

Westinghouse



Type DS Low-Voltage Metal-Enclosed Switchgear

Introduction

Type DS Low-Voltage

Metal-enclosed switchgear is used for the control and protection of power circuits at 208, 480 or 600 volts Ac. It is available for secondary unit substations through 3333 Kva at 480 or 600 volts or 1000 Kva at 208 volts.

Ratings

600 volts Ac maximum. 50 to 4000 amperes. 22000 to 130000 symmetrical amperes interrupting capacity.

Applications

1. Central Stations

Auxiliary power circuits for fans, blowers, pumps, compressors and lighting.

2. Industrial Plants

Power and lighting networks, power feeders, lighting feeders, power generation and auxiliaries, power drives for machine tools and material handling equipment.

3. Commercial Buildings

Power feeders for fans, pumps, blowers; lighting feeders; elevator service; air-conditioning systems.

Advantages

Modern Design and Construction

Completely metal-enclosed, self-supporting metal structure . . . modern in appearance and construction throughout . . . inherently dead front . . . 3 position drawout breaker design.

Maximum Protection and Continuity of Service

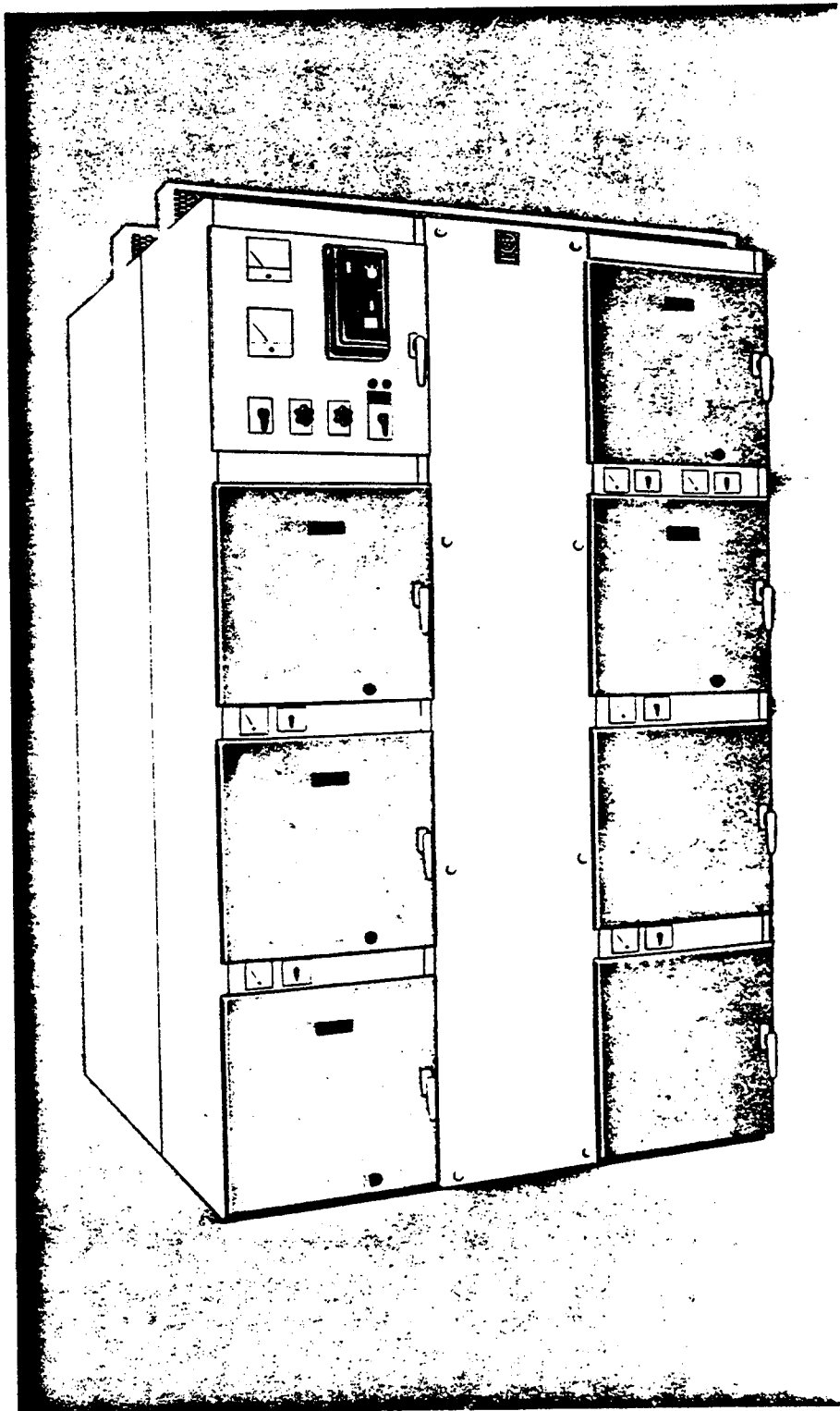
DS De-ion air circuit breakers provide superior power circuit protection, operating and maintenance features.

Standardized Design Affords Minimum Complete Cost

Standardized design throughout eliminates special design and engineering costs . . . sufficiently "custom-assembled" to meet all normal application requirements.

Quick and Easy Installation

Standardized units are grouped in the size assembly best handled at customer site . . . ready to be placed on the foundation and connected easily to the primary and secondary control circuits.



January, 1973

Supersedes DB H-32-150, dated January, 1961
Mailed to code 203 and 309

Westinghouse



Features

Two-tone finish

Light gray (A.S.A. #61) base with dark gray breaker compartment doors.

Three position

Breakers have Connected-Test-Disconnected positions with front door closed.

Aluminum Bus and Connections

All bus bars are of high strength, high conductivity tin plated aluminum. High strength bolts and extra large washers are used on all joints to ensure maximum pressure and even current distribution.

Isolated Incoming Line

Reduces possibility of fault transmission between incoming line and main bus. It is offered as an option only.

Protection During Levering Operation

During the operation of levering the breaker between the Connected-Test-Disconnected positions, there is a steel safety barrier between the operator and live parts.

Manual Charge of Stored-energy Mechanism

The stored-energy mechanism is charged by one downward stroke of the lever. No pumping required.

Stored-energy Closing Mechanism

A two-step closing mechanism with a charging motion and a "release to close" motion gives positive control of the closing instant.

Motor-operated Stored-energy Mechanism

Electrically operated breakers have motor charging devices operating at 125 V, Dc or 115 V, Ac, 3 amps. The emergency handle requires 10 to 12 strokes to close the breaker.

Closing-spring Automatic Discharge

Interlocking assures that the closing springs are discharged when the breaker is removed from its compartment.

Remote Close and Trip

After local manual charging of the mechanism, the breaker can be closed or tripped from a remote location by means of small solenoids operating at conventional control voltages. This feature is available at a modest price addition.

Breaker Inspection

When withdrawn on integral rails, the breakers are completely accessible for visual inspection; tilting of breaker is not necessary.

Current Transformers

Instrument current transformers are mounted in the circuit-breaker compartment; therefore, they are accessible from the front.

These are for metering application only, and meet accuracies of ANSI Standard C37.20, Section 20-4.6.3 for Low Voltage Metal Enclosed Switchgear.

Amptector™ Trip

A modern reliable solid-state trip device with excellent repeatability; requires a minimum of maintenance. No external power source needed.

Ground-fault Tripping

Ground-fault tripping can be included as part of Amptector.

Amptector Trip Adjustment

Adjustment of trip rating is made by sealed potentiometer. This permits a continuous adjustment between the specified limits. No confining fixed bands. Simplified coordination. No corrosion of contact surfaces.

Trip-rating Change

The tripping current range of a breaker is established by the sensor rating. The Amptector provides a continuous long time adjustment from 50% to 125% of the sensor rating. A tripping current range change is easily accomplished by a change of the breaker mounted sensors.

Glass Polyester Insulation

Westinghouse-produced glass polyester, with excellent mechanical and dielectric properties, is utilized as the insulation system. Current transformers, sensors and the operating links are insulated with epoxy, which has dielectric characteristics similar to glass polyester.

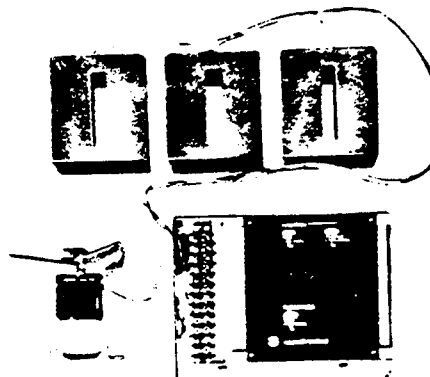
Double Steel Safety Barrier

Two layers of steel between the circuit breakers and the operator during normal operation.

Interphase Barriers

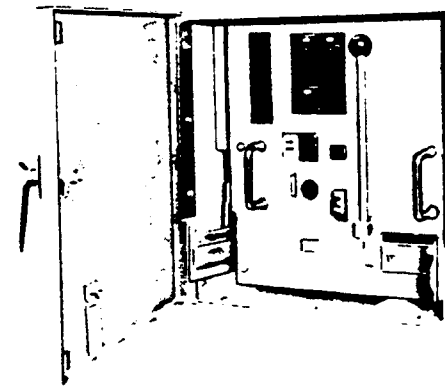
Maximum breaker insulation security is obtained by the use of interphase barriers, which are easily removed for breaker inspection.

Amptector™ Solid-State Trip



Provides continuous wide-range adjustability. Step-type adjustment is eliminated. Energy and signal provided by current sensors; no potential connections. Long delay, short delay, instantaneous and ground-fault protection in any combination. Test on standard 120-volt, 20-amp single-phase circuit.

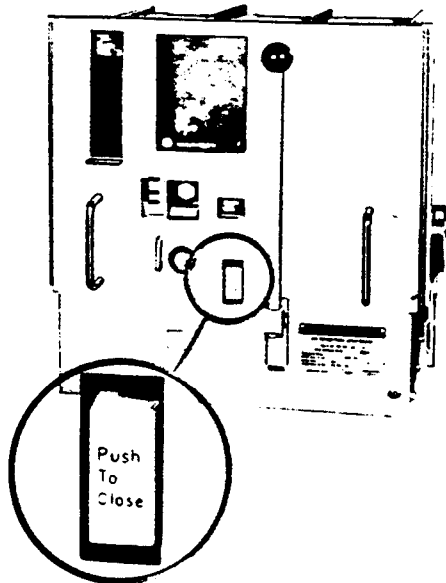
Metal-clad Like Safety Features in Breaker Compartment



Solid door closes compartment completely with breaker in or out. All controls are protected from unauthorized or accidental operation. Full-sized metal shield on breaker face protects operator from live parts while operating, racking or checking Amptector settings. Double interlocked device prevents racking until contacts are open; contacts can't be closed until racking is complete. Separate cable entrance and bus compartments can be provided at an extra price; removable barriers give access to bus compartment for inspection or cleaning.

Type DS Low-Voltage Metal-Enclosed Switchgear

Two-step Stored-energy Closing



Gives operator positive control of closing after spring mechanism is charged. Breaker can't close while you're still charging. Operation is optional—full manual, full electric, or manual charge and remote electric release.

Interlock discharges springs as breaker is removed from compartment. System patterned after 5-kv and 15-kv metal-clad switchgear.

There are three basic means of extinguishing an arc: lengthening the arc path; cooling by gas blast or contraction; deionizing or physically removing the conduction particles from the arc path. It was the discovery by Westinghouse of this last method which made the first large power air circuit breaker possible.

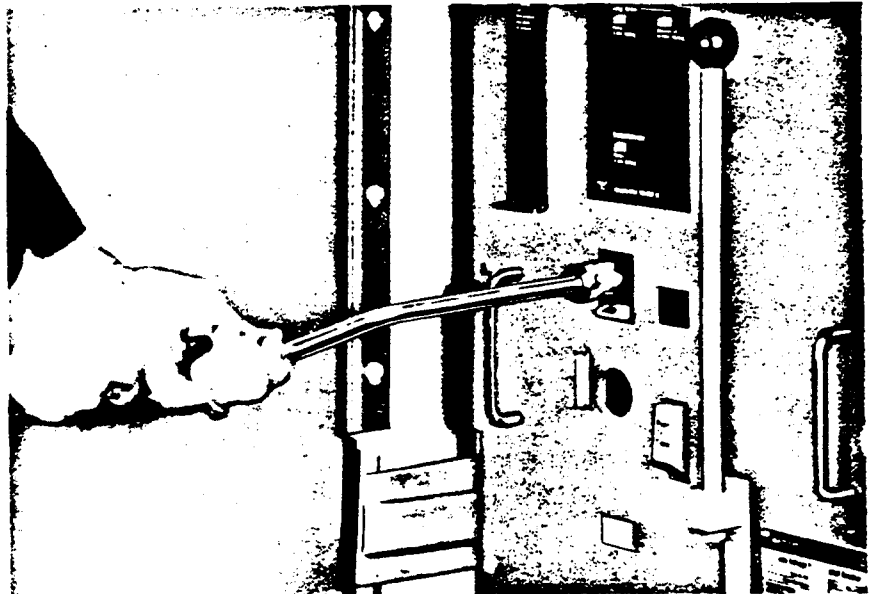
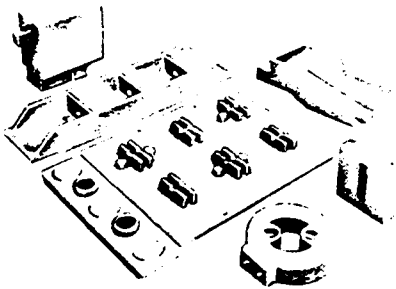


Figure 1: DS Breaker Levering Operation

Glass Polyester and Epoxy Insulation



Offers far better mechanical, thermal and electrical properties than phenolics. It has the mechanical strength to resist short-circuit forces; is highly resistant to heat, flame and moisture; and has been designed with generous creepage distances. Westinghouse gives it to you on all insulating parts in this type of 600-volt switchgear.

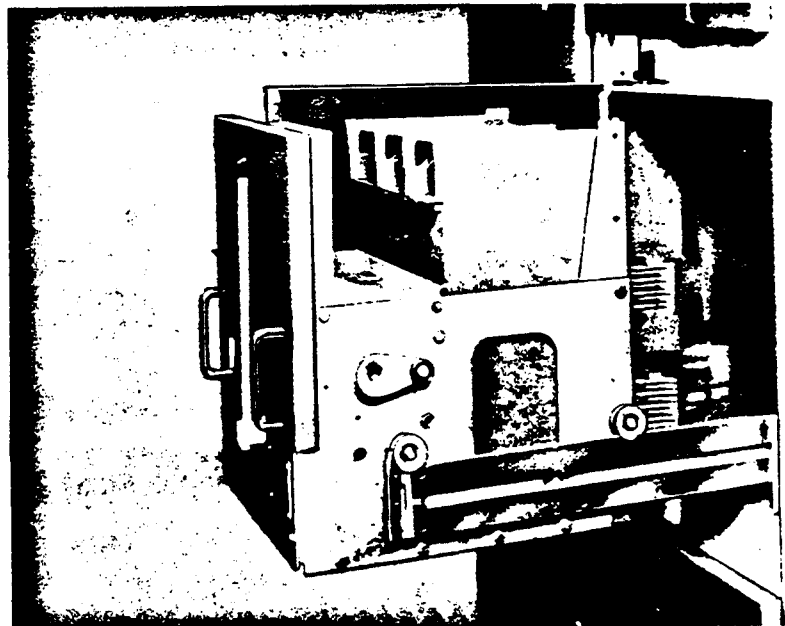


Figure 2: DS Breaker Showing Finger Clusters, Extension Rails and Levering Arms

Westinghouse

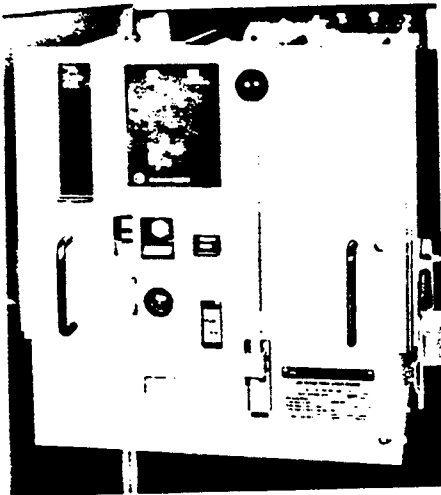


Figure 3: DS Breaker Faceplate

The De-ion® principle is incorporated in all these circuit breakers. This makes possible faster arc extinction for given contact travel; assures positive interruption and minimum contact burning.

The worm gear levering mechanism is self-contained on the breaker drawout element and engages slots in the breaker compartment. A removable crank is used to lever the breaker between the Connected-Test-Dis-connected positions.

Mechanical interlocking is arranged so that levering cannot be accomplished unless the breaker is in the tripped position.

A cam-type closing mechanism closes the breaker. It receives its energy from a spring which can be charged by a manual handle on the front of the breaker or by a universal electric motor.

Release of the stored energy is accomplished by manually depressing a button on the front of the breaker or electrically energizing a releasing solenoid.

All air circuit breakers have solid block, silver tungsten, inlaid main contacts. This construction insures lasting current-carrying ability, which is not seriously impaired even after repeated fault interruptions or repeated momentary overload.

It is not necessary to provide a substantial margin of safety above the actual circuit load current to prevent contact deterioration.

The main contacts are of the butt type and are composed of a multiplicity of fingers to give many points of contact without alignment being critical.

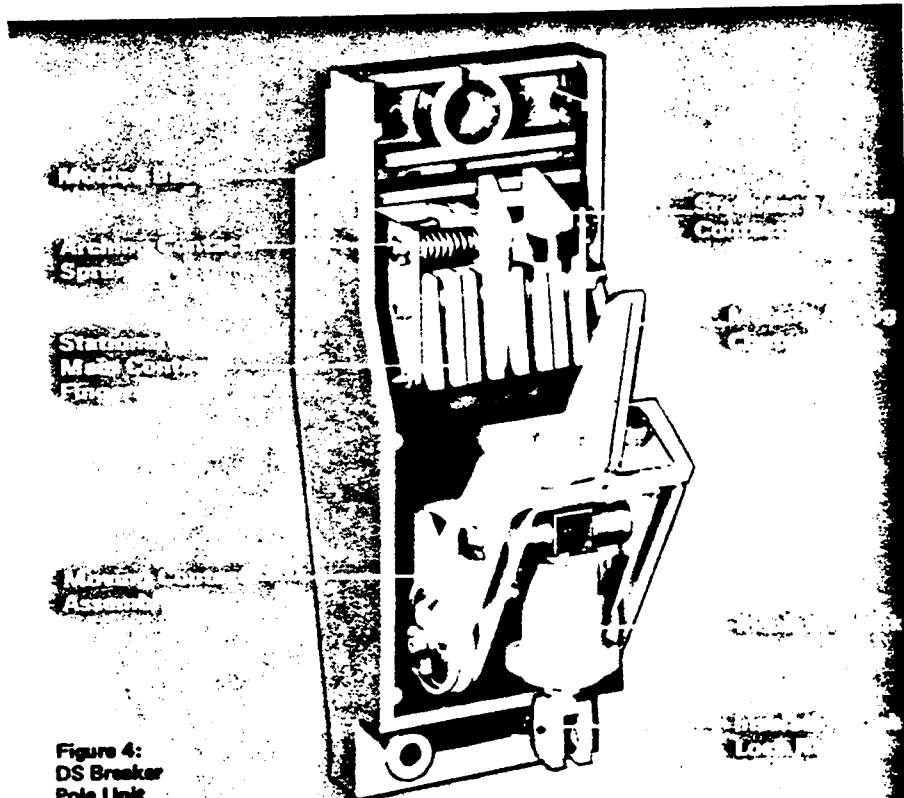
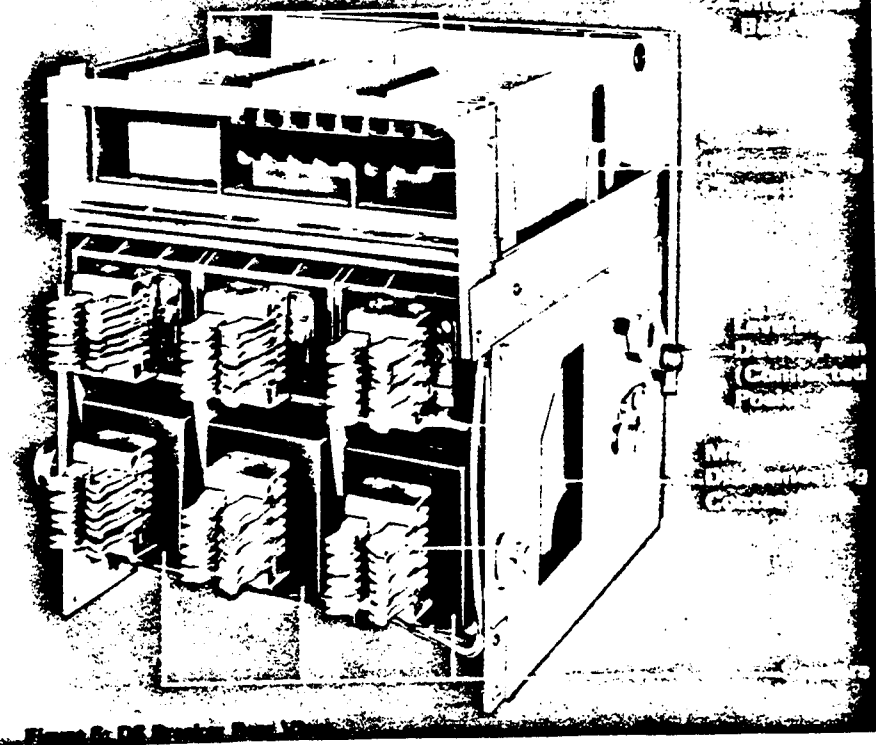
Figure 4:
DS Breaker
Pole Unit

Figure 5: DS Breaker Pole Unit

Type DS Low-Voltage Metal-Enclosed Switchgear

The breaker drawout element is interlocked so that it cannot be removed from the compartment with the closing spring charged. The following attachments are available:

1. Shunt trip
2. Undervoltage trip – time delay or instantaneous
3. Electric lockout
4. Key interlock
5. Ac trip
6. Ac capacitor trip
7. Overcurrent trip switch
This switch operates to close or open contacts when the breaker is tripped automatically for an overload or fault condition. It may be used for bell alarm or interlocking circuits.
8. Electric Close Release for a Manually Operated Breaker.

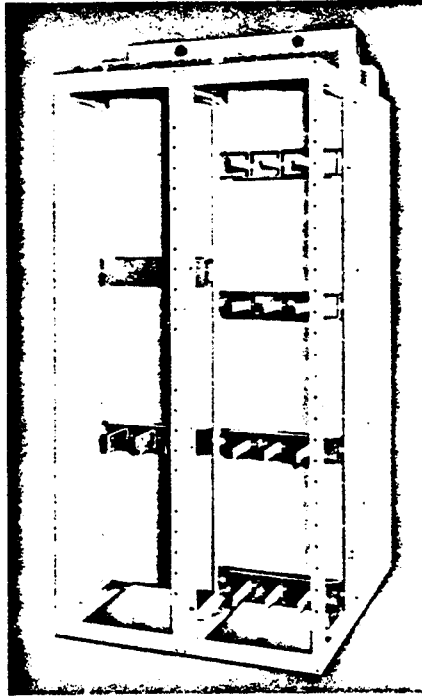


Figure 6: Cable Connection Compartment with Barriers in Place

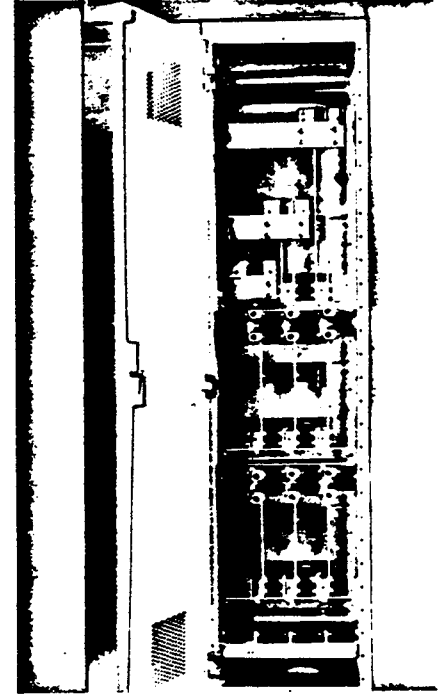


Figure 7: Cable Connections and Bus Compartments

If the purchaser desires, steel barriers will be furnished to separate the main bus and connections from the purchaser's connection compartment.

A ground bus is furnished the full length of the switchgear assembly and is fitted with terminals for purchaser's connections.

Rear covers are the bolt-on type. They are split into three horizontal sections to facilitate handling during removal and installation.

The rear portion of the switchgear assembly houses the main bus, connections, and terminals.

The main bus and connections consist of bare bolted tin plated aluminum. Copper bus with silver plated connections is also available as an option at an increase in price.

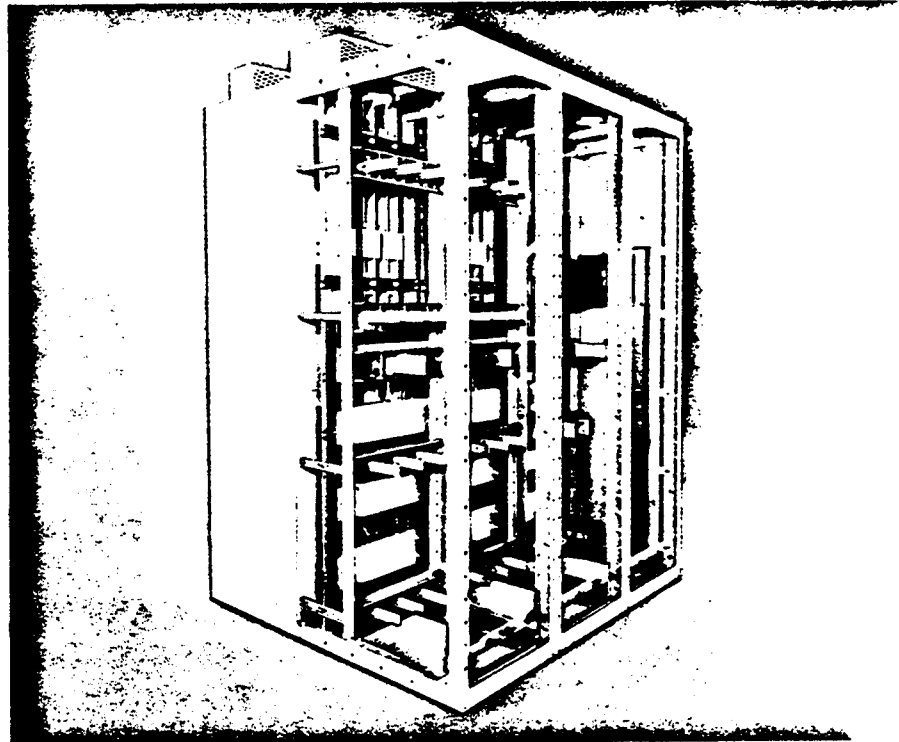


Figure 8: Bus and Cable Connection Compartment with Barriers Removed

Westinghouse

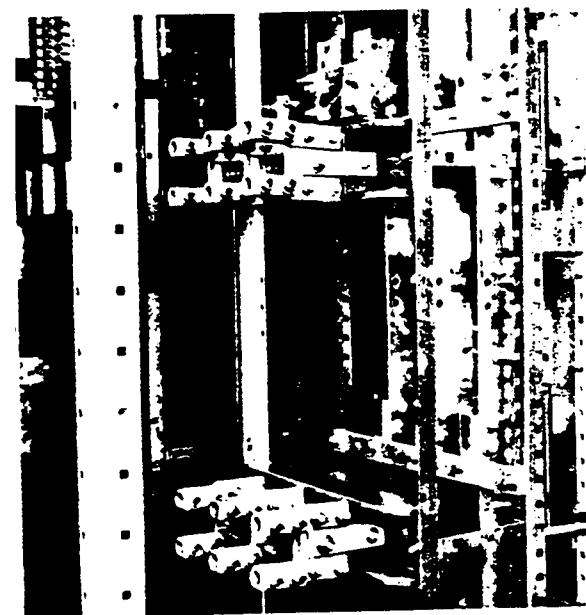


Figure 9: Terminal Blocks and Main Cable Terminals

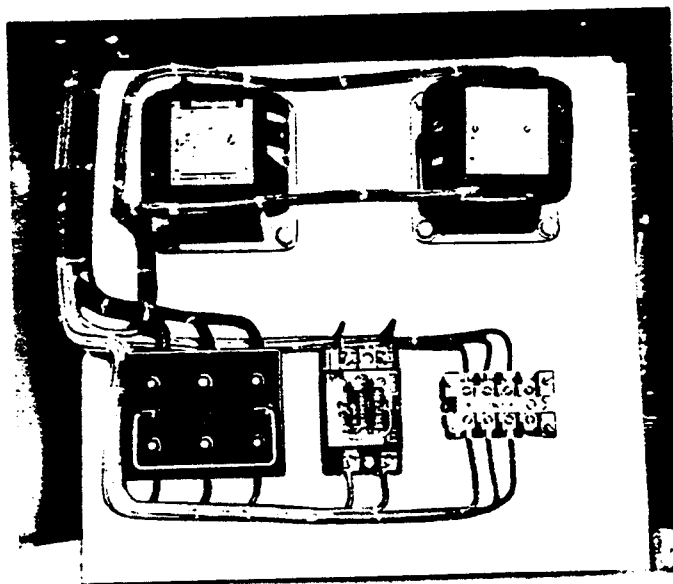


Figure 10: Potential Transformer and Control Power Transformer with Primary and Secondary Fuses

All insulation is Westinghouse glass polyester, which has been compounded to include the dielectric and mechanical strength necessary for the application. It is highly resistant to heat, flame and moisture, and has been designed with generous creepage distances.

The incoming line can be isolated from the main bus to reduce the possibility of fault transmission between them. Bus sections may also be isolated at a bus tie breaker.

Control circuit terminal blocks are mounted on the rear frame where they are readily accessible for purchaser's connections and inspection. Main circuit terminals may be oriented to suit cable entrance.

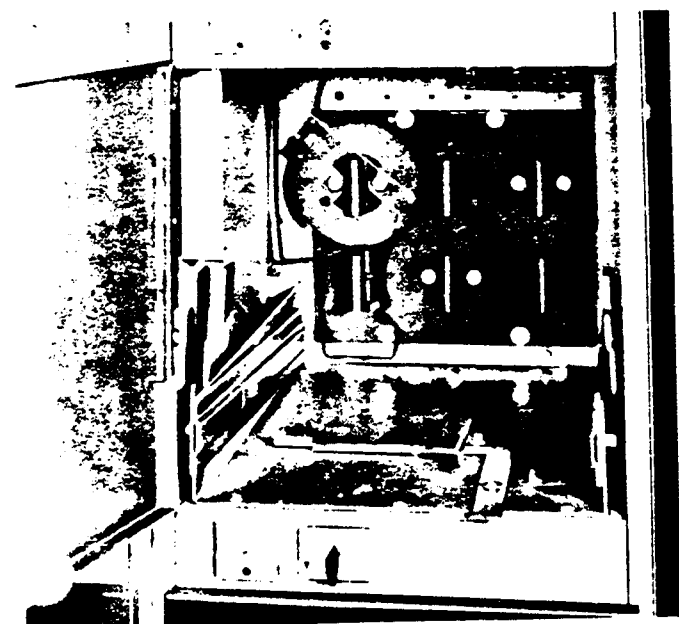


Figure 11: Current Transformers

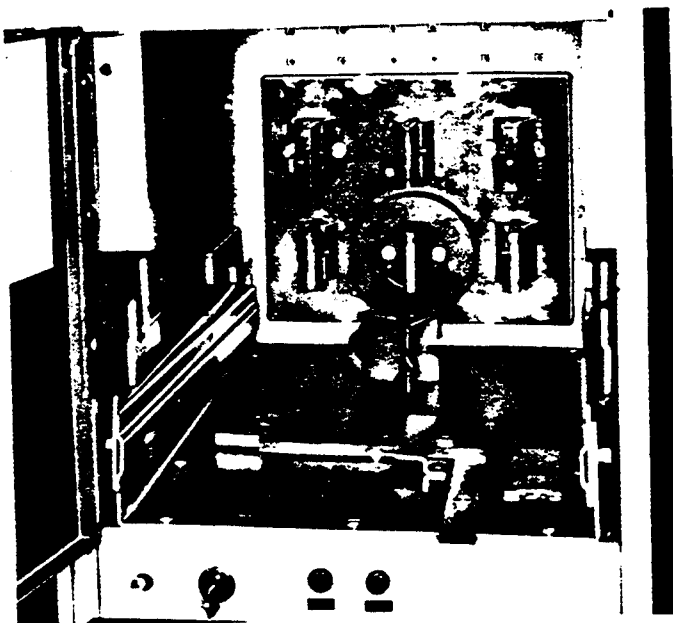


Figure 12: Insulating Boots

Type DS Low-Voltage Metal-Enclosed Switchgear

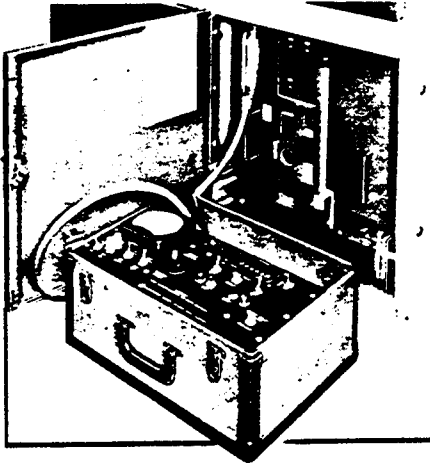


Figure 14: Test Kit

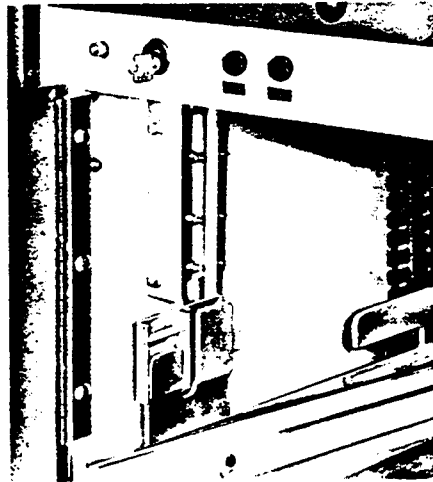


Figure 15: Key Interlock - Blocking Position

Potential transformers, control power transformers, primary and secondary fuses are mounted on a bolted plate. The fuses for the control power circuits are also mounted on this plate.

Primary fuses are Class 'C' Form II pull-out type. The metering potential transformers are type PT.6A or PT1.2 depending on the burden. Instrument and control wiring is type TBS with ring crimp type terminals.

Instrument current transformers are mounted

in the breaker compartment where they are accessible from the front of the switchgear assembly.

Insulating boots can be furnished, if desired, for protection from the energized stationary studs when maintenance is being performed in the breaker compartment.

A portable test set is available for test and field calibration of the Amptector at the low-voltage switchgear assembly. Operational, pick-up and time-delay tests are very easily performed.

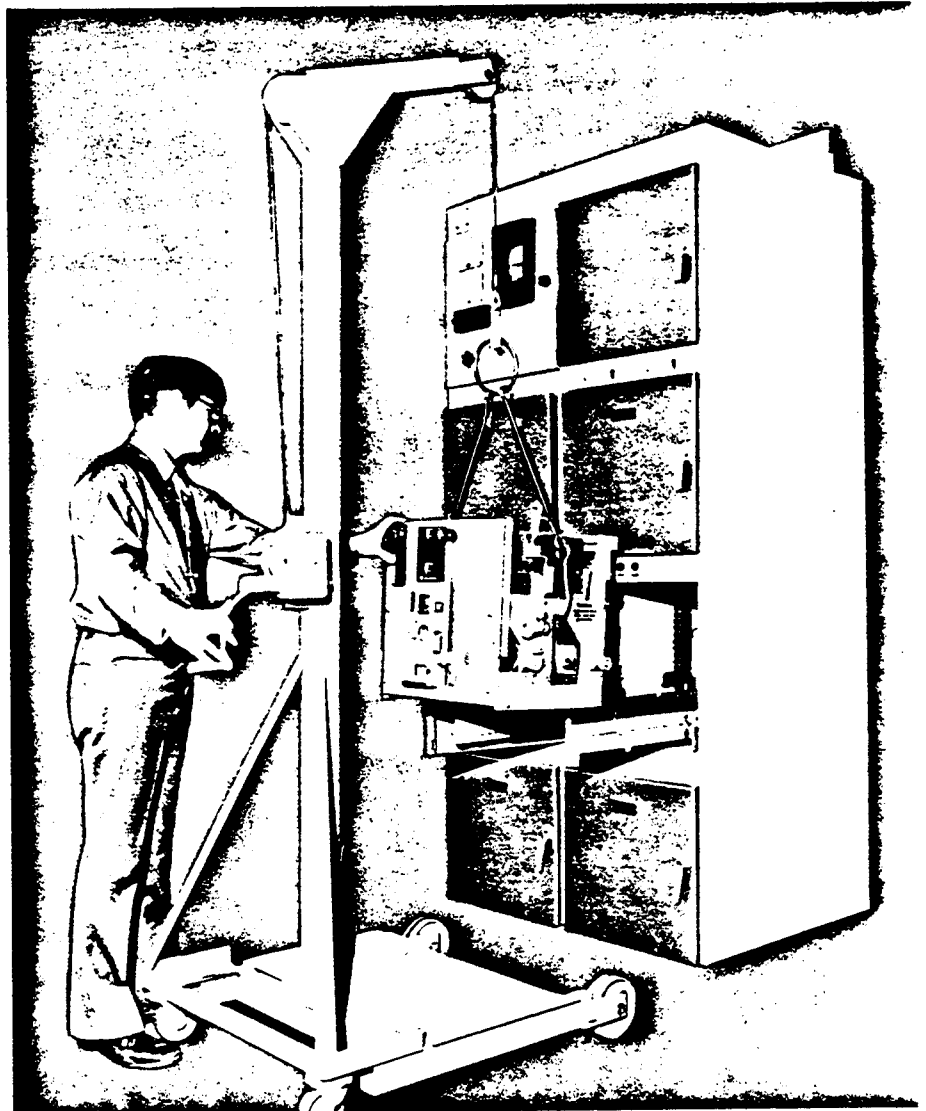


Figure 16: Breaker Lifting and Transfer Truck



Westinghouse Amptector™ Trip

The Westinghouse Amptector is a solid-state device that provides adjustable over-current tripping for Westinghouse Type DS low-voltage a-c power circuit breakers. Only one Amptector is required per breaker, and it receives all its energy from a set of sensors — one mounted on each pole of the breaker. It develops an output for an associated trip actuator when preselected conditions of current magnitude and duration are exceeded.

The device can be supplied with any combination of four continuously adjustable over-current tripping functions: these are: 1. long delay, 2. short delay, 3. instantaneous, and 4. ground protection.

The particular breaker current rating for any breaker frame size is determined by the rating of the sensor used with the Amptector. Sensor ratings are available as shown in the chart.

The breaker current rating for any frame size can be changed by simply changing the sensors, which are easily removed from the breaker drawout element. The wide range of long-delay pickup on the Amptector makes one set of sensors suitable for a number of current ratings. The Amptector itself need not be changed when the associated sensors are changed.

Each Amptector includes terminal receptacles to permit easy field checking of operation and calibration with an external power supply. A specially designed portable test device with a plug to match the Amptector receptacle is available to provide the utmost in simplicity for checking Amptector operation.

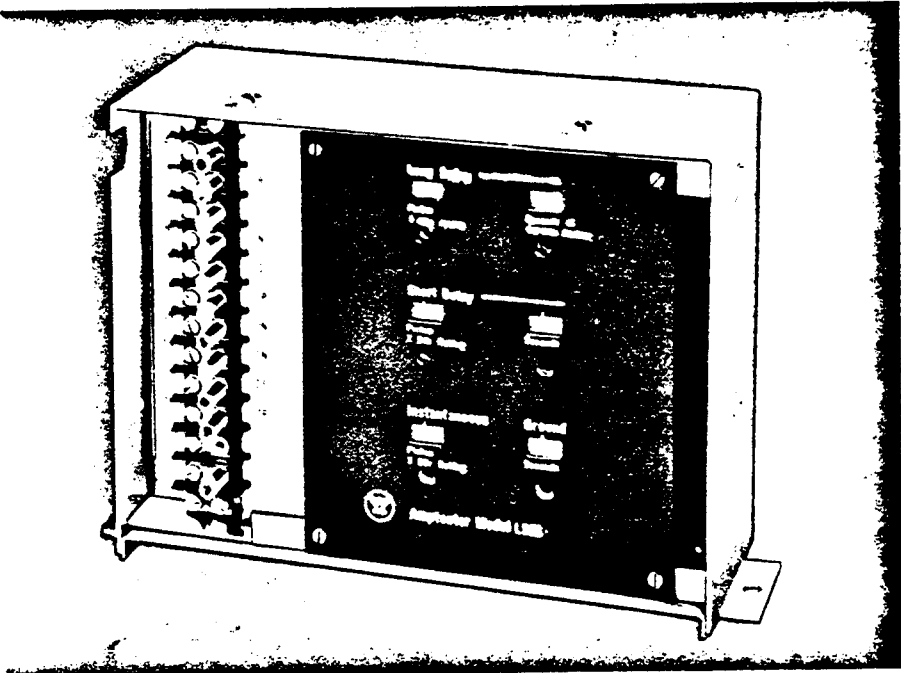


Figure 17: Amptector with Long, Short, Instantaneous and Ground Characteristics

Long delay pickup (multiples of sensor rating)	Long delay time seconds (6 times sensor rating)	Short delay pickup ① (multiples of sensor rating)	Short delay time seconds	Instantaneous pickup ① (multiples of sensor rating)	Ground pickup ② (multiples of sensor rating)	Ground time delay seconds
0.5	4	4	0.18	4	0.20	0.22
to	to	to	to	to		to
1.25	36	10	0.50	12		0.50

① Short delay and instantaneous pick-up can be set down to approximately 2 times sensor rating by using test kit.
② Also available at 40-60-80% of sensor rating.

Available Sensor Ratings

Breaker Type	Sensor Rating in Amperes
DS-206, DSL-206	50 100 150 200 300 400 600
DS-416, DSL-416	100 150 200 300 400 600 800 1,200 1,600
DS-420	100 150 200 300 400 600 800 1,200 1,600 2,000
DS-632, DSL-632	2,400 3,200
DS-840	4,000

The graph plots Time in Seconds (Y-axis, logarithmic scale from 0.01 to 1000) against Current in Multiples of Sensor Rating (X-axis, logarithmic scale from 0.005 to 100). It illustrates the response time of a sensor for different pickup settings.

Key Labels and Annotations:

- Ground Pickup Calibrated at 5.2 Times Sensor Rating:** Points to the leftmost curve.
- Long Delay Time Calibrated at 0.5, 0.6, 0.7, 0.8, 0.9, 1.0, 1.1, 1.2, 1.3, 1.4, 1.5, 1.6, 1.7, 1.8, 1.9, 2.0, 2.1, 2.2, 2.3, 2.4, 2.5, 2.6, 2.7, 2.8, 2.9, 3.0, 3.1, 3.2, 3.3, 3.4, 3.5, 3.6, 3.7, 3.8, 3.9, 4.0, 4.1, 4.2, 4.3, 4.4, 4.5, 4.6, 4.7, 4.8, 4.9, 5.0, 5.1, 5.2, 5.3, 5.4, 5.5, 5.6, 5.7, 5.8, 5.9, 6.0, 6.1, 6.2, 6.3, 6.4, 6.5, 6.6, 6.7, 6.8, 6.9, 7.0, 7.1, 7.2, 7.3, 7.4, 7.5, 7.6, 7.7, 7.8, 7.9, 8.0, 8.1, 8.2, 8.3, 8.4, 8.5, 8.6, 8.7, 8.8, 8.9, 9.0, 9.1, 9.2, 9.3, 9.4, 9.5, 9.6, 9.7, 9.8, 9.9, 10.0, 10.1, 10.2, 10.3, 10.4, 10.5, 10.6, 10.7, 10.8, 10.9, 11.0, 11.1, 11.2, 11.3, 11.4, 11.5, 11.6, 11.7, 11.8, 11.9, 12.0, 12.1, 12.2, 12.3, 12.4, 12.5, 12.6, 12.7, 12.8, 12.9, 13.0, 13.1, 13.2, 13.3, 13.4, 13.5, 13.6, 13.7, 13.8, 13.9, 14.0, 14.1, 14.2, 14.3, 14.4, 14.5, 14.6, 14.7, 14.8, 14.9, 15.0, 15.1, 15.2, 15.3, 15.4, 15.5, 15.6, 15.7, 15.8, 15.9, 16.0, 16.1, 16.2, 16.3, 16.4, 16.5, 16.6, 16.7, 16.8, 16.9, 17.0, 17.1, 17.2, 17.3, 17.4, 17.5, 17.6, 17.7, 17.8, 17.9, 18.0, 18.1, 18.2, 18.3, 18.4, 18.5, 18.6, 18.7, 18.8, 18.9, 19.0, 19.1, 19.2, 19.3, 19.4, 19.5, 19.6, 19.7, 19.8, 19.9, 20.0, 20.1, 20.2, 20.3, 20.4, 20.5, 20.6, 20.7, 20.8, 20.9, 21.0, 21.1, 21.2, 21.3, 21.4, 21.5, 21.6, 21.7, 21.8, 21.9, 22.0, 22.1, 22.2, 22.3, 22.4, 22.5, 22.6, 22.7, 22.8, 22.9, 23.0, 23.1, 23.2, 23.3, 23.4, 23.5, 23.6, 23.7, 23.8, 23.9, 24.0, 24.1, 24.2, 24.3, 24.4, 24.5, 24.6, 24.7, 24.8, 24.9, 25.0, 25.1, 25.2, 25.3, 25.4, 25.5, 25.6, 25.7, 25.8, 25.9, 26.0, 26.1, 26.2, 26.3, 26.4, 26.5, 26.6, 26.7, 26.8, 26.9, 27.0, 27.1, 27.2, 27.3, 27.4, 27.5, 27.6, 27.7, 27.8, 27.9, 28.0, 28.1, 28.2, 28.3, 28.4, 28.5, 28.6, 28.7, 28.8, 28.9, 29.0, 29.1, 29.2, 29.3, 29.4, 29.5, 29.6, 29.7, 29.8, 29.9, 30.0, 30.1, 30.2, 30.3, 30.4, 30.5, 30.6, 30.7, 30.8, 30.9, 31.0, 31.1, 31.2, 31.3, 31.4, 31.5, 31.6, 31.7, 31.8, 31.9, 32.0, 32.1, 32.2, 32.3, 32.4, 32.5, 32.6, 32.7, 32.8, 32.9, 33.0, 33.1, 33.2, 33.3, 33.4, 33.5, 33.6, 33.7, 33.8, 33.9, 34.0, 34.1, 34.2, 34.3, 34.4, 34.5, 34.6, 34.7, 34.8, 34.9, 35.0, 35.1, 35.2, 35.3, 35.4, 35.5, 35.6, 35.7, 35.8, 35.9, 36.0, 36.1, 36.2, 36.3, 36.4, 36.5, 36.6, 36.7, 36.8, 36.9, 37.0, 37.1, 37.2, 37.3, 37.4, 37.5, 37.6, 37.7, 37.8, 37.9, 38.0, 38.1, 38.2, 38.3, 38.4, 38.5, 38.6, 38.7, 38.8, 38.9, 39.0, 39.1, 39.2, 39.3, 39.4, 39.5, 39.6, 39.7, 39.8, 39.9, 40.0, 40.1, 40.2, 40.3, 40.4, 40.5, 40.6, 40.7, 40.8, 40.9, 41.0, 41.1, 41.2, 41.3, 41.4, 41.5, 41.6, 41.7, 41.8, 41.9, 42.0, 42.1, 42.2, 42.3, 42.4, 42.5, 42.6, 42.7, 42.8, 42.9, 43.0, 43.1, 43.2, 43.3, 43.4, 43.5, 43.6, 43.7, 43.8, 43.9, 44.0, 44.1, 44.2, 44.3, 44.4, 44.5, 44.6, 44.7, 44.8, 44.9, 45.0, 45.1, 45.2, 45.3, 45.4, 45.5, 45.6, 45.7, 45.8, 45.9, 46.0, 46.1, 46.2, 46.3, 46.4, 46.5, 46.6, 46.7, 46.8, 46.9, 47.0, 47.1, 47.2, 47.3, 47.4, 47.5, 47.6, 47.7, 47.8, 47.9, 48.0, 48.1, 48.2, 48.3, 48.4, 48.5, 48.6, 48.7, 48.8, 48.9, 49.0, 49.1, 49.2, 49.3, 49.4, 49.5, 49.6, 49.7, 49.8, 49.9, 50.0, 50.1, 50.2, 50.3, 50.4, 50.5, 50.6, 50.7, 50.8, 50.9, 51.0, 51.1, 51.2, 51.3, 51.4, 51.5, 51.6, 51.7, 51.8, 51.9, 52.0, 52.1, 52.2, 52.3, 52.4, 52.5, 52.6, 52.7, 52.8, 52.9, 53.0, 53.1, 53.2, 53.3, 53.4, 53.5, 53.6, 53.7, 53.8, 53.9, 54.0, 54.1, 54.2, 54.3, 54.4, 54.5, 54.6, 54.7, 54.8, 54.9, 55.0, 55.1, 55.2, 55.3, 55.4, 55.5, 55.6, 55.7, 55.8, 55.9, 56.0, 56.1, 56.2, 56.3, 56.4, 56.5, 56.6, 56.7, 56.8, 56.9, 57.0, 57.1, 57.2, 57.3, 57.4, 57.5, 57.6, 57.7, 57.8, 57.9, 58.0, 58.1, 58.2, 58.3, 58.4, 58.5, 58.6, 58.7, 58.8, 58.9, 59.0, 59.1, 59.2, 59.3, 59.4, 59.5, 59.6, 59.7, 59.8, 59.9, 60.0, 60.1, 60.2, 60.3, 60.4, 60.5, 60.6, 60.7, 60.8, 60.9, 61.0, 61.1, 61.2, 61.3, 61.4, 61.5, 61.6, 61.7, 61.8, 61.9, 62.0, 62.1, 62.2, 62.3, 62.4, 62.5, 62.6, 62.7, 62.8, 62.9, 63.0, 63.1, 63.2, 63.3, 63.4, 63.5, 63.6, 63.7, 63.8, 63.9, 64.0, 64.1, 64.2, 64.3, 64.4, 64.5, 64.6, 64.7, 64.8, 64.9, 65.0, 65.1, 65.2, 65.3, 65.4, 65.5, 65.6, 65.7, 65.8, 65.9, 66.0, 66.1, 66.2, 66.3, 66.4, 66.5, 66.6, 66.7, 66.8, 66.9, 67.0, 67.1, 67.2, 67.3, 67.4, 67.5, 67.6, 67.7, 6**

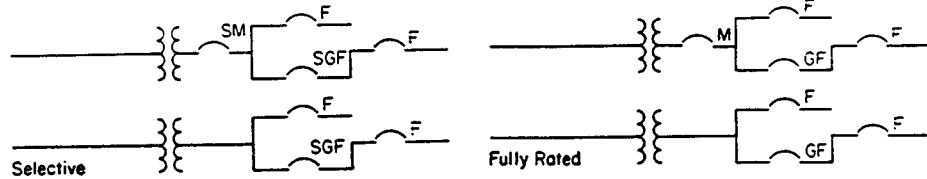
Application Data Ratings				
Ac voltage	Breaker type	Trip current range	Interrupting capacity symmetrical amperes	Maximum short-circuit current at which breaker can be applied when furnished with short-time delay
481 to 600	DS-206	25-600	22,000	22,000
	DS-416	50-1600	42,000	42,000
	DS-420	50-2000	42,000	42,000
	DS-632	1200-3200	65,000	65,000
	DS-840	2000-4000	85,000	85,000
241 to 480	DS-206	25-600	30,000	30,000
	DS-416	50-1600	50,000	50,000
	DS-420	50-2000	50,000	50,000
	DS-632	1200-3200	65,000	65,000
	DS-840	2000-4000	85,000	85,000
240 and below	DS-206	25-600	42,000	30,000
	DS-416	50-1600	65,000	50,000
	DS-420	50-2000	65,000	50,000
	DS-632	1200-3200	85,000	65,000
	DS-840	2000-4000	130,000	85,000

Westinghouse



Recommended Type DS Air Circuit Breakers

For Application with Standard Westinghouse
Transformers (Liquid, Dry Ventilated and
Dry Sealed Type)



Transformer Base (100%) Rating Kva and Amperes Percent Impedance ^①	Maximum Short- Circuit Kva Available from Primary System	Secondary Short-Circuit Currents RMS Symmetrical Amperes			Breakers for Selective Trip Systems			Breakers for Non-Selective Trip Systems	
		Through Transformer Only	Motor Contribution ③	Combined	Main ^② Breaker Short Delay Trip	Feeder ^④ Breaker Short Delay Trip	Feeder ^⑤ Breaker Instant. Trip	Main ^② Breaker Instant. Trip	Feeder ^④ Breaker Instant. Trip

Table A : 208 Volts, 3 Phase — 50% Motor Load

300	833	50000	14900	1700	16600	DS-416	DS-206	DS-206	DS-416	DS-206
		100000	15700		17400					
		150000	16000		17700					
		250000	16300		18000					
		500000	16500		18200					
5.0%		Unlimited	16700		18400	DS-206	DS-206	DS-206	DS-206	DS-206
500	1389	50000	23100	2800	25900	DS-416	DS-206	DS-206	DS-416	DS-206
		100000	25200		28000					
		150000	26000		28800					
		250000	26700		29500					
		500000	27200		30000					
5.0%		Unlimited	27800		30600	DS-416	DS-206	DS-206	DS-206	DS-206
	2083	50000	28700	4200	32900	DS-632	DS-416	DS-206	DS-632	DS-206
		100000	32000		36200					
		150000	33300		37500					
		250000	34400		38600					
		500000	35200		39400					
5.75%		Unlimited	36200		40400	DS-416	DS-206	DS-206	DS-206	DS-206
1000	2778	50000	35900	5600	41500	DS-632	DS-416	DS-206	DS-632	DS-206
		100000	41200		46800					
		150000	43300		48900					
		250000	45200		50800					
		500000	46700		52300					
5.75%		Unlimited	48300		53900	DS-632#	DS-416	DS-416	DS-416	DS-416

General Notes for Application Tables A Through C

M = Main breaker selected to have adequate interrupting and continuous ratings.

SM = Selective main breaker selected to have adequate interruption, short-time and continuous current ratings and equipped with short time overcurrent tripping.

GF = Group feeder breaker selected to have adequate interrupting rating. The breaker is assumed to have adequate continuous current capacity.

SGF = Selective group feeder breaker selected to have adequate interrupting and short-time ratings, and equipped with short time overcurrent tripping. The breaker is assumed to have adequate continuous current capacity.

F = Feeder breaker selected to have adequate interrupting rating.

① The transformer Kva ratings and equivalent continuous amperes as listed are basic self-cooled (ONAN or ANN) ratings only. Modern standard 3 phase unit substation transformers of various types have supplementary continuous self-cooled and forced-air (FA) Kva ratings as follows:

Liquid Filled 55°/65°C			Liquid Filled 65°C		Ventilated Dry	
ONAN	ONAN	ONAF	65°	65°	ANN	AFN
55°	65°	65°	65°	65°	100%	133.3%
100%	112%	128.8%	100%	115%		
300	336	—	300	—	300	400
500	567	—	500	—	500	667
750	840	966	750	862	750	1000
1000	1120	1288	1000	1150	1000	1333
1500	1680	1932	1500	1725	1500	2000
2000	2240	2576	2000	2300	2000	2667
2500	2800	3500 (140%)	2500	3125 (125%)	2500	3333

Sealed dry type transformers are ANC self-cooled (100%) only.

② The short-circuit currents are calculated by dividing the transformer basic (100%) rated amperes by the sum of the transformer and primary system impedances, expressed in per unit. The motor contributions are estimated as approximately 4 times the motor load amperes. The transformer impedance percentages as listed are standard for most secondary unit substation transformers. Higher impedances and/or lower motor loads will reduce the short-

circuit currents correspondingly. Supplementary transformer ratings above will not increase the short-circuit currents, provided the motor loads are not increased.

Special Note: These Tables do not apply for 3 phase banks of single phase distributor transformers, which usually have impedances of 2% to 3% or even lower. The short-circuit currents must be recalculated for all such applications and the breakers selected accordingly.

③ Main breakers as selected have adequate interrupting ratings, and adequate continuous current ratings for the transformer base ratings. For certain supplementary ratings and/or temporary overloads, larger frame main breakers must be substituted.

④ Feeder breakers as selected have adequate interrupting ratings for the "combined short-circuits", and are assumed to have adequate continuous current ratings for maximum load demands. Larger frame breakers may be substituted when required.

⑤ Bus sectionalizing or tie breakers, as used in double-ended unit substations or for connecting two single ended substations, must have adequate interrupting ratings for the "combined" short-circuits. The minimum recommended continuous current rating is half that of the associated main breakers. Many engineers, however, prefer the breakers identical to the main breakers, for interchangeability as spares for the main breakers.

⑥ All breaker systems in these Tables, both selective and non-selective, are fully rated only. Systems including breakers of less than adequate interrupting ratings, such as "cascaded" systems, are not recognized by ANSI and NEMA Standards, and are not recommended.

Type DS Low-Voltage Metal-Enclosed Switchgear

Transformer Base (100%) Rating Kva and Percent Impedance ①	Amperes	Maximum Short Circuit Kva Available from Primary System	Secondary Short-Circuit Currents RMS Symmetrical Amperes			Breakers for Selective Trip Systems			Breakers for Non-Selective Trip Systems	
			Through Transformer Only	Motor Contribution ②	Combined	Main③ Breaker Short Delay Trip	Feeder④ Breaker Short Delay Trip	Feeder④ Breaker Instant Trip	Main③ Breaker Instant Trip	Feeder④ Breaker Instant Trip

Table B : 480 Volts, 3 Phase — 100% Motor Load

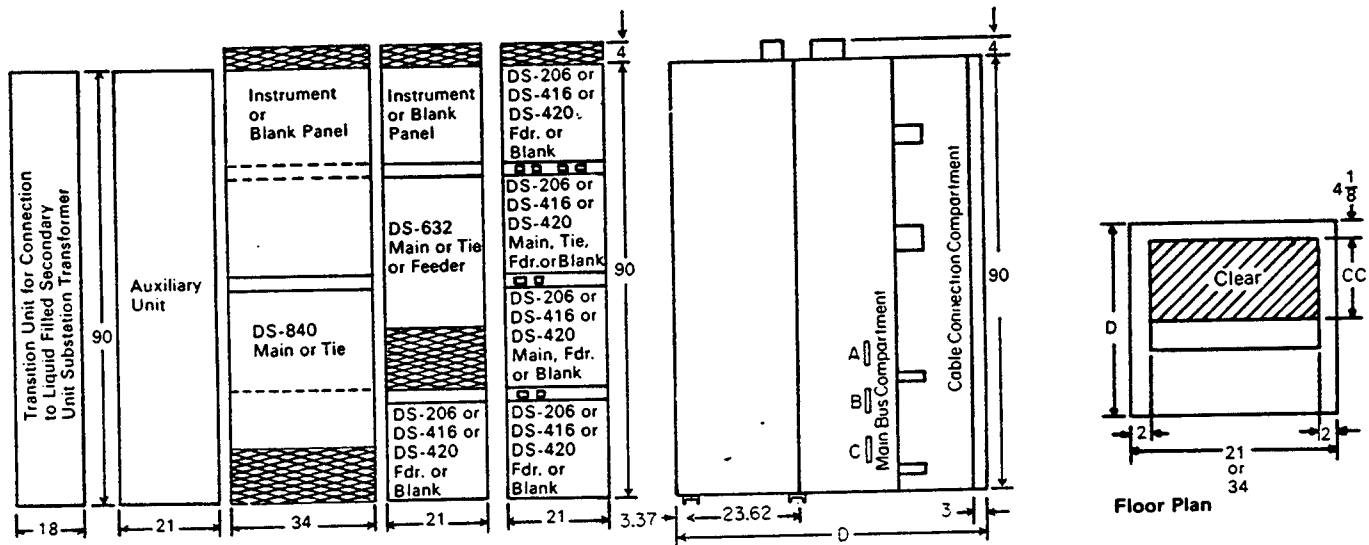
500	601	50000	10000	2400	12400	DS-416	DS-206	DS-206	DS-416	DS-206
		100000	10900		13300					
		150000	11300		13700					
		250000	11600		14000					
		500000	11800		14200					
750	902	Unlimited	12000		14400	DS-416	DS-206	DS-206	DS-416	DS-206
		50000	12400	3600	16000					
		100000	13900		17500					
		150000	14400		18000					
		250000	14900		18500					
1000	1203	500000	15300		18900	DS-416	DS-206	DS-206	DS-416	DS-206
		Unlimited	15700		19300					
		50000	15500	4800	20300					
		100000	17800		22600					
		150000	18700		23500					
1500	1804	250000	19600		24400	DS-420	DS-206	DS-206	DS-420	DS-206
		500000	20200		25000					
		Unlimited	20900		25700					
		50000	20600	7200	27800					
		100000	24900		32100					
2000	2406	150000	26700		33900	DS-632	DS-416	DS-416	DS-632	DS-416
		250000	28400		35600					
		500000	29800		37000					
		Unlimited	31400		38600					
		50000	24700	9600	34300					
2500	3008	100000	31000		40600	DS-632	DS-416	DS-416	DS-632	DS-416
		150000	34000		43600					
		250000	36700		46300					
		500000	39100		48700					
		Unlimited	41800		51400					
5.75%		50000	28000	12000	40000	DS-632	DS-416	DS-416	DS-632	DS-416
		100000	36500		48500					
		150000	40500		52500					
		250000	44600		56600					
		500000	48100		60100					
5.75%		Unlimited	52300		64300					
		50000	28000	12000	40000					
		100000	36500		48500					
		150000	40500		52500					
		250000	44600		56600					
5.75%		500000	48100		60100					
		Unlimited	52300		64300					
		50000	28000	12000	40000					
		100000	36500		48500					
		150000	40500		52500					
5.75%		250000	44600		56600					
		500000	48100		60100					
		Unlimited	52300		64300					
		50000	28000	12000	40000					
		100000	36500		48500					
5.75%		150000	40500		52500					
		250000	44600		56600					
		500000	48100		60100					
		Unlimited	52300		64300					
		50000	28000	12000	40000					
5.75%		100000	36500		48500					
		150000	40500		52500					
		250000	44600		56600					
		500000	48100		60100					
		Unlimited	52300		64300					

Table C : 600 Volts 3 Phase — 100% Motor Load

Table C-1000 Volts 3 Phase - 100% Motor Load											
500	481	50000	8000	1900	9900	DS-206	DS-206	DS-206	DS-206	DS-206	
5.0%		100000	8700		10600		DS-206	DS-206		DS-206	DS-206
		150000	9000		10900		DS-206	DS-206		DS-206	DS-206
		250000	9300		11200		DS-206	DS-206		DS-206	DS-206
		500000	9400		11300		DS-206	DS-206		DS-206	DS-206
		Unlimited	9600		11500		DS-206	DS-206		DS-206	
750	722	50000	10000	2900	12900	DS-416	DS-206	DS-206	DS-416	DS-206	
5.75%		100000	11100		14000		DS-206	DS-206		DS-206	DS-206
		150000	11600		14500		DS-206	DS-206		DS-206	DS-206
		250000	11900		14800		DS-206	DS-206		DS-206	DS-206
		500000	12200		15100		DS-206	DS-206		DS-206	DS-206
		Unlimited	12600		15500		DS-206	DS-206		DS-206	
1000	962	50000	12400	3900	16300	DS-416	DS-206	DS-206	DS-416	DS-206	
5.75%		100000	14300		18200		DS-206	DS-206		DS-206	DS-206
		150000	15000		18900		DS-206	DS-206		DS-206	DS-206
		250000	15600		19500		DS-206	DS-206		DS-206	DS-206
		500000	16200		20100		DS-206	DS-206		DS-206	DS-206
		Unlimited	16700		20600		DS-206	DS-206		DS-206	
1500	1443	50000	16500	5800	22300	DS-416	DS-416	DS-416	DS-416	DS-416	
5.75%		100000	20000		25800		DS-416	DS-416		DS-416	DS-416
		150000	21400		27200		DS-416	DS-416		DS-416	DS-416
		250000	22700		28500		DS-416	DS-416		DS-416	DS-416
		500000	23900		29700		DS-416	DS-416		DS-416	DS-416
		Unlimited	25100		30900		DS-416	DS-416		DS-416	
2000	1924	50000	19700	7700	27400	DS-420	DS-416	DS-416	DS-420	DS-416	
5.75%		100000	24800		32500		DS-416	DS-416		DS-416	DS-416
		150000	27200		34900		DS-416	DS-416		DS-416	DS-416
		250000	29400		37100		DS-416	DS-416		DS-416	DS-416
		500000	31300		39000		DS-416	DS-416		DS-416	DS-416
		Unlimited	33500		41200		DS-416	DS-416		DS-416	
2500	2406	50000	22400	9600	32000	DS-632	DS-416	DS-416	DS-632	DS-416	
5.75%		100000	29200		38800		DS-416	DS-416		DS-416	DS-416
		150000	32400		42000		DS-416	DS-416		DS-416	DS-416
		250000	35600		45200		DS-632#	DS-632#		DS-632#	DS-632#
		500000	38500		48100		DS-632#	DS-632#		DS-632#	DS-632#
		Unlimited	41800		51400		DS-632#	DS-632#		DS-632#	

Type DS Low-Voltage
Metal-Enclosed Switchgear

Indoor Dimensions (Inches)



N.B. DSL-206 and DSL-416 are mounted in the same locations as DS-206 and DS-416. For DSL-632, refer to Westinghouse.

Weights and Dimensions (Typical)

Breaker	Weight Lbs.	Dimensions, inches		
		CC (Min.)		D ①
		Bottom	Top	
DS-206	175	10	15	54, 60
DS-416	180	10	15	54, 60
DS-420	185	10	15	54, 60
DS-632	275	10	15	60
DS-840	405	10	15	68
DSL-206	225	10	15	62
DSL-416	230	10	15	62
DSL-632	375	10	15	①
Cell without breaker	1300			54, 60
Transition cell	700			54, 60
Auxiliary unit without devices	500			54, 60

①Other Depths Available. Refer to Westinghouse.
②Refer to Westinghouse.