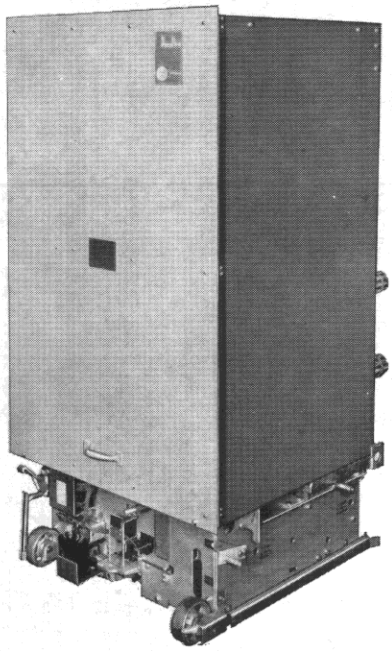
Porcel-line™ metal-clad switchgear with type DH-P air circuit breakers

75 to 750 mva interrupting capacity • 4160 to 13800 volts
1200 and 2000 amperes • indoor and outdoor

type DH-P magnetic air circuit breaker—for indoor or outdoor Porcel-line metal-clad switchgear

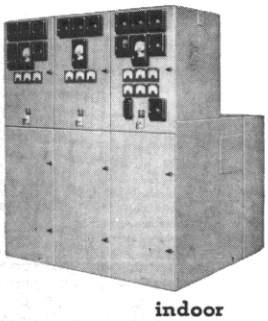


application

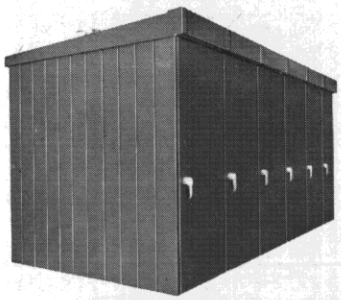
Westinghouse Porcel-line metal-clad switchgear with type DH-P air circuit breakers provides centralized control and protection for generators, motors, transformers, capacitors, and all types of feeder circuits. Use of high-strength porcelain on all DH-P breakers to insulate all live parts from ground is the key to superior performance of Porcel-line metal-clad switchgear.

Porcel-line metal-clad switchgear is available in ratings of 4160 and 13,800 volts with maximum interrupting capacities of 250 mva and 750 mva, respectively. Each unit is self-contained with Westinghouse components. These components include circuit breaker, bus, instrument transformers, potential transformers, relays, instruments, meters and control devices—all assembled into a compact, completely metal enclosed structure.

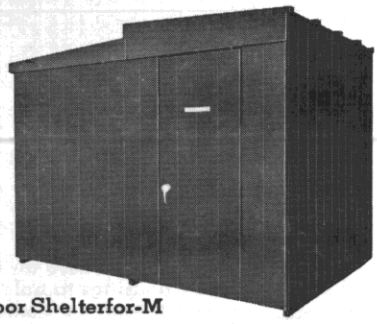
typical applications: electric utility systems, industrial plants, commercial buildings, municipal pumping stations, transportation systems, unit substations.



indoor



outdoor Aisle-less



outdoor Shelterfor-M

advantages

● **porcelain is non-tracking, non-combustible, and non-hygroscopic.**

● **high-strength porcelain** insulates all live parts from ground on DH-P breakers.

● **highest available degree of performance reliability** is provided by the characteristics of porcelain, under the widest range of operating conditions.

● **DH-P breakers still retain such time-proven Westinghouse features** as horizontal drawout construction, disconnecting contact fingers on the breaker, hinged tilting arc chutes, and center coil blowout magnets on the arc chutes.

● **ring-type current transformers** are front accessible . . . can be located on both bus and line side of breaker.

● **trunnion mounted potential transformers and control power transformers** are automatically disconnected and rotated to grounded vertical position as side-hinged compartment door is opened, permitting safe, easy replacement of primary fuses.

● **maximum safety to operating personnel assured . . .** with grounded metal enclosures and barriers, automatic shutter, and safety interlocks. Breaker cannot be levered in or out of "connected" position unless its contacts are in the open position.

● **automatic shutter,** made of high-strength, flame-retardant glass polyester, is ***at full air clearance from live parts*** when breaker is in "disconnected" position or out of the cell.

● **reduced depth** saves floor space.

March, 1965
new information
mailed to: E/1138/DB; C/322/DB

porcelain insulation system

use of porcelain

As an insulating material for power frequency applications, porcelain is non-tracking, non-combustible, and non-hygroscopic. Westinghouse research studies showed that it would be possible to make all breaker insulation from live parts to ground of porcelain. This has been accomplished in the type DH-P breakers utilized in Porcel-line metal-clad switchgear. The porcelain pole units of the type DH-P breakers are apparent in the 13.8 kv type DH-P breaker shown here with its main barrier assembly removed.

The basic concept of the type DH-P breaker is the all porcelain pole unit support mounted on a flat chassis and the center-coil type of magnetic interrupter chute. The high strength porcelain pole supports can withstand mechanical shock much greater than that transmitted through the stationary contacts when the breaker operates. These supports are equally successful in withstanding the electro-mechanical forces between pole units during fault conditions.

The operating rods for the breaker moving contacts are also made of high strength porcelain, as are the lower portions of the puffer tubes. Thus there is no organic insulation between live parts and ground, and there are no grounded or metallic parts extending in the vicinity of live parts.

In addition, arc chute supports and lower contact braces on 13.8 kv type DH-P breakers are high strength porcelain, as shown in the illustration. These supports are not required on 4.16 kv breakers.

The use of high-strength porcelain on DH-P breakers between all live parts and ground is the key to superior performance of Porcel-line metal-clad switchgear, under the widest range of operating conditions.

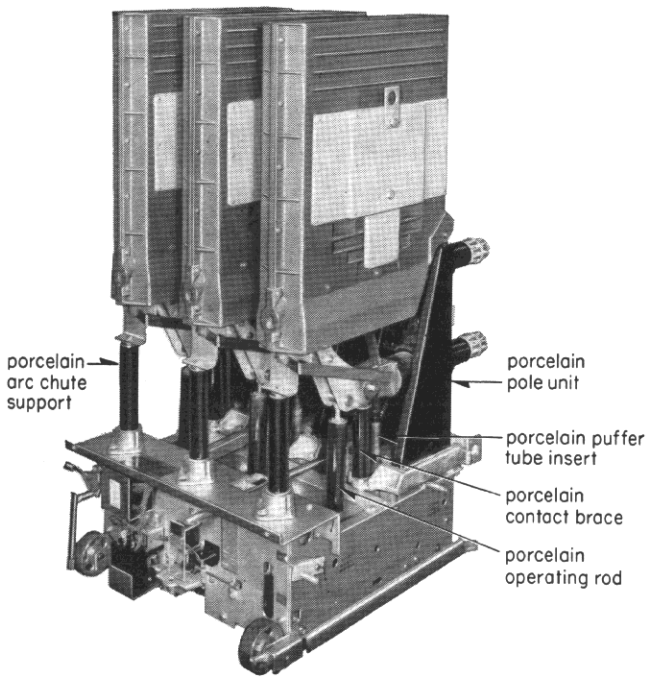


figure 1: 13.8 kv DH-P breaker with barrier assembly removed.

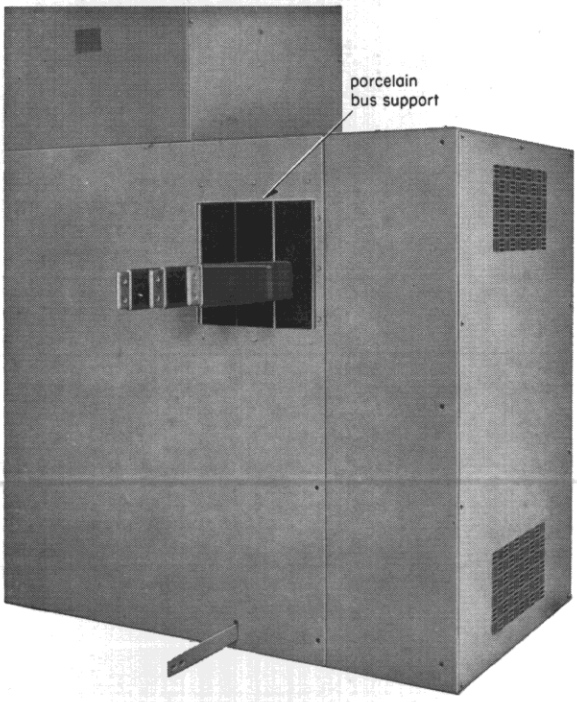


figure 2: High strength porcelain is used for main bus supports in both 4.16 kv and 13.8 kv housings to hold and position the insulated bus bars . . . and to preserve the integrity of compartmentation between adjacent section units.

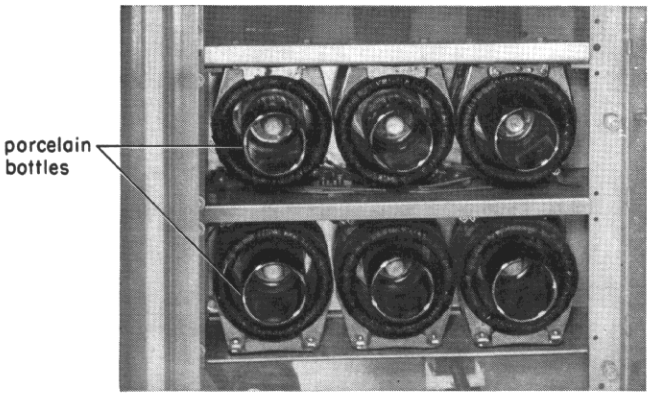


figure 3: Porcelain bottles enclose the stationary primary contacts in both 4.16 kv and 13.8 kv DH-P housings.

indoor general construction

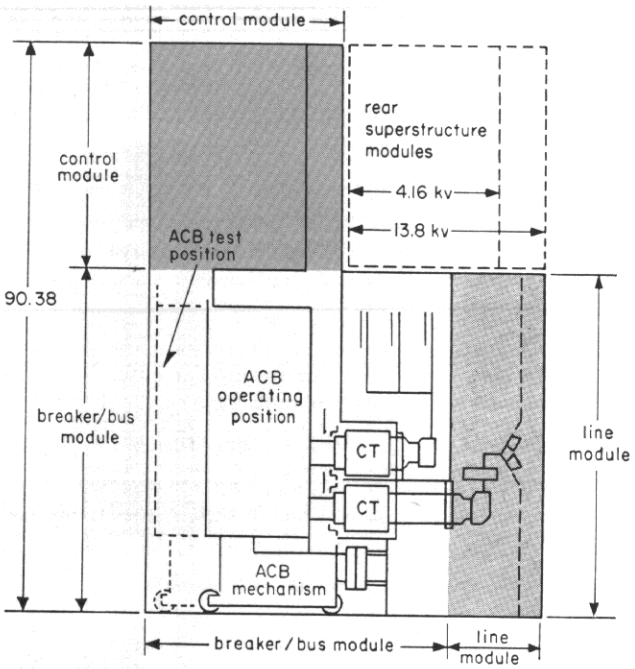


figure 4: sectional view of typical indoor circuit breaker housing

stationary structure: Figure 4 is a sectional view of a typical indoor circuit breaker housing. The unit is assembled of welded functional components. Basic sub-assemblies or modules are the control, breaker/bus, and line modules. An additional rear superstructure module can be added for auxiliary equipment such as potential transformers.

Two hinged panels enclose the front of the housing. The upper panel is used for mounting control devices, protective relays and instruments. The lower panel covers the circuit breaker portion of the unit. Each unit includes an integral panel on each side, thus providing a double thickness of steel between adjacent units. The rear of each unit is enclosed with removable bolted steel panels.

horizontal levering: The breaker is levered in and out horizontally by rotating a levering shaft on the breaker. The rear of this shaft is equipped with a nut which engages a stationary screw in the cell. A guide rail on the housing floor provides accurate horizontal breaker movement. An access port in the lower panel permits levering the breaker between the operating and disconnect positions with the door closed.

A rail latch on the breaker truck blocks its movement from the disconnect position until it is released by depressing a foot pedal on the truck. When in the disconnect position, the breaker's primary and secondary contacts are disconnected and a glass polyester shutter covers the primary cell contacts.

interlocks: The screw-type levering device is mechanically interlocked with the breaker moving contact linkage to prevent levering the breaker in either direction with the breaker contacts closed. An interlock also prevents closing the breaker between the operating and disconnect positions.

primary disconnecting contacts: Fingers on the removable breaker unit engage stationary contacts recessed within porcelain bottles. These fingers are retained with individual leaf springs to assure positive contact.

secondary disconnecting device: Consists of multiple plug and socket contacts of the trainline coupler type. These contacts automatically engage when the breaker is levered into the operating position.

test position: Breaker is placed in the test position by manually engaging the secondary disconnecting contacts with breaker itself in the disconnect position.

current transformers: Ring type current transformers are mounted around the porcelain primary contact bottles in the cell and are front accessible. Up to six current transformers can be so mounted—three on bus side and three on line side.

main bus and connections: Buses and joints are made of flat aluminum bar completely insulated. The bus insulation is flame retardant tubing containing Insuldur. Each conductor of the main bus is held in a one piece porcelain support at the wall between adjacent units.

ground bus and connections: The ground bus runs through and is bolted to each stationary structure. Both ground bus and ground cable connections are easily accessible in the cable compartment. The breaker is grounded at all times as it moves from disconnect or test position to operating position. Ground contact fingers on the breaker engage a ground bus extension in the housing.

preparation of surfaces: The welded assemblies, after fabrication, are thoroughly cleaned and phosphatized. This provides an inert crystalline phosphate coating that gives excellent corrosion resistance and superior adhesion of paint finish.

finish of surfaces: Final indoor finish is a coat of light gray paint, ASA #61, Munsell Notation 8.3G6.10/0.54.

insulation level: Each type DH-P 4.16 kv unit is designed to withstand an impulse test of 60 kv and is given a production test of 19 kv, 60 cycles, for one minute. Each Type DH-P 13.8 kv unit is designed to withstand an impulse test of 95 kv and is given a production test of 36 kv, 60 cycles, for one minute.

indoor design features

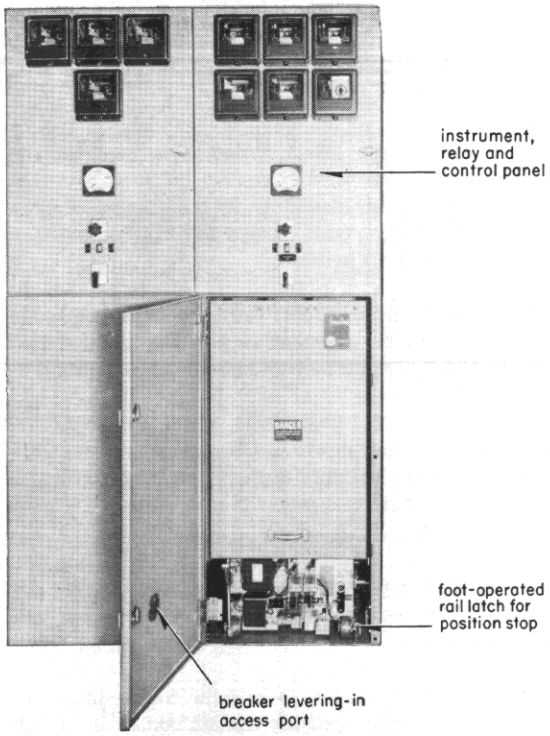


figure 5: Typical 4.16 kv DH-P metal-clad housing with one breaker in disconnect position.

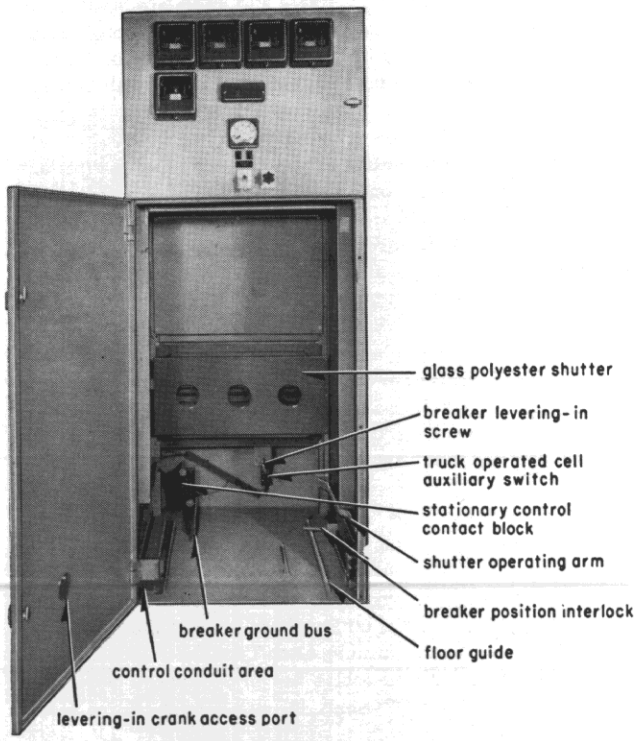


figure 6: 13.8 kv DH-P housing with breaker removed.

some of the safety features of DH-P metal-clad

- Complete metal barriers isolate breaker, bus, control, and line compartments.
- Steel-front interphase barrier prevents access to live breaker parts. It is bolted to rear of breaker chassis and cannot be removed unless breaker is removed from cell.
- Safety interlocks prevent levering when breaker is closed and keep breaker trip free while levering.
- Levering device spins free at end of breaker travel to assure positive engagement of main disconnecting contacts and eliminate danger of over travel.
- Glass polyester shutter automatically covers the primary cell contacts when breaker is withdrawn and is at full air clearance from live parts when breaker is withdrawn.
- Breaker can be levered in and out with housing door closed, by means of access port in door.
- Breaker connected to ground bus in both operating and test position.
- Indicator shows position of shutter at all times.

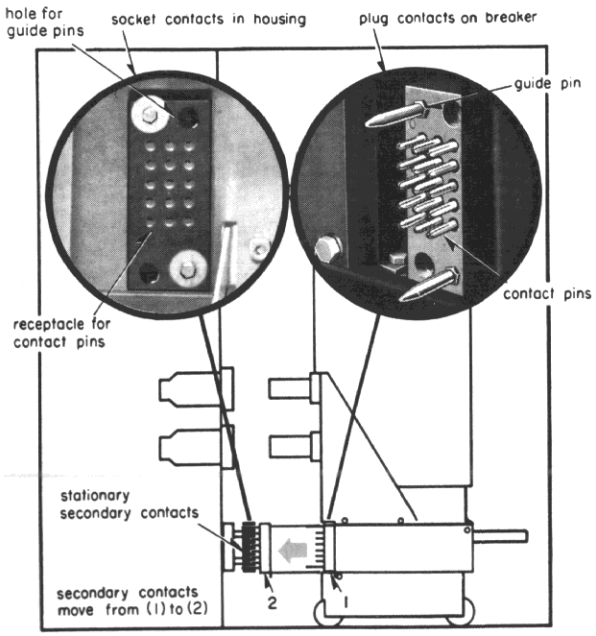


figure 7: Engagement of secondary contacts for breaker testing.

horizontal drawout construction

DH-P breaker time proven horizontal drawout arrangement for inspection or replacement. Withdrawal and inspection of DH-P breaker is accomplished by four simple procedures:

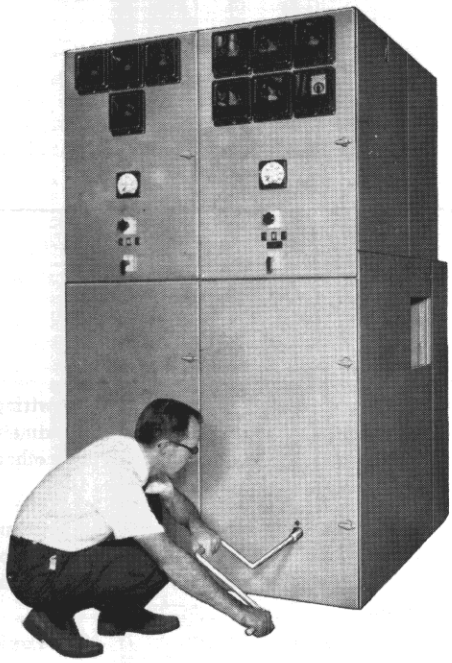


figure 8: Breaker is levered from connected to disconnected position.

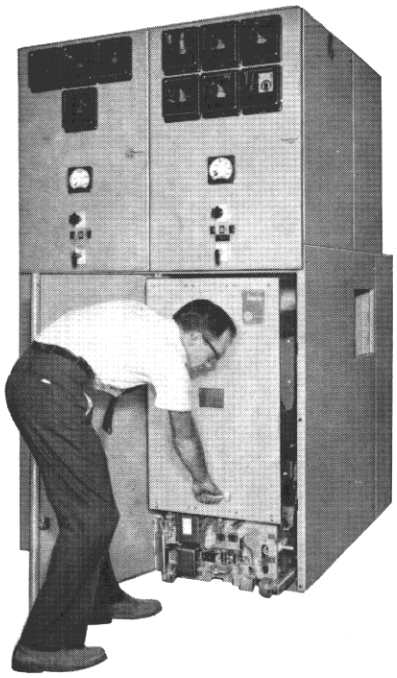


figure 9: Breaker is unlatched from disconnected position and horizontally drawn out.

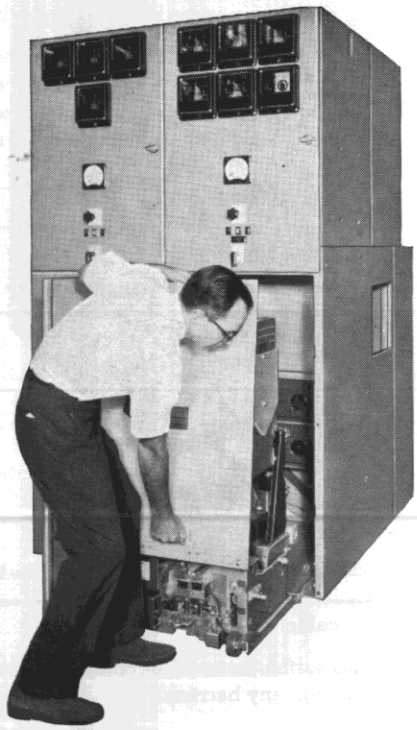


figure 10: Breaker barrier is removed.

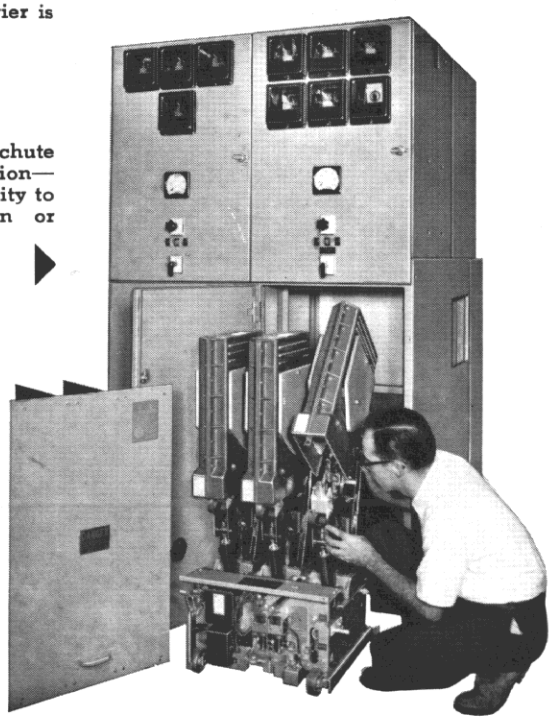


figure 11: Hinged arc chute is moved to tilted position—provides easy accessibility to contacts for inspection or maintenance.

indoor additional housing features

- Deep recess of primary contact studs within porcelain contact bottles. These bottles are used at both 4.16 kv and 13.8 kv.

- Ring type current transformers are front accessible—up to 6 current transformers can be installed around bottles—3 on bus side and 3 on line side of breaker.

- Bus structure is also front accessible by removing cover just above upper primary contact cover.

- Pin on side of breaker truck must pass through notch in plate at lower left front. This interlock prevents putting wrong continuous or interrupting rating breaker in cell.

- Truck operated cell switches just below levering screw indicate physical position of breaker truck (optional).

- Breaker position interlock at lower right is shown padlocked in position to prevent levering in a breaker. Key interlock can be used instead of padlock. (both features optional)

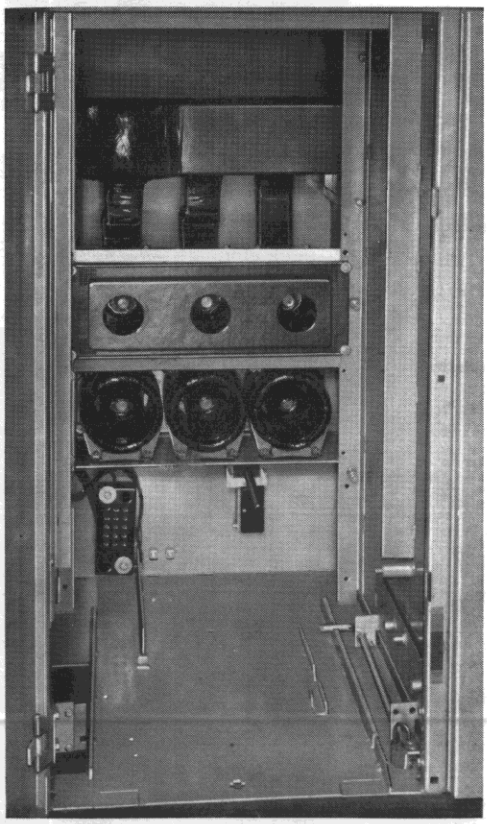


figure 12: In the front of this housing, shutter and one stationary contact cover have been removed to expose one set of porcelain contact bottles and current transformers.

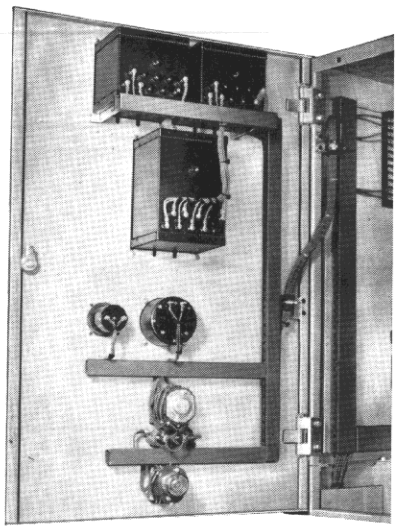


figure 13

wiring—All cell and panel wiring is run in plastic wiring troughs. Leads are taken out of the trough at the approximate location through holes in the side of the trough. This wiring method facilitates field wiring revisions after initial installation.

The panel wire is carried across the hinge in a bundle without the use of terminal blocks, eliminating a source of poor connections. The bundle is arranged so that the wire twists rather than bends, prolonging wire life.

The wire is #14 stranded.

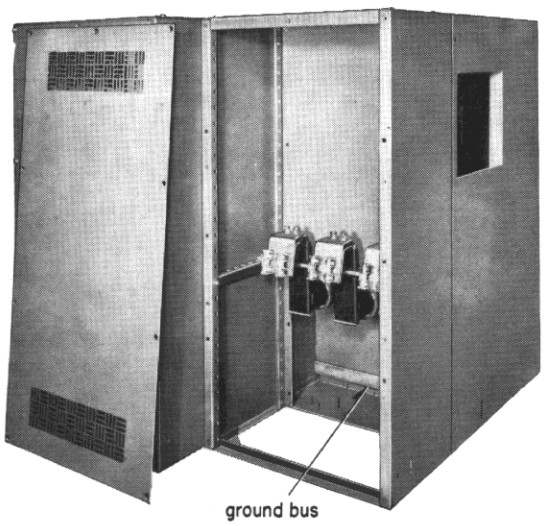


figure 14

cable compartment—Rear view of 5 kv housing illustrates accessibility to cable connections. Main bus is accessible by removing upper barrier behind cable terminals.

Ground bus is directly accessible from cable compartment without removing or going through any barriers.

indoor optional design features

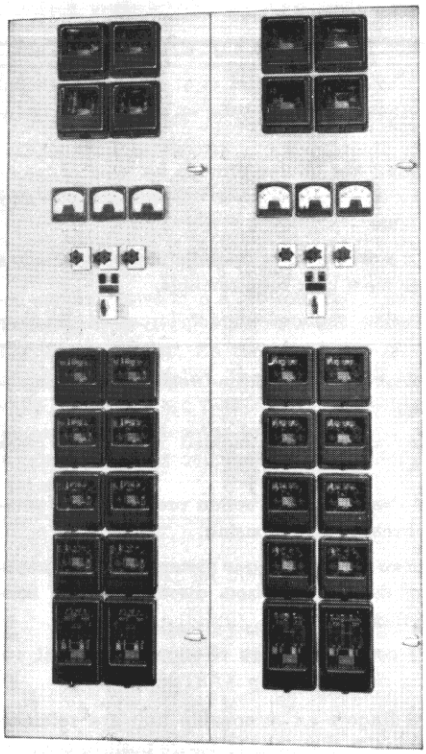


figure 15

full height instrument panels

When the upper door in the standard split door arrangement provides insufficient panel space for relays, instruments or meters, a full height door can be provided as shown in figure 15. This is accomplished by the addition of an eight inch deep front extension to the unit.

mechanism operated cell switch

Figure 16 shows a mechanism operated cell switch to provide additional auxiliary switch contacts when more are required than the eight provided on the breaker. Note the brackets for additional switches as required. Contacts on these switches indicate whether the breaker is closed or open. The lower end of the vertical rod is connected to a pantograph which is operated by a pin attached to the breaker mechanism.

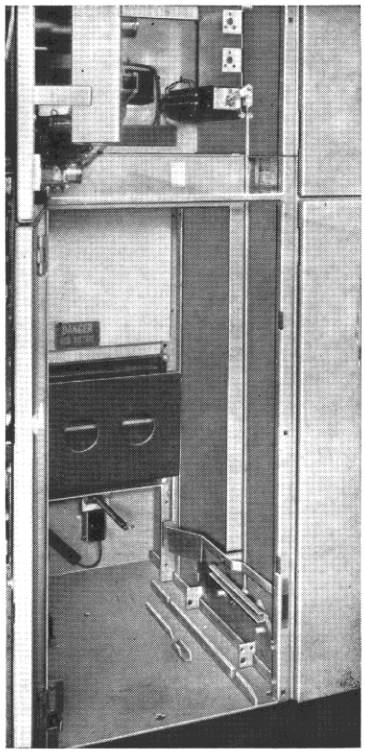


figure 16

auxiliary housings

Auxiliary housings of Porcel-line metal-clad switchgear are arranged for maximum operating flexibility. These housings are available for equipment such as disconnecting potential transformers and fuses, control power transformers, lightning arresters, and motor or generator field equipment.

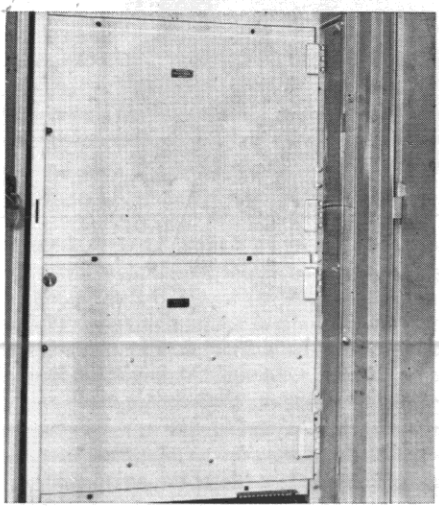


figure 17

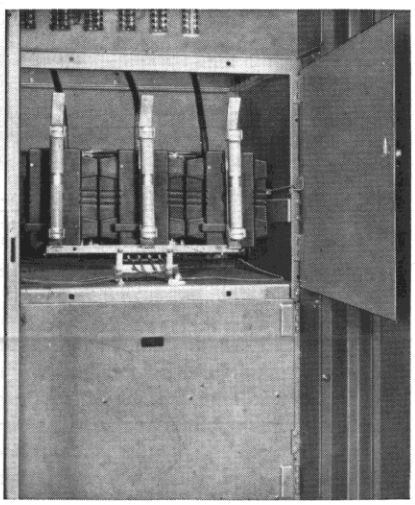


figure 18

Figures 17 and 18 show a typical auxiliary housing arranged for two sets of fused disconnecting potential transformers. With the side hinged doors closed, as in figure 17, the potential transformers are in the connected position.

Simply opening either compartment door, as shown in figure 18, automatically disconnects the fused potential transformers in that compartment by causing them to rotate to the vertical position for easy and safe replacement of fuses. The primary fuses are grounded at the potential transformer winding end, thus positively grounding the transformer also.

magnetic air circuit breakers type DH-P

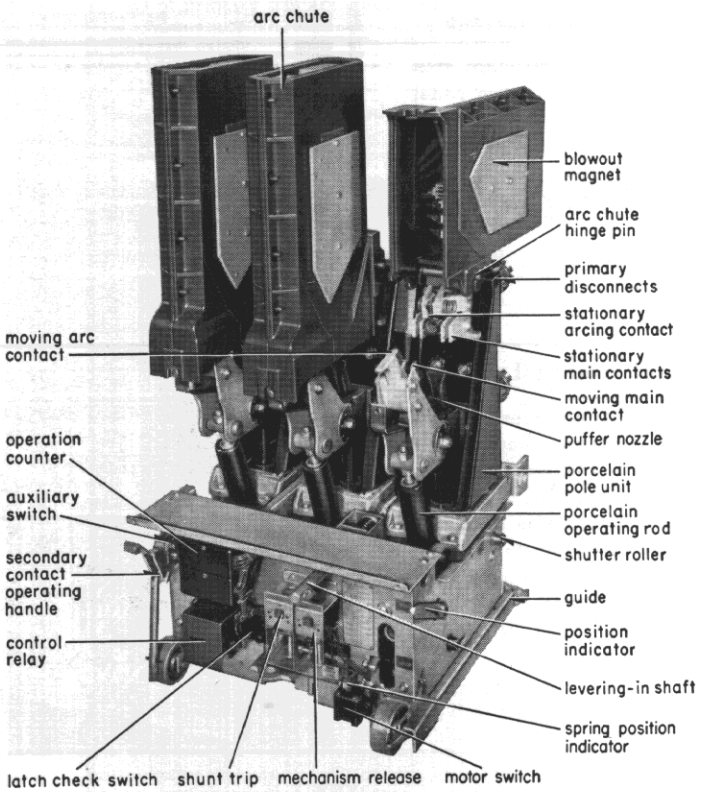


figure 19: Front view of 4.16 kv breaker with barrier assembly removed and one arc chute tilted back

description

- All insulation to ground is high-strength porcelain.
- Center coil blowout magnet is at floating potential which decreases voltage stress on arc chute insulation.
- Hinged tilting arc chutes provide for ease of maintenance. Tilted chute exposes breaker contacts and inside of chute.
- Solenoid or stored energy operating mechanisms are available to meet user requirements.
- Contact design reduces impact forces of breaker closing.
- Control relays mounted on the breaker permit simplified wiring.
- Arc chute enclosure is molded LIMITRAK glass polyester.
- Horizontal drawout construction provides easy withdrawal of breaker from housing.
- Positive screw type levering-in system provides simple levering of the breaker from disconnected to connected position.
- Secondary contacts can be re-engaged without accessories.
- Disconnect fingers on removable unit are retained with individual leaf springs to assure positive contact. In addition, mounting on the breaker provides for easy inspection.

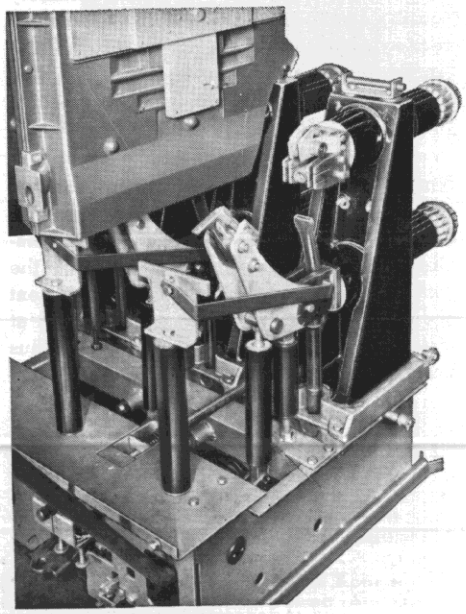


figure 21

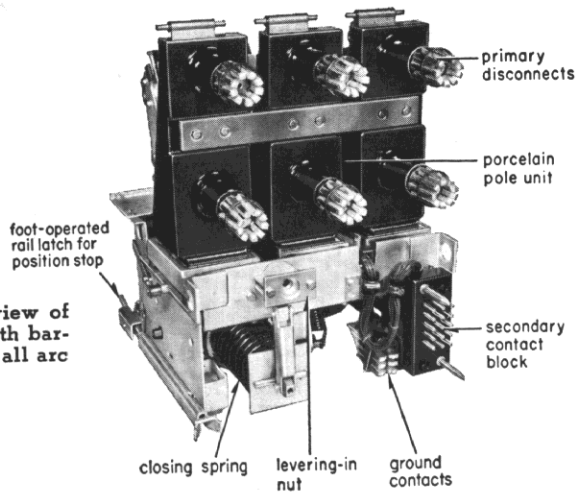


figure 20: Rear view of 4.16 kv breaker with barrier assembly and all arc chutes removed

13.8 kv DH-P breaker contact assembly: Note similarity to 4.16 kv contacts shown in figure 19. Both breakers have wedge-and-finger contact arrangement for low impact and long life. These stationary arcing and main contacts are made of fatigue-resisting zirconium copper with silver tungsten arcing tips and inserts. Fingers maintain firm contact with wedge-type blades. Tests show no relaxation after twice as many operations as could be expected throughout life of the equipment.

De-ion principle of arc interruption

The De-ion principle of arc interruption and the magnetic De-ion interrupter are pioneer developments of Westinghouse. The De-ion principle as utilized in DH-P breakers results in fast, positive arc interruption.

The arc is drawn inside the arc chute, which is the interrupter. The natural movement of the arc is upward into the arc chute. The blowout coil is in the center of the arc chute, so the arc is broken into two arcs in series with the blowout coil. When the arc current flows in the blowout coil, the magnetic effect of the H-shaped iron circuit creates a magnetic field drawing the arc into the arc chute. As the arc progresses into the chute, it is lengthened and cooled. The cooling reduces the rate of ionization, while the longer arc path requires a higher ionization to support the arc. Thus, when the ionization drops below that required to sustain the arc, it becomes unstable and is extinguished at the next current zero.

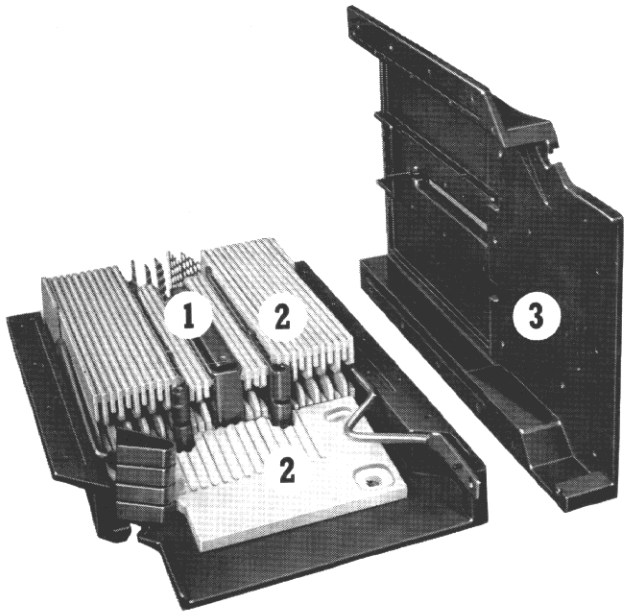


figure 22: arc chute with side removed

1 magnet yoke for blowout coil

2 ceramic refractory material—resists thermal shock

3 molded LIMITRAK glass polyester arc chute enclosure

operating mechanisms

There are two basic breaker chassis sizes, 4.16 and 13.8 kv. Each chassis can be equipped with either a d-c solenoid or a motor-charged spring-type stored energy mechanism. The stored energy type is available for either d-c or a-c operation.

solenoid mechanism: A basically conventional type consisting essentially of d-c magnets and mechanically trip free linkages. This means that the breaker contacts are always tripped free of the closing core. Thus the breaker will always open even though the closing core may remain energized and in its closed position.

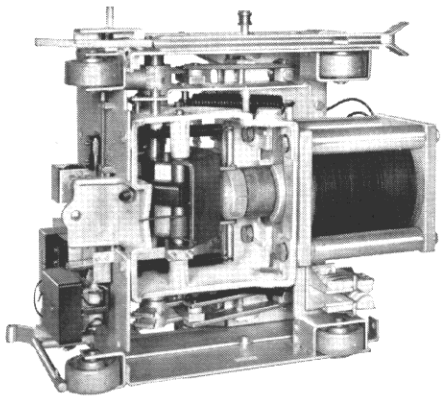


figure 23:
solenoid mechanism

stored energy mechanism: The spring is charged by a universal motor by ratchet action. The closing spring acts through a cam in the lever system to exert a high closing force toward the end of the closing stroke and a relatively low force at the beginning. The spring travel is a reciprocating motion derived from a crank attached to the ratchet and cam. This provides for excess closing energy to be absorbed in partially recompressing the closing spring. This relieves the entire unit of considerable mechanical shock on spring closing.

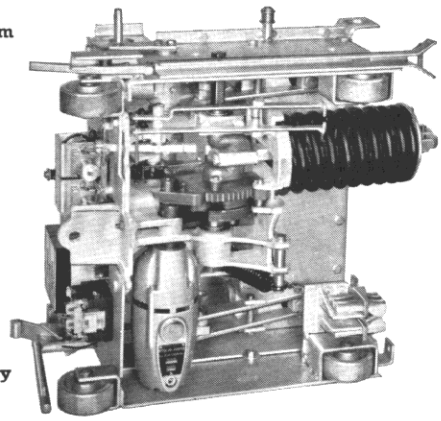


figure 24:
stored energy mechanism

panel mounted equipment

indicating instruments are semi-flush mounted switchboard type, accurate within 1% of the full scale. Dials are white with black markings and black pointers. Pointers are equipped with external zero adjustment.

protective relays and watthour meters are furnished in semi-flush mounted Flexitest cases which include built-in knife blade test switches. Relay and meter elements are removable from their cases. Watthour meters have a high accuracy over a wide range, and are equipped with potential indicating lamps.

type W-2 instrument and control switches are equipped with enclosed rotary contacts. Rolling action keeps contacts clean. Control switches have pistol grip, spring return handles, and have the necessary closing, tripping, alarm, and lamp cutout contacts. Instrument switches have a notching action.

indicating lamps are rectangular Minalites with slide base bulbs. Bulbs and lenses are replaceable from the front of the panel on which they are mounted.

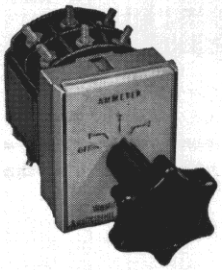


figure 26: type W-2 instrument switch

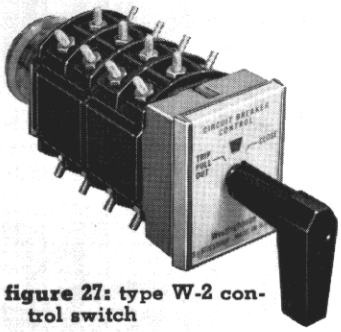


figure 27: type W-2 control switch

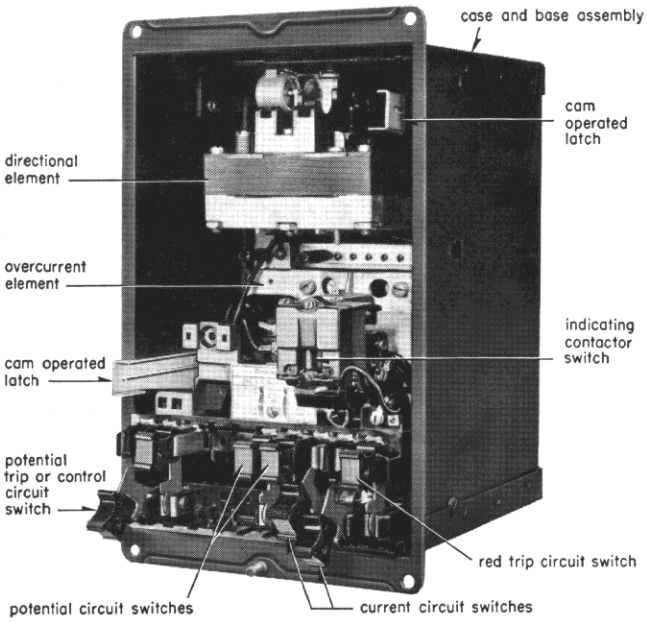


figure 25: Flexitest relay

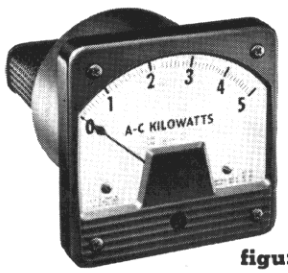


figure 29: indicating instrument

figure 28: indicating lamp

non-segregated (group phase) bus

Group phase main bus assemblies are recommended for connections between groups of metal-clad switchgear; also to connect power transformers, generators and synchronizing buses to metal-clad switchgear. This bus can be supplied for indoor and outdoor applications.

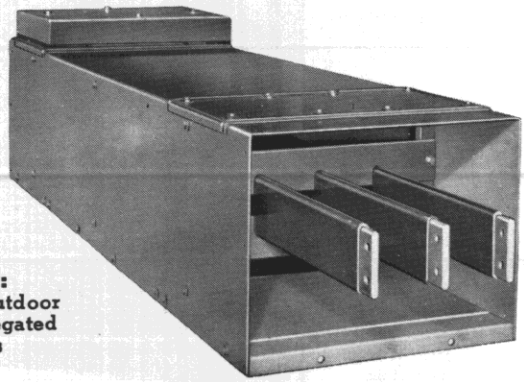


figure 30: typical outdoor non-segregated phase bus

These bus assemblies are completely metal-enclosed. The main bus is insulated aluminum or copper bar mounted on supports made of track resistant, flame retardant glass polyester spaced at such intervals as to insure adequate mechanical strength to withstand forces due to fault conditions.

Condensation barriers may be installed in the bus run to provide temperature barriers between indoor and outdoor sections or fire walls between vaults or rooms.

Standard group phase main bus assemblies are made in either 1200, 2000, 3000 or 4000 ampere capacity in sections not exceeding 8 feet in length, with insulation and overall dimensions as required for either 4160 or 13800 volt applications.

This bus is available for indoor and outdoor installations. Figure 30 shows an outdoor section. Note the ventilator enclosure at the rear, for outdoor runs only. Space heater enclosures are also provided for outdoor runs.

outdoor design features

general construction features

Shelterfor-M and Aisle-less type DH-P Porcel-line outdoor units **have the same features as indoor DH-P units and are available in the same ratings.**

Both types of outdoor switchgear are constructed by assembling a weatherproof enclosure onto and around the appropriate group of indoor housings. Each shipping section is mounted on an integral base frame of welded steel channels, and pier mounting of the assembly can be employed if desired. A pad for breaker drawout would still be required for the Aisle-less type, however.

Insulation levels and 60 cycle dielectric tests are the same as for equivalent indoor ratings.

Both types have space for two potheads in the line module of the standard unit without a rear extension. The rear of each unit has a bolted cover with lifting handles.

surface preparation and finish

Initial surface preparation and finish of the assemblies, including a coat of light gray paint, is exactly as described for indoor units on page 3. Then a final coat of dark gray enamel, ASA #24, Munsell Notation 10B2.40/1.18, is applied to the exterior surfaces. An undercoating compound is applied to the under side of all bottom surfaces.

Shelterfor-M design

This type of DH-P Porcel-line outdoor metal-clad switchgear provides an operating or maintenance aisle where equipment is accessible without exposure to the weather. This area is large enough to permit interchanging breakers between cells. Doors are located at each end of the aisle, and are equipped with "crash" latch mechanisms which permit quick release from the inside even when the doors are padlocked from the outside.

Each unit has an upper and lower front hinged panel as described for indoor units on page 3. Where additional panel space is required for relays, instruments, or meters, an eight inch front extension into the aisle is provided to accommodate a full height panel. Aisle lights, switches, and service receptacles are provided.

Ventilating air enters through a screen at the bottom of each line compartment and is expelled through a screen under the rear roof overhang. Air also enters through a screen in the floor of the breaker compartment or in the aisle floor and is expelled through a labyrinth under the peak of the roof.

Aisle-less design

The Aisle-less type of DH-P Porcel-line outdoor metal-clad switchgear does not include an operating-maintenance sheltered area. A weatherproof door is located on the breaker drawout side (front) of each cell. A full height instrument and relay panel is located behind the outer weatherproof door. A light and service receptacle is provided inside the front of each unit.

Ventilating air enters through a screen at the bottom of the line compartment and is expelled through a screen under the rear roof overhang. Air also enters through a screen in the floor of the breaker compartment and is expelled through a screen under the front roof overhang.

figure 31: Shelterfor-M DH-P Porcel-line outdoor metal-clad switchgear with one aisle door open.

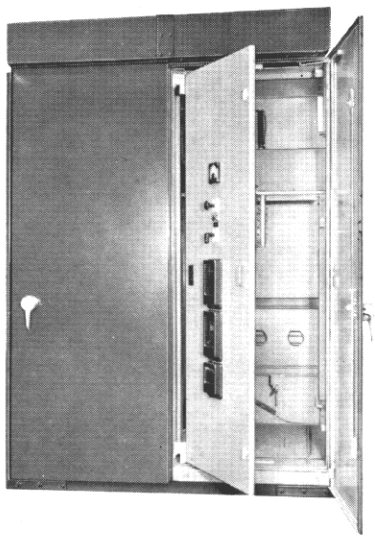


figure 32: Aisle-less DH-P Porcel-line outdoor metal-clad switchgear with one front weatherproof door open and instrument panel partly open. Breaker is inserted into cell from portable transport truck which attaches to front of cell.

reliability report

The concepts used in DH-P Porcel-line metal-clad switchgear required numerous tests to prove their design. Many of these tests, such as thermal cycling, thermal shock and strength tests of the porcelain, were performed upon unassembled apparatus preparatory to assembled tests. In the course of testing, optimum arrangements were proven and incorporated into the final design.

The final assembled switchgear was subjected to a series of tests in line with ASA, AIEE, and NEMA Standards. These design proof tests included: dielectric, current carrying ability, heating, momentary, four-second, interrupting, radio influence, mechanical operation, sequence, and weather-proofing.

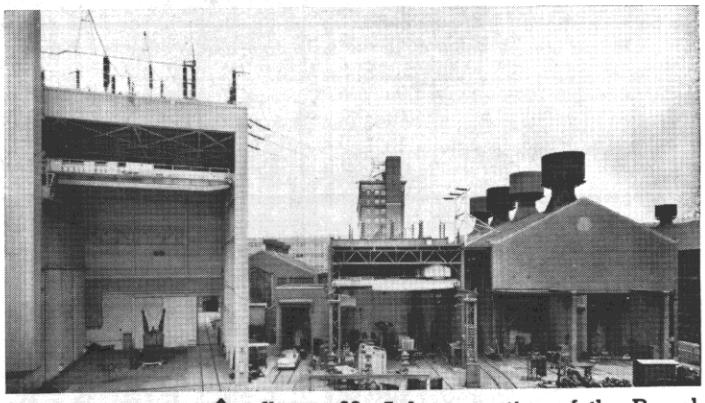


figure 33: A large portion of the Porcel-line switchgear testing program was conducted at the Westinghouse high-power laboratory at East Pittsburgh, Pa.

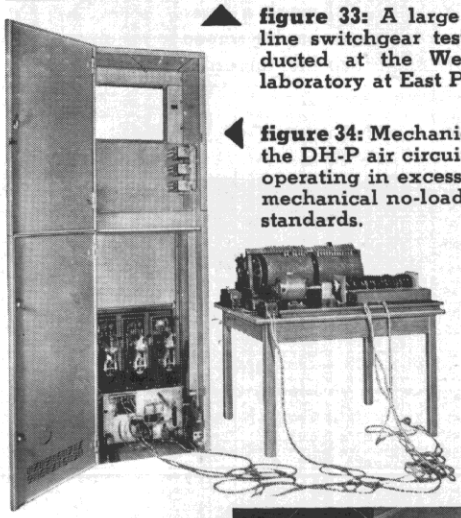


figure 34: Mechanical life tests demonstrate the DH-P air circuit breaker's capability of operating in excess of the minimum 10,000 mechanical no-load operations required by standards.

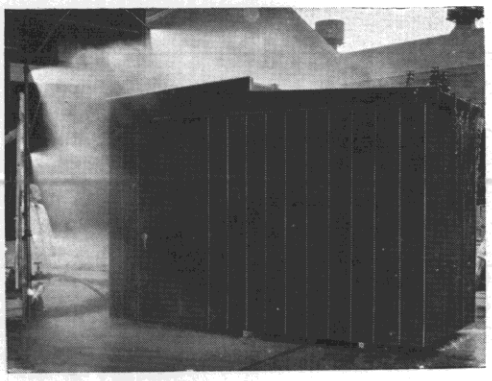


figure 35: Water test of DH-P outdoor metal-clad switchgear to establish ability to withstand driving rains.

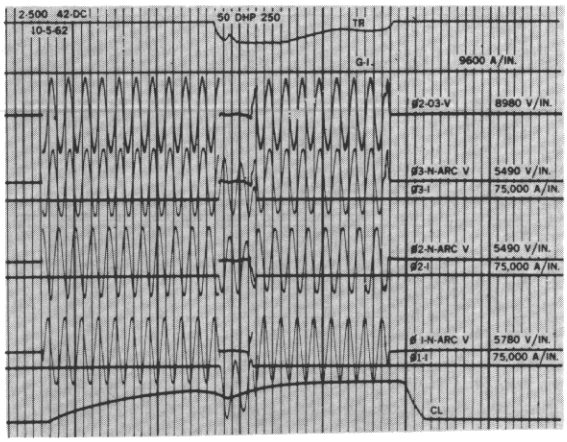


figure 36: Interrupting tests are conducted with breaker in housing in order to establish performance in a switchgear environment. These tests demonstrate the breaker's ability to meet its rating and are made at full interrupting rating as well as various intermediate ratings.

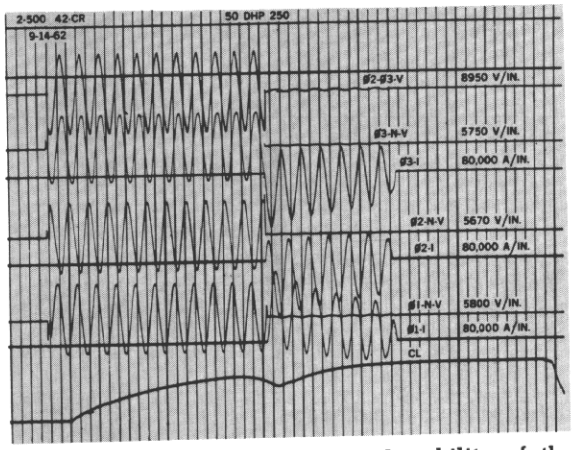


figure 37: Momentary tests show the ability of the equipment to withstand the severe electro-mechanical forces associated with short circuit currents. DH-P metal-clad switchgear has successfully withstood momentary currents far in excess of its rating, fully establishing the strength capability of the high-strength porcelain.

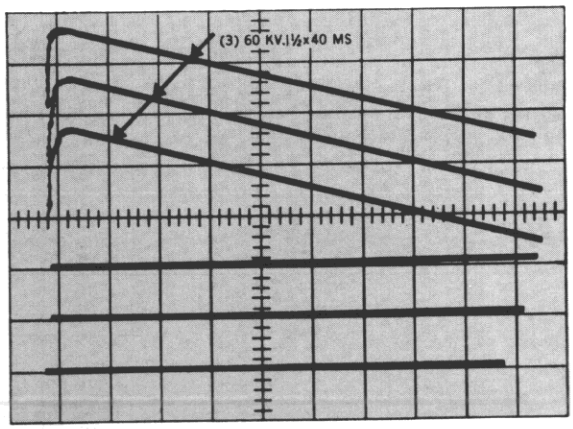


figure 38: Impulse tests, conducted in Westinghouse Impulse Laboratory, assure that DH-P Porcel-line switchgear meets basic insulation level requirements.

further information

application: application data 32-262

Westinghouse Electric Corporation
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printed in U.S.A.

Westinghouse

Porcel-line Metal Clad Switchgear

with Type DH-P Air Circuit Breakers
Indoor and Outdoor

75 to 750 mva Interrupting Capacity
4160 to 13800 Volts ● 1200 and
2000 Amperes

Bus Joint Insulation

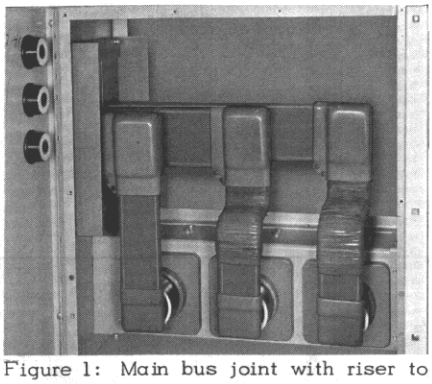

Figure 1: Main bus joint with riser to circuit breaker studs.

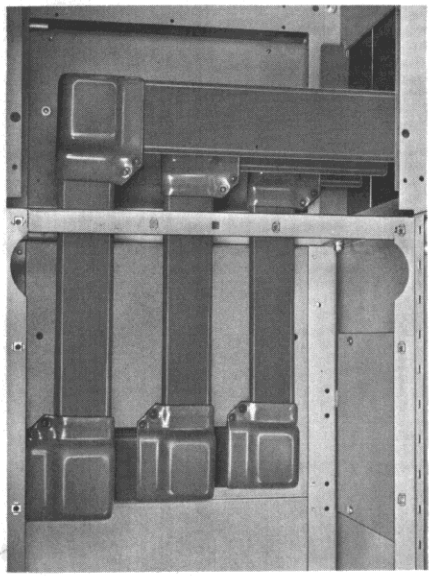

Figure 3: Transition bus with right angle joint.

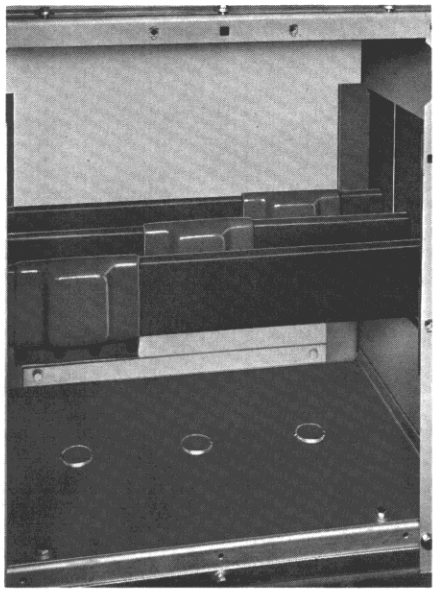

Figure 2: Main bus joint with no taps.

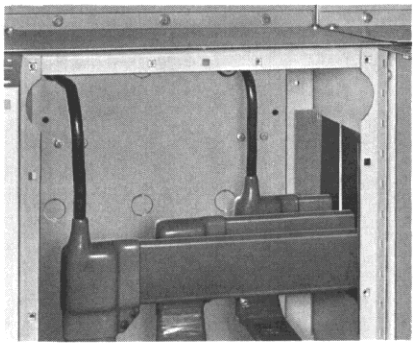

Figure 4: Right angle joint with cable tap to potential transformer.

General

A new bus joint cover has been developed which is "form fitting" and has liberal overlap over conductor insulation, including potential transformer leads providing full insulation for the bus conductors. The flame retardent PVC joint cover is held in place with either two or four nylon screws with nylon nuts.

The polyvinyl chloride joint cover provided on both 5 kv and 15 kv switchgear, is shown in figures 1, 2, 3 and 4. Design tests show that this construction meets the requirements of ASA Standard C37.20.

The main bus conductors and riser bars are insulated with flame retardant epoxy impregnated high dielectric insulation.

Advantages

- Eliminates time consuming and costly taping procedures which permits units to be joined together in the field much more quickly.
- Guarantees that all bus joints are fully insulated.
- Higher performance and proven reliability demonstrated by tests.

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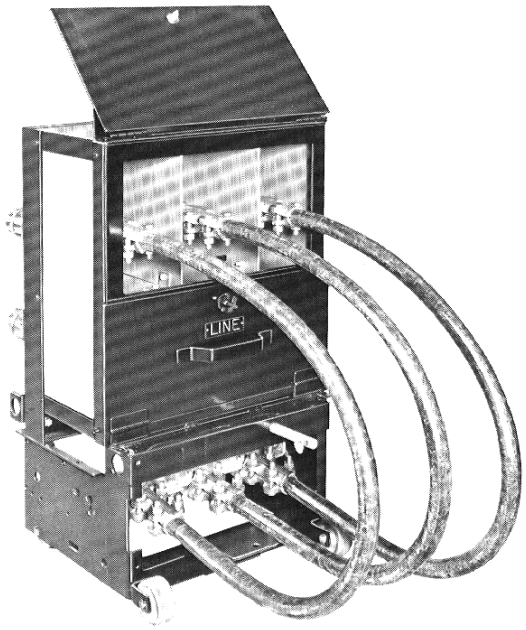
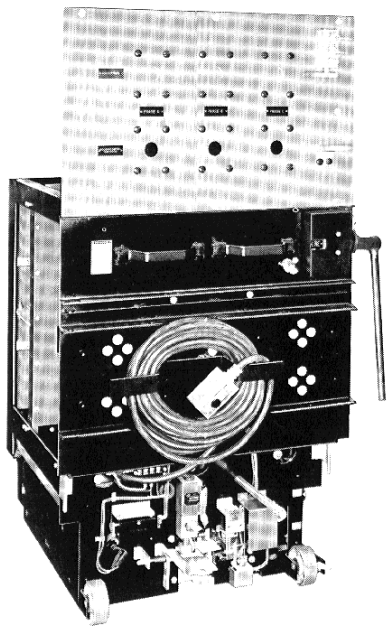
September, 1966
New Information
E,D,C/1942/DB

Westinghouse

Metal-Clad Switchgear
Grounding and Test Devices



Standard Grounding and Test Device



Complete Grounding and Test Device

Application

Modern metal-clad switchgear assemblies are designed with all bus work completely insulated for safety. Since the current carrying parts are not readily accessible, suitable ground and test devices have been designed. These devices take advantage of the fact that insertion of a suitable constructed device into a circuit breaker cell will gain access to the circuit breaker stationary contacts and thus allow various tests and connections to either the bus or the outgoing line. Ground and test devices provide for:

for:

a. Grounding a circuit for safety during maintenance work.

b. Application of potential for cable testing.

c. Access to both bus and line circuits for "phasing out" tests.

d. Emergency connection of power sources during primary power outages or scheduled shutdowns.

e. A variety of other tests which the user might require.

Description

Standard Grounding and Test Device

The standard grounding and test device consists of a drawout element that is inserted into the air circuit breaker housing in the same manner as the drawout air circuit breaker element. The device includes six insulated bushings arranged with isolating barriers and ground bus connections. The grounding of either bus or line is accomplished by connecting suitable cables from either the bus or the line bushings to the ground connection. Cable testing or "phasing out" testing may be accomplished by connecting suitable test equipment, as required, to the bushings. The bus, line and ground connections are separated from each other by isolating barriers with the bus and line connections each accessible after opening a front hinged door. The ground connection is located in the lower section of the unit.

Complete Grounding and Test Device

The complete grounding and test device combines the facility of the standard device with an electrically operated switch for connecting the test circuit to ground or test equipment. The switch is capable of closing against fault current and is interlocked to prevent an incorrect operation. Since the switch has no interrupting ability, faults must be cleared by an interrupter on the source side of the equipment.

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