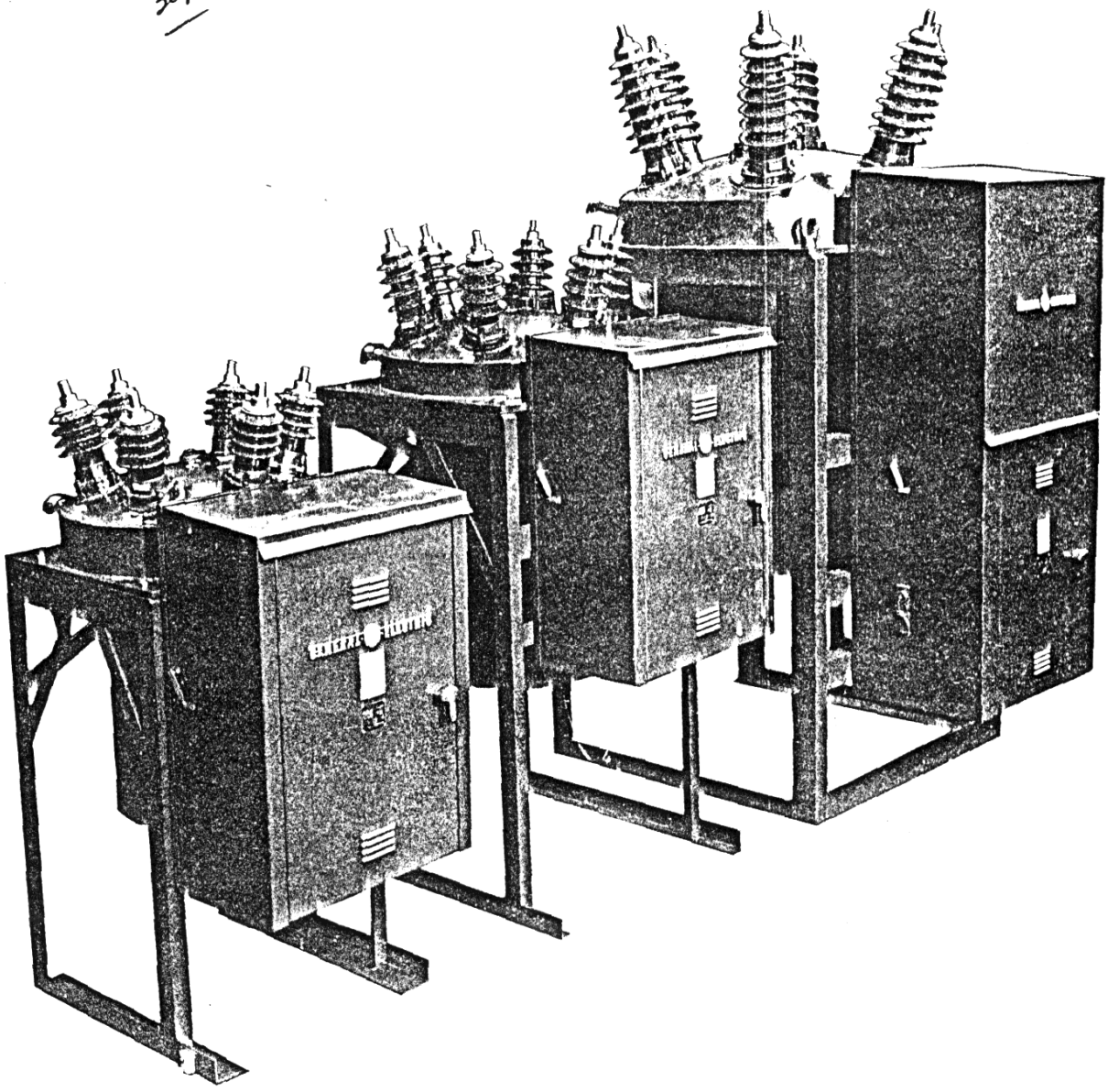
SWITCHGEAR

INSTRUCTIONS

OIL-BLAST CIRCUIT BREAKERS

TYPES KSO 14.4 KV TO KSO 69 KV



CANADIAN GENERAL ELECTRIC COMPANY LIMITED

CONTENTS

General Information

These instructions do not purport to cover all details or variations in equipment nor to provide for every possible contingency to be met in connection with installation, operation or maintenance. Should information be desired or should particular problems arise which are not covered sufficiently for the purchaser's purposes, the matter should be referred to the Canadian General Electric Company.

INTRODUCTION

These breakers are of the most modern design, incorporating the oil blast principle of arc interruption. The fast breaker interrupting time means less system disturbance because of a quicker clearing of the fault. The shorter arc length means lower maintenance because of reduced contact burning and oil deterioration.

These instructions apply to outdoor breakers rated 14,400 volts to 69,000 volts and with interrupting capacities as designated on the breaker nameplate.

An oil circuit breaker is a very important unit in the modern transmission system, being depended upon for protection and flexibility of control. They may be used at any altitude up to 10,000 ft. if the proper bushings are selected. The operating mechanism is installed in a weather-tight housing attached to the circuit breaker framework, and its door provides accessability to all control parts. The breaker should not be installed in places where it will be called upon to operate at voltages or currents greater than those given on the nameplate. The short circuit conditions imposed should not exceed the breaker rating.

Proper installation and maintenance are necessary to insure continued satisfactory operation of the breaker. Section 19 of the Standard of the A.I.E.E., and the N.E.M.A. Switchgear Standard published by the National Electrical Manufacturers' Association, in addition to these instructions, are recommended for reference on the installation and use of the oil circuit breakers.

RECEIVING, HANDLING AND STORAGE

Shipment

All breakers are assembled and tested completely at the factory. They are shipped assembled in as completed units as handling and transportation facilities will permit. Each breaker is carefully inspected and packed by workmen experienced in the proper handling and packing of electrical equipment. Immediately upon receipt of a breaker an examination should be made for any damage sustained in transit. If injury or rough handling is evident, a damage claim should be filed at once with the transportation Company and notification made promptly to the nearest Canadian General Electric Sales Office.

Unpacking

For shipment to certain locations it will be necessary to remove the bushings and interrupters.

When unpacking, the crating and boxing must be removed carefully. The bushing porcelains and other parts are sometimes damaged by the careless handling of uncrating tools.

Storage

When the breaker can be set up immediately in its permanent location and filled with oil, it is advisable to do so, even though it may not be put in service for some time. The oil tanks should be cleaned and dried before they are filled with oil. The protective crating should not be taken from the bushings until the breaker has reached its permanent location and all overhead work completed.

If stored outdoors, the breaker parts which are not weather-proof should be thoroughly covered to protect them from the weather. Machined parts of the operating mechanism etc., should be slushed to prevent rusting and if the breaker is stored for any length of time it should be inspected periodically to see that rusting has not started and to insure good mechanical condition.

Particular care should be taken to protect insulation parts which might absorb moisture. It is necessary that these parts be stored in a dry room.

INSTALLATION

The installation of the breaker will be facilitated by a study of these instructions and a review of the approved drawings which supplement these instructions. The drawings show the general arrangement, dimensions, location of foundation bolts, provision for conduit connection, electrical connections and other information necessary for the proper installation of the breaker. The approved drawings consist of a requisition summary, outline of the breaker, and the diagram of connections.

Location

The breaker should be located so that it will be readily accessible for cleaning and inspection. It is important that sufficient space be provided for operation of the maintenance closing device. Where flood conditions exist, the mechanism housing should be above high water level.

Mounting

The total weight of the breaker with oil is given on the outline drawing and on the nameplate. This information will serve as a guide to the strength of the lifting means required for handling the breaker. It may be lifted by hooking into the framework. When cable slings are used, the slings must not strike the bushings, as any undue strain may cause them to crack or break.

Connections

After the breaker has been located and foundation bolts secured, electrical connections can be made. Before making these, every precaution must be made to see that all leads to be connected to the breaker are dead.

Leads should be brought down from above if possible. Ample electrical clearance must be provided between leads and parts of the station, such as walls, channels, and framework. Leads should be properly supported so as not to put any unusual strain on the bushings. The bushing should not carry any cable or bus strains. To avoid overheating, the connecting leads must be of current carrying capacity at least equal to the maximum operating current of the circuit which should not exceed the breaker rating.

Connections to the breaker are made by bolted connectors fastened to the end of the bushings. The bolts on the terminal connectors must be securely tightened to ensure good contact. All contacts must be clean, bright and free from dents or burrs.

Control and Secondary Wiring

All control wires should be run in conduit insofar as it is practicable. Control wires must be run separately and remote from high tension leads and must not be run in the same duct or parallel to the high tension leads unless the distance separating them is sufficient to prevent possible communication in the vent of a short circuit. Control wiring of adequate size should be used so that with full operating current

supplied to the control circuit, voltage across the mechanism terminals is within the limits specified as standard for the range of control voltage.

Grounding

The framework of each breaker should be permanently grounded. The usual practice is to connect a heavy cable from framework to ground, a bolted connector being supplied for this purpose. The cable should be able to carry 25% of rated current of the breaker but should not be smaller than #4/0.

A good permanent low resistance ground is essential for adequate protection. A poor ground gives a false feeling of safety to those working around the breaker and may result in ultimate loss of life or damage to the equipment.

ADJUSTMENTS

Note:

Before making any changes or adjustments to the breaker read carefully the factory electrical and mechanical inspection sheets pertaining by serial number to the breaker in question.

Although the breaker has been completely set up, adjusted and tested at the factory, it is suggested that all adjustments be reviewed to see that no change has occured during shipment and installation. Manual operation should be used for all preliminary inspections. The breaker should be operated by hand to see that it is smooth throughout the closing and opening strokes, that no binding occurs and that no excessive play is noticeable between parts. Electrical operation should only be attempted after it is certain all adjustments are made correctly.

The adjustments of the operating mechanism are not included and instructions for the particular operating mechanism used should be referred to for details.

With the tank-lifter the tank can be lowered leaving the contacts and breaker mechanism accessible for inspection. *The trip latch of the operating mechanism is wired in place during SHIPMENT AND THIS WIRE MUST BE REMOVED BEFORE INSPECTION.* All wire and blocks used to hold parts in place during shipment must be removed before breaker is tripped open.

OIL

The specific high speed performance of the modern oil blast breaker is dependent upon the uses, in the breaker, of oil having the proper characteristics and refined under a controlled method by a reliable refiner to meet fully the rigid Specifications of the Canadian General Electric Company. A high dielectric strength is necessary to meet insulation requirements. A low freezing point is required for successful operation when installed in locations subject to freezing temperaturs. High resistance to carbonization minimizes the sludge and carbon deposits which reduce the dielectric strength and cooling effect of the oil. It is very important that the oil be free of all moisture as the presence of one tenth of one percent may reduce its puncturing resistance by fifty percent.

Before final adjustments are made the oil tank should be filled with GE #10C oil. Precautions must be taken to insure absolute dryness and cleanliness of the apparatus before filling and to prevent the entrance of water and dirt during transfer of oil to the tank. Customers desiring detailed information on equipment and procedure for filtering G.E. #10-C oil should obtain Bulletin GEA-1130A from the nearest CGE Sales Office. Before filling with oil, all accessories such as valves and gauges must be oil tight. The threads should be covered with glyptal or equivalent. Plugs are furnished for the outlet side of the drain valves and should be used to prevent any leakage should the valve seats become damaged from use. The normal oil level is indicated by the oil gauge and may vary from minimum to maximum, but should never drop below the visible portion of the glass.

While the oil is shipped in sealed containers, careless handling during shipment or storage may result in absorption of moisture by the oil. All new oil should be tested before being placed in the oil circuit breaker. The dielectric strength of the oil when shipped is at least 22,000 volts when tested in a standard gap with 1" disc terminals 0.1" apart. New oil of less than standard dielectric strength (22,000 volts) should not be put in the breaker tank until its insulating value has been brought up to standard, (by filtering or otherwise).

In filling, care must be taken so that moisture will not be absorbed by the oil. When cold drums are brought into a warm place they must be left standing until condensation has disappeared and drums are thoroughly dry. If the installation is outdoors the preparation and filling must be done on a clear dry day or adequate protection of some kind provided against moisture being absorbed.

Metal or oil proof rubber hose must be used because oil dissolves the sulphur in ordinary rubber hose, this condition being undesirable as the sulphur attacks the copper in contacts, etc.

BREAKER ANALYSER CHARTS

When all breaker adjustments have been made, the bearing surfaces of the mechanism properly lubricated and the tank filled with oil, the breaker may be operated.

A travel analyser may be attached to the breaker to obtain an accurate travel record of breaker performance. The removable operating rod of the analyser screws into the top of the breaker crosshead, access through the dome being obtained with a removable pipe plug inserted for this purpose. A #10-24 hole is drilled in the crosshead to receive analyser rod.

Representative travel curves of opening, closing and trip free operations are illustrated in Fig. 1. It should not be necessary to make any adjustments to come within the limits shown. Any variation from the limits given in Table 1 should be reported to the nearest Canadian General Electric Sales Office.

FINAL INSTALLATION INSPECTION
(See Table 1)

After the oil circuit breaker has been installed with all mechanical and electrical connections completed, the following tests and inspections should be made. Reference should be made to the electrical and mechanical inspection sheets supplied with each breaker.

1. See that the breaker is properly set up and levelled on its foundation.

2. Close the breaker by hand and check the following points:

   (a) Interrupter port alignment—Figure 2.

   (b) Contact alignment.

   (c) Minimum clearance between blade and bottom of interrupter.

   (d) Stroke (inspection sheet).

   (e) Clearance for all moving parts; connecting pipes, etc.

   (f) Distance between top plate and crosshead. (See Inspection Sheet).

3. See that all nuts, bolts, washers, cotter pins, and terminal connections are in place and tightened.

4. Inspect and test all insulated wiring to see that no damage, possible grounds or short circuits have occured during installation.

5. See that all bearing surfaces of the breaker operating mechanism have been properly lubricated.

6. See that the tank is filled with oil to the proper level.

7. Operate breaker electrically and check.

   (a) Operating times—

      1. Closing time from closing impulse till contacts touch.

      2. Opening time from tripping impulse till contacts Part.

      3. Trip free time from contacts touch till contacts part on trip free operation.

      Refer Figure 1, Analyser Chart, and Table 1.

   (b) Rebound (Maximum of 5% of stroke).

8. See that current carrying parts connected to the bushings are correctly installed according to standard practice and that all joints, whether made with bar or cable, are made correctly.

9. See that all covers and bolted connections are securely tightened and that all pipe plugs for inspection openings are tightened and glyptalled so as to prevent the entrance of moisture.

10. See that all points where the surface of the paint has been damaged during shipping and installation are repainted immediately.

BREAKER GENERAL

The oil circuit breaker is composed of the solenoid mechanism and house, top frame and dome, bushings, stationary and moving contacts, and the breaker mechanism which transmits motion from the solenoid to the moving contacts.

The top frame supports the bushings, bushing current transformers, breaker mechanism and the removable tank. Figure 3 is a plan view of the dome and shows the relative position of bushing current transformers and bushing current transformer leads with respect to the mechanism. The transformer leads are brought out to the terminal blocks in the housing, making them easily accessible for connecting to meters and protective devices.

Figure 4 shows the linkage involved in transmitting the vertical travel of the solenoid to the breaker lift rod (Fig. 4-6). On a closing operation the coupling 22 is pulled down, rotates the bellcrank and gives vertical motion to the link assembly 21. This in turn rotates the crank lever giving upward motion to the lift rods.

Oil dash pots Fig. 5-(3) absorb the energy of the moving parts on opening. The oil level in these dash pots should be checked during regular maintenance.

Venting

Gases generated during circuit interruption are separated from the oil and vented to the outside by means of a pebble filled chamber Fig. 6 located in the top frame Fig. 3 - (1). There are no adjustments and no maintenance required unless the pebbles should be removed and cleaned. The elbow (4) is removeable for this purpose.

Tank Lifter

A pair of chain blocks serves as a tank lifter. Two men can raise the tank filled with oil quite readily. Clearance should be left to the rear of the breaker to allow for the removal of the tank for cleaning and maintenance purposes.

Contacts

The contacts consist of a stationary explosion chamber mounted on the lower end of the bushings, and moving blades and rods supported from the mechanism linkage.

Line-up of the chamber contact to the vertical position is important. The contact rod moves through the throat of the chamber and therefore the centre line of the chamber should coincide with the centre line of the contact rod. In mounting the adapter support and adapter, a spirit level should be used to make certain the chambers are lined up vertically. This vertical alignment can be adjusted by turning the adapter support on the centre line of the bushing or by loosening the bolts between the bushing and top frame and altering the angle of the bushing.

The moving contacts consist of blades clamped to the lower end of the wooden operating rods and holding, by means of slotted supports, the adjustable contact rods, Figure 4 (5). These contacts may be screwed in or out to obtain correct contact compression on all stationary contacts and to ensure that each phase is making and breaking at approximately the same time.

Contact Assembly

The complete explosion chamber, Fig. 4 (7) is removed by unclamping from the bottom of the bushing. It is important that the explosion chambers be set up so the parts are exhausting radially as shown in Fig. 2. To inspect the fixed contacts the entire baffle assembly may be taken apart by removing the dowel screws. The explosion chamber contacts, spring loaded, are assembled on the adapter and are renewable.

The explosion chamber contacts and moving contact rods should be replaced when they become badly burned. Over a period of time the baffles may become burned sufficiently to require replacement of the baffle assembly.

Operation and Maintenance

The safety and successful functioning of connected apparatus depends upon proper and reliable operation of the oil circuit breaker. To obtain this the breaker as a whole must have regular systematic inspections. The frequency of these inspections should be determined by each operating company on the basis of the number of operations (including switching), the magnitude of the current interrupted and any unusual operations which occasionally occur. Operating experience will soon establish a maintenance schedule which will give an assurance of proper breaker condition. The following paragraphs give a resume of the points to be included in an inspection and a number of general recommendations.

1. At regular inspections:

   (a) The current carrying capacity of high pressure line or point contacts is practically independent of the condition of the contact surface. With sufficient contact pressure the area of contact is not important. Therefore, with these contacts, where arcing and current carrying functions are performed by the same contact, it is not necessary to maintain the surface of the contacts. As the contacts are burnt away by arcing, it may be necessary to readjust the contact compression and when burned sufficiently, to replace the contacts.

   (b) The oil should be checked. Oil in service should be tested at approximately three month periods. If the dielectric strength of the oil tests less than 16,500 volts, it should be filtered. When sampling oil, the sample container should be a wide mouthed glass bottle, cork stoppered, with at least one pint capacity. The bottle should be cleaned and dried and free from moisture before it is used.

   Test samples should be taken only after the oil has settled for some time. Samples should be taken from the valve at the bottom of the tank and sufficient oil drawn off to make certain that the sample represents oil from the tank proper and not oil that is stored in the drain pipe. A glass receptacle is desired so that if water is present it may be readily observed. If water is found, an investigation of the cause should be made and a remedy applied. Excessive water is indicative of leakage somewhere in the breaker structure.

(c) All insulation parts should be thoroughly cleaned to remove any trace of carbon which may remain when the oil is drained from the tank. It is recommended that the oil be removed and the tank cleaned since the carbon which adheres to the side of the tank is not removed by filtering.

(d) The operating and breaker mechanism should be thoroughly checked and all bearing surfaces lubricated, using D50H15 circuit breaker lubrication.

(e) Dashpots should be checked and the pistons examined to see that they work freely and function properly.

(f) All bolts, nuts, washers, cotter pins and terminal connections should be in place and properly tightened. The gland nuts, small valves and oil gauge should be checked to see that they are sufficiently tight to prevent leakage. In tightening gland nuts and gauge connections, care must be taken not to damage packing nor put undue strains on the gauge glass.

(g) Operate the breaker slowly by hand and then electrically; check the points listed under final inspection in each case.

2. Be sure the breaker and its mechanism are disconnected from all sources of electric power before inspecting or repairing. After breaker has been disconnected from power lines, grounding leads should be properly attached before coming in contact with breaker parts.

3. Be sure breaker framework is well grounded.

4. Inspect the bushing supports as the vibration due to the operation of the breaker may cause the bushings to move slightly and cause misalignment of contacts.

5. Clean the bushings at regular intervals. This is very important where abnormal conditions exist, such as salt deposits, cement dust or acid fumes, to avoid flashover as a result of accumulation of foreign substances on their surfaces.

6. See that the oil is kept at the proper level in the breaker tank.

7. The maintenance closing device is to be used in making adjustments only and should never be used to close the breaker on load. Care should be taken also to see that the breaker is never operated electrically with the maintenance jack in position.

8. The apparatus should always be operated by hand after any adjustments are made to make certain all parts are in order.

Preparation of Gaskets and Gasket Surfaces (for cork, neoprene, vellumoid, rubber and similar material.)

All gasket surfaces should be thoroughly cleaned to remove all oil, grease, or foreign material which would prevent adhesion of the gaskets or sealing of the joints. They should be allowed to become thoroughly dry before proceeding with treatment.

All surfaces, where gaskets (except rubber gaskets) are to be permanently assembled, should be given a full unbroken coat of "1201" compound. All gaskets (except rubber gaskets) for such joints should be given a similar coat. This should be done at such a time in the assembly cycle so that the compound be allowed to dry at least one half hour, and not more than twenty four hours, before assembly. In making up permanent joints, both the gasket and gasket surfaces should again be coated with glyptal and the parts bolted up before the glyptal sets.

For joints which have to be opened, the surface of the removable gasket should not be coated nor the part installed until the compound on the gasket is perfectly dry. The side of the gasket to be assembled against the uncoated surfaces should be greased to prevent sticking.

Rubber gaskets, due to their composition do not require coating with compound or greasing as outlined above for gaskets of other material.

RENEWAL PARTS

It is recommended that sufficient renewal parts be carried in stock to enable the prompt replacement of any worn, broken or damaged part. It will be readily appreciated that a stock of such parts minimizes service interruptions caused by breakdowns and saves time and expense.

Table 2 is a list of parts which are most subject to wear or breakage and which are recommended for stocking. The number stocked will vary depending on severity of service and the time required to secure replacements but a study of the following table will indicate a basis for ordering spares.

Table 2: Renewal Parts Data

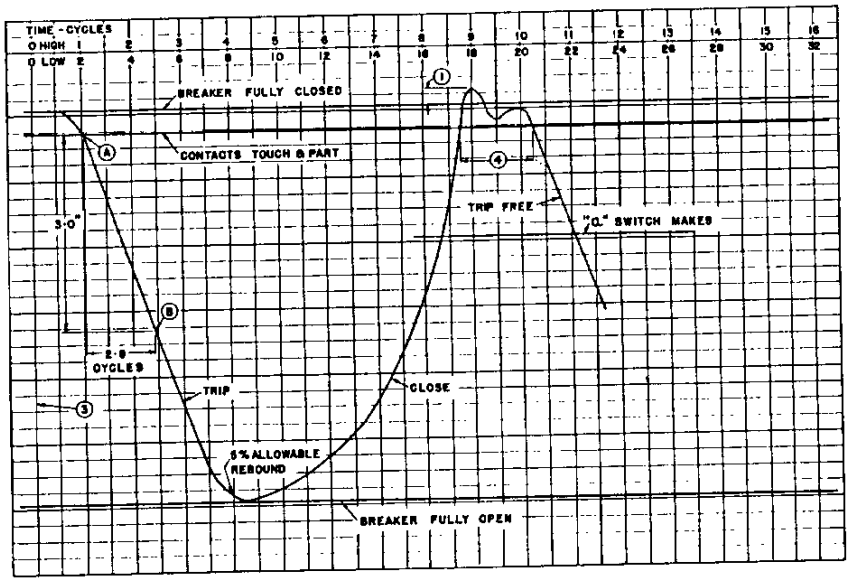
Type of Breaker	No. per Breaker							Recommended Stock														
								1 Breaker							5 Breakers							
	Bushing	Contact Finger	Contact Rod	Contact Blade	Lift Rod	Lift Rod Guide	Oil Gauge Glass	Bushing	Contact Finger	Contact Rod	Contact Blade	Lift Rod	Lift Rod Guide	Oil Gauge Glass	Bushing	Contact Finger	Contact Rod	Contact Blade *	Lift Rod	Lift Rod Guide	Oil Gauge Glass
KSO-14.4- 250-600 500-1200 1000-2000	6	36	6	3	3	1	1	1	36	6	0	1	0	1	3	72	12	2	3	1	2
KSO-14.4-1000-3000	6	54	6	3	3	1	1	1	54	6	0	1	0	1	3	108	12	2	3	1	2
KSO-23-250-600 500-1200	6	36	6	3	3	1	1	1	36	6	0	1	0	1	3	72	12	2	3	1	2
KSO-34.5- 500-800 1000-1200 1000-2000	6	24	6	3	3	1	1	1	24	6	0	1	0	1	3	48	12	2	3	1	2
KSO-46- 500-800 1000-1200	6	24	6	3	3	1	1	1	24	6	0	1	0	1	3	48	12	2	3	1	2
KSO-69-1000-800 1500-1200	6	12	6	3	3	1	1	1	12	6	0	1	0	1	3	24	12	2	3	1	2
KSO-69-2500-1200 3500-2000	6	30	6	3	3	1	1	1	30	6	0	1	0	1	3	60	12	2	3	1	2

* The contact blade has two lengths, the longer blade for use on the centre phase. Recommended 1 long blade, 1 short blade.

TYPICAL ANALYSER CHART AS TAKEN ON TYPE KSO 14.4–500 1200 AMPERE—OIL CIRCUIT BREAKER

(REFER TO TABLE 1 FOR VALUES ON BREAKER OF OTHER RATINGS)

DRAWING #309C735



1. OVERTRAVEL ¼", MAX. ½"
2. AVERAGE OPENING SPEED FROM 'A' TO 'B'
   $\frac{60}{2.8} \times \frac{3}{12}$ = 5.4 FT./SEC. RANGE-5 TO 6 FT./SEC.
3. CLOSE & TRIP COIL ENERGIZED ON ZERO LINE
4. TRIP FREE TIME-CONTACTS TOUCH TO CONTACTS OPEN. .3.0 CYCLES

A. CONTACTS PART

B. 3" FROM CONTACT TOUCH POSITION

Fig. 1

VIEW OF INTERRUPTER FROM ARROW "A" SHOWING PORT

DRAWING #309C734

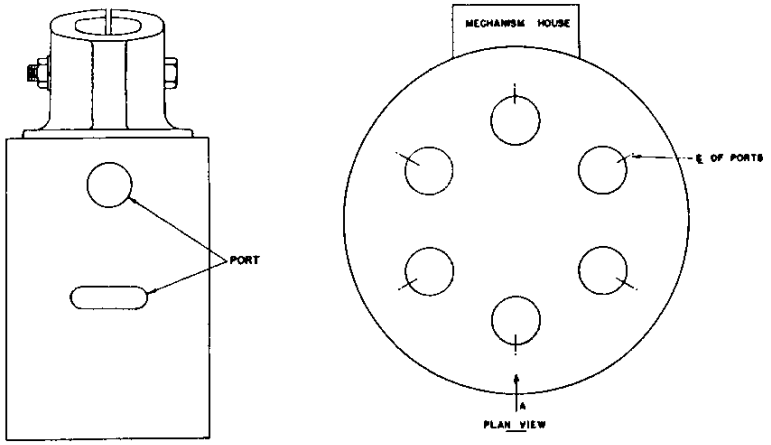
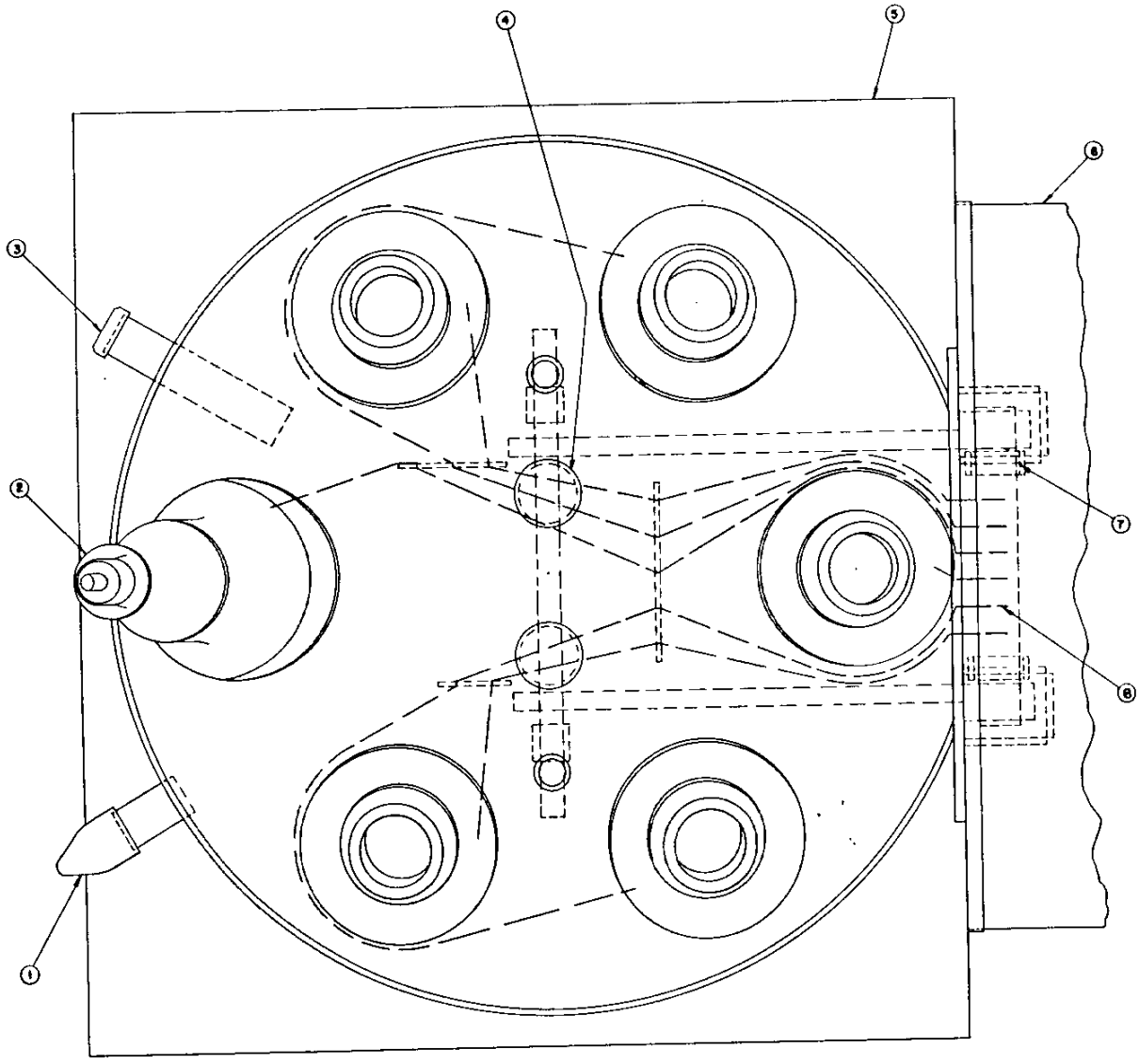


Fig. 2



DRAWING -498C800

Fig. 3

PLAN VIEW

1. SEPARATING VENT
2. HIGH VOLTAGE BUSHING
3. FILL VALVE
4. BUFFER
5. TOP FRAME
6. MECHANISM HOUSE
7. SHAFT BUSHING
8. BUSHING CURRENT TRANSFORMER LEAD

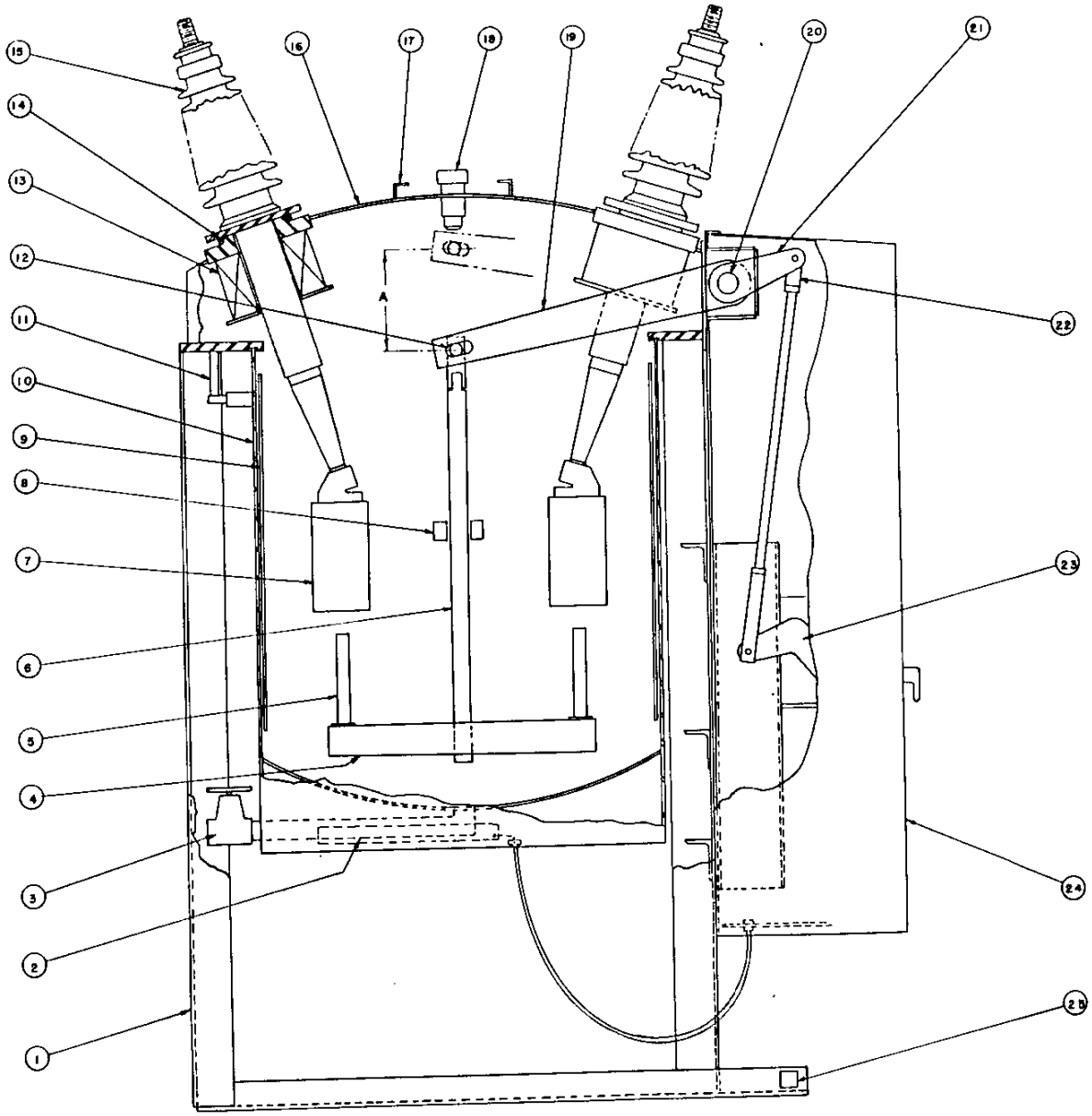


Fig. 4

SECTIONAL VIEW THROUGH CENTRE PHASE

1. FRAMEWORK
2. TANK HEATERS
3. DRAIN VALVE
4. CONTACT BLADE
5. CONTACT ROD
6. LIFT ROD
7. EXPLOSION CHAMBER
8. GUIDE
9. TANK LINING
10. OIL TANK
11. OIL GAUGE
12. CROSSHEAD
13. BUSHING CURRENT TRANS.
14. BUSHING GASKET
15. BUSHING
16. TOP FRAME
17. ANALYZER SUPPORT
18. BUFFER
19. CRANK
20. SPLINE SHAFT
21. LEVER
22. ADJUSTABLE COUPLING
23. SOLENOID CRANK
24. MECHANISM HOUSE
25. GROUNDING TERMINAL

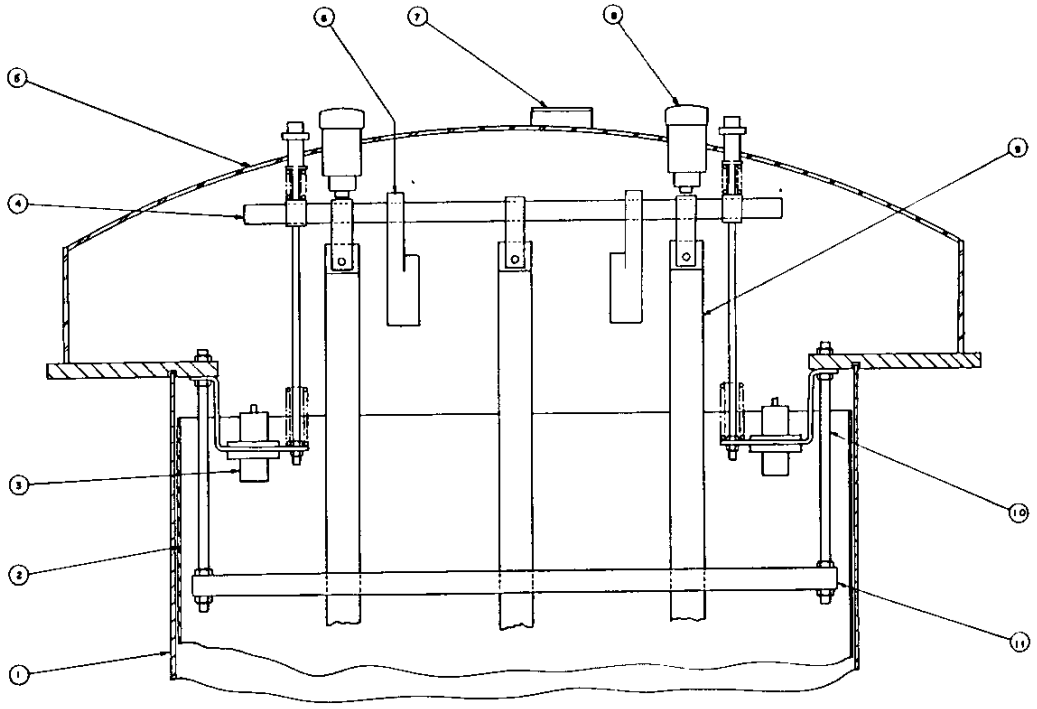


Fig. 5

BREAKER MECHANISM

1. TANK
2. TANK LINING
3. OIL DASHPOT
4. CROSSHEAD
5. TOP FRAME
6. CRANK
7. ANALYSER SUPPORT
8. BUFFER
9. LIFT ROD
10. GUIDE SUPPORT
11. GUIDE

DRAWING 498C944

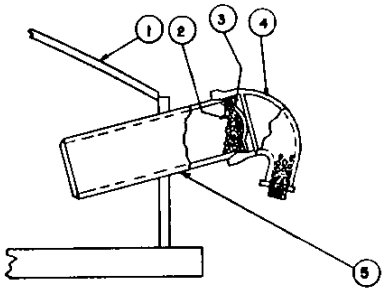


Fig. 6

SEPARATING VENT

1. TOP FRAME
2. PEBBLES
3. SCREEN
4. STREET ELBOW
5. CHAMBER

DRAWING #309C733

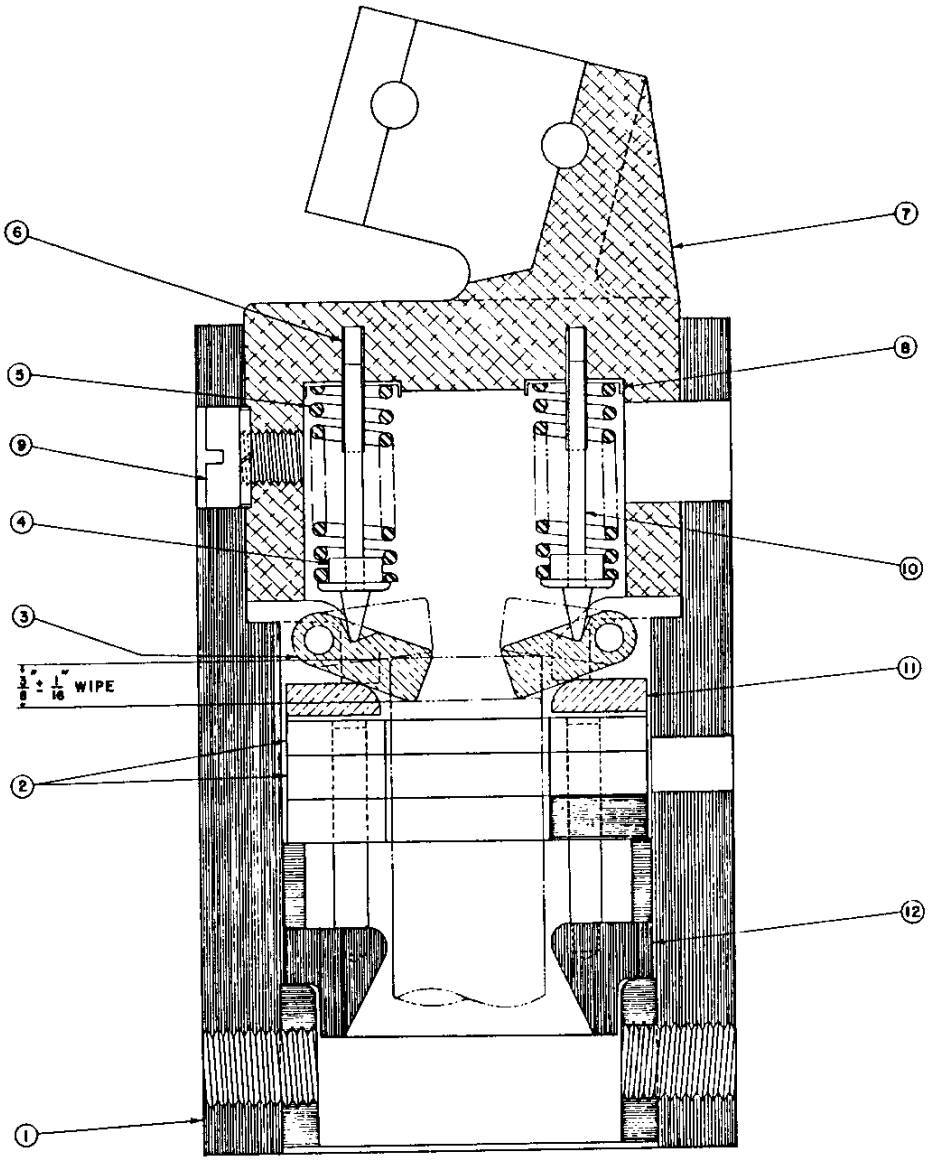


Fig. 7

EXPLOSION CHAMBER

14.4 and 23 KV—600, 1200 and 2000 Amperes

1. EXPLOSION POT BODY
2. JET PLATES
3. CONTACT FINGER
4. SPRING BUSHING
5. SPRING
6. GUIDE
7. ADAPTER
8. INSULATING CAP
9. DOWEL SCREW
10. SPRING STEM
11. STOP PLATE
12. THROAT

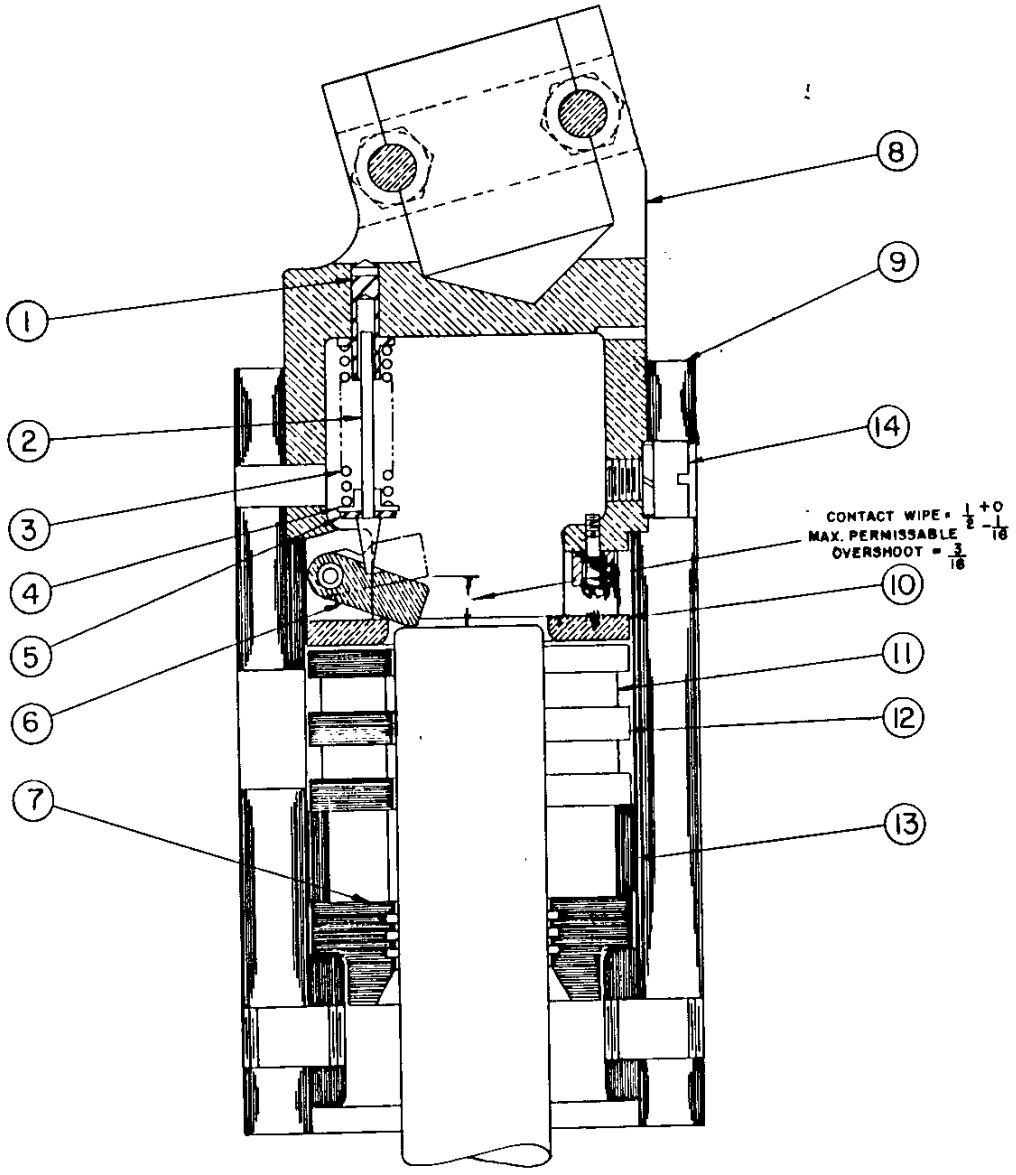


Fig. 8

EXPLOSION CHAMBER

14.4 KV—3000 Amperes

1. GUIDE
2. STEM
3. SPRING
4. BUSHING
5. WASHER
6. CONTACT FINGER
7. THROAT PLATE
8. ADAPTER
9. BODY
10. STOP PLATE
11. JET PLATE
12. BAFFLE
13. SPACER
14. DOWEL SCREW

DRAWING 498C982

DRAWING #498C801

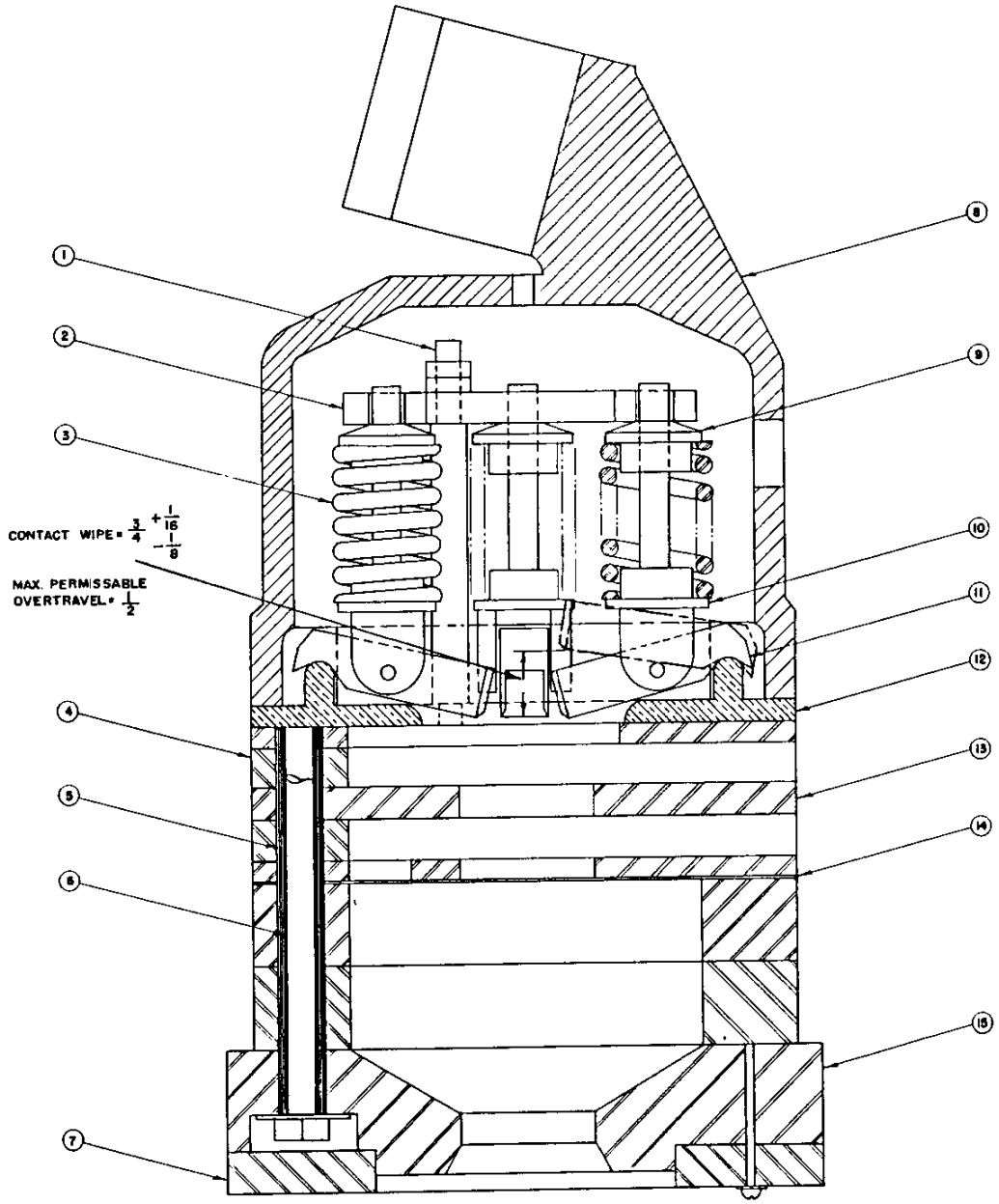
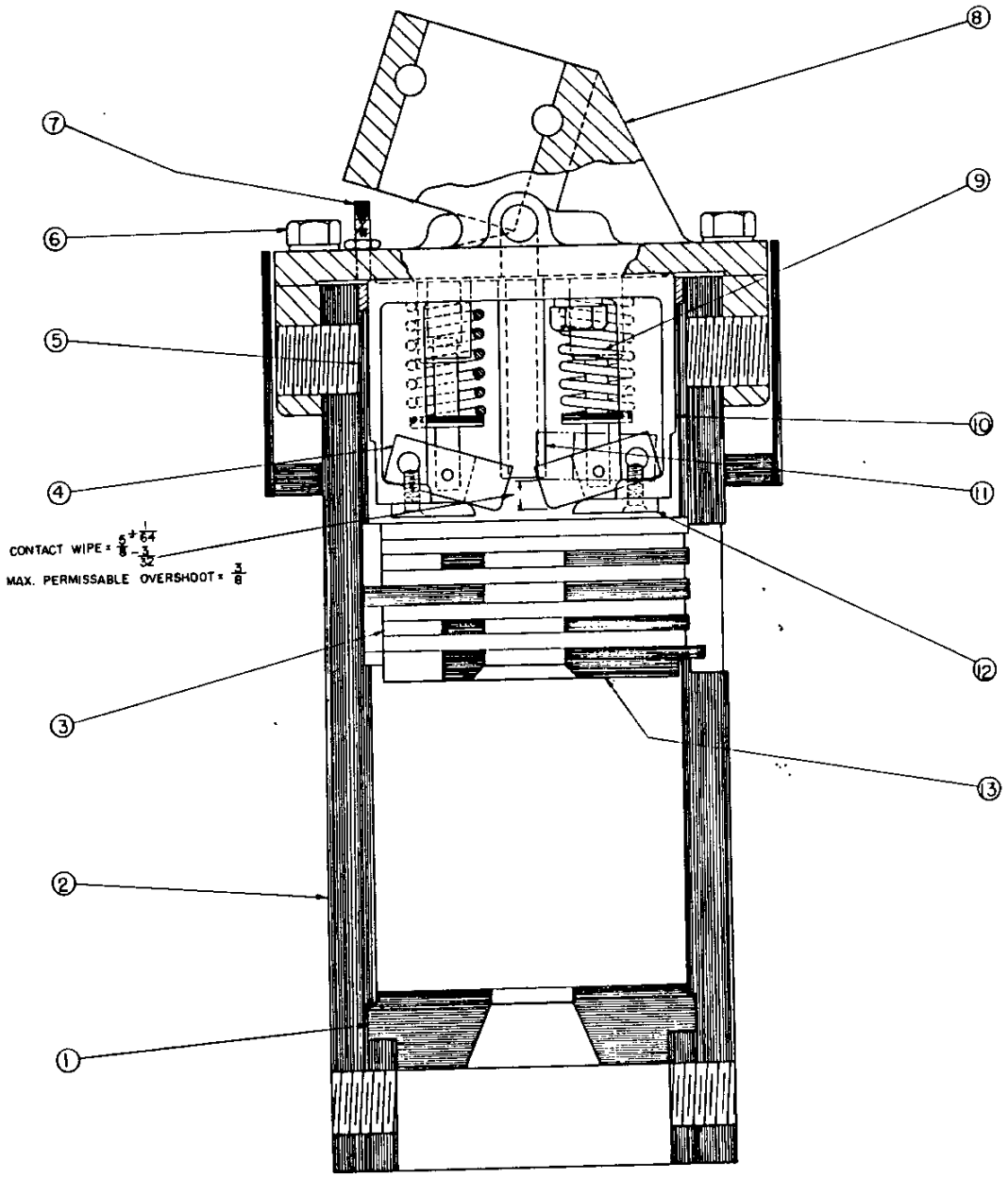


Fig. 9

EXPLOSION CHAMBER

34.5 and 46KV

1. STUD
2. GUIDE PLATE
3. SPRING
4. SPACER
5. TUBE
6. DOWEL SCREW
7. INSULATING PLATE
8. ADAPTER
9. SPRING SEAT
10. SPRING COLLAR
11. CONTACT FINGER
12. BASE PLATE
13. BAFFLE
14. GASKET
15. THROAT



DRAWING #498C947

Fig. 10

EXPLOSION CHAMBER

69KV—1000 and 1500 MVA

1. THROAT
2. CHAMBER BODY
3. BAFFLE ASSEMBLY
4. CONTACT
5. SPACER
6. DOWEL SCREW
7. JACK SCREW
8. ADAPTOR
9. SPRING
10. CONTACT BASE
11. VENT TUBE
12. ARCING PLATE
13. INNER THROAT

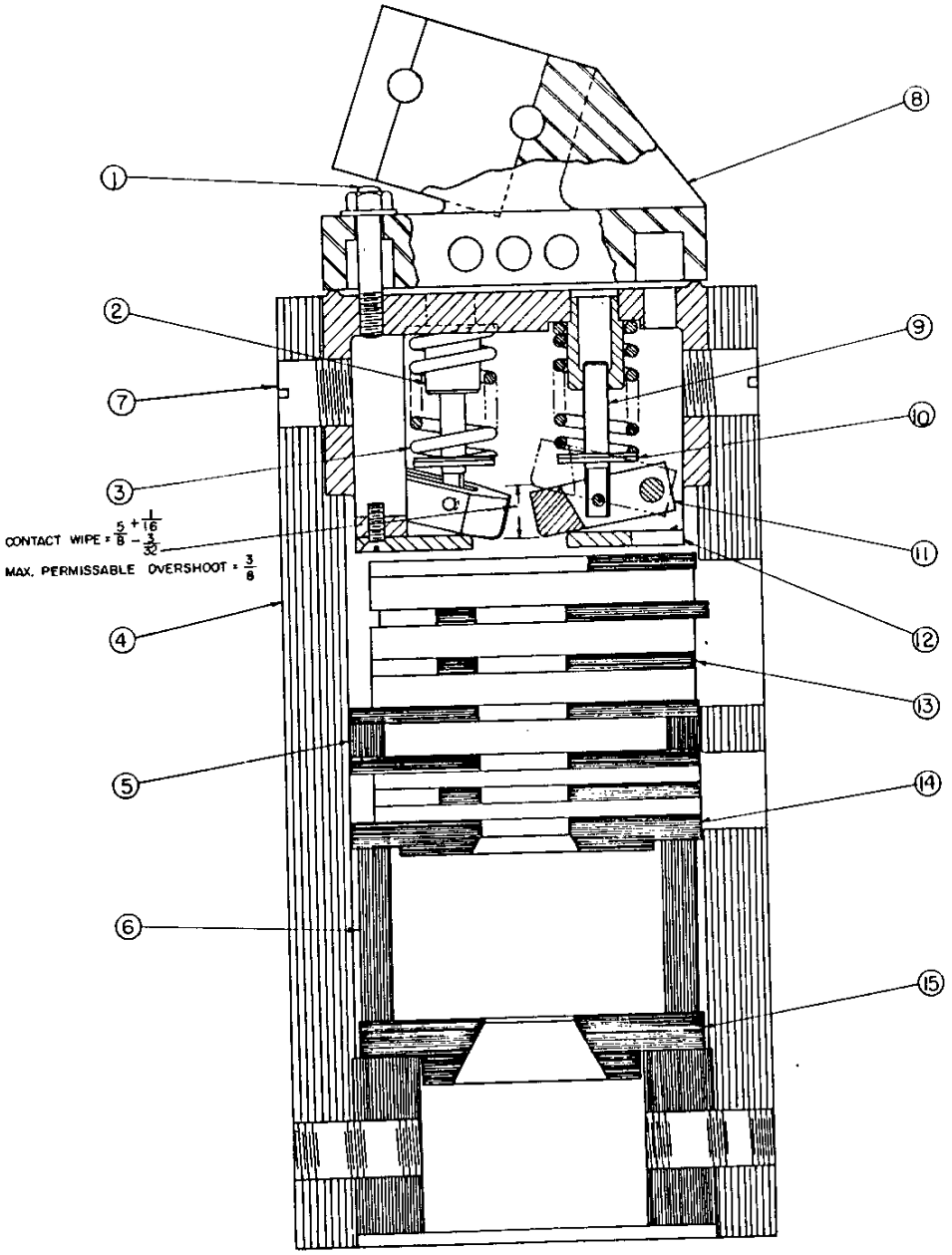


Fig. 11

EXPLOSION CHAMBER

69KV—2500 and 3500MVA

1. STUD
2. GUIDE BUSH
3. SPRING
4. BODY
5. SPACER
6. TUBE
7. DOWEL SCREW
8. ADAPTER
9. SPRING GUIDE
10. SPRING COLLAR
11. CONTACT FINGER
12. ARCING PLATE
13. BAFFLE PLATE
14. INNER THROAT
15. OUTER THROAT

TABLE 1: INSTALLATION INSPECTION DATA