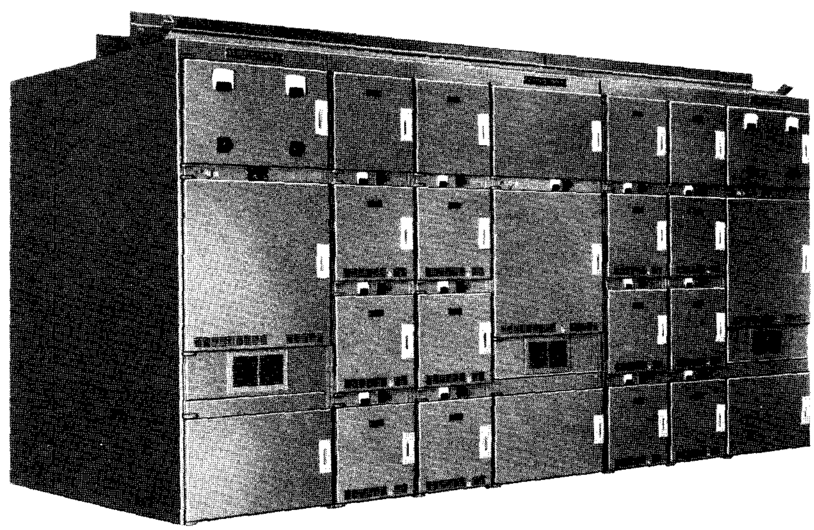
Class 6030
(Formerly Section 6130)
APRIL, 1983
Supersedes 4/82 Edition



Double Ended Low Voltage Switchgear Using DS-840 Mains and Tie

POWER-ZONE® II Low Voltage Metal-Enclosed Drawout Switchgear

CONTENTS

SQUARE D COMPANY

FILE: Distribution Products Catalog

CLASS 6030

POWER-ZONE® II LOW VOLTAGE METAL-ENCLOSED DRAWOUT SWITCHGEAR

APRIL, 1983

DESCRIPTIVE INFORMATION

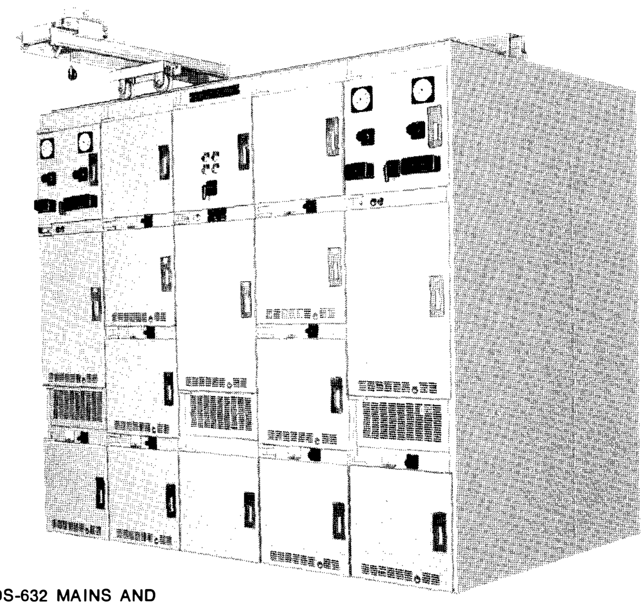
GENERAL DESCRIPTION

RATINGS:

Main Bus—4000 ampere maximum
120/208 to 600 Volts, AC, 1Ø 3W., 3Ø 3W. or 3Ø 4W.

AVAILABLE BREAKERS:

DS, DSL-206, DS-206S	800A. Frame
DS, DSL-416, DS-416S	1600A. Frame
DS-420	2000A. Frame
DS, DSL-632	3200A. Frame
DS, DSL-840	4000A. Frame



TYPICAL INDOOR SWITCHGEAR ASSEMBLY USING DS-632 MAINS AND TIE AND DS-206, DS-416, AND DS-420 FEEDERS.

GENERAL

POWER-ZONE® II LOW VOLTAGE METAL-ENCLOSED DRAWOUT SWITCHGEAR is premium distribution equipment designed to offer the user many safety features, minimum down-time, system selectivity, ease of maintenance, and large functional capacity.

The types DS (not fusible) and DSL (fused) low voltage power circuit breakers are the primary components of POWER-ZONE II switchgear. These circuit breakers employ a solid state tripping device offering the latest in circuit protection.

Functional and operational advantages are:

Safety Features—Compartmentalized and barriered constuction per ANSI C37.20 assures protection to operating personnel even under severe short circuit conditions.

Minimum Down-Time—Drawout construction allows quick and simple replacement of breaker elements. If an emergency occurs, breakers may be removed from low priority circuits and re-installed to serve high priority circuits.

System Selectivity—The solid state trip device provided on each DS and DSL low voltage power circuit breaker is field adjustable, enabling the user to attain optimum selectivity and coordination.

Ease of Maintenance—Circuit breakers are simple to inspect, adjust, and replace. They can be withdrawn from their compartments for convenient and safe maintenance or inspection.

Functional Capacity—Large frame sizes and high interrupting ratings make the DS and DSL low voltage power circuit breakers ideal for application on today's high capacity distribution systems.

Applicable Standards—Structures: NEMA SG5
ANSI C37.20
ANSI C37.51

Circuit Breakers: NEMA SG3
ANSI C37.13
ANSI C37.16

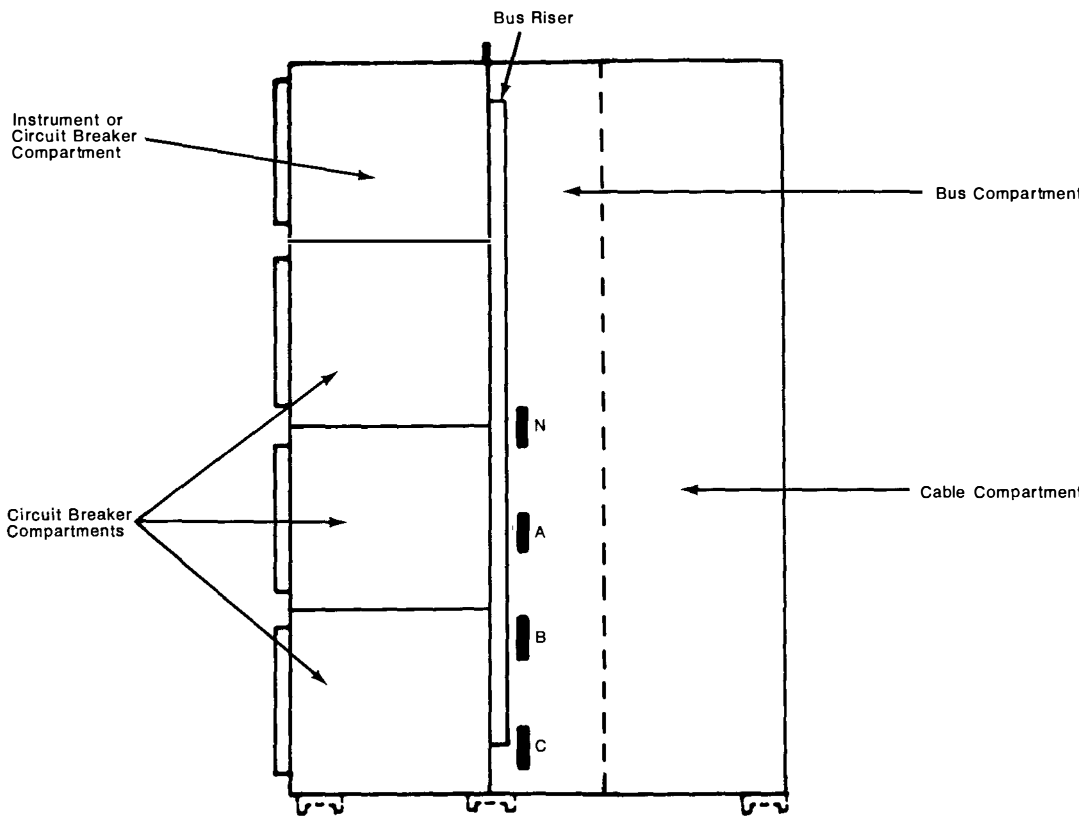
UL Listing—POWER-ZONE II switchgear can be designed and engineered to comply with UL requirements. All DS and DSL power circuit breakers are optionally available with a UL listing with the exception of the DS-206S, DS-416S, DSL-632, and DSL-840. Where UL Standards exist for all component materials, parts and devices in a switchgear section, a UL label can be affixed.

PRINTED IN U.S.A.

POWER-ZONE® II LOW VOLTAGE METAL-ENCLOSED DRAWOUT SWITCHGEAR

DESCRIPTIVE INFORMATION

COMPARTMENTALIZED CONSTRUCTION



SIDE VIEW ILLUSTRATION OF TYPICAL SWITCHGEAR

Compartmentalized Construction:
POWER-ZONE II LOW VOLTAGE METAL-ENCLOSED DRAWOUT SWITCHGEAR offers high reliability through compartmentalized construction.

The three compartments are:
1. Circuit breaker or instrument compartment.
2. Bus compartment.
3. Cable compartment.

Isolation between the bus and cable compartments and/or between adjacent bays is available through optional vertical bus barriers.

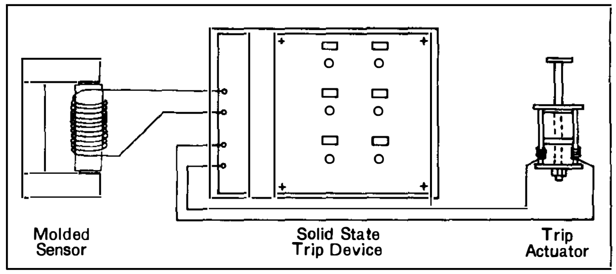
NOTE: If incoming conductors are considered to be "Service Conductors," then barriers per N.E.C. Article 384-3 must be specified.

DESCRIPTIVE INFORMATION

CIRCUIT BREAKERS

POWER-ZONE II Switchgear utilizes the Type DS Low-Voltage Power Circuit Breaker. This circuit breaker is available in five basic frame sizes which are tabulated along with their respective interrupting capacities in Table A on Page 13. The breaker overcurrent protection consists of a modern solid-state trip device that requires no external power source. The complete tripping system has three basic components; the molded sensors, the trip device and the trip actuator.

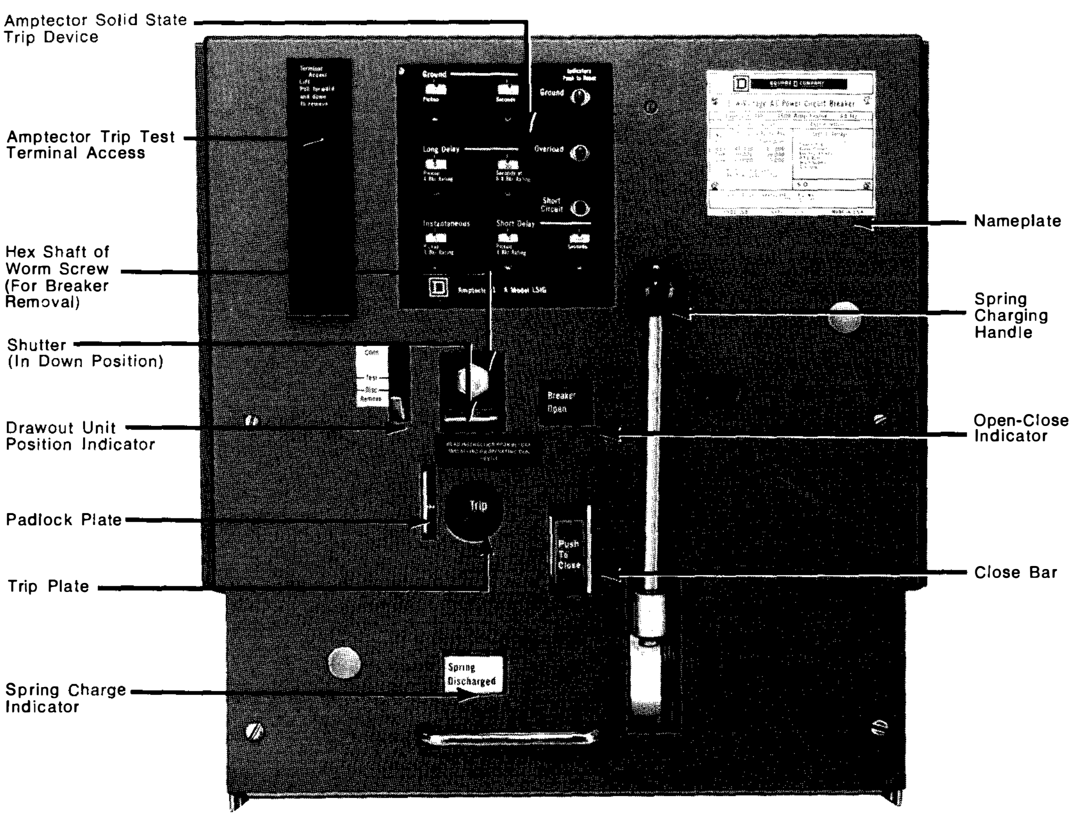
Each pole of the circuit breaker is equipped with a molded sensor located on the bottom rear main disconnect contacts. These sensors produce an output proportional to the load current, that is fed into the trip device which has the intelligence and energy to operate the trip actuator when required. The trip actuator receives the tripping pulse from the solid-state trip unit and produces a mechanical force to trip the circuit breaker.



SCHEMATIC ILLUSTRATION OF TRIPPING SYSTEM

Type DS circuit breakers are equipped with the controls as shown below (Amptector I-A - optional). The circuit breaker is a fully stored energy device with a two-step operating mechanism. A spring charging handle charges the mechanism and the breaker contacts are closed by pushing the "Push To Close" button.

Electrically operated breakers have a motor to charge the stored energy mechanism, electric close feature and electric open feature.



FRONT VIEW OF DS CIRCUIT BREAKER
(DS-206, DS-416 or DS-420)

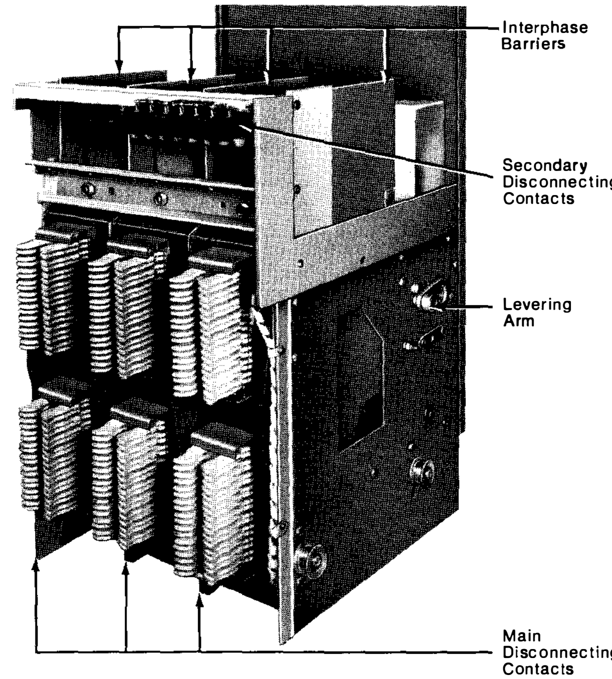
POWER-ZONE® II LOW VOLTAGE METAL-ENCLOSED DRAWOUT SWITCHGEAR

DESCRIPTIVE INFORMATION

CIRCUIT BREAKERS

The main disconnecting contacts located on the rear of the breaker are spring loaded and self-aligning to insure positive electrical contact when the breaker is in the connected position. These contacts are designed so the pressure at the point of contact on the stationary stud becomes greater under short circuit conditions.

The secondary disconnecting contacts are also located on the rear of the circuit breaker element and are used for connecting the accessories to the control power source or other control circuits. These contacts are in the "make" position when the element is in the "Connected" and "Test" positions.



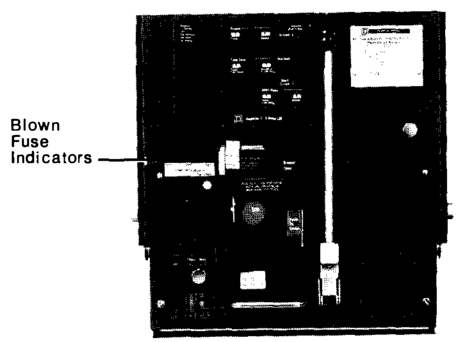
REAR VIEW OF DS-632 CIRCUIT BREAKER ELEMENT

FUSED BREAKERS

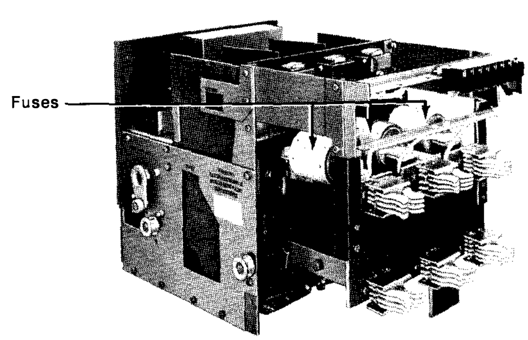
POWER-ZONE II Switchgear is also available with fused power circuit breakers. Fused circuit breakers have a short circuit interrupting capacity of 200,000 amperes symmetrical. The breaker element including the solid-state tripping system is identical to that of a not-fusible circuit breaker except for the addition of the fuses and other circuitry necessary for the proper functioning of the fuse protection system.

Current limiting fuses are available on the 800 A., 1600 A., 3200 A., and 4000 A. frame power circuit breakers. The current limiting fuses are mounted integrally on the rear of the circuit breaker element for the 800 A. and 1600 A. frame sizes and are mounted on a separate drawout truck for the 3200 A. and 4000 A. frame sizes (see illustration, page 20). When fuses are mounted on a separate fuse truck the drawout mechanisms are mechanically key interlocked with the circuit breaker element.

ALL VERSIONS OF THE FUSED CIRCUIT BREAKER ARE EQUIPPED WITH BLOWN FUSE INDICATION AND ANTI-SINGLE PHASING AS STANDARD.



FRONT VIEW OF DSL-206 CIRCUIT BREAKER



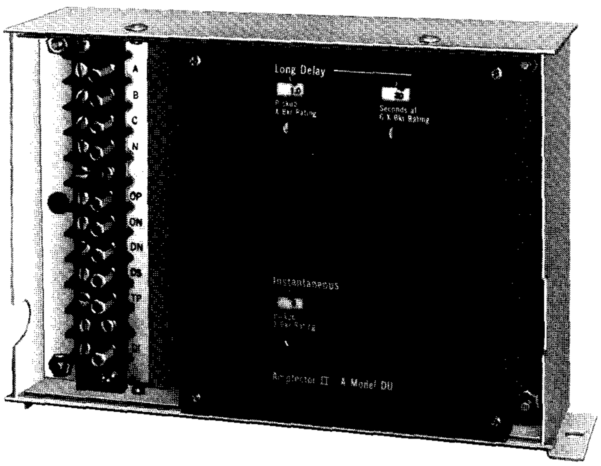
REAR VIEW OF DSL-206 CIRCUIT BREAKER EQUIPPED WITH INTEGRAL CURRENT LIMITING FUSES

POWER-ZONE® II LOW VOLTAGE METAL-ENCLOSED DRAWOUT SWITCHGEAR

APRIL, 1983

DESCRIPTIVE INFORMATION

SOLID STATE TRIP DEVICES



AMPTECTOR II-A SOLID STATE TRIP DEVICE

The Amptector II-A† is the standard solid-state trip device supplied with DS power circuit breakers. It has adjustable settings for long delay time, long delay pickup, instantaneous pickup, and (as an option), short delay time and short delay pickup. When pre-set conditions of current magnitude and time delay are exceeded, it supplies a signal to the trip actuator which trips the breaker. The energy required for this operation is derived from the breaker-mounted current sensors. An optionally available portable test kit may be plugged into the trip device for testing and calibration.

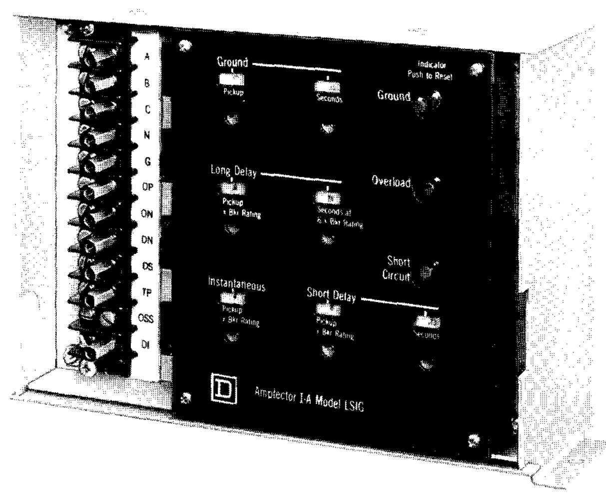
Three combinations of tripping functions are available:
1. Long delay and instantaneous (DU).
2. Long delay and short delay (SE).*
3. Long delay, short delay, and instantaneous (TR).*

For time current characteristics refer to the trip curve on page 14 and the breaker sensor rating table on page 13, table B.

The Amptector I-A† solid-state trip device is optionally available for DS power circuit breakers. In addition to the features offered with Amptector II-A, Amptector I-A is supplied with pop-out indicators to annunicate trips due to overload, short circuit or ground fault (if equipped). Short delay is optional. Ground fault trip is also optional; available with adjustable pickup and delay.

Six combinations of tripping functions are available:
1. Long delay and instantaneous (LI).
2. Long delay and short delay (LS).*
3. Long delay, short delay and instantaneous (LSI).*
4. Long delay, instantaneous and ground fault (LIG).*
5. Long delay, short delay, and ground fault (LSG).*
6. Long delay, short delay, instantaneous and ground fault (LSIG).*

For time current characteristics, refer to the trip curve on page 14 and the breaker sensor rating table on page 13, table B. Ground trip pickup values are listed on page 13, table D.

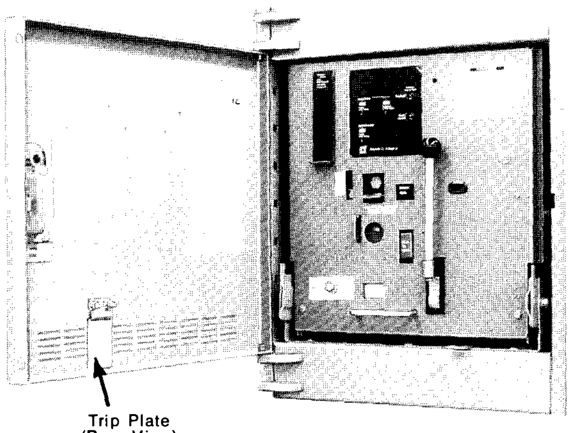


OPTIONAL AMPTECTOR I-A SOLID STATE TRIP DEVICE

†TM of Westinghouse Electric Corp.
*Optional.

DESCRIPTIVE INFORMATION

CIRCUIT BREAKER COMPARTMENT

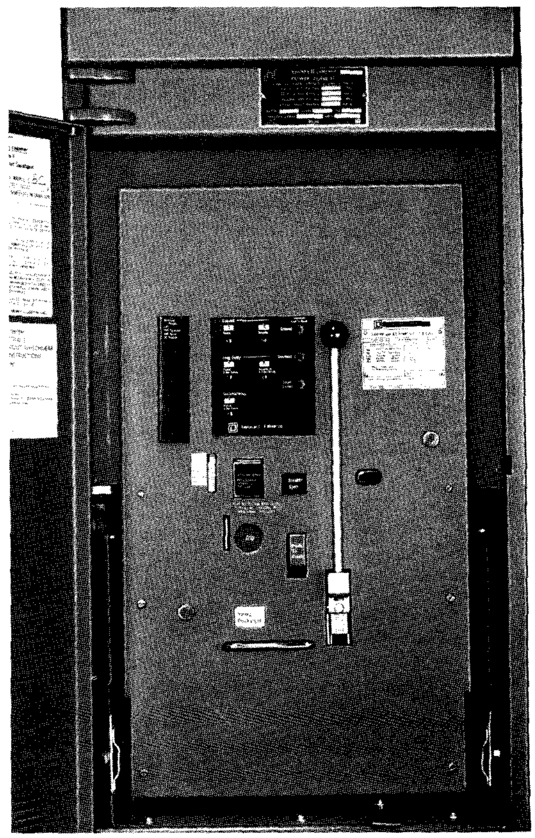


TYPE DS-206 CIRCUIT BREAKER

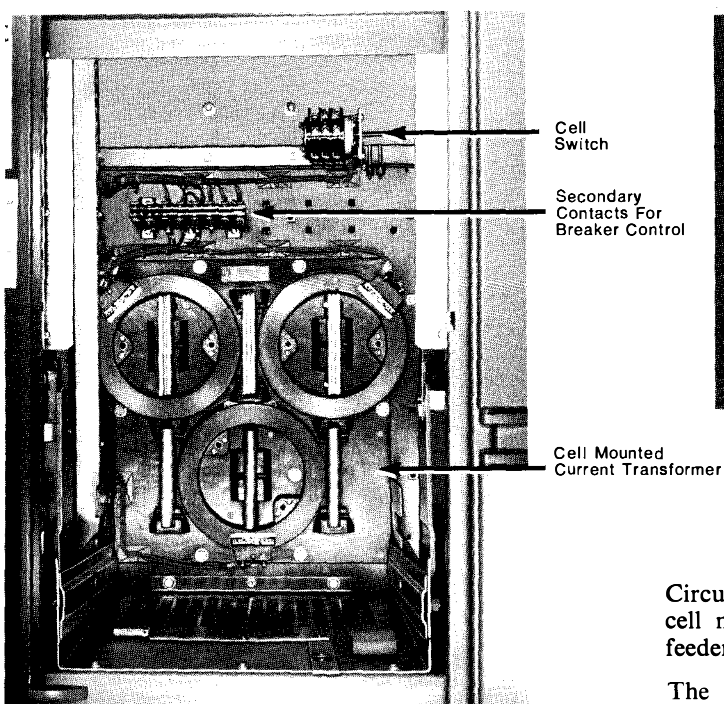
Each drawout low-voltage power circuit breaker is mounted in its own individual barriered compartment. The steel barriers are in accordance with all NEMA and ANSI specifications for this class of equipment. The front door can be closed with the circuit breaker in the "Connected, Test or Disconnected" position. All circuit breaker controls, except the external trip plate are located behind the compartment door so they are not readily accessible or obvious to unauthorized personnel.

An external trip plate is accessible from the front of the equipment, without opening the compartment door, for emergency tripping.

A steel barrier is installed on the front of each circuit breaker to protect operating personnel when the compartment door is open. This barrier offers full protection during closing, opening and racking operations. To offer maximum safety, live parts in the cell or on the breaker element are not accessible until the circuit breaker is fully withdrawn. When the breaker is in the full connected position and the compartment door is closed, POWER-ZONE II construction offers double safety by providing two full steel barriers between energized parts and operating personnel.



TYPE DS-632 CIRCUIT BREAKER



DS-632 CIRCUIT BREAKER COMPARTMENT
WITH BREAKER ELEMENT REMOVED

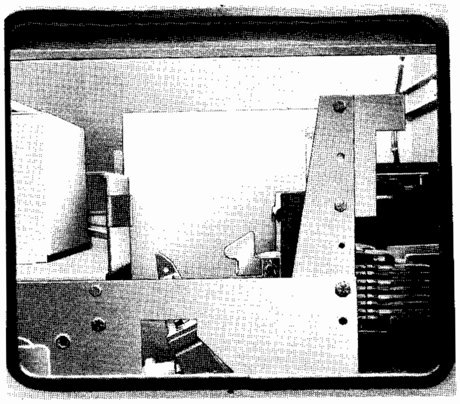
Circuit breaker compartments can be equipped with cell mounted current transformers for either main or feeder metering requirements.

The optional cell switch signals the circuit breaker's position.

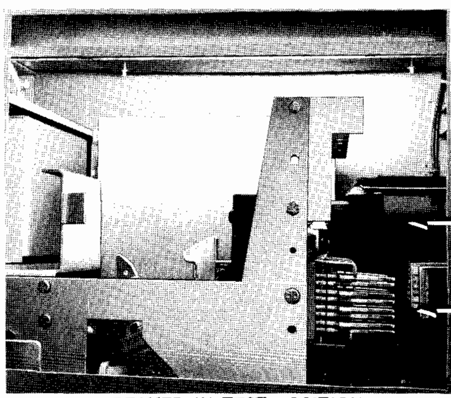
DESCRIPTIVE INFORMATION

CIRCUIT BREAKER COMPARTMENT

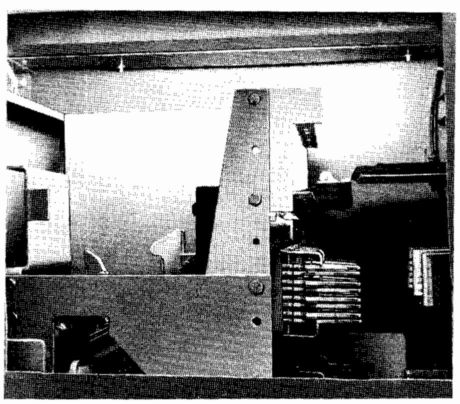
Each switchgear assembly is provided with a removable crank for levering the circuit breaker element between positions. Mechanical interlocking prevents levering a closed breaker and will not permit closing the breaker contacts while the element is between positions. The circuit breaker contacts can only be closed when the breaker is in the "connected" or "test" position.



BREAKER IN FULLY CONNECTED POSITION



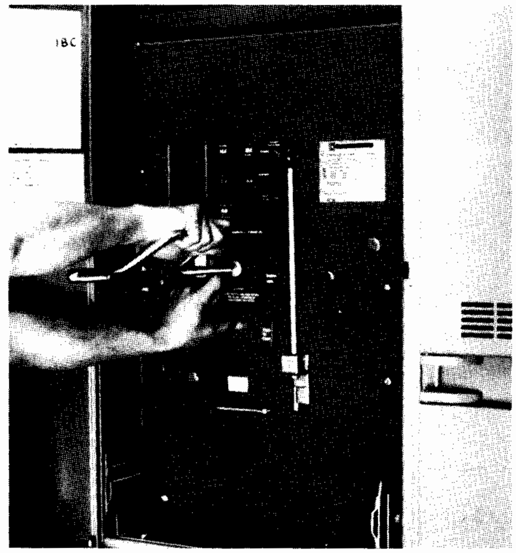
BREAKER IN TEST POSITION



BREAKER IN DISCONNECTED POSITION

In the withdraw position, retractable extension rails which are permanently attached to the drawout cradle enable the breaker element to be fully withdrawn from its cell.

A mechanical interlock assures that the stored energy closing springs will be discharged when the breaker is withdrawn.

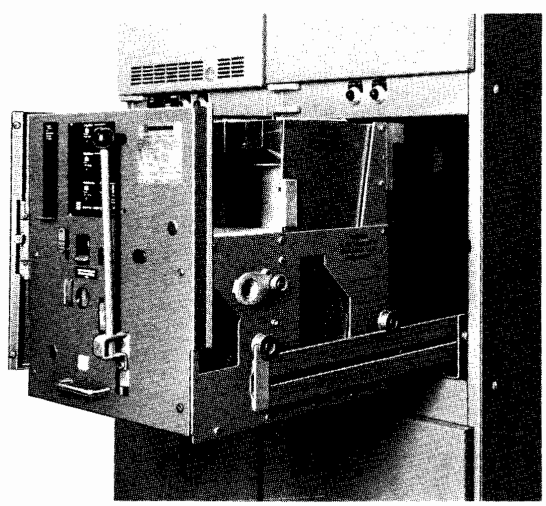


BREAKER LEVERING OPERATION

In the connected position the circuit breaker main contacts and the secondary control contacts are fully connected. The circuit breaker and its secondary control contacts are completely functional.

In the test position the circuit breaker main contacts are disconnected while the secondary control contacts are connected. The secondary control circuits are completely functional, enabling testing of the circuit breaker.

In the disconnected position, both the circuit breaker main contacts and the secondary control contacts are completely disconnected.

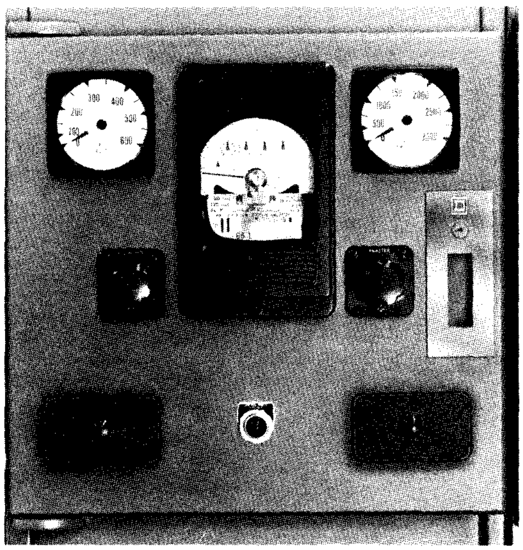


BREAKER IN FULLY WITHDRAWN POSITION

POWER-ZONE® II LOW VOLTAGE METAL-ENCLOSED DRAWOUT SWITCHGEAR

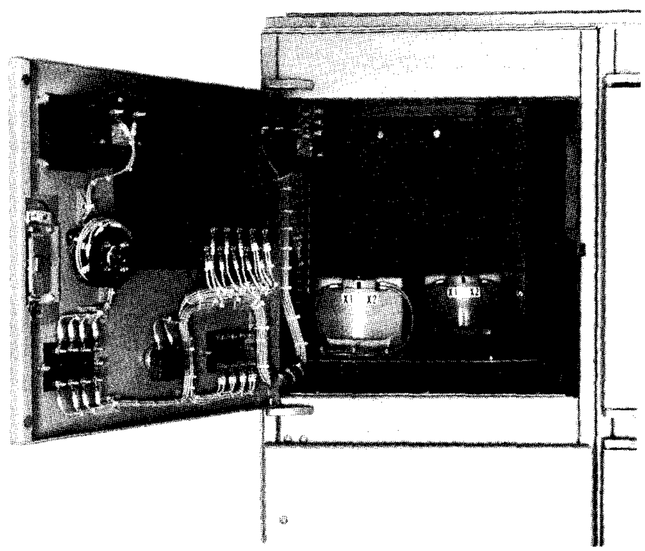
DESCRIPTIVE INFORMATION

INSTRUMENT COMPARTMENT



METER COMPARTMENT DOOR

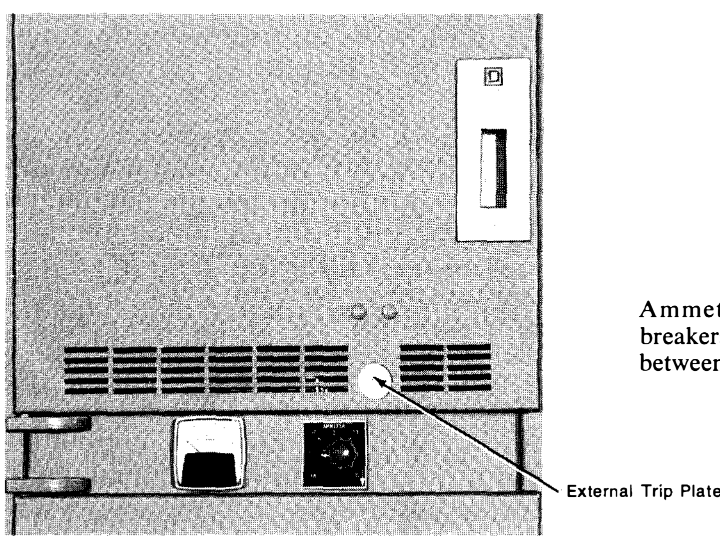
Metering for a main breaker or the main bus is generally located in the top compartment of the service entrance section. These meters are mounted on a hinged door equipped with a flush handle and key lock to prevent exposure of unauthorized personnel to energized live parts. Stranded flexible wiring between the meter compartment door and the stationary structure is neatly bundled and looped at the door hinge to allow a full 90 degree swing and easy access to all metering devices and components.



METER COMPARTMENT INTERIOR

Terminal and fuse blocks are located near the front of the meter compartment for easy access. Where wires pass through steel barriers, neoprene grommets or other protective coverings are used to prevent damage of the wire insulation. All control or meter wiring used in POWER-ZONE II switchgear structures is stranded and of the 600 volt insulation class.

Ammeters and selector switches for feeder circuit breakers can be mounted on the stationary panel located between breaker cells.

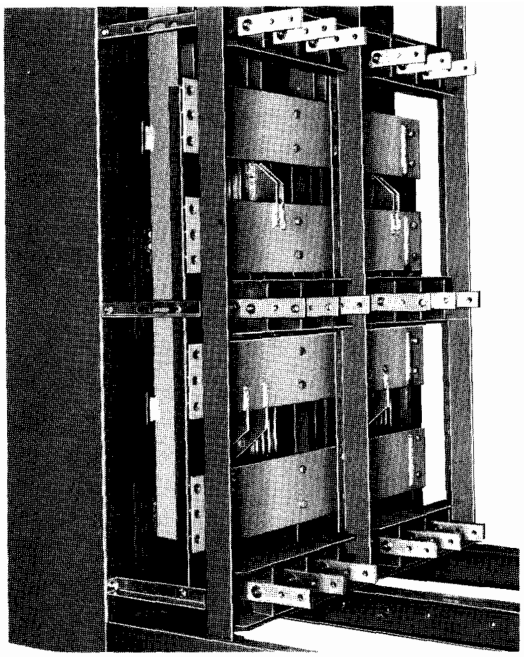


FEEDER AMMETER AND SWITCH

PRINTED IN U.S.A.

DESCRIPTIVE INFORMATION

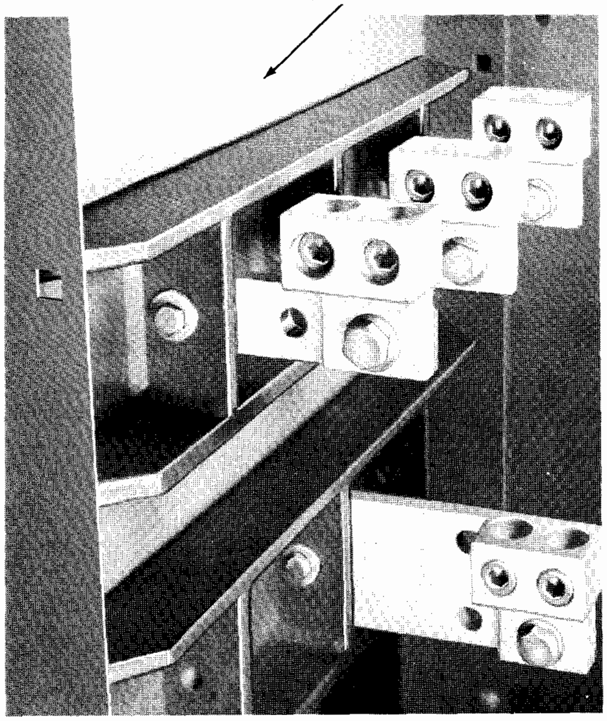
BUS AND CABLE COMPARTMENTS



CROSS BUS WITH PROVISIONS FOR FUTURE EXTENSION

Main and riser busses are available in ratings of 1600 A., 2000 A., 3000 A. and 4000 A. Welded aluminum bus is supplied as standard.

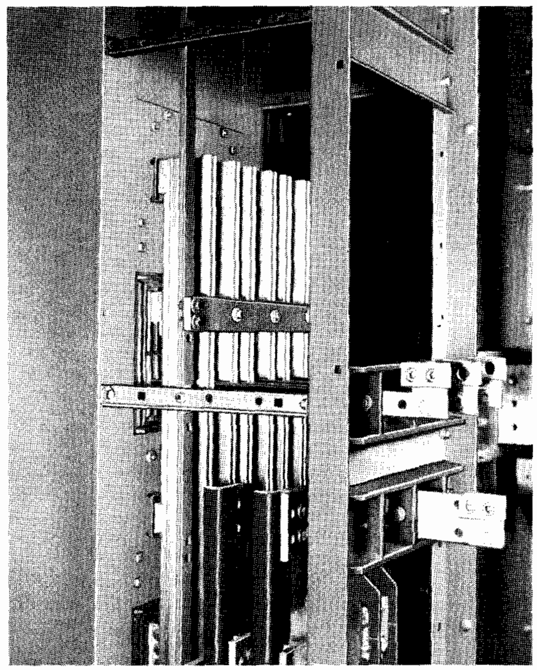
Optional Barriers



LOAD SIDE BUS WITH OPTIONAL CABLE LUGS EXTENDED INTO CABLE COMPARTMENT

The main cross bus is connected to the extruded vertical riser bus by means of welded aluminum splice plates. The cross bus is stacked vertically in the bus compartment and has provisions for future extension on at least one end.

Copper bus with bolted connections is optionally available.



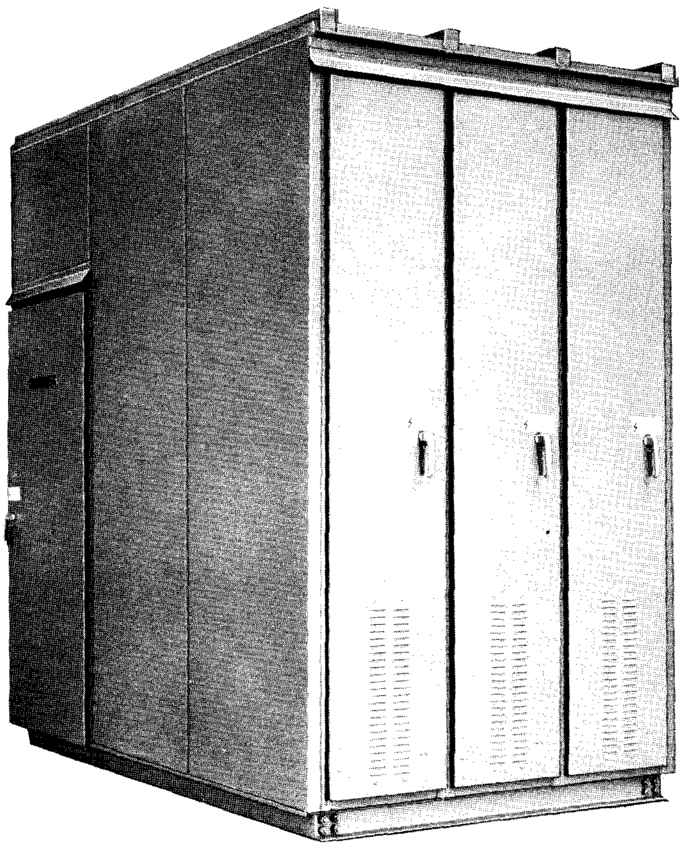
TYPICAL SECTION RISER BUS FEEDING INDIVIDUAL BREAKER COMPARTMENTS

The cable compartment contains NEMA standard drillings for load side connections for outgoing feeder cables. These connections are located in the cable compartment in accordance with the National Electric Code, Article 384-3 (d) which requires, it be unnecessary to reach across the line and section riser bus to make load connections. All load side connectors extending from the breaker compartments are insulated with sleeving to physically isolate them from the line bussing in the center bus compartment. Phase bus extensions for customer connections are made of silver plated copper.

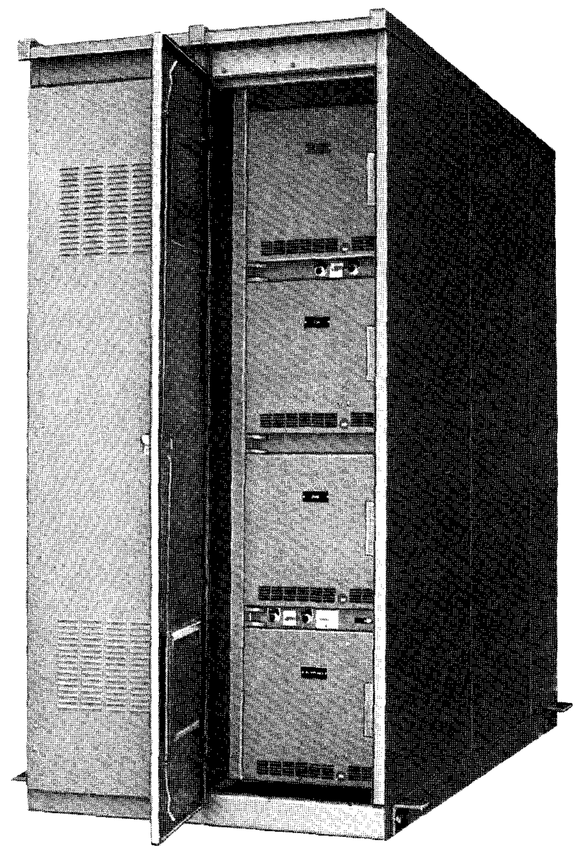
POWER-ZONE® II LOW VOLTAGE METAL-ENCLOSED DRAWOUT SWITCHGEAR

DESCRIPTIVE INFORMATION

OUTDOOR ENCLOSURES



WALK-IN
NEMA 3R ENCLOSURE
(REAR VIEW)



NON WALK-IN
NEMA 3R ENCLOSURE

POWER-ZONE II Low Voltage Drawout Switchgear is available in a non walk-in or walk-in front aisle enclosure for outdoor installations. Both enclosures are NEMA type 3R.

Non walk-in enclosures are equipped with:

- Cell strip heaters.
- ANSI #49 paint inside and out.

Options available:

- Mobile floor crane to handle circuit breakers.
- Removable steel coverplates over conduit entrance area.
- Convenience outlets.

The walk-in enclosure is equipped with the following standard features:

- Full length front aisle with steel access doors on each end. Doors are provided with panic hardware.
- Hinged coverplates held by tamper-resistant hardware on the rear of each equipment section.
- Incandescent lighting.
- Convenience outlets.
- Breaker cell strip heater.
- Breaker lifting device.
- Removable steel coverplates over conduit entrance area.
- ANSI #49 paint inside and out.

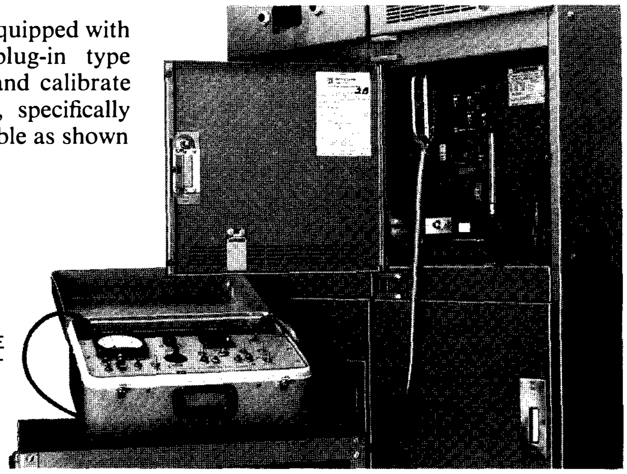
The enclosure dimensions are illustrated on page 22.

POWER-ZONE® II LOW VOLTAGE METAL-ENCLOSED DRAWOUT SWITCHGEAR

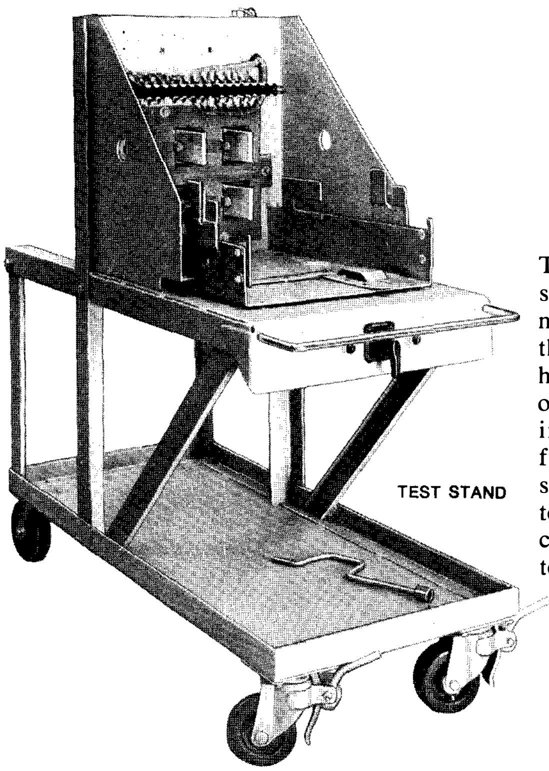
DESCRIPTIVE INFORMATION

ACCESSORIES

All type DS and DSL power circuit breakers equipped with Amptector solid-state trip devices have plug-in type test facilities which enable the user to test and calibrate all tripping functions. A portable test kit, specifically designed for this purpose, is optionally available as shown below.

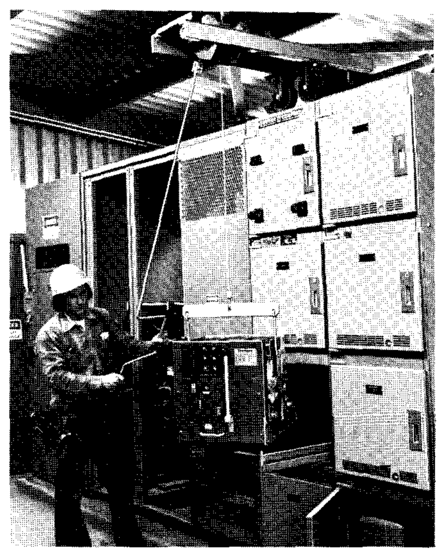


PORTABLE TEST KIT



TEST STAND

The DS circuit breaker test stand provides mobility fpr moving circuit breakers to the test area, a convenient height for visual inspection of breakers, contacts for testing all secondary control functions, a test equipment shelf for mounting the Amptector test kit, and power contacts for high current testing and calibration.



BREAKER LIFTING DEVICE

A rail-mounted travelling type breaker lifting device is optionally available with indoor type switchgear. It is supplied as standard with outdoor walk-in enclosures.

MISCELLANEOUS BREAKER OPTIONS & ACCESSORIES

Miscellaneous Breaker Options and Accessories:

- Shunt trip for manually operated breakers.
- Auxiliary switch with four 10 ampere contacts. A maximum of three auxiliary switches can be supplied per breaker.
- Cell switch with 12 Form "C" contacts. Operates when breaker is drawn from connected to test position.
- Undervoltage trip-instantaneous or time delay type. Trips the breaker on 30-60% undervoltage.
- Overcurrent trip switch-operates and latches when breaker is automatically tripped on overload or fault conditions.
- High load switch-operates on overload of lower value than the long time pickup setting for advanced warning of overload condition.
- Electric lockout for manually operated breakers.
- Electric close release for manually operated breakers.
- Square D Key Interlocks or other recognized key interlock systems.
- Operations counter.
- AC capacitor trip.
- Integral ground fault sensing (see page 17).
- Insulated bussing.
- UL Label.
- Two breaker mechanical interlocks.

PRINTED IN U.S.A.

POWER-ZONE® II LOW VOLTAGE METAL-ENCLOSED DRAWOUT SWITCHGEAR

APPLICATION DATA

RATINGS

TABLE A
INTERRUPTING RATINGS OF TYPE DS CIRCUIT BREAKER (RMS SYMMETRICAL AMPERES)

Trip Current Range	Breaker Type	w/Instantaneous Trip			w/Short Delay Trip		
		208-240V	480V	600V	208-240V	480V	600V
25-800	DS-206	42,000	30,000	30,000	30,000	30,000	30,000
25-800	DS-206S	50,000	42,000	42,000	42,000	42,000	42,000
50-1600	DS-416	65,000	50,000	42,000	50,000	50,000	42,000
50-1600	DS-416S	65,000	65,000	50,000	65,000	65,000	50,000
50-2000	DS-420	65,000	65,000	50,000	65,000	65,000	50,000
1200-3200	DS-632	85,000	65,000	65,000	65,000	65,000	65,000
2000-4000	DS-840	130,000	85,000	85,000	85,000	85,000	85,000
25-800 50-1600 1200-3200 2000-4000	DSL-206 DSL-416 DSL-632 DSL-840	All Ranges: 200,000 (DSL-840, 6000A LIMITER IS 150,000)					

TABLE B
AVAILABLE SENSOR RATINGS

Breaker Type	Sensor Rating (Amperes)
DS-206, DSL-206, DS-206S	50, 100, 150, 200, 300, 400, 600 & 800
DS-416, DSL-416, DS-416S	100, 150, 200, 300, 400, 600, 800, 1200 & 1600
DS-420	100, 150, 200, 300, 400, 600, 800, 1200, 1600 & 2000
DS-632	2400 & 3200
DS-840	4000

TABLE C
AMPTECTOR II-A AND AMPTECTOR I-A SOLID-STATE TRIP DEVICE CONTINUOUSLY ADJUSTABLE RANGES

Long delay pickup (multiples of sensor rating)	Long delay time seconds (6 times sensor rating)	Short delay pickup (multiples of sensor rating)	Short delay time seconds	Instantaneous pickup (multiples of sensor rating)	Ground † pickup (multiples of sensor rating)	Ground † time delay seconds
0.5 to 1.25	4* to 36	4 to 10	0.18 to 0.50	4 to 12	See Table D	0.22 to 0.50

*Amptector II-A is calibrated 8 to 36 seconds.
†Available on Amptector I-A trip only.

TABLE D
AMPTECTOR I-A GROUND PICK-UP VALUE—AMPERES

Dial Setting	Sensor Rating														Secondary Current①
	50	100	150	200	300	400	600	800	1200	1600	2000	2400	3200	4000	
A	13	57	60	65	80	110	145	180	260	330	400	530	640	800	1.0
B	18	67	75	85	110	150	205	260	385	505	600	770	1000	1200	1.5
C	22	75	85	100	130	185	250	325	480	625	760	960	1200	*1520	1.9
D	33	100	120	145	200	270	385	500	730	970	1200	*1465	*1920	*2400	3.0

All pick-up values may vary ± 10%.

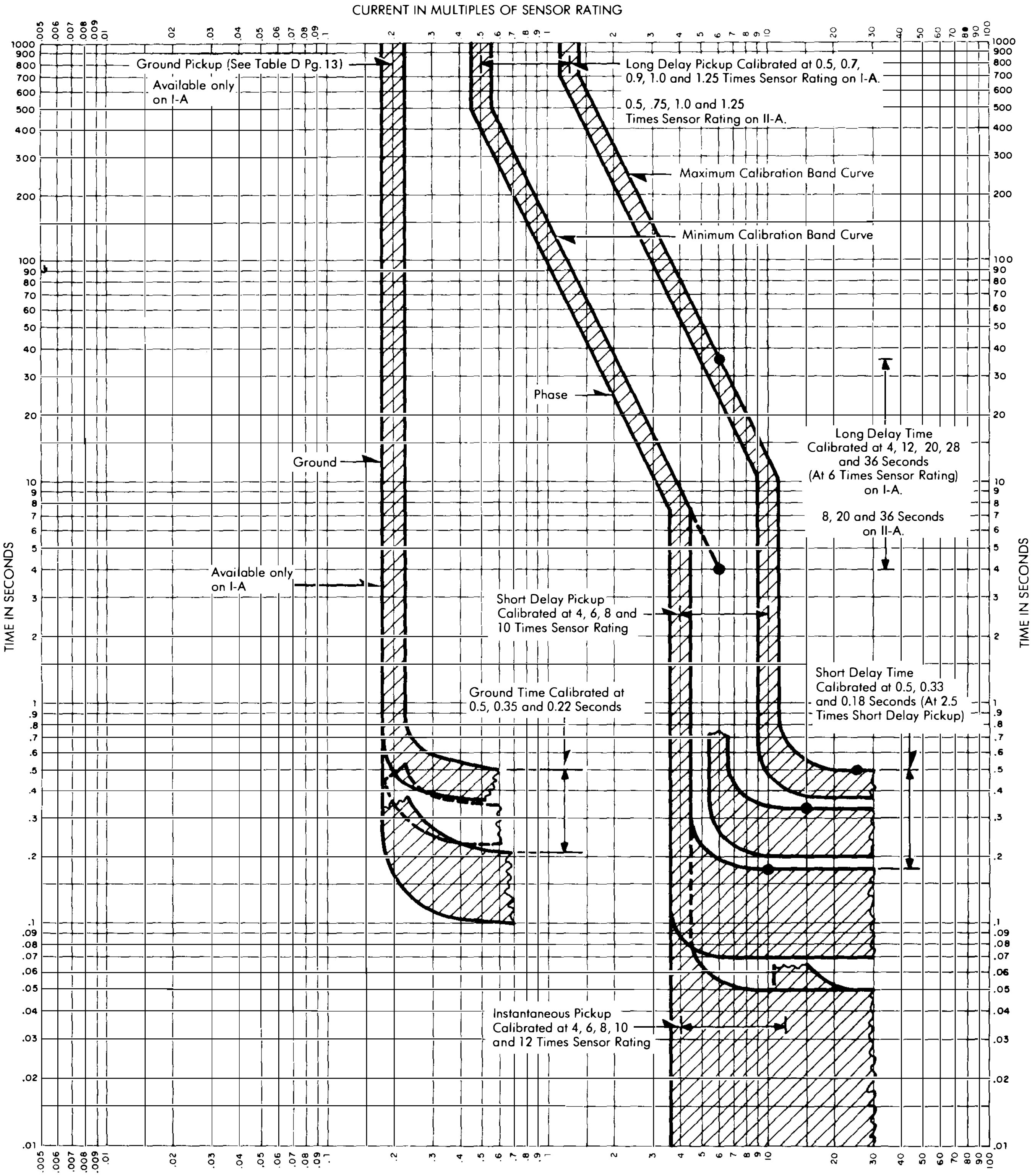
CAUTION—ONLY THOSE PICK-UP VALUES ABOVE AND TO THE LEFT OF THE LINE MEET REQUIREMENTS OF N.E.C. SECTION 230-95. PICK-UP VALUES MARKED * DO NOT MEET REQUIREMENT.

①—Current of this value from the secondary of an external ground transformer will cause the ground element to function. Ground element pick-up can also be tested using this value. All sensors must be disconnected during test.

POWER-ZONE® II LOW VOLTAGE METAL-ENCLOSED DRAWOUT SWITCHGEAR

APPLICATION DATA

AMPTECTOR I-A & II-A TIME CURRENT CHARACTERISTICS



Type DS Air Circuit Breakers
For Application up to 600 Volts ac

APPLICATION DATA

DSL FUSE LIMITERS

DSL circuit breakers are equipped with limiters having characteristics as illustrated in curves A through F. Fuse limiters are used where fault currents exceed the interrupting capacity of the circuit breaker alone. The let-thru and I²T characteristics of the limiters are co-ordinated with the circuit breaker elements to allow safe application on circuits which have available fault currents up to 200,000 RMS symmetrical amperes.

Selection of the proper limiter size depends upon whether the limiter's function is to protect downstream equipment or to protect circuit breaker. If downstream equipment protection is the main criterion, the smallest available limiter should be selected. Due to coordination problems, selection of certain small limiters may cause nuisance blowing on overloads or low level short circuits. For protection of the circuit breaker only, the largest available limiter should be selected.

Table E lists available limiter ratings for DSL-206 and DSL-416 breakers.

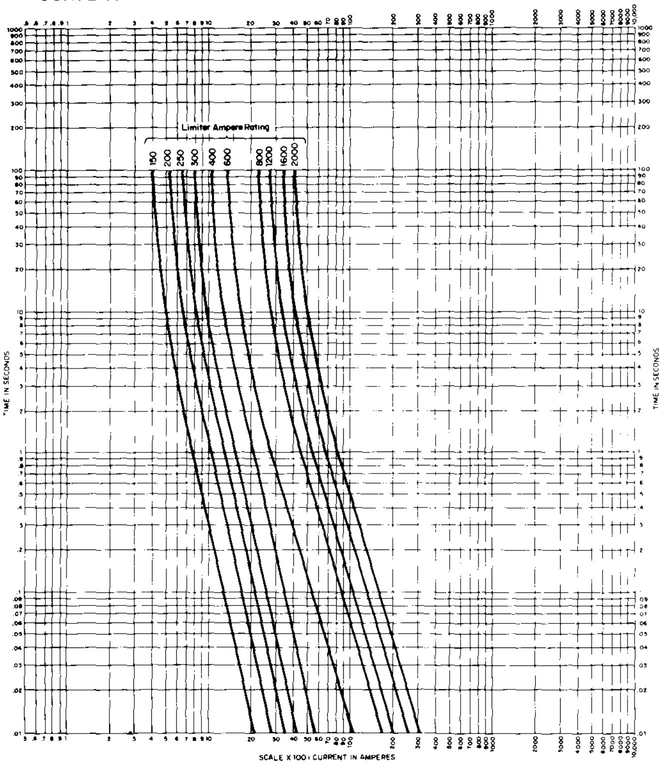
TABLE E

Minimum, recommended, and maximum limiter sizes for Type DSL-206 and DSL-416 breakers are given in the following table:

Breaker Type	Sensor Rating Amperes	Limiter Rating, Amperes Minimum ①	Recommended ②	Maximum ③
DSL-206	50 or 100	150	1200	2000
DSL-206	150	200	1200	2000
DSL-206	200	250	1200	2000
DSL-206	300	400	1200	2000
DSL-206	400	600	1200	2000
DSL-206	600	800	1200	2000
DSL-206	800	1200	1600	2000
DSL-416	600	800	2000	3000
DSL-416	800	1000	2000	3000
DSL-416	1200	2000	2500	3000
DSL-416	1600	3000	3000	3000

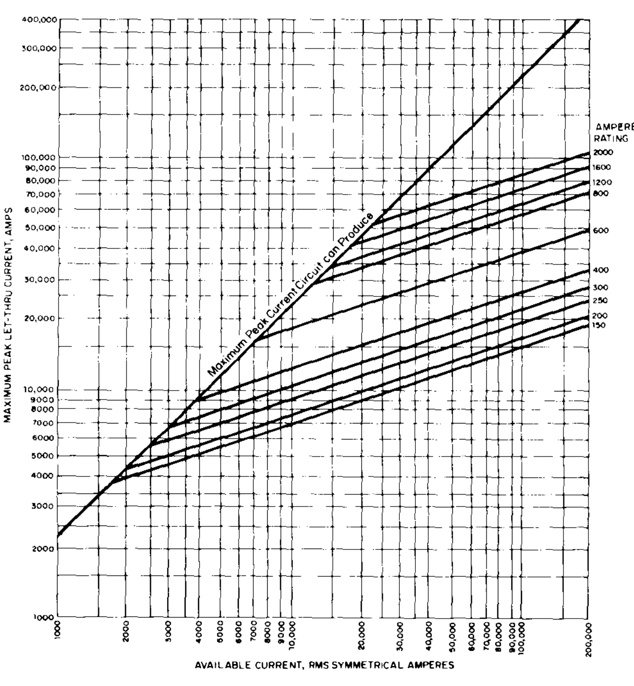
①For use only when protection of downstream equipment is required. Not completely co-ordinated with breaker to avoid nuisance blowing.
●Lowest rating which can be co-ordinated with breaker to minimize nuisance blowing.
③Highest available ratings, for protection of breaker only.
Limiters are mounted in separate trucks for the DSL-632 and DSL-840 breakers. Three sizes, 2500, 3000 and 4000 amps. capacity, are available for DSL-632. Five sizes, 2500, 3000, 4000, 5000 and 6000 amps. capacity, are available for DSL-840.

CURVE A



Type DSL-206 Limiters
Average Melting Time—Current Characteristics

CURVE B



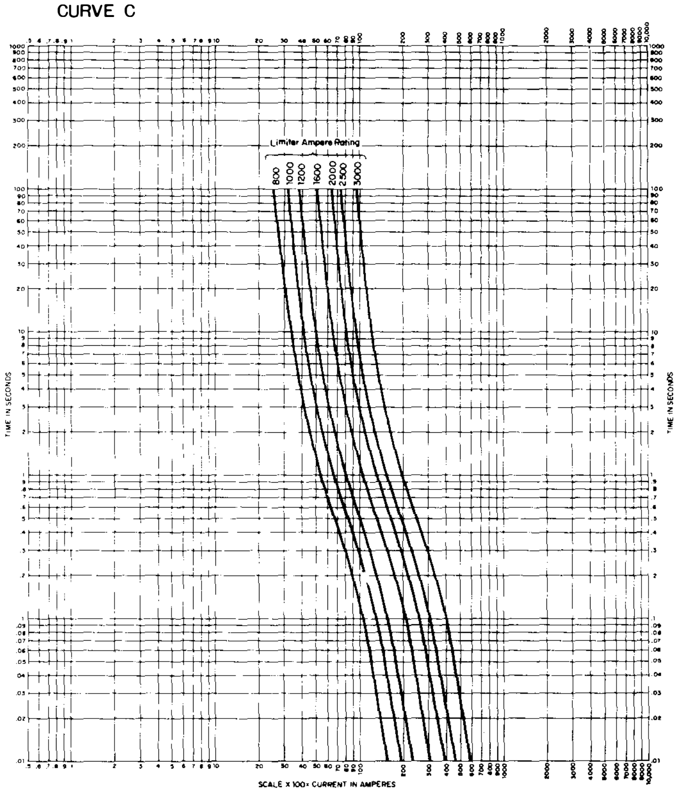
Type DSL-206 Limiters
Let Through Characteristics

POWER-ZONE® II LOW VOLTAGE METAL-ENCLOSED DRAWOUT SWITCHGEAR

APPLICATION DATA

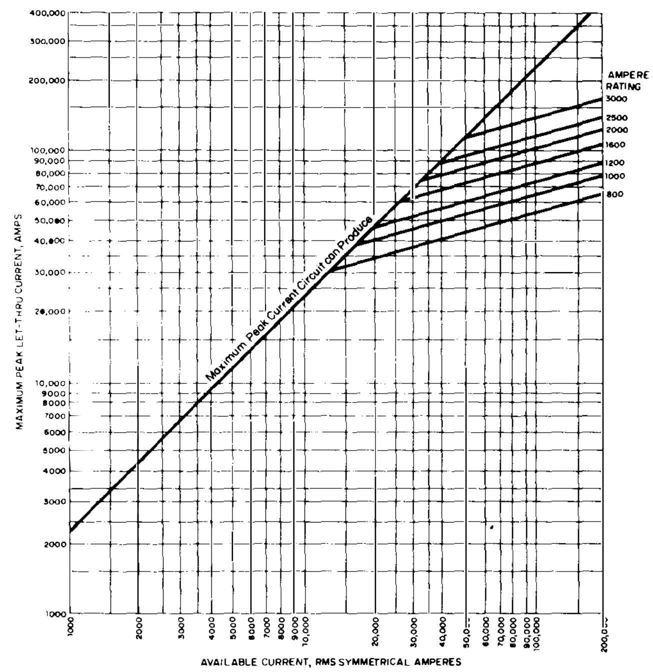
DSL FUSE LIMITERS

CURVE C



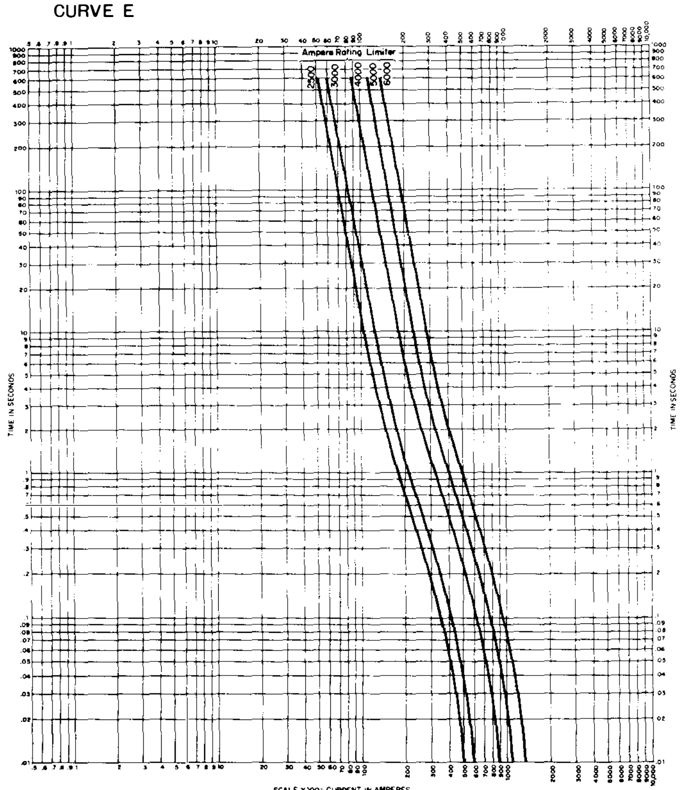
Type DSL-416 Limiters
Average Melting Time—Current Characteristics

CURVE D



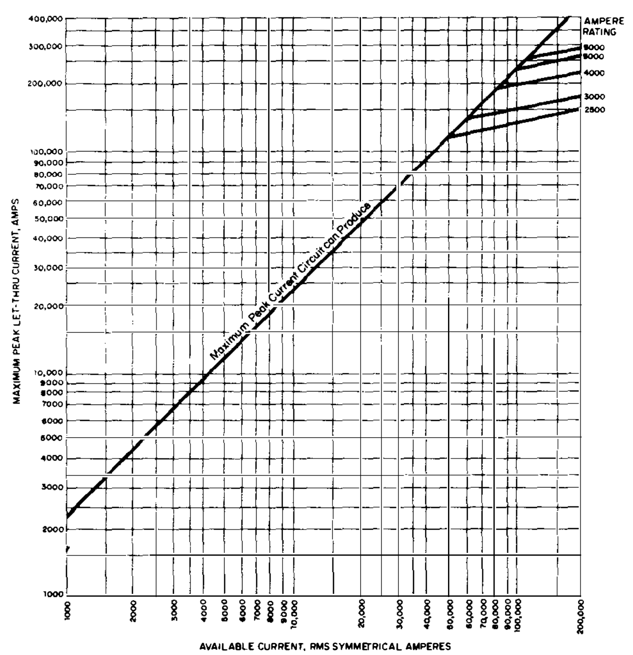
Type DSL-416 Limiters
Let Through Characteristics

CURVE E



Types DSL-632 and DSL-840 Limiters
Average Melting Time—Current Characteristics

CURVE F



Types DSL-632 and DSL-840 Limiters
Let Through Characteristics

APPLICATION DATA

GROUND FAULT PROTECTION

All type DS and type DSL low voltage power circuit breakers equipped with the Amptector I-A solid-state tripping unit can be provided with optional ground fault protection. Ground fault protection is not available on circuit breakers equipped with the Amptector II-A solid-state tripping unit. Multiple levels of ground fault protection can be selectively set by time-current coordination which meets all present codes and standards.

The ground element of the Amptector I-A provides two adjustable parameters: ground fault pick-up and ground fault time delay. The actual pick-up current is a function of the pick-up dial setting and the rating of the current sensors supplied with the circuit breakers as shown in Table D page 13. One of four dial settings (A, B, C or D) may be selected. Each setting results in a different pick-up value for a particular sensor rating. The pick-up point is that value of ground fault current which initiates the time delay cycle. The ground element time delay setting is continuously adjustable with calibrated points at 0.22, 0.35, and 0.5 seconds. (For zone selective interlocking with restraint signals, consult Square D Headquarters.)

Two types of sensing circuits are available. The application of a particular sensing circuit depends on the function of the circuit breaker involved. These two circuits are illustrated in figures A and B.

Figure A: Residual Main and Feeder Breaker
This configuration applies to main breakers of 3 wire systems or feeder breakers on 3 wire or 4 wire systems. The external sensor must be added when applied on feeder breakers of 4 wire systems.

Figure B: Source Neutral Main Breaker
This configuration applied to main breakers of 4 wire systems. The external sensor is placed on the neutral to ground link and is connected to the ground element terminals.

(For zero sequence ground fault protection or high resistance grounding, consult Square D Headquarters.)

FIGURE A
Residual Main and Feeder Breaker*

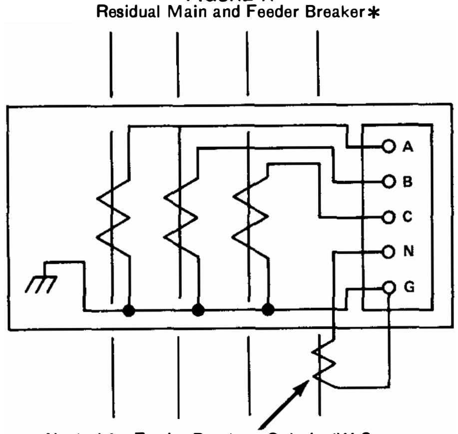
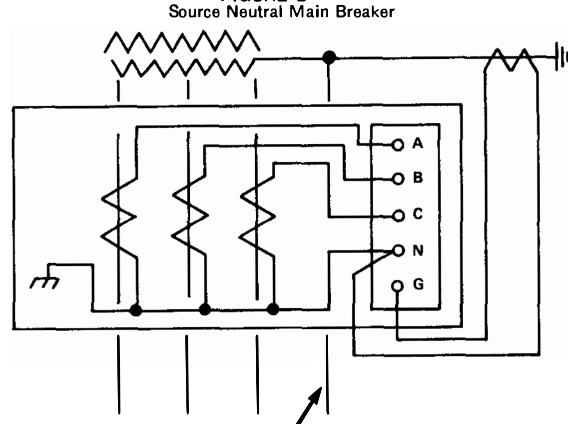


FIGURE B
Source Neutral Main Breaker



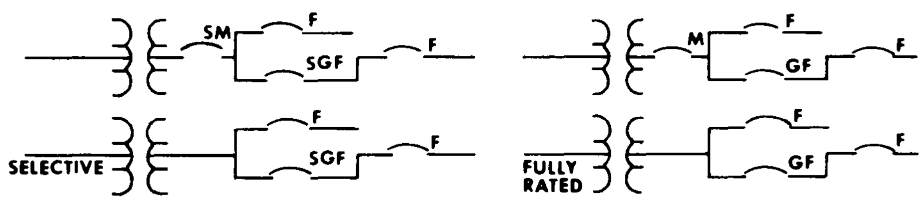
* Apply in 3 Wire Systems for Main Breaker and in 3 or 4 Wire Systems for Feeder Breakers.

POWER-ZONE® II LOW VOLTAGE METAL-ENCLOSED DRAWOUT SWITCHGEAR

APPLICATION DATA

SELECTION TABLES

Recommended Type DS
All Circuit Breakers
For Application with Transformers with impedances listed (Liquid, Dry Ventilated and Dry Sealed Type)



Transformer Rating 3 Phase Kva and Impedance Percent	Maximum Short Circuit Kva Available from Primary System	Rated Load Continuous Current Amperes	Short-Circuit Current① RMS Symmetrical Amperes: Transformer Alone	50% Motor Load (208V) 100% Motor Load (240V)	Combined	Selective Trip Systems: SM Selective Main Breaker	SGF Selective Group Feeder Breaker	F Feeder Breaker	Fully-rated Non-Selective Systems: M Main Breaker	F or GF Feeder or Group Feeder Breakers
TABLE A: 208 VOLTS—3 PHASE②										
300	50000		14900		16600		DS-206	DS-206		DS-206
5%	100000		15700		17400		DS-206	DS-206		DS-206
	150000	834	16000	1700	17700	DS-416	DS-206	DS-206	DS-416	DS-206
	250000		16300		18000		DS-206	DS-206		DS-206
	500000		16500		18200		DS-206	DS-206		DS-206
	Unlimited		16700		18400		DS-206	DS-206		DS-206
500	50000		23100		25900		DS-206	DS-206		DS-206
5%	100000		25200		28000		DS-206	DS-206		DS-206
	150000	1388	26000	2800	28800	DS-416	DS-206	DS-206	DS-416	DS-206
	250000		26700		29500		DS-206	DS-206		DS-206
	500000		27200		30000		DS-206	DS-206		DS-206
	Unlimited		27800		30600		DS-206S	DS-206		DS-206
750	50000		28700		32900		DS-206S	DS-206		DS-206
5.75%	100000		32000		36200		DS-206S	DS-206		DS-206
	150000	2080	33300	4200	37500	DS-632	DS-206S	DS-206	DS-632	DS-206
	250000		34400		38600		DS-206S	DS-206		DS-206
	500000		35200		39400		DS-206S	DS-206		DS-206
	Unlimited		36200		40400		DS-206S	DS-206		DS-206
1000	50000		35900		41500		DS-206S	DS-206		DS-206
5.75%	100000	2780	41200	5600	46800	DS-632	DS-416	DS-206S	DS-632	DS-206S
	150000		43300		48900		DS-416	DS-206S		DS-206S
	250000		45200		50800		DS-416S	DS-416S		DS-416
	500000		46700		52300		DS-416S	DS-416S		DS-416
	Unlimited		48300		53900		DS-416S	DS-416S		DS-416
TABLE B: 240 VOLTS—3 PHASE②										
300	50000		12900		15800		DS-206	DS-206		DS-206
5%	100000		13600		16500		DS-206	DS-206		DS-206
	150000	722	13900	2900	16800	DS-206	DS-206	DS-206	DS-206	DS-206
	250000		14100		17000		DS-206	DS-206		DS-206
	500000		14300		17200		DS-206	DS-206		DS-206
	Unlimited		14400		17300		DS-206	DS-206		DS-206
500	50000		20000		24800		DS-206	DS-206		DS-206
5%	100000		21900		26700		DS-206	DS-206		DS-206
	150000	1203	22500	4800	27300	DS-416	DS-206	DS-206	DS-416	DS-206
	250000		23100		27900		DS-206	DS-206		DS-206
	500000		23600		28400		DS-206	DS-206		DS-206
	Unlimited		24100		28900		DS-206	DS-206		DS-206
750	50000		24900		32100		DS-206S	DS-206		DS-206
5.75%	100000		27800		35000		DS-206S	DS-206		DS-206
	150000	1804	28900	7200	36100	DS-420	DS-206S	DS-206	DS-420	DS-206
	250000		29800		37000		DS-206S	DS-206		DS-206
	500000		30600		37800		DS-206S	DS-206		DS-206
	Unlimited		31400		38600		DS-206S	DS-206		DS-206
1000	50000		31000		40600		DS-206S	DS-206		DS-206
5.75%	100000		35600		45200		DS-416	DS-206S		DS-206S
	150000	2406	37500	9600	47100	DS-632	DS-416	DS-206S	DS-632	DS-206S
	250000		39100		48700		DS-416	DS-206S		DS-206S
	500000		40400		50000		DS-416	DS-206S		DS-206S
	Unlimited		41800		51400		DS-416S	DS-416		DS-416

M = Main breaker selected to have adequate interrupting and continuous ratings.
SM = Selective main breaker selected to have adequate interrupting, short-time and continuous current rating 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.

①Short circuit currents are calculated by dividing transformer full-load current by the sum of transformer and system impedance expressed in per unit. Motor contribution is assured to be 4 times total motor load.
②Standard sensor ratings are listed in a table on page 13.
Recommended Type DS
Air Circuit Breakers
For Application with Transformers with impedances listed (Liquid, Dry Ventilated and Dry Sealed Type)

PRINTED IN U.S.A.

POWER-ZONE® II LOW VOLTAGE METAL-ENCLOSED DRAWOUT SWITCHGEAR

APPLICATION DATA

SELECTION TABLES

Transformer Rating 3 Phase Kva and Impedance Percent	Maximum Short Circuit Kva Available from Primary System	Rated Load Continuous Current Amperes	Short-Circuit Current① RMS Symmetrical Amperes			Selective Trip Systems			Fully-rated Non-Selective Systems	
			Transformer Alone	50% Motor Load (208V) 100% Motor Load (240V)	Combined	SM Selective Main Breaker	SGF Selective Group Feeder Breaker	F Feeder Breaker	M Main Breaker	F or GF Feeder or Group Feeder Breakers
TABLE C: 480 VOLTS—3 PHASE ②										
500 5%	50000		10000		12400		DS-206	DS-206		DS-206
	100000		10900		13300		DS-206	DS-206		DS-206
	150000	601	11300	2400	13700	DS-206	DS-206	DS-206	DS-2C6	DS-206
	250000		11600		14000		DS-206	DS-206		DS-206
	500000		11800		14200		DS-206	DS-206		DS-206
	Unlimited		12000		14400		DS-206	DS-206		DS-206
750 5.75%	50000		12400		16000		DS-206	DS-206		DS-206
	100000		13900		17500		DS-206	DS-206		DS-206
	150000	902	14400	3600	18000	DS-416	DS-206	DS-206	DS-416	DS-206
	250000		14900		18500		DS-206	DS-206		DS-206
	500000		15300		18900		DS-206	DS-206		DS-206
	Unlimited		15700		19300		DS-206	DS-206		DS-206
1000 5.75%	50000		15500		20300		DS-206	DS-206		DS-206
	100000		17800		22600		DS-206	DS-206		DS-206
	150000	1203	18700	4800	23500	DS-416	DS-206	DS-206	DS-416	DS-206
	250000		19600		24400		DS-206	DS-206		DS-206
	500000		20200		25000		DS-206	DS-206		DS-206
	Unlimited		20900		25700		DS-206	DS-206		DS-206
1500 5.75%	50000		20600		27800		DS-206	DS-206		DS-206
	100000		24900		32100		DS-206S	DS-206S		DS-416
	150000	1804	26700	7200	33900	DS-420	DS-206S	DS-206S	DS-420	DS-416
	250000		28400		35600		DS-206S	DS-2C6S		DS-416
	500000		29800		37000		DS-206S	DS-206S		DS-416
	Unlimited		31400		38600		DS-2C6S	DS-206S		DS-416
2000 5.75%	50000		24700		34300		DS-206S	DS-206S		DS-416
	100000		31000		40600		DS-206S	DS-206S		DS-416
	150000	2406	34000	9600	43600	DS-632	DS-416	DS-416	DS-632	DS-416
	250000		36700		46300		DS-416	DS-416		DS-416
	500000		39100		48700		DS-416	DS-416		DS-416
	Unlimited		41800		51400		DS-416S	DS-416S		DS-632
2500 5.75%	50000		27900		39900		DS-416	DS-416		DS-416
	100000		36300		48300		DS-416	DS-416		DS-416
	150000	3010	40400	12000	52400	DS-632	DS-416S	DS-416S	DS-632	DS-632
	250000		44500		56500		DS-416S	DS-416S		DS-632
	500000		48100		62400		DS-416S	DS-416S		DS-632
	Unlimited		52300		64300		DS-416S	DS-416S		DS-632
TABLE D: 600 VOLTS—3 PHASE ②										
500 5%	50000		8000		9900		DS-206	DS-206		DS-206
	100000		8700		10600		DS-206	DS-206		DS-206
	150000	481	9000	1900	10900	DS-206	DS-206	DS-206	DS-206	DS-206
	250000		9300		11200		DS-206	DS-206		DS-206
	500000		9400		11300		DS-206	DS-206		DS-206
	Unlimited		9600		11500		DS-206	DS-206		DS-206
750 5.75%	50000		10000		12900		DS-206	DS-206		DS-206
	100000		11100		14000		DS-206	DS-206		DS-286
	150000	722	11600	2900	14500	DS-206	DS-206	DS-206	DS-206	DS-206
	250000		11900		14800		DS-206	DS-206		DS-206
	500000		12200		15100		DS-206	DS-206		DS-206
	Unlimited		12600		15500		DS-206	DS-206		DS-206
1000 5.75%	50000		12400		16300		DS-206	DS-206		DS-206
	100000		14300		18200		DS-206	DS-206		DS-206
	150000	962	15000	3900	18900	DS-416	DS-206	DS-206	DS-416	DS-206
	250000		15600		19500		DS-206	DS-206		DS-206
	500000		16200		20100		DS-206	DS-206		DS-206
	Unlimited		16700		20600		DS-206	DS-206		DS-206
1500 5.75%	50000		16500		22300		DS-206	DS-206		DS-206
	100000		20000		25800		DS-206	DS-206		DS-206
	150000	1444	21400	5800	27200	DS-416	DS-206	DS-206	DS-416	DS-206
	250000		22700		28500		DS-206	DS-206		DS-206
	500000		23900		29700		DS-206	DS-206		DS-206
	Unlimited		25100		30900		DS-206S	DS-206S		DS-206S
2000 5.75%	50000		19700		27400		DS-416	DS-416		DS-416
	100000		24800		32500		DS-206S	DS-206S		DS-206S
	150000	1924	27200	7800	34900	DS-420	DS-206S	DS-206S	DS-420	DS-206S
	250000		29400		37100		DS-206S	DS-206S		DS-206S
	500000		31300		39000		DS-206S	DS-206S		DS-206S
	Unlimited		33500		41200		DS-206S	DS-206S		DS-206S
2500 5.75%	50000		22400		32000		DS-206S	DS-206S		DS-206S
	100000		29200		38800		DS-206S	DS-206S		DS-206S
	150000	2406	32400	9600	42000	DS-632	DS-206S	DS-206S	DS-632	DS-206S
	250000		35600		45200		DS-416S	DS-416S		DS-416S
	500000		38500		48100		DS-416S	DS-416S		DS-416S
	Unlimited		41800		51400		DS-632	DS-632		DS-632

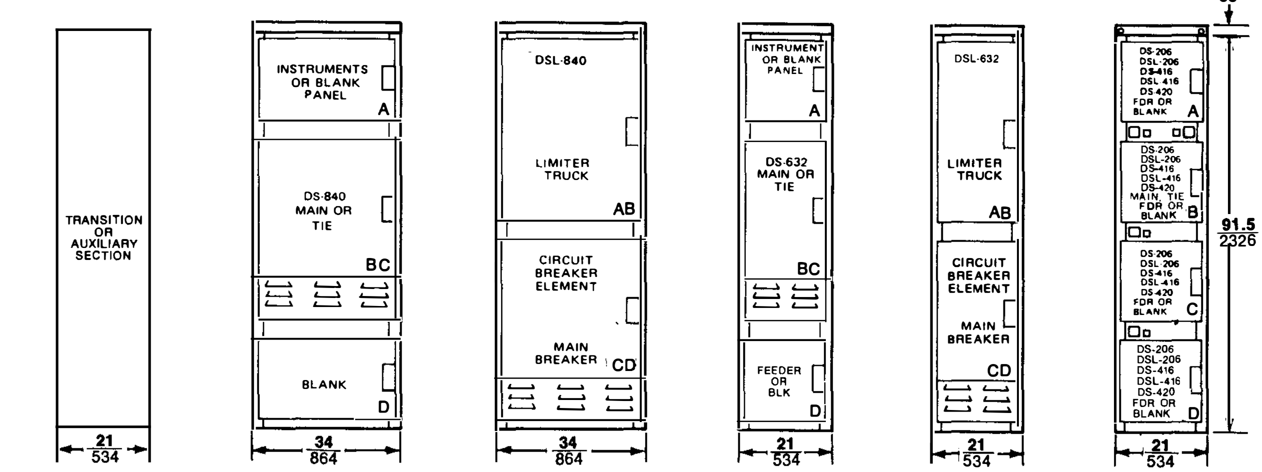
②Standard sensor ratings are listed in a table on page 13.

POWER-ZONE® II LOW VOLTAGE METAL-ENCLOSED DRAWOUT SWITCHGEAR

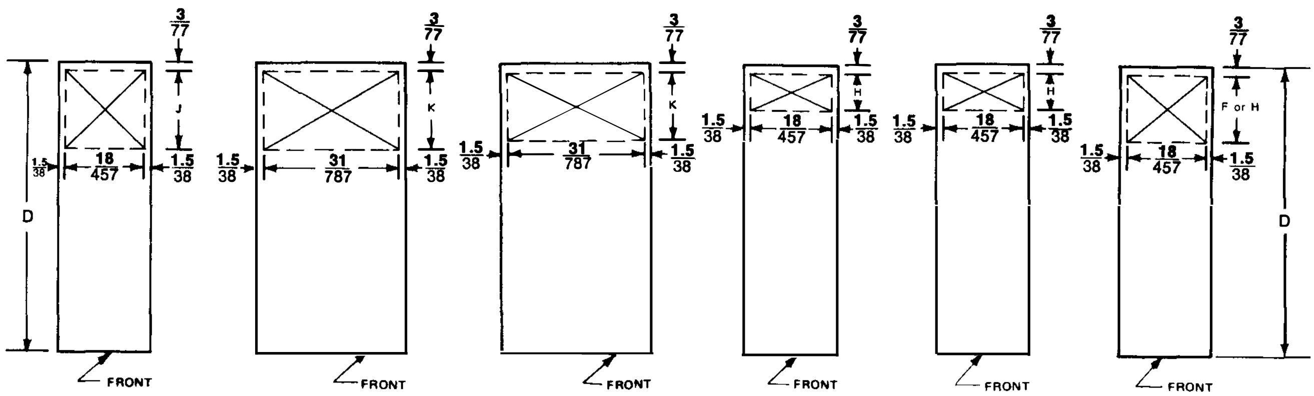
APRIL, 1983

APPLICATION DATA
DIMENSIONS
INDOOR CONSTRUCTION
APPROXIMATE DIMENSIONS—NOT FOR CONSTRUCTION

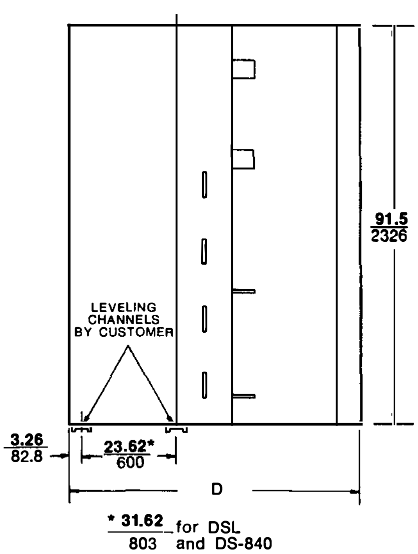
FRONT ELEVATIONS



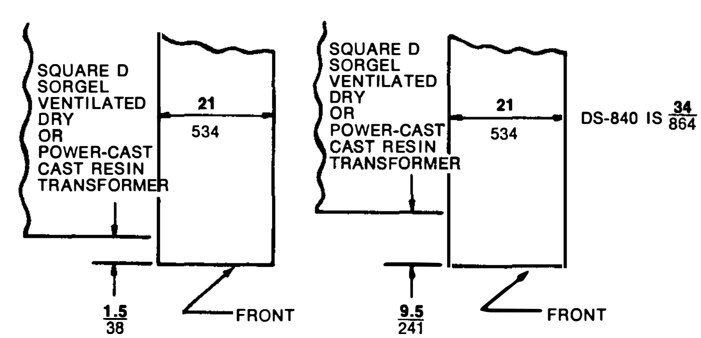
CONDUIT ENTRANCES



Dual Dimensions: INCHES / Millimeters



* 31.62/803 for DSL and DS-840



OFFSET DS (EXCEPT DS-840) OFFSET DSL, DS-840, AND DSL-840

SQUARE D — SORGEL VENTILATED DRY OR POWER- AST® CAST RESIN TRANSFORMER LINE-UP
FLOOR PLAN

FOR SEISMIC MOUNTING:
CONSULT SQUARE D HEADQUARTERS

POWER-ZONE® II LOW VOLTAGE METAL-ENCLOSED DRAWOUT SWITCHGEAR

APPLICATION DATA
DIMENSIONS
INDOOR CONSTRUCTION
APPROXIMATE DIMENSIONS—NOT FOR CONSTRUCTION

DIMENSIONS

Bus Size	Breaker Type	Section Depth D IN	Section Depth D mm	Conduit Area Depths F+ IN	F+ mm	H+ IN	H+ mm	K+ IN	K+ mm	J IN	J mm
1600A or 2000A	DS	**55** **60** **66** **72**	1397 1524 1677 1829	**8** **14** **20** **26**	203 355 508 660	— — — —	— — — —	— — — —	— — — —	**14** **20** **26** **32**	355 508 660 813
1600A or 2000A	DSL	**63** **68** **74** **80**	1600 1728 1880 2032	**8** **14** **20** **26**	203 355 508 660	— — — —	— — — —	— — — —	— — — —	**14** **20** **26** **32**	355 508 660 813
3000A or 4000A	DS (Except DS-840)	**60** **66** **72**	1524 1677 1829	— — —	— — —	**9** **15** **21**	228 381 533	— — —	— — —	**15** **21** **27**	381 533 685
3000A or 4000A	DSL (Except DSL-840)	**68** **74** **80**	1728 1880 2032	— — —	— — —	**9** **15** **21**	228 381 533	— — —	— — —	**15** **21** **27**	381 533 685
4000A	DS-840 DSL-840	**68** **74** **80**	1728 1880 2032	— — —	— — —	— — —	— — —	**14** **20** **26**	355 508 660	**20** **26** **32**	508 660 812

+Additional **6** (152mm) available if bottom compartment is blank.

Recommended Minimum Clearance:
Front — **42** (1067mm)
Rear — **42** (1067mm)
Ref. See NEC Article 110-16

METHOD FOR DETERMINING SECTION DEPTH AND CONDUIT AREA

1. Determine size of main bus from main breaker size and/or transformer output.
2. Select section depth acceptable — use deepest section possible. (Note: All DSL and DS-840 sections are **8** (203mm) deeper than standard DS. Use of DSL and/or DS-840 determines minimum depth of entire line-up.
3. Find conduit area available — CAUTION! Conduit area should be as large as possible. Much consideration must be given to area available when all conduits enter from top or bottom only.

For bus duct connections to sections, consult Square D Headquarters.

APPROXIMATE WEIGHTS

Type of Device	Lbs.	Kg.
DS-206 Breaker	**175**	79
DS-416 Breaker	**180**	82
DS-420 Breaker	**192**	87
DS-632 Breaker	**300**	136
DS-840 Breaker	**405**	184
DSL-206 Breaker	**205**	93
DSL-416 Breaker	**255**	116
DSL-632 Limiter Truck	**325**	147
DSL-840 Limiter Truck	**430**	195
4-High Unit w/o Breakers	**1208**	548
Auxiliary Unit w/o Devices	**500**	227

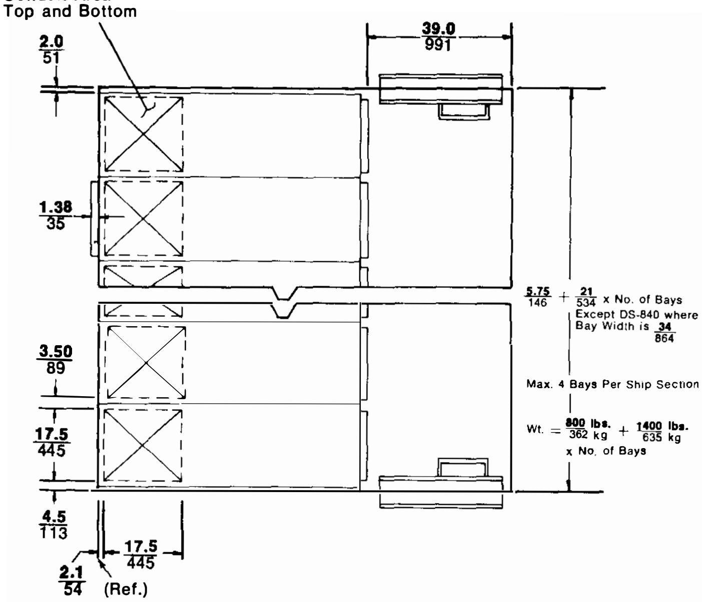
Dual Dimensions: $\frac{\textbf{INCHES}}{\text{Millimeters}}$

POWER-ZONE® II LOW VOLTAGE METAL-ENCLOSED DRAWOUT SWITCHGEAR

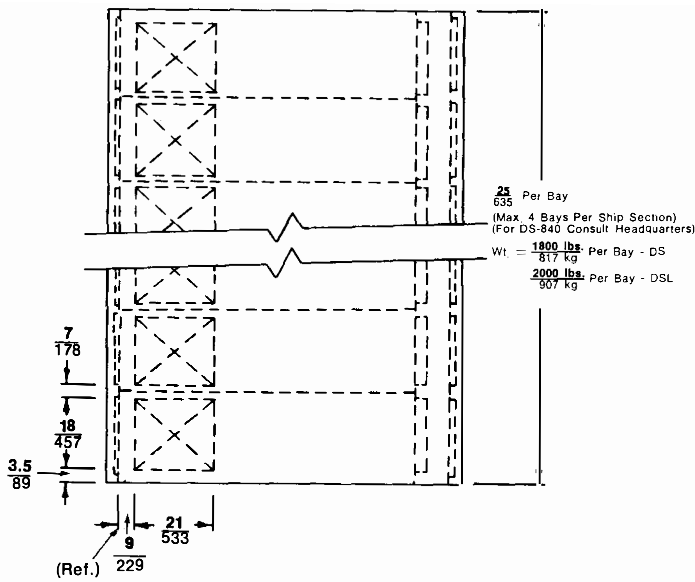
APPLICATION DATA
DIMENSIONS
OUTDOOR ENCLOSURES
APPROXIMATE DIMENSIONS—NOT FOR CONSTRUCTION

FLOOR PLAN

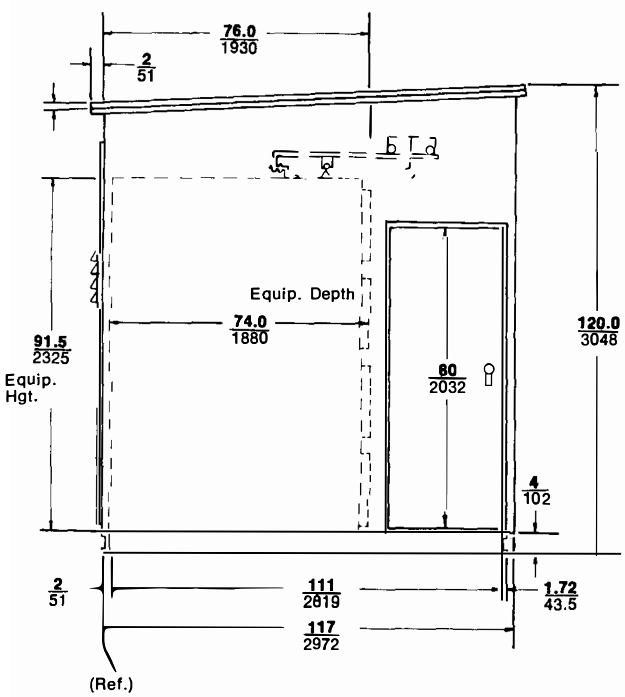
NEMA 3R WALK-IN

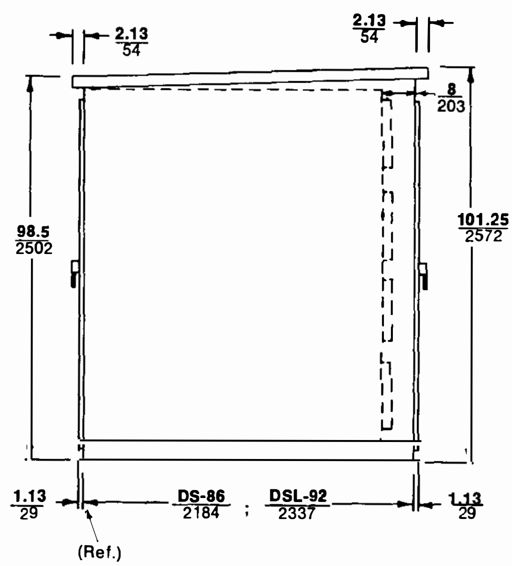


NEMA 3R NON WALK-IN



SIDE ELEVATION





Dual Dimensions: INCHES / Millimeters

POWER-ZONE® II LOW VOLTAGE METAL-ENCLOSED DRAWOUT SWITCHGEAR

APPLICATION DATA

SUGGESTED SPECIFICATIONS

General
The specifications and associated drawings describe the indoor Low Voltage Metal-Enclosed Drawout Switchgear Assembly. The assembly is to be designed for use on a ——— volt, (single) (3) phase, ——— wire, (50) (60) Hz. system, with ——— amperes symmetrical fault current available. Equipment is to be complete from the incoming line connections to the outgoing feeder connections. Any items not specifically mentioned but obviously necessary for proper operation are implied in this description.

The switchgear shall be POWER-ZONE II® Low Voltage Metal-Enclosed Drawout Switchgear, as manufactured by the Square D Company, or approved equal, designed, manufactured and tested in accordance with applicable NEMA, ANSI and IEEE Standards for power circuit breakers and metal-enclosed switchgear. The enclosure shall be finished with medium gray ANSI-49 enamel applied over a rust inhibiting phosphate primer. (Equipment shall be equipped with (UL) (service entrance) label where qualified.)

Enclosure
The enclosure and internal barriers shall be fabricated of steel members in accordance with NEMA and ANSI Standards. A lifting bar is to be provided with each shipping group for lifting the structure from the top with a crane. Supply a wooden skid to permit the use of pipe rollers for moving the switchgear to its final location inside the building.

The enclosure construction shall prevent the entry of rodents into the switchgear interior. Ventilation openings on the front of the switchgear breaker compartments are to be located in such a way as to preclude the possibility of metal objects being inserted through them and easily contacting energized parts.

The equipment shall be assembled, adjusted and tested at the factory and shall be sectionalized, if required, for shipment as requested or approved. The largest section is not to exceed ——— inches wide, ——— inches deep, and ——— inches high to enable installation at the job site.

The structure is to consist of three basic compartments from front to rear: the Front Breaker Compartment, the Center Bus Compartment, and the Rear Cable Compartment.

Front Breaker Compartment
The front compartment is to contain the drawout circuit breaker elements, each mounted in its own barriered cell. Circuit breaker cells to have dual steel front barriers. One barrier to be the full cell door covering circuit breaker manual operating controls. The second barrier to be the front of the circuit breaker element covering the circuit breaker mechanism. Cell doors to be equipped with external trip buttons. Active or future use cells equipped to accept circuit breakers are to be complete with the circuit breaker drawout mechanism and all current-carrying parts.

Center Bus Compartment
The bus compartment is to contain the section riser and main cross bus which is to be rated for a 65 degree Centigrade temperature rise. The main cross bus shall be rated for ——— continuous amperes. All main and riser bus is to be (welded aluminum) (bolted copper) and be adequately braced to withstand the short circuit of ——— symmetrical amperes. When the cross bus is split for shipping purposes, all contact surfaces at the joint shall be plated and the joint bolts are to be of high strength grade 5 steel equipped with Belleville type spring washers. All electrical clearances are to be for 600 volts ac. (An isolated neutral bus is to be supplied rated at (50) (100) percent of the phase current.)

Rear Cable Compartment
Size the cable compartment to accommodate all incoming and outgoing cables required within each vertical switchgear section. Cable lugs are to be mounted on the load side (or line side as applicable) run-back bus which is extended into this compartment from the bus compartment. Run-back bus for main or feeder breakers is to be insulated from the section riser and cross bus. This compartment shall also contain a plated (aluminum) (copper) ground bus bolted directly to the switchgear frame. (Extend a neutral stud into the cable compartment in each vertical section for connection of neutral conductors. A bus connection shall be provided for connecting the neutral to the ground bus with a removable isolating link). Clamp type cable lugs suitable for use with aluminum or copper cable are to be supplied as shown on the plans.

(OPTION 1) As a safety precaution to prevent accidental contact with live parts during maintenance procedures, the center bus compartment containing the section riser bus and main cross bus shall be segregated from the rear cable compartment by means of metal barriers.

*— ( ) indicates a selection is to be made for quantity or applicability.

POWER-ZONE® II LOW VOLTAGE METAL-ENCLOSED DRAWOUT SWITCHGEAR

APPLICATION DATA

SUGGESTED SPECIFICATIONS

Circuit Breakers
The circuit breakers shall be of the drawout type, manually or electrically operated type DS (DSL) as shown on the associated drawings or as listed in the equipment tabulation. The breakers are to mount on a rigid, self-aligning drawout mechanism with "connected", "test", "disconnected", and "remove" positions. The front door shall be capable of being closed in the "connected", "test", or "disconnected" positions. Provide interlocks to insure the breaker is open before it can be moved from any position or when it is between positions. Include an interlock to discharge the stored energy spring before the breaker element can be withdrawn from its cell. In the "test" and "connected" positions, provide a positive ground contact between the breaker element and the structure. The circuit breaker trip device is to be of a solid-state design which requires no external power connections and is provided with an adjustable long-time delay, instantaneous and (short-time delay) over-current/short circuit protection. (Include ground fault tripping as an integral part of the solid-state trip device where shown.) Settings are to be continuous between calibrated points. Provisions for testing and calibrating shall be provided. (Indicators for overload, short circuit, or ground trip shall be provided.) (Breakers are to have U. L. label.)

The breaker operating mechanism is to be of the two-step stored energy quick-make, quick-break type. One stroke of the operating handle or one operation cycle of the breaker motor is to charge the closing springs and operation of a local "close" button is to close the breaker contacts. Closing of the breaker contacts shall automatically charge the opening springs to insure quick-break operation.

Padlocking provisions shall be furnished to receive up to three padlocks when the breaker is in the open position, positively preventing unauthorized closing of the breaker contacts. A manual trip button and position indicator shall be furnished.

Include the following only when type DSL breakers are specified: (Circuit breakers shall be equipped with current limiters. Current limiters shall be integrally mounted on 800A. and 1600A. frame sizes and separately mounted on 3200A. and 4000A. frame sizes. Equip each breaker with a blown limiter indicator visible from the front of the breaker, and with an anti-single phase device which will trip the breaker when any limiter blows, and which will prevent reclosing the breaker on a single phase condition resulting from blown or missing limiters.)

The following equipment shall be provided:
(1) (2) — Type DS-______ main breaker(s), ______ ampere frame 3-pole, (manually) (electrically) operated. Tripping sensors rated ______ amperes.
— Type DS-______ tie breaker, ______ ampere frame, 3-pole, (manually) (electrically) operated. Tripping sensors rated ______ amperes.
— Type DS-______ feeder breaker(s), ______ ampere frame, 3-pole, (manually) (electrically) operated. Tripping sensors rated ______ amperes.
— Type DS-______ feeder breaker(s), ______ ampere frame, 3-pole, (manually) (electrically) operated. Tripping sensors rated ______ amperes.

Metering Components
Main Bus
(1) (2) — (2%) (1%) voltmeter and 3-phase selector switch with OFF position.
(1) (2) — (2% (1%) ammeter and 3-phase selector switch with OFF position.
(1) (2) — Watthour meter, (2) (2½) (3) element type, (with) (without) demand register.
______ — Current transformer, suitable ratio.
______ — Potential transformer, suitable ratio.

Feeder Circuits
______ — 2% ammeter and 3-phase selector switch with OFF position.
______ — Current transformer, suitable ratio.

(OPTION 2) A portable testing and calibration device shall be provided.

*— ( ) indicates a selection is to be made for quantity or applicability.