

POWER-ZONE[®] Load Center Unit Substations

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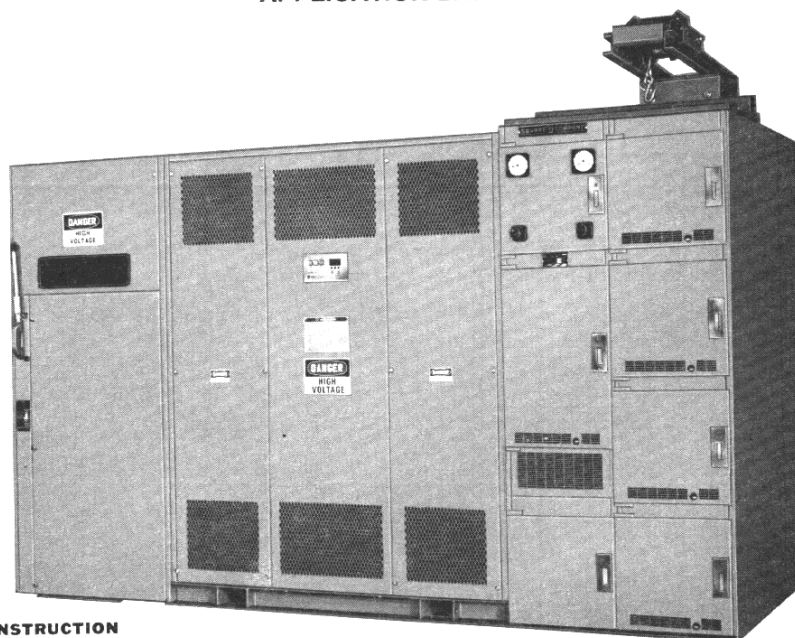
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SQUARE D COMPANY

POWER-ZONE® LOAD CENTER UNIT SUBSTATIONS APPLICATION DATA

JUNE, 1984



- INDOOR OR OUTDOOR CONSTRUCTION
- DRY OR LIQUID FILLED TRANSFORMERS
- PRIMARY VOLTAGES UP TO 34,500 VOLTS
- SECONDARY VOLTAGES UP TO 600 VOLTS
- LOAD RATINGS UP TO 3,000 KVA

GENERAL

Planning modern industrial, commercial, and institutional electrical systems demands serious consideration of primary voltage power distribution systems. The POWER-ZONE LOAD CENTER UNIT SUBSTATION is a coordinated piece of equipment designed to receive electrical power at voltages up to 34,500 volts, transform it to low utilization voltages of 600 volts or less, and control its distribution to nearby load areas. Such a system, in addition to being more reliable, also possesses operation more desirable, and normal maintenance more convenient. Better systems at lower cost frequently result from the many operational and economical advantages:

Savings: Power is purchased at lower primary power rates. Transformation to the utilization voltage at the load center replaces costly long high current low voltage feeder circuits with less expensive primary cable in the distribution system.

Better System Performance: Primary voltage distribution systems feeding load center transformers will minimize system voltage drop and improve voltage regulation. Unit substations also divide the electrical system into independent load areas so that when a short circuit occurs, less damage results, and it is easily isolated without affecting the service to the rest of the system.

Easier Location: Lightweight, compact metal enclosed construction enables convenient location in load areas without need for special foundations, vaults, or isolation rooms (except oil-filled transformers). Smaller primary voltage distribution conductors are more easily routed than large high

current low voltage feeders. For greater flexibility, the low voltage distribution section may be either to the right or the left of the transformer.

Safety: The live parts of all electrical devices are completely enclosed in a grounded steel enclosure to prevent operating personnel from contacting them. Internal steel barriers isolate the incoming line, transformer, and low voltage distribution sections from each other for separate accessibility. All equipment is designed and built in accordance with the latest NEMA and ANSI standards.

Ease of Installation: The equipment is divided into factory coordinated shipping sections for ease of handling and re-bolting at the job site. Incoming and outgoing connections are readily accessible and easily made.

Ease of Expansion: New unit substations are easily added to primary voltage distribution systems with little effect on the existing equipment. Additional incoming line or low voltage distribution sections can be added to an existing unit substation.

Little Maintenance: The equipment consists of components designed for minimum maintenance. The enclosure construction and system design allows for routine servicing and convenient inspection with minimum downtime of only a small part of the system.

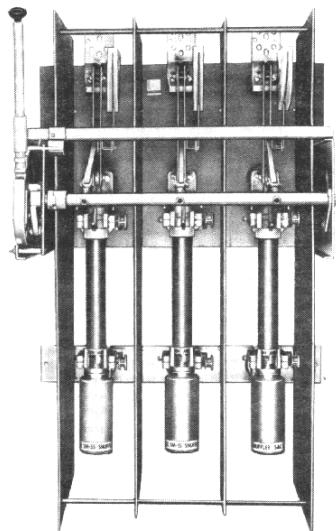
Manufacturer's Responsibility: Unit substations are engineered and completely coordinated by the Square D Company and backed by its warranty and field service facilities.



POWER-ZONE® LOAD CENTER UNIT SUBSTATIONS

INCOMING LINE SECTION APPLICATION DATA

CLASS
6020



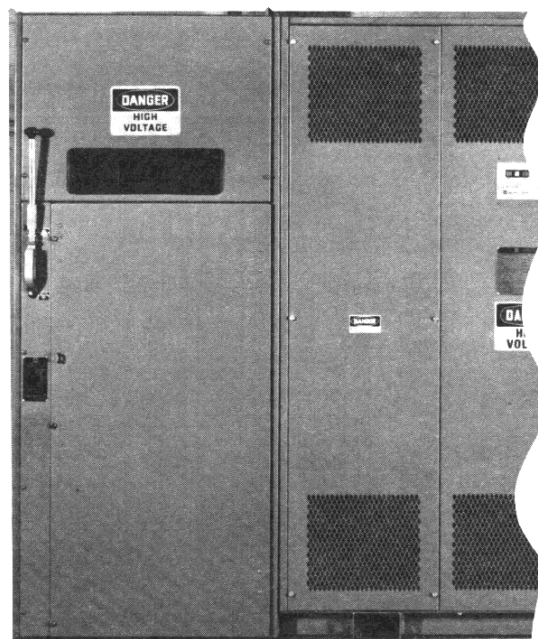
TYPE HVL LOAD INTERRUPTER SWITCH

Most POWER-ZONE LOAD CENTER UNIT SUBSTATIONS are supplied with a type HVL Load Interrupter Switch. The basic HVL switch is an air-insulated, 3-pole 2-position load break device with a quick-make, quick-break stored energy spring mechanism. When the handle is in the UP position the switch is closed, and when the handle is in the DOWN position, the switch is open. Each enclosure is supplied with a Lucite AR viewing window, DANGER HIGH VOLTAGE sign, and a ground bus.

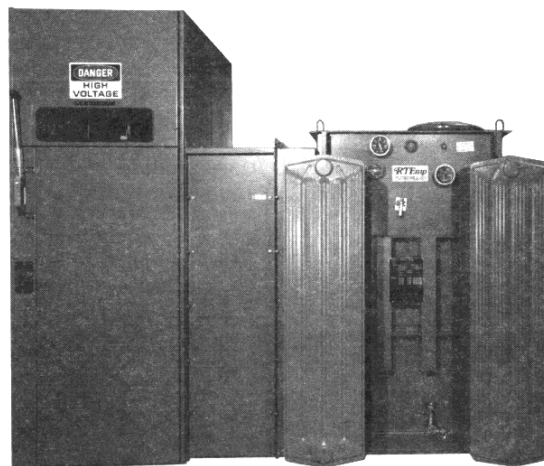
Fuses are generally used in conjunction with the HVL switch to provide short circuit protection. They are normally mounted vertically below the switch on the load side so they are de-energized when the switch is open. When mounted in the enclosure, the fuses are visible through the viewing window, readily accessible through a door interlocked with the switch mechanism and are easily removed with a fuse handling tool. Many types of current limiting and boric acid fuses can be provided with the Square D type HVL switch.

Duplex Switches for two incoming services can be provided by using key interlocked HVL switches with their load sides connected together to feed a common load. Each incoming feeder is isolated in its own switch enclosure by this arrangement. The switches may be fused or not-fusible and interlocked in any manner, depending on the distribution system.

For detailed descriptive and rating information, see Catalog Class 6040.



INDOOR TYPE HVL LOAD INTERRUPTER
SWITCH CLOSE COUPLED TO A DRY TYPE
TRANSFORMER



INDOOR-TYPE HVL LOAD
INTERRUPTER SWITCH FOR
CONNECTION TO LIQUID FILLED
TRANSFORMER



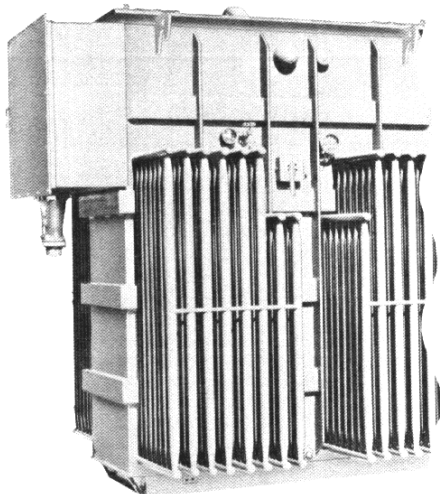
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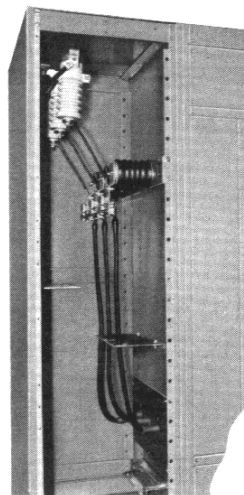
POWER-ZONE® LOAD CENTER UNIT SUBSTATIONS INCOMING LINE SECTION APPLICATION DATA

JUNE, 1984

TERMINAL CHAMBERS



WITH POTHEAD—MOUNTED ON
LIQUID FILLED TRANSFORMER

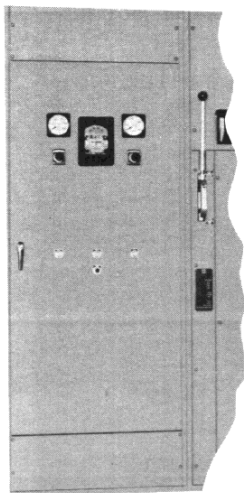


WITH CABLE LUGS—MOUNTED
NEXT TO DRY TYPE TRANSFORMER

Air terminal chambers are the simplest type of incoming line section, but offer no overcurrent protection for the substation and should only be used where such protection is provided elsewhere. A free-standing enclosure is provided for a dry type transformer. A simple junction box is usually provided with a liquid-filled transformer, but a full

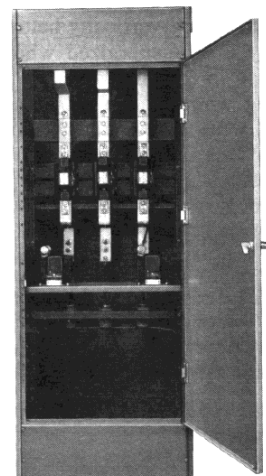
height terminal chamber can be supplied. Terminal chambers can be supplied with cable lugs, potheads, terminators, or other additional components as required. These are easily accessible through bolted closure plates. Adequate space is provided for stress cones or other termination of incoming cables.

PRIMARY METERING



INDOOR USER METERING

Metering bays for user or power company equipment are available. They may be supplied fully equipped with necessary current transformers, potential transformers, meters, and associated devices, or with provisions for installing power company components at the job site. Standardized metering bays match the adjacent switchgear and incorporate all special requirements of the power company.



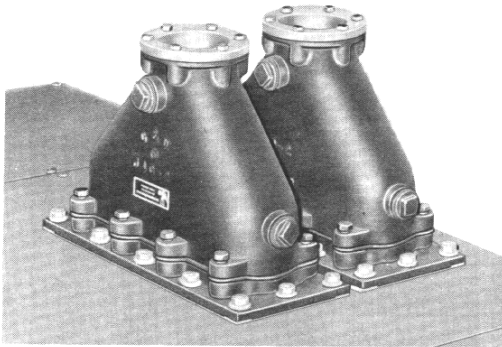
INDOOR POWER COMPANY METERING

POWER-ZONE® LOAD CENTER UNIT SUBSTATIONS

INCOMING LINE SECTION
APPLICATION DATA

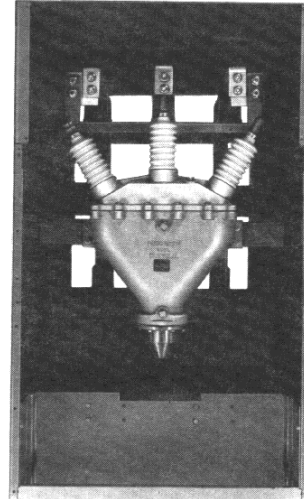
CLASS
6020

ADDITIONAL COMPONENTS

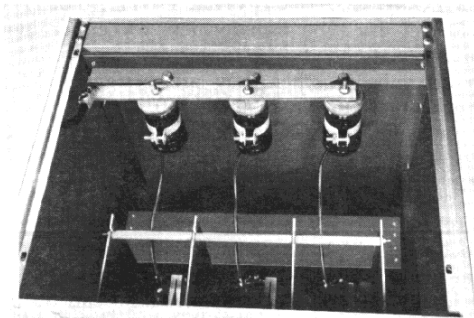


FLANGE MOUNTED POTHEAD

Potheads are available for all types of single or multiple conductor primary cables for top or bottom entrance into interrupter switches or terminal chambers. Potheads are desirable in many applications despite their expense, time consumed in termination, and often requiring larger equipment enclosures. Cable manufacturer's recommendations should be followed in their use.

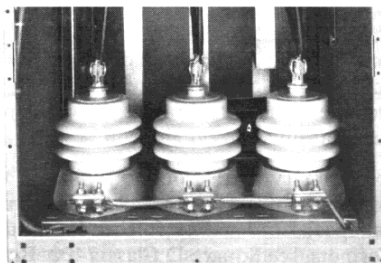


POTHEAD INTERNALLY MOUNTED

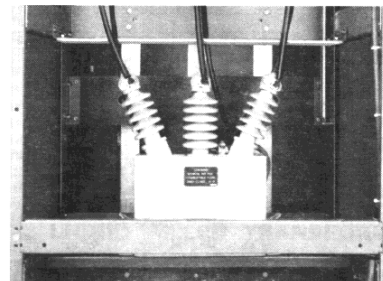


DISTRIBUTION CLASS ARRESTERS

Lightning arresters are available to protect the cable, incoming line equipment, and transformers from lightning and high voltage switching surges. Distribution type arresters are adequate for many applications, but larger more expensive intermediate or station type arresters can be provided. Surge capacitors may also be supplied with lightning arresters to offer additional protection. Due to the peculiar nature of voltage surges, one set of lightning arresters often will not protect the entire system; in this case it is usually desirable to connect a set of lightning arresters near the terminals of each piece of equipment on the primary distribution system.



STATION CLASS ARRESTERS



SURGE CAPACITOR



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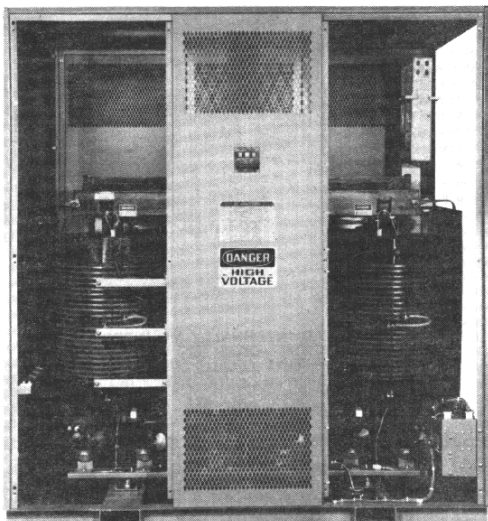
POWER-ZONE® LOAD CENTER UNIT SUBSTATIONS

JUNE, 1984

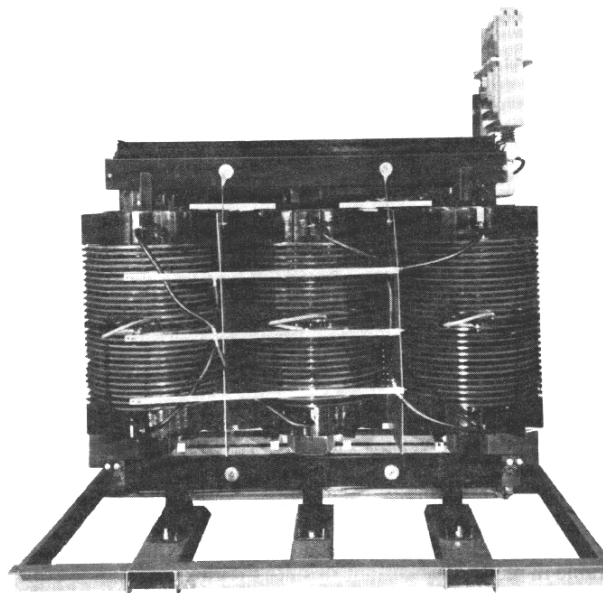
TRANSFORMER SECTION APPLICATION DATA

OPEN VENTILATED DRY TYPE

- 225 TO 2,500 KVA SELF-COOLED RATINGS
- UP TO 95 KV BIL INSULATION
- NEMA 220°C. INSULATION SYSTEM
- PRIMARY: 2,400, 4,160, 4,800, 7,200, 12,000, 12,470, 13,200, 13,800, 14,400, 22,900, 26,400, OR 34,500 VOLTS
- SECONDARY: 208Y/120, 240, 480Y/277, 480, 600, 2,400, OR 4,160 VOLTS



INDOOR ENCLOSURE FOR OPEN VENTILATED
DRY TYPE

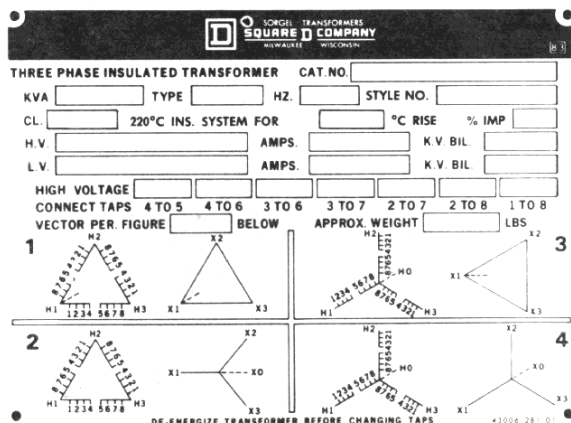


CORE AND COIL ASSEMBLY

POWER-ZONE LOAD CENTER UNIT SUBSTATIONS utilize Sorgel dry type transformers for either indoor or outdoor applications. A 220°C. insulation system is standard on all units whether they are designed for 150°C. standard temperature rise above 40°C. ambient, or for 115°C. or 80°C. Standard coils have four primary taps — two 2½ % taps above and two 2½ % taps below rated voltage.

The core and coil assembly is mounted in a heavy gauge steel enclosure which matches the height and depth of the adjacent incoming line and secondary distribution sections. The welded structural steel channel base can be used for lifting, jacking, or rolling the unit into position. Liberally designed ventilation openings at the top and bottom of the front and rear screw-removable panels provide free circulation of cooling air. The addition of cooling fans increases the capacity of the transformer by 33⅓ % for short time load peaks or emergency overloads. Standard NEMA or extra quiet guaranteed sound levels can be supplied. The core and coil assembly is mounted on sound isolation pads; primary connections are made with flexible cable, and secondary connections with braided flexible connectors to reduce sound transmission.

Special taps, primary and secondary voltages, temperature rise, fan cooling controls and larger capacity units can be obtained on special order. For further information on dry type transformers, see Square D Class 7400/Bulletin D1-C, D1-E and D1-G.



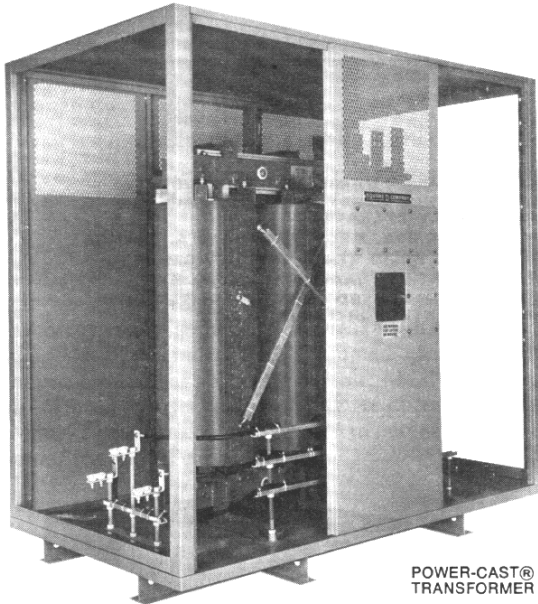
TYPICAL DIAGRAMMATIC NAMEPLATE



POWER-ZONE® LOAD CENTER UNIT SUBSTATIONS

TRANSFORMER SECTION APPLICATION DATA

CLASS
6020



POWER-CAST®
TRANSFORMER

•225 TO 5,000 KVA SELF-COOLED RATINGS
•PRIMARY: 2,400, 4,160, 4,800, 6,900, 7,200, 8,320, 12,000, 12,470, 13,200, 13,800, 14,400, 22,900, 26,400, OR 34,400 VOLTS
•SECONDARY: 208Y/120, 240, 480Y/277, 480, 600, 2,400, OR 4,160 VOLTS

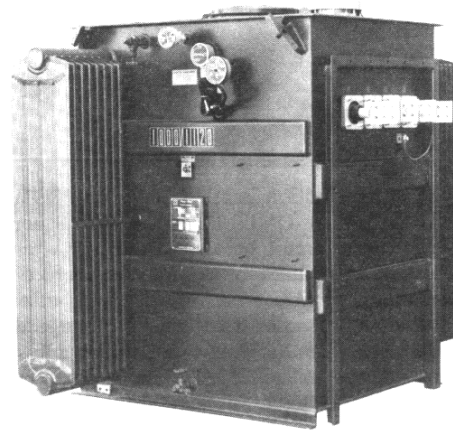
POWER-CAST® AND POWER-CAST® II TRANSFORMERS

POWER-CAST® and POWER-CAST® II Transformers are fabricated with a solid dielectric completely encapsulating the primary and secondary coils. The copper windings of the Power-Cast® transformer and the aluminum windings of the Power-Cast® II transformer are permanently embedded between layers of fiberglass cloth and impregnated in a vacuum molding process with a high temperature resin.

The result is a power transformer of unsurpassed characteristics. Among the benefits of this design are: Impulse ratings comparable to oil-filled transformers, superior dynamic short circuit strength, exceptional short-time thermal overload capability, outstanding resistance to moisture and atmospheric contaminants and a low maintenance factor.

The unique proven design and proprietary manufacturing techniques used in the Power-Cast® and Power-Cast® II transformers were developed nearly two decades ago, and have been continuously employed in the construction of power transformers now in operation in all parts of the world.*

The primary coil and secondary coil are vacuum cast. Space is left between the primary and secondary coil assemblies to assure air circulation and heat dissipation. In larger units, air ducts are cast into the coil assemblies for the same purpose.



FLUSH END
CONSTRUCTION FOR
UNIT SUBSTATION

LIQUID FILLED TRANSFORMERS

POWER-ZONE Load Center Unit Substations are available with liquid-filled transformers. Mineral oil, RTemp or silicone filled unit can be supplied.

*Power-Cast transformers are built under a license from the May and Christe Company of West Germany.



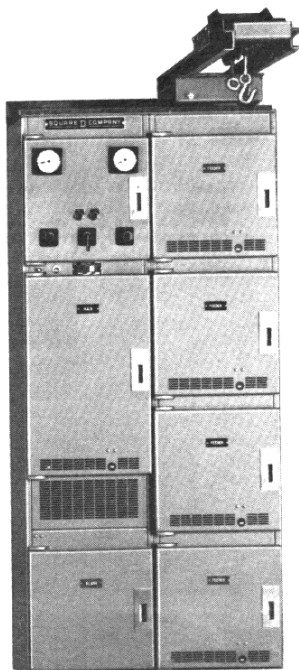
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POWER-ZONE®
LOAD CENTER UNIT SUBSTATIONS
LOW VOLTAGE DISTRIBUTION SECTIONS
APPLICATION DATA

JUNE, 1984

POWER CIRCUIT BREAKER DRAWOUT SWITCHGEAR

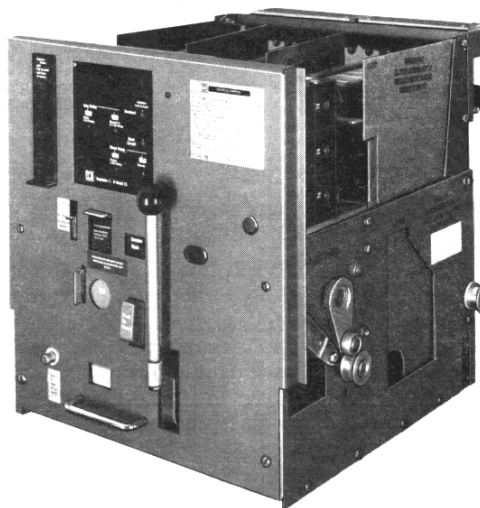


- METAL ENCLOSED DRAWOUT CONSTRUCTION
- STORED ENERGY BREAKER MECHANISM MANUALLY OR ELECTRICALLY OPERATED
- 800, 1,600, 2,000, 3,200, AND 4,000 A. FRAMES
- ADJUSTABLE SOLID STATE TRIP DEVICES
- INTERRUPTING RATINGS TO 85,000 A. SYM.
- INTEGRALLY-MOUNTED CURRENT LIMITERS FOR 200,000 A. INTERRUPTING CAPACITY

CONSTRUCTION

The low voltage distribution section of many POWER-ZONE LOAD CENTER UNIT SUBSTATIONS consists of low voltage power circuit breaker drawout switchgear which provides a combination of the most modern circuit breaker devices with flexible structure design to offer the maximum in system protection to most low voltage distribution requirements. The self-powered fully adjustable solid state trip devices utilized in the circuit breaker elements provide completely coordinated over current and short circuit protection with the availability of narrow trip bands, selective tripping, and integrally mounted ground fault protection.

The structure is completely compartmentized to isolate each circuit breaker in its own cell. A full height load side rear cable compartment eliminates the need for pull boxes and may be optionally isolated from the bus compartment in front of it. Standardized busing provides most of the common low voltage distribution busing arrangements and is equipped for future extension. Cable or busway connections are easily made out the top, bottom, or other locations as required.



ACCESSORIES

Standard accessories easily provided are: secondary metering, including transformers, feeder metering, electrical, mechanical, and key interlocking, breaker element lifting device, and an array of tripping and auxiliary functions available on the breaker elements. For detailed descriptive and rating information, see Catalog Class 6030.



POWER-ZONE®
LOAD CENTER UNIT SUBSTATIONS
 LOW VOLTAGE DISTRIBUTION SECTIONS
 APPLICATION DATA

CLASS
6020

MOLDED CASE DRAWOUT SWITCHBOARDS
TYPE MCDO II

UTILIZES TYPE SE SOLID STATE TRIP CIRCUIT BREAKERS

- 100% CONTINUOUS DUTY RATED
- 7 FUNCTION ADJUSTABLE SOLID STATE TRIP DEVICE
- STORED ENERGY MECHANISM, MANUALLY OR ELECTRICALLY OPERATED
- INTERRUPTING RATINGS TO 150,000 AMPERES SYMMETRICAL
- INTEGRAL ZONE SELECTIVE INTERLOCKING AVAILABLE
- MAXIMUM 5 CYCLE CLOSING

MAIN BUS RATINGS TO 3,000A.

- LOREST™ PLUG IN LINE AND LOAD CONNECTIONS**
- TRUE DRAWOUT ASSEMBLIES**
- COMPARTMENTALIZED CONSTRUCTION**
- UL LABELED**

Power Zone® Load Center Unit Substation may contain Powerstyle MCDO II Switchboards. Utilizing type SE, stored energy, solid state, circuit breakers they represent the most advanced individually mounted circuit breaker distribution switchboard design available. MCDO II switchboards offer the user many safety features, minimum down-time, system selectivity, ease of maintenance and expansion of functional capacity.

Functional and operational benefits are:

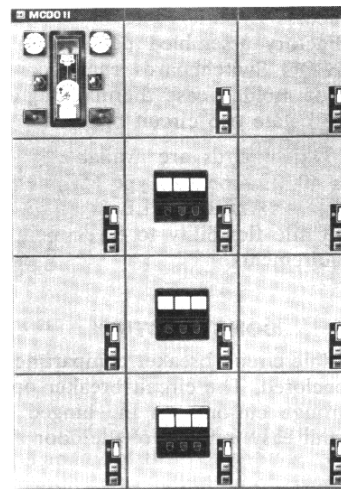
Safety Features — Compartmentalized and barriered construction assures protection to equipment and operating personnel even under severe short circuit conditions.

Minimum Down-Time — Drawout construction allows quick and simple replacement of breaker elements. 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 SE circuit breaker is field adjustable, enabling the user to attain optimum selectivity and coordination.

CONSTRUCTION

All front accessible circuit breaker compartments are completely metal enclosed. The type SE circuit breakers may be operated, with the compartment door closed, by



mechanically linked trip and close pushbuttons. Hinge pins permit easy door removal if desired.

The breaker compartment provides for three positions of the removable element; connected, test/disconnected and remove. In the connected position both primary and secondary disconnecting devices are engaged the circuit breaker is ready for operation. The test/disconnected position permits the secondary control contacts to be engaged while the primary line and load connections are disengaged. In the remove position the breaker may be withdrawn from its compartment. The compartment door may be closed and latched with the removable breaker element in any one of the above positions. The primary line and load breaker stabs are connected to the bus utilizing LoRes connectors (refer to the description on page 10). All cable terminations are located in a rear accessible cable compartment.



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LOAD CENTER UNIT SUBSTATIONS

LOW VOLTAGE DISTRIBUTION SECTIONS
APPLICATION DATAMOLDED CASE DRAWOUT SWITCHBOARDS
TYPE MCDO

- CURRENT RATINGS TO 4,000 AMPERES
- LORES PLUG-IN LINE, LOAD CONSTRUCTION
- CIRCUIT BREAKERS INDIVIDUALLY MOUNTED
- LOAD SIDE LUGS EXTENDED TO BARRIERED REAR COMPARTMENTS
- TRIP ON REMOVAL MECHANICAL INTERLOCK

POWER-ZONE® Load Center Unit Substations containing POWER-STYLE Switchboards Type MCDO represent the most advanced individually mounted circuit breaker distribution switchboard design available. All circuit breaker branches are compartmentalized and drawout mounted. Inspection of the circuit breaker compartments will reveal no exposed current carrying parts. The mechanically interlocked drawout unit will trip an energized circuit breaker if personnel attempt to remove it.

Type MCDO is a front and rear accessible switchboard design. (Rear access is required to make load side cable connections.) Factory assembled per customer specifications. Type MCDO Switchboards can accommodate the Square D line of molded case thermal-magnetic, current limiting and solid state trip circuit breakers.

Type MCDO Switchboards are available in through bus ratings through 4000 amperes. Type MCDO can be combined with other POWER-STYLE main or distribution sections offering the flexibility to meet most low voltage distribution requirements.

CONSTRUCTION

All front accessible circuit breaker compartments are completely metal enclosed. The circuit breaker operating handles extend through cut-outs on the hinged cover doors. Hinge pins permit easy removal of the door if desired.

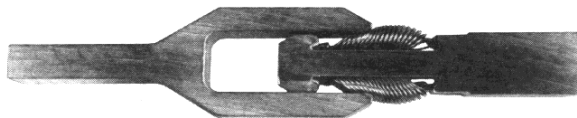


TWIN MOUNTED CIRCUIT BREAKERS IN INDIVIDUAL COMPARTMENTS

Both the stationary and drawout bus connectors use copper or high tensile strength electrical grade aluminum extrusions. The removable drawout stabs are slotted and fitted

- ALL BRANCH CIRCUIT BREAKERS RATCHET IN & OUT
- COMPARTMENTALIZED CONSTRUCTION
- UL LABELED
- STANDARD BRACING 100,000 AMPERES
- ISOLATED VERTICAL & HORIZONTAL BUS

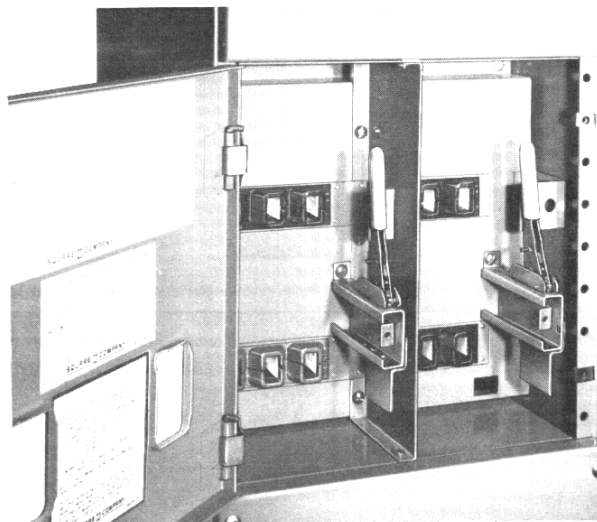
with LoRes connectors. These connectors keep insertion force to a minimum and maintain low heat rise characteristics. The spring connectors on the removable stab are readily visible for routine field inspection. This



LoRes CONNECTOR

revolutionary new connection eliminates the historical problems associated with "Spring Connectors." The one piece copper and aluminum extrusions have been designed and verified through extensive short circuit current testing to retain their mechanical integrity under high level fault current conditions.

A ratchet mechanism and rails are provided as standard with all circuit breakers. Use of the ratchet mechanism assures smooth, safe, and positive removal or insertion of the circuit breaker. The rail supports the circuit breaker while the ratchet clears the drawout stags from the stationary assembly. All drawout assemblies are provided with a mechanical interlock that will activate the trip bar within the circuit breaker when it is not completely racked in and fully engaged. This feature helps protect personnel and equipment from the hazards of electrical shock or burn during the removal of energized equipment.

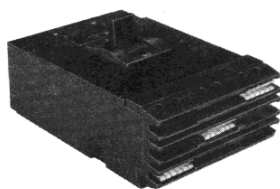
STATIONARY BUS CONNECTORS AND DRAWOUT ASSEMBLY
RAIL SUPPORTS

POWER-ZONE® LOAD CENTER UNIT SUBSTATIONS

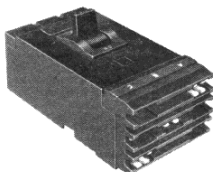
LOW VOLTAGE DISTRIBUTION SECTIONS APPLICATION DATA

CLASS
6020**MOLDED CASE CIRCUIT BREAKERS**

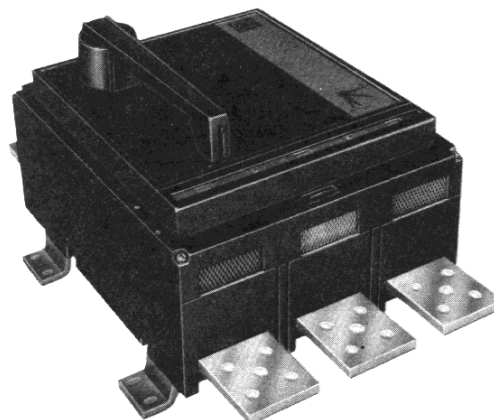
- 15 THROUGH 4,000 AMPERE RATING
- INTERRUPTING RATINGS TO 200,000 A. SYMMETRICAL
- POSITIVE INDICATING TRIP FREE MECHANISMS
- STANDARD THERMAL MAGNETIC, 1-75,000TM HIGH INTERRUPTING CAPACITY, CURRENT LIMITING OR SOLID STATE TRIP CIRCUIT BREAKERS
- GROUP-MOUNTED PLUG-ON I-LINE ARRANGEMENT THROUGH 800 AMPERE RATINGS
- INDIVIDUALLY MOUNTED DRAW-OUT MCDO CONSTRUCTION



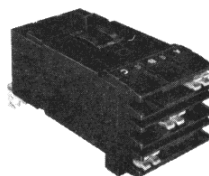
ME, 125-800 A.



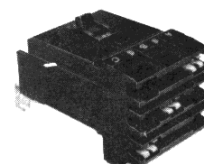
LA, 250-400 A.



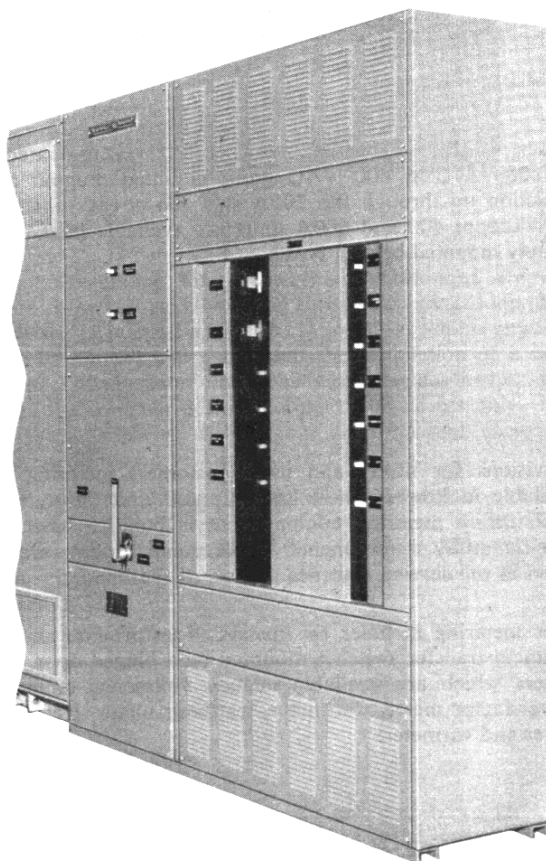
PA, 600-2,000 A.



IK, 110-225 A.



FA, 15-100 A.

LOW VOLTAGE DISTRIBUTION
SECTION CONTAINING I-LINE GROUP
MOUNTED MOLDED CASE CIRCUIT BREAKERS

Power-Zone® Load Center Unit Substation's offer the flexibility and reliability of the Power-Style switchboard product line. Versatility is achieved by offering a complete line of circuit breaker and fusible over-current protection devices, metering, automatic transfer switches and relaying devices. This equipment is designed to meet the latest UL short circuit current requirements. For additional information see Catalog Class 2700, 2760 and 2770.

The circuit breaker line includes thermal magnetic (standard and high interrupting), current limiting, solid state trip and systems power circuit breakers. These circuit breakers can be group mounted utilizing I-Line construction or individually mounted in draw-out type MCDO construction through 800 amperes. Separately mounted circuit breakers up to 4,000 amperes completes the line of available devices.



SQUARE D COMPANY

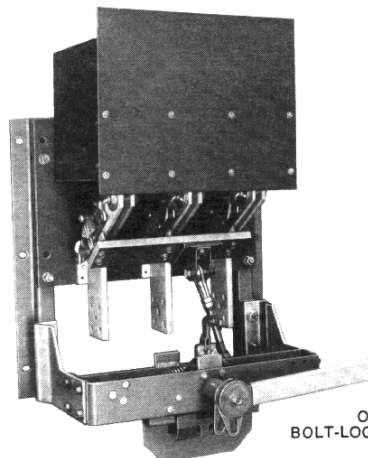
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POWER-ZONE® LOAD CENTER UNIT SUBSTATIONS LOW VOLTAGE DISTRIBUTION SECTIONS APPLICATION DATA

JUNE, 1984

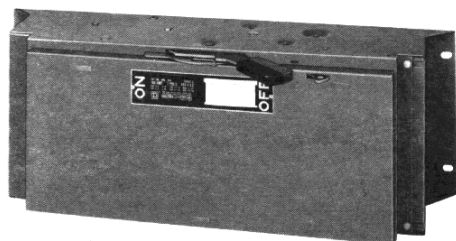
BOLT-LOC® FUSIBLE SWITCHES

BOLT-LOC bolted pressure contact switches rated 800 through 4,000 amperes are quick-make, quick-break type, capable of interrupting the full rated current with complete safety for the operator. Switches may be equipped with electric trip for ground fault relaying or remote operation. A mechanical linkage operated during the closing cycle tightly bolts the movable blades to both line and load side connectors of the switch. BOLT-LOC fusible switches are equipped with provisions for NEMA Class L current limiting fuses, permitting application on systems capable of up to 200,000 amperes short circuit current.

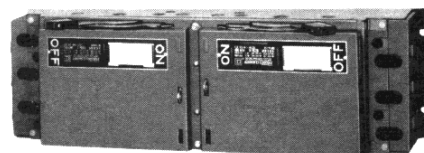


OPEN TYPE 4,000 A.
BOLT-LOC FUSIBLE SWITCH

QMB FUSIBLE SWITCHES



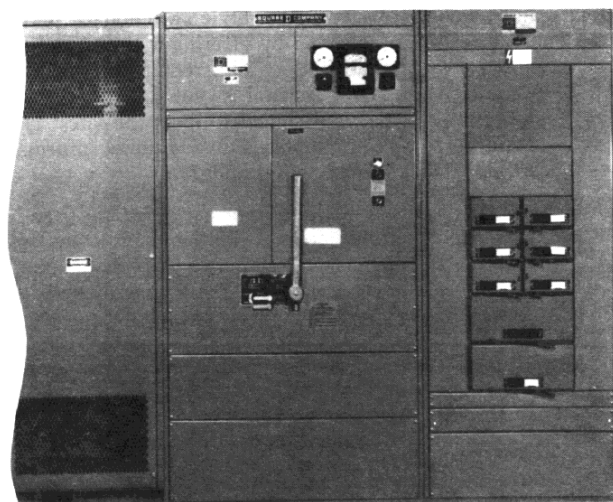
200 A. SINGLE UNIT



30, 60, AND 100 A. TWIN UNITS

QMB fusible switches rated 30 through 600 amperes are quick-make, quick-break heavy duty industrial switches which will accept either Class H or R Fuses. Class R Fuse rejection kits are available for preventing the installation of the non-current limiting Class H Fuses. A special QMB Unit is also available, which will accept only Class J

Fuses, QMB Units with Class J or R Fuses are rated at 200,000 AIC at 600 VAC group-mounted plug-on construction up through the 200A size allows easy changing or addition: 400 and 600A units are available in the separately mounted bolt-on type.



LOW VOLTAGE DISTRIBUTION SECTION CONTAINING
METERING SECTION, BOLT LOC MAIN AND
QMB BRANCH FUSIBLE SWITCHES

Provisions for utility and user (customer) metering are available in Power-Zone® Load Center Unit Substations. Each utility metering compartment is built to meet the specific utility requirements. These compartments are located in the service entrance section of the line-up.

User metering includes the meters, transformers, and instrument transfer switches mounted on a hinged door. The meters which are available include voltmeter, ammeter, power-factor meter, wattmeter, watthour meter, frequency meter and varmeter.

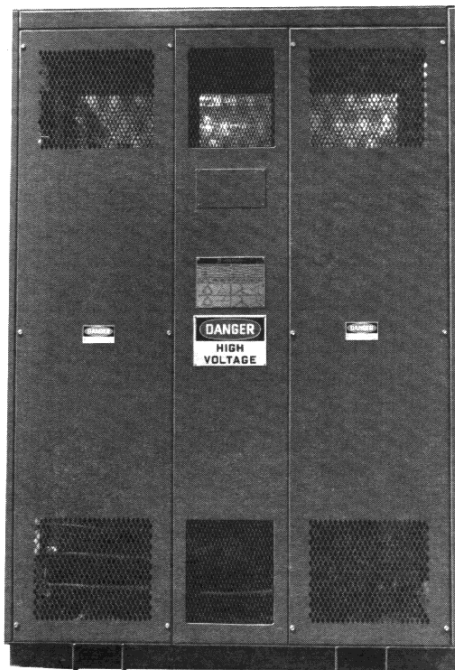


POWER-ZONE® LOAD CENTER UNIT SUBSTATIONS

**CLASS
6020**

APPLICATION DATA

COMPACT SECTIONAL UNIT SUBSTATION



OPEN VENTILATED DRY-TYPE TRANSFORMER

- FRONT ACCESSIBILITY.
- 36" DEPTH.
- 225 THROUGH 750 KVA — SELF-COOLED RATING.
- FORCED AIR COOLING FOR INCREASED 33 1/3% KVA CAPACITY. (OPTIONAL)
- PRIMARY VOLTAGE: 2400, 4160, 4800, 12470, 13200 and 13800 VOLTS. OTHERS AVAILABLE.
- 220°C INSULATION SYSTEM — 150°C RISE. (115°C and 80°C UNITS OPTIONAL THROUGH 500 KVA)
- ALUMINUM CONDUCTORS.
- BARREL WOUND COILS.

Compact sectional load center unit substations are designed to permit easy handling through existing doors and hallways. They can be installed in locations where physical space limitations will not permit the installation of a conventional load center unit substation. Besides having less depth, the compact design requires front access only. The transformer's barrel wound core and coil and enclosure design requires no ventilation from the rear.

Even though small in size, flexibility in substation design is maintained. A wide range of Power Style switchboard secondary arrangements can be provided. Metering devices, circuit breaker panels and fusible switches all can be included.

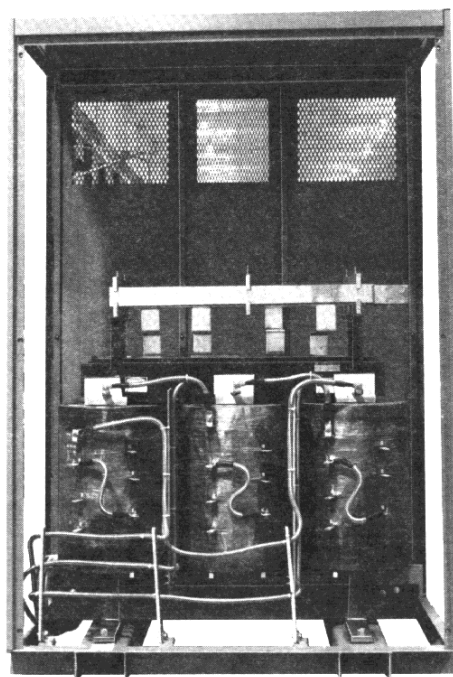

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TABLE 1
APPLICATION DATA

SECONDARY FULL LOAD AND SHORT CIRCUIT CURRENTS

Transformer Rating 3Ø kVA (%) ①	Available Primary Short Circuit kVA	SECONDARY DISTRIBUTION VOLTAGE — 3 PHASE															
		208			240			480			600						
		Normal Load Cont. Amps.	Short Circuit† RMS Sym. Amps.		Normal Load Cont. Amps.	Short Circuit† RMS Sym. Amps.		Normal Load Cont. Amps.	Short Circuit† RMS Sym. Amps.		Normal Load Cont. Amps.	Short Circuit† RMS Sym. Amps.					
			Transf. Alone	Plus 50% Motor Load		Transf. Alone	Plus 100% Motor Load		Transf. Alone	Plus 100% Motor Load		Transf. Alone	Plus 100% Motor Load				
225 (4.5%)	50,000	625	12,616	13,866	542	10,934	13,100	271	5,467	6,550	217	4,373	5,240				
	100,000		13,217	14,467		11,455	13,620		5,727	6,810		4,582	5,448				
	150,000		13,430	14,680		11,640	13,805		5,820	6,903		4,656	5,522				
	250,000		13,606	14,856		11,792	13,957		5,896	6,979		4,716	5,583				
	500,000		13,741	14,990		11,909	14,074		5,954	7,037		4,763	5,630				
	Unlimited		13,878	15,128		12,028	14,193		6,014	7,097		4,811	5,677				
300 (4.5%)	50,000	833	16,327	17,993	722	14,150	17,037	361	7,075	8,519	289	5,660	6,815				
	100,000		17,348	19,014		15,035	17,922		7,517	8,961		6,014	7,169				
	150,000		17,717	19,383		15,355	18,242		7,677	9,121		6,142	7,297				
	250,000		18,024	19,690		15,620	18,508		7,810	9,254		6,248	7,403				
	500,000		18,261	19,927		15,826	18,713		7,913	9,357		6,330	7,485				
	Unlimited		18,504	20,170		16,037	18,924		8,018	9,462		6,415	7,570				
500 (5.0%)	50,000	1388	23,131	25,907	1203	20,046	24,858	602	10,023	12,429	482	8,018	9,943				
	100,000		25,233	28,010		21,869	26,681		10,934	13,340		8,747	10,672				
	150,000		26,022	28,798		22,552	27,364		11,276	13,682		9,021	10,946				
	250,000		26,689	29,465		23,131	27,942		11,565	13,971		9,252	11,177				
	500,000		27,212	29,989		23,584	28,396		11,792	14,198		9,433	11,358				
	Unlimited		27,757	30,533		24,056	28,868		12,028	14,434		9,622	11,547				
750 863* 1000* 1125* (5.75%)	50,000	2082	28,714	32,878	1805	24,885	32,103	903	12,442	16,051	722	9,954	12,841				
	100,000		32,027	36,191		27,757	34,974		13,878	17,487		11,102	13,990				
	150,000		2395*	33,308		37,472	2075*		28,867	36,084		1038*	14,433	18,042	831*	11,547	14,434
	250,000		2776*	34,409		38,573	2406*		29,821	37,039		1203*	14,910	18,519	963*	11,928	14,815
	500,000		3120*	35,284		39,448	2706*		30,579	37,797		1353*	15,289	18,898	1083*	12,231	15,119
	Unlimited			36,205		40,369			31,377	38,595			15,688	19,297		12,551	15,438
1000 1150* 1333* 1500* (5.75%)	50,000	2776	35,815	41,367	2406	31,040	40,663	1203	15,520	20,331	963	12,416	16,265				
	100,000		41,121	46,673		35,638	45,261		17,819	22,631		14,255	18,105				
	150,000		3193*	43,258		48,809	2767*		37,490	47,113		1384*	18,745	23,556	1107*	14,996	18,845
	250,000		3702*	45,133		50,685	3208*		39,115	48,738		1604*	19,557	24,369	1284*	15,646	19,495
	500,000		4164*	46,650		52,202	3609*		40,430	50,053		1805*	20,215	25,027	1443*	16,172	20,021
	Unlimited			48,273		53,825			41,836	51,459			20,918	25,730		16,734	20,584
1500 1725* 2000* 2250* (5.75%)	50,000	4164	47,583	55,911	3609	41,239	55,673	1805	20,619	27,837	1444	16,495	22,269				
	100,000		57,428	65,756		49,771	64,205		24,885	32,103		19,908	25,682				
	150,000		4789*	61,682		70,010	4150*		53,458	67,892		2075*	26,729	33,946	1660*	21,383	27,157
	250,000		5552*	65,568		73,895	4812*		56,825	71,260		2406*	28,412	35,630	1925*	22,730	28,504
	500,000		6246*	68,819		77,147	5414*		59,643	74,077		2706*	29,821	37,039	2165*	23,857	29,631
	Unlimited			72,410		80,737			62,755	77,189			31,377	38,595		25,102	30,876
2000 2300* 2667* 3000* (5.75%)	50,000	5552	56,937	68,041	4812	49,346	68,591	2406	24,673	34,296	1925	19,738	27,436				
	100,000		71,631	82,734		62,080	81,326		31,040	40,663		24,832	32,530				
	150,000		6385*	78,373		89,476	5534*		67,923	87,169		2767*	33,961	43,584	2214*	27,169	34,867
	250,000		7403*	84,754		95,858	6416*		73,454	92,699		3208*	36,727	46,350	2567*	29,381	37,080
	500,000		8328*	90,267		101,370	7217*		78,231	97,477		3609*	39,115	48,738	2888*	31,292	38,991
	Unlimited			96,548		107,650			83,673	102,919			41,836	51,459		33,469	41,168



TABLE 1
APPLICATION DATA

SECONDARY FULL LOAD AND SHORT CIRCUIT CURRENTS

Transformer Rating 3Ø kVA (%Z) ①	Available Primary Short Circuit kVA	SECONDARY DISTRIBUTION VOLTAGE — 3 PHASE											
		208			240			480			600		
		Normal Load Cont. Amps.	Short Circuit† RMS Sym. Amps.		Normal Load Cont. Amps.	Short Circuit† RMS Sym. Amps.		Normal Load Cont. Amps.	Short Circuit† RMS Sym. Amps.		Normal Load Cont. Amps.	Short Circuit† RMS Sym. Amps.	
			Transf. Alone	Plus 50% Motor Load		Transf. Alone	Plus 100% Motor Load		Transf. Alone	Plus 100% Motor Load		Transf. Alone	Plus 100% Motor Load
2500 3125* 3333* 3750* (5.75%)	50,000 100,000 150,000 250,000 500,000 Unlimited	6940 8675* 9253* 10410* 10410*	64,551 84,112 93,563 102,804 111,028 120,683	78,430 97,991 107,442 116,683 124,908 134,562	6015 7518* 8019* 9021* 9021*	55,944 72,897 81,088 89,097 96,225 104,592	80,001 96,954 105,145 113,154 120,281 128,649	3008 3759* 4010* 4511* 4511*	27,972 36,448 40,544 44,548 48,112 52,296	40,001 48,477 52,572 56,577 60,141 64,324	2406 3008* 3208* 3609* 3609*	22,377 29,159 32,435 35,638 38,490 41,836	32,000 38,782 42,058 45,261 48,113 51,459
3000 3750* 4000* 4500* (5.75%)	50,000 100,000 150,000 250,000 500,000 Unlimited	8328 10410* 11104* 12491* 12491*	70,869 95,167 107,447 119,815 131,136 144,820	87,524 111,822 124,102 136,470 147,791 161,475	7217 9022* 9623* 10826* 10826*	61,420 82,478 93,121 103,839 113,651 125,510	90,288 111,346 121,989 132,707 142,519 154,378	3609 4511* 4812* 5413* 5413*	30,710 41,239 46,560 51,919 56,825 62,755	45,144 55,673 60,994 66,354 71,260 77,189	2887 3609* 3850* 4331* 4331*	24,568 32,991 37,248 41,535 45,460 50,204	36,115 44,538 48,795 53,083 57,008 61,751
3750 5625* (7.0%) ②	50,000 100,000 150,000 250,000 500,000 Unlimited	10409 10409 15614* 15614* 15614*	71,785 76,827 109,567 122,458 134,309 148,699	92,604 117,645 130,386 143,276 155,127 169,517	9022 9022 13532* 13532* 13532*	62,214 83,917 94,958 106,130 116,401 128,872	98,299 120,002 131,043 142,215 152,486 164,957	4511 6767* 6767* 6767* 6767*	31,107 41,958 47,479 53,065 58,200 64,436	49,149 60,001 65,552 71,107 76,243 82,479	3609 5413* 5413* 5413*	24,885 33,566 37,983 42,452 46,560 51,549	39,320 48,001 52,417 56,886 60,994 65,983
3750 5625* (7.5%) ③	50,000 100,000 150,000 250,000 500,000 Unlimited	10409 10409 15614* 15614* 15614*	69,393 92,524 104,089 115,655 126,169 138,786	90,211 113,342 124,908 136,473 146,987 159,604	9022 9022 13532* 13532* 13532*	60,140 80,187 90,210 100,234 109,346 120,281	96,225 116,272 126,295 136,319 145,431 156,366	4511 6767* 6767* 6767* 6767*	30,070 40,093 45,105 50,117 54,673 60,140	48,113 58,136 63,148 68,159 72,716 78,183	3609 5413* 5413* 5413*	24,056 32,075 36,084 40,093 43,738 48,112	38,490 46,509 50,518 54,528 58,172 62,546
5000 7500* (7.0%) ④	50,000 100,000 150,000 250,000 500,000 Unlimited	13879 13879 20819* 20819* 20819*	81,638 115,655 134,309 154,206 173,482 198,265	109,396 143,412 162,066 181,964 201,240 226,023	12029 12029 18043* 18043* 18043*	70,753 100,234 116,401 133,645 150,351 171,830	118,866 148,347 164,514 181,758 198,464 219,943	6015 9022* 9022* 9022*	35,376 50,117 58,200 66,822 75,175 85,915	59,433 74,173 82,257 90,879 99,232 109,971	4812 7218* 7218* 7218*	28,301 40,093 46,560 53,458 60,140 68,732	47,546 59,339 65,806 72,703 79,386 87,977
5000 7500* (7.5%) ⑤	50,000 100,000 150,000 250,000 500,000 Unlimited	13879 13879 20819* 20819* 20819*	79,306 111,028 128,110 146,090 163,277 185,048	107,064 138,786 155,867 173,848 191,035 212,805	12029 12029 18043* 18043* 18043*	68,732 96,225 111,028 126,611 141,507 160,375	116,845 144,338 159,141 174,724 189,620 208,488	6015 9022* 9022* 9022*	34,366 48,112 55,514 63,305 70,753 80,187	58,422 72,169 79,571 87,362 94,810 104,244	4812 7218* 7218* 7218*	27,492 38,490 44,411 50,644 56,602 64,150	46,738 57,735 63,657 69,890 75,848 83,395

① Forced Air cooled (FA) transformer ratings (denoted by an *) based on:

a) 115% of the self-cooled kVA rating for 750-2000kVA liquid-filled transformers;

b) 125% of the self-cooled kVA rating for 2500 and 3000kVA liquid-filled transformers;

② Nominal %Z for Power Cast transformers with less than 25kV rated primary voltage.

③ Nominal %Z for Power Cast transformers with 34.5kV and 25kV rated primary voltage.

④ Short-circuit currents are calculated by dividing the transformer self-cooled secondary full load current by the arithmetic sum of the transformer and primary system impedances (assumes transformer X/R identical to primary system X/R). Vectorial addition of these impedances would produce slightly higher short-circuit current values. Motor contribution to the short circuit amperes based on 4 times the motor full load current (assumes average motor impedance of 25%). Motor full load current assumed to be 50% at 208V or 100% at 240V and above of the transformer self-cooled rated full load amperes.

⑤ Short-circuit values are based on the nominal percent impedance (%Z) shown. Per NEMA and ANSI standards, actual %Z may vary $\pm 7.5\%$ due to manufacturing tolerances. If desired to account for a minimum tolerance, multiply the "Transformer Alone" short-circuit values by 1.081.

† Per cent impedance (%Z) may vary for different types of transformers of the same rating.

‡ Based on standard self-cooled ratings, short circuit currents are calculated by dividing transformer full load current by the sum of transformer and system impedance expressed per unit; motor contribution assumed 4 times full load current (2 times on 208 volts). Applies when power factor of 15% or greater (X/R—6.5); if less, check asymmetrical ratings of secondary distribution devices used—see appropriate catalog sections for ratings.

○ NOTE: Ampacities over 4000 A. max. present secondary bus complications. Consult local Square D field office.



TABLE 2
APPLICATION DATA

FULL LOAD CURRENTS OF 3 PHASE TRANSFORMERS

kVA	SYSTEM VOLTAGE (V)															
	208	240	480	600	2400	4160	4800	6900	7200	8320	12000	12470	13200	13800	14400	22900
*225	624	541	270	216	54.1	31.2	27.0	18.8	18.0	15.6	10.8	10.4	9.8	9.4	9.02	5.7
*300	832	721	360	288	72.1	41.6	36.0	25.1	24.0	20.8	14.4	13.8	13.1	12.5	12.0	7.6
400	1110	962	481	384	96.2	55.5	48.1	33.4	32.0	27.7	19.2	18.5	17.4	16.7		
*500	1388	1202	601	481	120	69.3	60.1	41.8	40.0	34.6	24.0	23.1	21.8	20.9	20.1	12.6
666	1849	1602	801	640	160	92.4	80.1	55.7	53.4	46.2	32.0	30.8	29.1	27.8		
*750	2081	1804	902	721	180	104	90.2	62.7	60.1	52.0	36.0	34.7	32.8	31.3	30.1	18.9
862	2392	2073	1036	829	207	119	103	72.1	69.1	59.8	41.4	39.9	37.7	36.0		
*1000	2775	2405	1202	962	240	138	120	83.6	80.1	69.3	48.1	46.3	43.7	41.8	40.1	25.2
1150	3192	2766	1383	1106	276	159	138	96.2	92.2	79.8	55.3	53.2	50.3	48.1		
1333	3700	3206	1603	1282	320	185	160	111	106	92.5	64.1	61.7	58.3	55.7		
*1500		3608	1804	1443	360	208	180	125	120	104	72.1	69.4	65.6	62.7	60.1	37.8
1725			2074	1659	414	239	207	144	138	119	82.9	79.8	75.4	72.1		
*2000			2405	1924	481	277	240	167	160	138	96.2	92.6	87.4	83.6	80.2	50.4
2300			2766	2213	553	319	276	192	184	159	110	106	100	96.2		
*2500			3007	2405	601	346	300	209	200	173	120	115	109	104	100	63.0
2667			3207	2566	641	370	320	223	213	185	128	123	116	111		
*3000			3608	2886	722	416	360	251	240	208	144	138	131	125	120	75.6
3125			3758	3007	751	433	375	261	250	216	150	144	136	130		
3333				3207	801	462	400	278	267	231	160	154	145	139		
*3750				3608	902	520	451	313	300	260	180	173	164	156	150	94.5
4000				3849	962	555	481	334	320	277	192	185	174	167		
4686					1127	650	563	392	375	325	225	216	204	196		
*5000					1202	693	601	418	400	346	240	231	218	209	201	126.0

*Standard 3 phase transformer ratings

Full load currents calculated from formula $VA = V \times I \times \sqrt{3}$

CAUTION: SEE NOTE ○ PAGE 15

THREE PHASE SHORT CIRCUIT FAULT CURRENT CALCULATION

Total $I_{sc} = I_{sc}$ available at transformer secondary terminals + I_{sc} contributed by motor load. (Sym.)

$$= \frac{\text{transformer KVA} \times 1000}{(\sum Z_{\text{transformer}} + \sum Z_{\text{primary system}}) \times \text{secondary } V \times \sqrt{3}} + \frac{\text{transformer KVA} \times 1000 \times M}{\text{secondary } V \times \sqrt{3}}$$

Where M = motor contribution constant

= 2.0 for 208V and 4 for 240, 480 & 600V

V = line to line voltage

Z = per unit impedance (percent impedance ÷ 100)

Z = Primary System =

$$= \frac{\text{substation transformer KVA}}{\text{primary system short circuit capacity}}$$

Example:

Determine the short-circuit current available at the low voltage feeder breakers of a substation having the following ratings:

Primary system maximum short circuit KVA 500,000
 Transformer KVA 750
 Secondary voltage 208Y/120
 Transformer impedance 5.75%

$$I_{sc} = \frac{750 \times 1000}{(.0575 + \frac{750}{500,000}) \times 208 \times \sqrt{3}} + \frac{750 \times 1000 \times 2.0}{208 \times \sqrt{3}}$$

= 39,360 amps. rms. symmetrical

Note: To obtain asymmetrical amperes multiply symmetrical amperes by 1.17.



POWER-ZONE® LOAD CENTER UNIT SUBSTATIONS

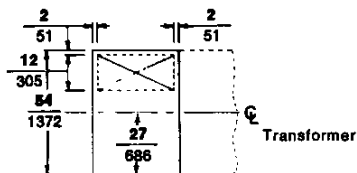
 CLASS
6020

(APPROXIMATE DIMENSIONS — NOT FOR CONSTRUCTION)

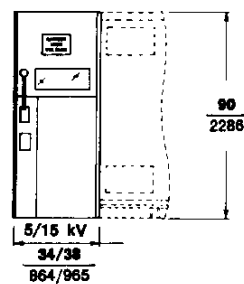
5 & 15 kV

HVL SWITCH CONNECTING TO STANDARD DRY TRANSFORMER

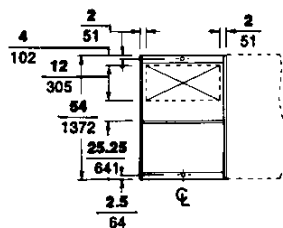
Indoor Equipment



TOP VIEW



FRONT ELEVATION

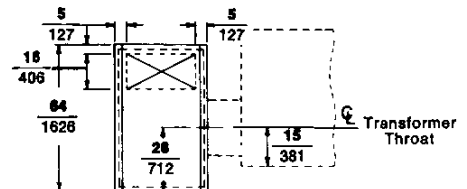


FLOOR PLAN

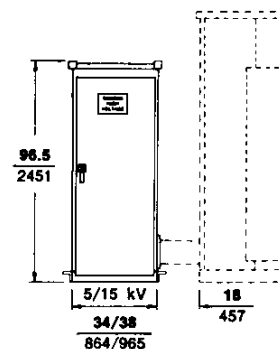
Approximate Weight:
5 kV 1200 lbs./544.3 kg
15 kV 1350 lbs./612.4 kg

HVL SWITCH CONNECTING TO NON-VENTILATED TRANSFORMER

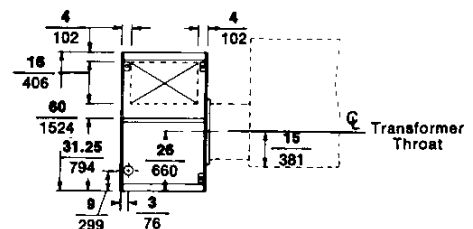
Outdoor Equipment



TOP VIEW



FRONT ELEVATION



FLOOR PLAN

Approximate Weight:
5 kV 1400 lbs./635.0 kg
15 kV 1550 lbs./703.0 kg

⊠ Represents Suggested Conduit
Entrance Area

⊕ Represents Suggested Conduit
Entrance Area for Strip Heater
Control Power Source

Dual Dimensions: INCHES
Millimeters


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POWER-ZONE® LOAD CENTER UNIT SUBSTATIONS

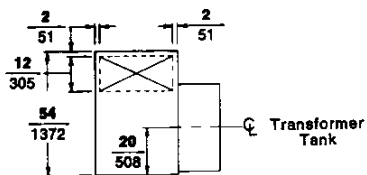
JUNE, 1984

(APPROXIMATE DIMENSIONS—NOT FOR CONSTRUCTION)

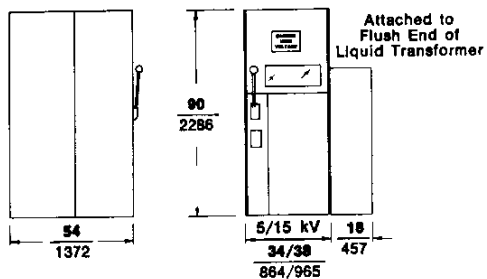
5 & 15 kV

HVL SWITCH CONNECTING TO LIQUID TRANSFORMER

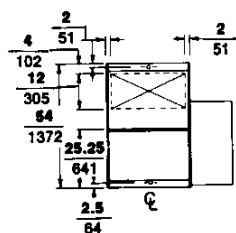
Indoor Equipment



TOP VIEW



LEFT END ELEVATION

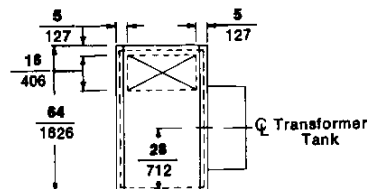


FLOOR PLAN

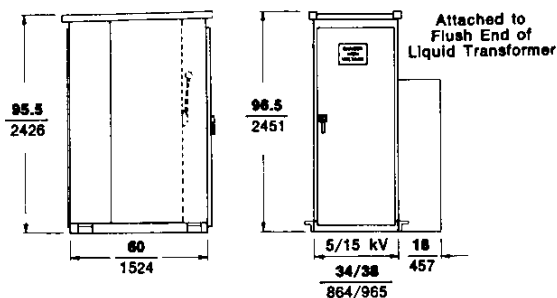
Approximate Weight:
5 kV 1300 lbs./589.7 kg
15 kV 1450 lbs./657.7 kg

HVL SWITCH CONNECTING TO LIQUID TRANSFORMER

Outdoor Equipment

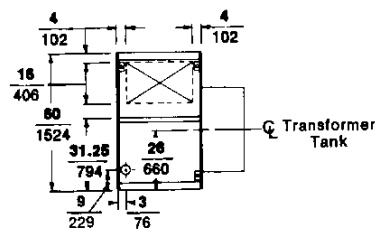


TOP VIEW



LEFT END ELEVATION

FRONT ELEVATION



FLOOR PLAN

Approximate Weight:
5 kV 1500 lbs./680.0 kg
15 kV 1650 lbs./748.4 kg

Represents Suggested Conduit Entrance Area

Represents Suggested Conduit Entrance Area for Strip Heater Control Power Source

Dual Dimensions: INCHES
Millimeters



POWER-ZONE® LOAD CENTER UNIT SUBSTATIONS

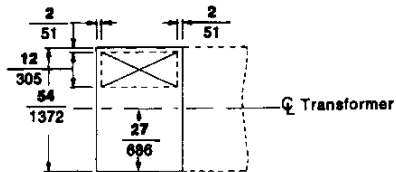
CLASS
6020

(APPROXIMATE DIMENSIONS — NOT FOR CONSTRUCTION)

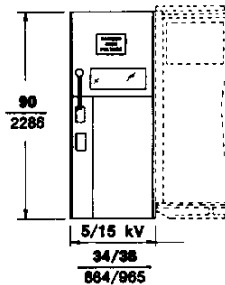
5 & 15 kV

HVL SWITCH CONNECTING TO CAST RESIN TRANSFORMER

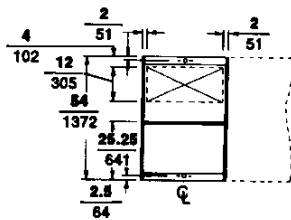
Indoor Equipment



TOP VIEW



FRONT ELEVATION

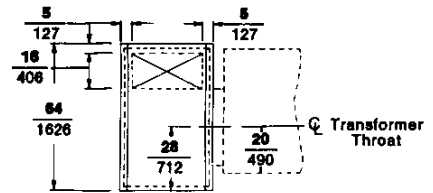


FLOOR PLAN

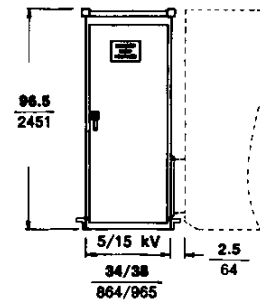
Approximate Weight:
5 kV 1200 lbs./544.3 kg
15 kV 1350 lbs./612.4 kg

HVL SWITCH CONNECTING TO CAST RESIN TRANSFORMER

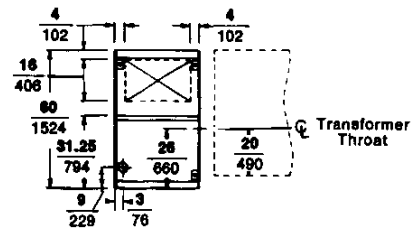
Outdoor Equipment



TOP VIEW



FRONT ELEVATION



FLOOR PLAN

Approximate Weight:
5 kV 1400 lbs./635.0 kg
15 kV 1550 lbs./703.0 kg

⊗ Represents Suggested Conduit Entrance Area

⊕ Represents Suggested Conduit Entrance Area for Strip Heater Control Power Source

Dual Dimensions: INCHES
Millimeters



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POWER-ZONE® LOAD CENTER UNIT SUBSTATIONS

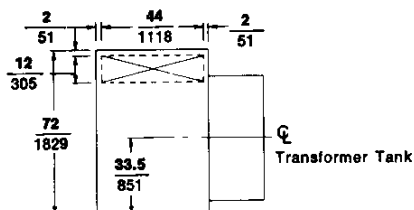
JUNE, 1984

(APPROXIMATE DIMENSIONS — NOT FOR CONSTRUCTION)

INDOOR EQUIPMENT

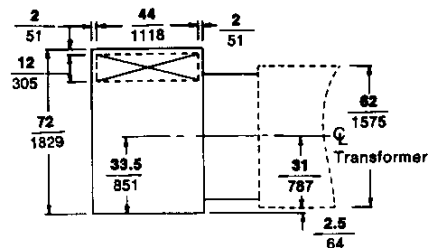
25 kV

HVL SWITCH CONNECTING TO LIQUID TRANSFORMER

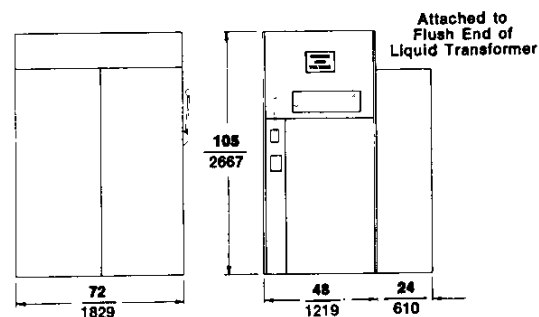


TOP VIEW

HVL SWITCH CONNECTING TO CAST RESIN TRANSFORMER

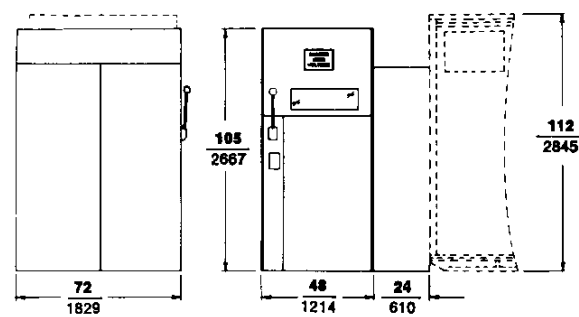


TOP VIEW



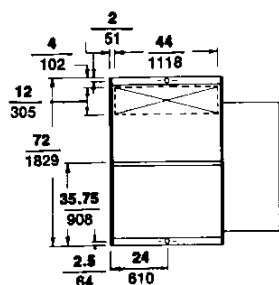
LEFT END ELEVATION

FRONT ELEVATION



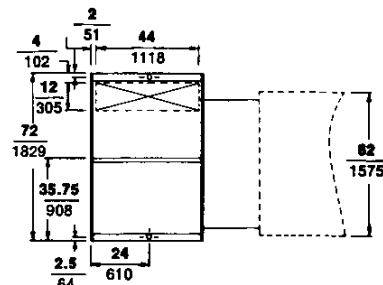
LEFT END ELEVATION

FRONT ELEVATION



FLOOR PLAN

Approximate Weight:
2200 lbs./997.9 kg



FLOOR PLAN

Approximate Weight:
2200 lbs./997.9 kg

 Represents Suggested Conduit Entrance Area

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



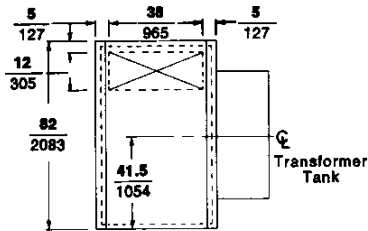
POWER-ZONE® LOAD CENTER UNIT SUBSTATIONS

 CLASS
6020

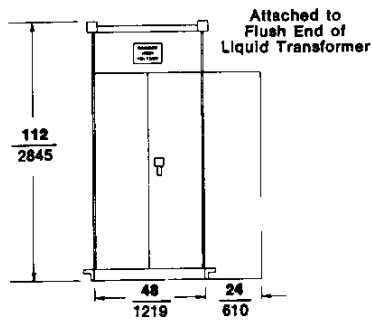
(APPROXIMATE DIMENSIONS — NOT FOR CONSTRUCTION)

OUTDOOR EQUIPMENT

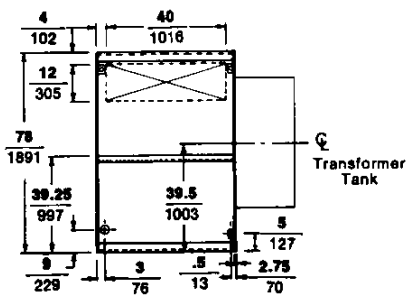
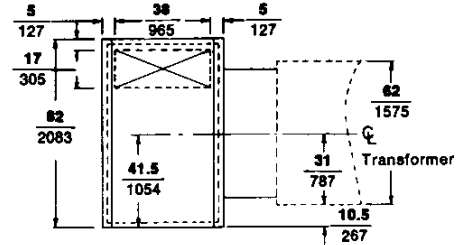
25 kV

HVL SWITCH CONNECTING TO
LIQUID TRANSFORMER

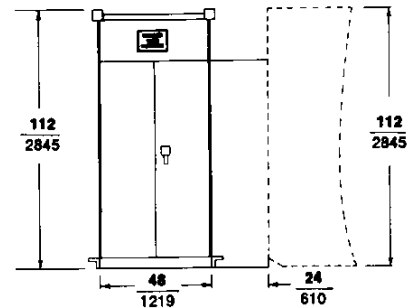
TOP VIEW



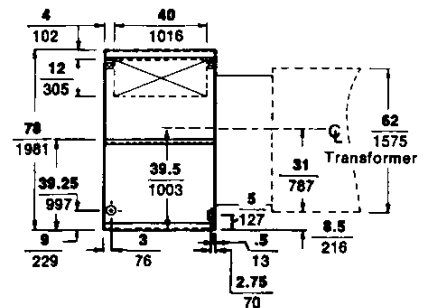
FRONT ELEVATION


 FLOOR PLAN
Approximate Weight:
2400 lbs./1088.6 kg
HVL SWITCH CONNECTING TO
CAST RESIN TRANSFORMER

TOP VIEW



FRONT ELEVATION


 FLOOR PLAN
Approximate Weight:
2400 lbs./1088.6 kg

Represents Suggested Conduit Entrance Area

Represents Suggested Conduit Entrance Area for Strip Heater Control Power Source

 Dual Dimensions: INCHES
Millimeters


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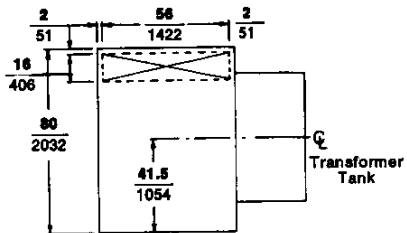
POWER-ZONE® LOAD CENTER UNIT SUBSTATIONS

JUNE, 1984

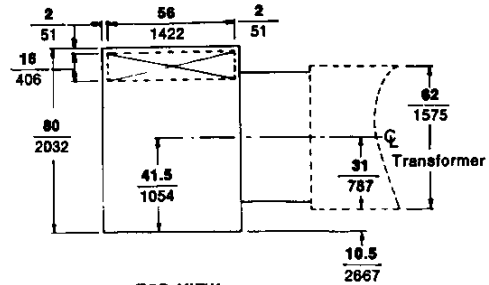
(APPROXIMATE DIMENSIONS — NOT FOR CONSTRUCTION)

INDOOR EQUIPMENT

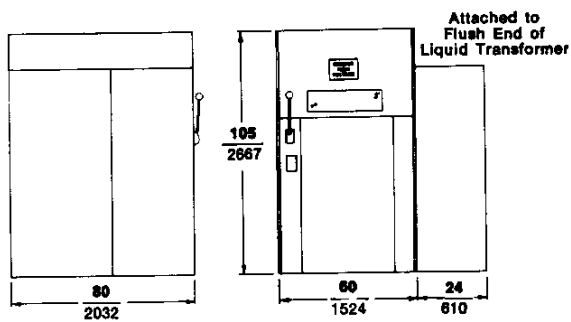
38 kV

HVL SWITCH CONNECTING TO
LIQUID TRANSFORMER

TOP VIEW

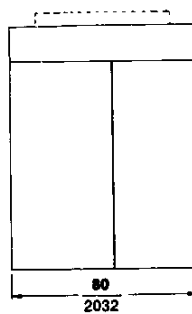
HVL SWITCH CONNECTING TO
CAST RESIN TRANSFORMER

TOP VIEW

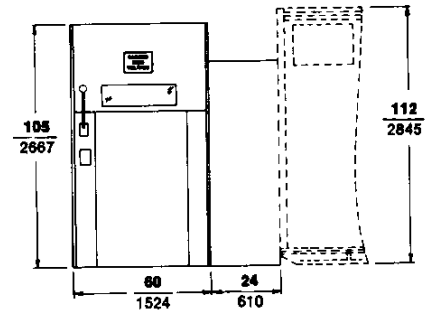


LEFT END ELEVATION

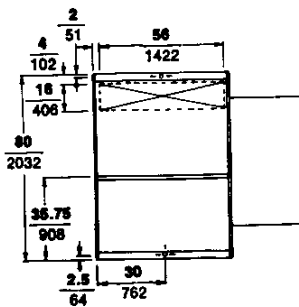
FRONT ELEVATION



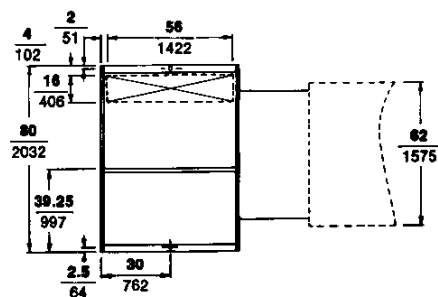
LEFT END ELEVATION



FRONT ELEVATION



FLOOR PLAN

Approximate Weight:
2450 lbs./1111.3 kg

FLOOR PLAN

Approximate Weight:
2450 lbs./1111.3 kg

 Represents Suggested Conduit Entrance Area

Dual Dimensions: INCHES
Millimeters



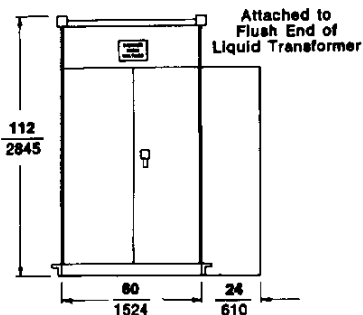
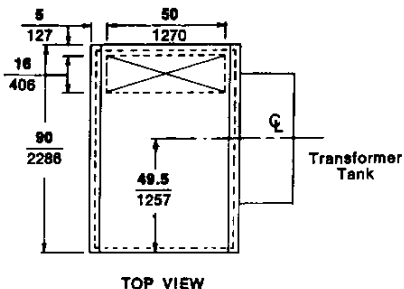
POWER-ZONE® LOAD CENTER UNIT SUBSTATIONS

CLASS
6020

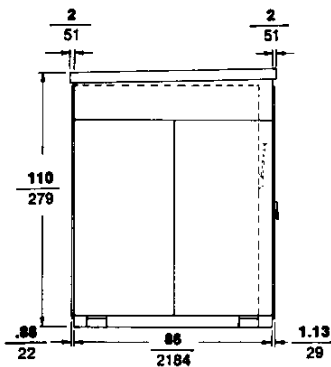
(APPROXIMATE DIMENSIONS — NOT FOR CONSTRUCTION)

OUTDOOR EQUIPMENT

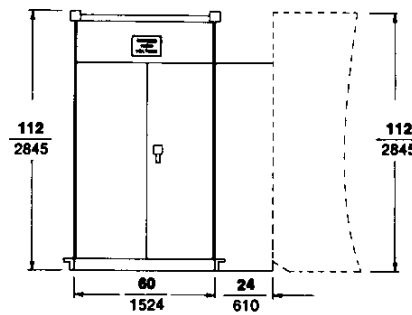
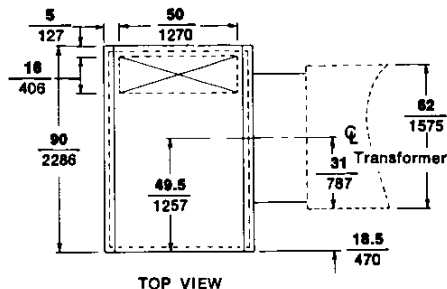
38 kV

HVL SWITCH CONNECTING TO
LIQUID TRANSFORMER

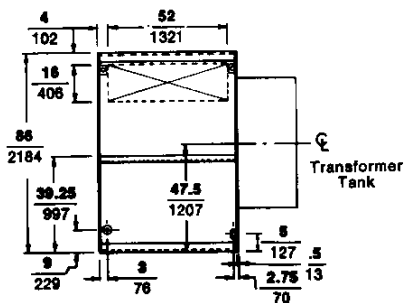
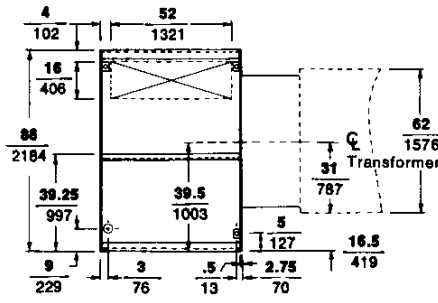
FRONT ELEVATION



LEFT END ELEVATION

HVL SWITCH CONNECTING TO
CAST RESIN TRANSFORMER

FRONT ELEVATION

Approximate Weight:
2700 lbs./1224.7 kgRepresents Suggested Conduit
Entrance AreaRepresents Suggested Conduit
Entrance Area for Strip Heater
Control Power SourceDual Dimensions: $\frac{\text{INCHES}}{\text{Millimeters}}$ Approximate Weight:
2400 lbs./1088.6 kg

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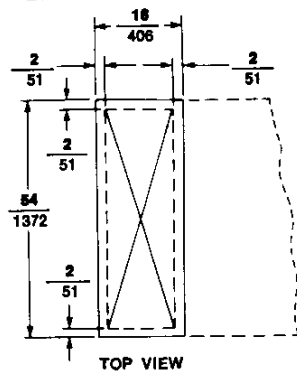
POWER-ZONE® LOAD CENTER UNIT SUBSTATIONS

JUNE, 1984

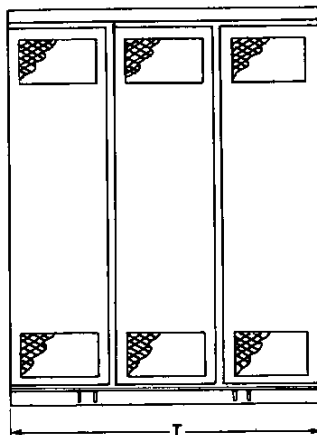
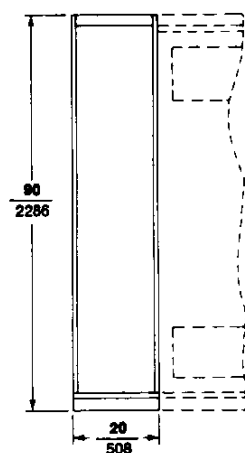
(APPROXIMATE DIMENSIONS — NOT FOR CONSTRUCTION)
INDOOR STANDARD DRY TYPE TRANSFORMER

5 kV and 15 kV

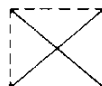
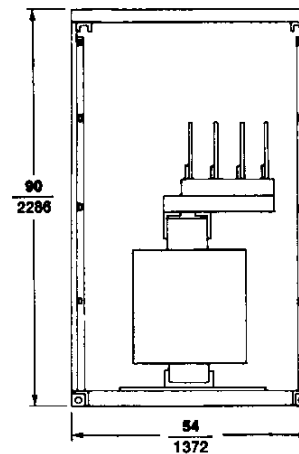
TERMINAL CHAMBER



TERMINAL CHAMBER



FRONT VIEW



Represents Suggested Conduit
Entrance Area

VENTILATED DRY TRANSFORMER DIMENSION DATA

KVA Rating	5000 Volt Class								15000 Volt Class							
	115°C. & 150°C. Rise 30KV BIL				80°C. Rise 30KV BIL				115°C. & 150°C. Rise 60KV BIL *				80°C. Rise 60KV BIL *			
	T		Weight		T		Weight		T		Weight		T		Weight	
	IN.	mm	Lbs.	Kg.	IN.	mm	Lbs.	Kg.	IN.	mm	Lbs.	Kg.	IN.	mm	Lbs.	Kg.
225	56	1422	2850	1293	56	1422	3190	1406	56	1422	2850	1293	56	1422	3100	1406
300	56	1422	3250	1474	56	1422	3700	1678	56	1422	3250	1474	72	1829	3800	1724
500	72	1829	3750	1701	72	1829	5300	2404	72	1829	4200	1905	72	1829	5300	2404
750	72	1829	5700	2585	84	2134	6400	2903	72	1829	5700	2586	84	2134	6400	2903
1000	84	2134	6500	2948	84	2134	7500	3402	84	2134	6500	2948	84	2134	7500	3402
1500	84	2134	7700	3493	84	2134	8900	4037	84	2134	7700	3493	84	2134	8900	4037
2000	84	2134	9700	4410	84	2134	10150	4604	84	2134	9700	4400	84	2134	10150	4604
2500	84	2134	11250	5103	96	2438	11650	5284	84	2134	11250	5080	96	2438	11650	5284

3000 KVA and larger units are available on special order.
*95KV BIL rated units are available.

Dual Dimensions: INCHES Dimensions subject to change without notice.
 Millimeters



JUNE, 1984

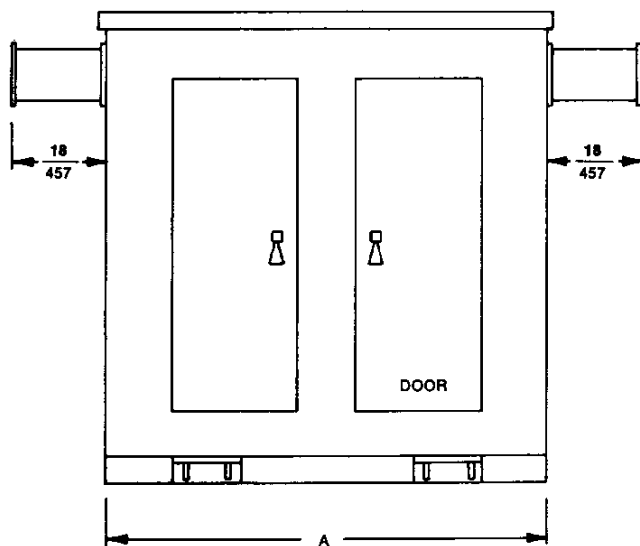
POWER-ZONE® LOAD CENTER UNIT SUBSTATIONS

6020

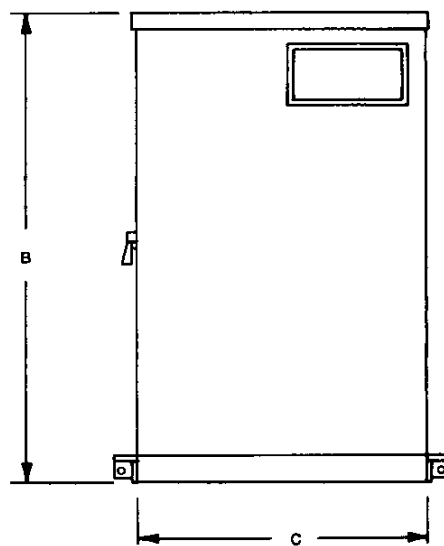
(APPROXIMATE DIMENSIONS — NOT FOR CONSTRUCTION)

OUTDOOR NON-VENTILATED DRY TYPE TRANSFORMER

5 kV and 15 kV



FRONT VIEW



RIGHT END VIEW

NON-VENTILATED DRY TRANSFORMER DIMENSIONAL DATA

KVA Rating	5000 and 15000 Volt Class							
	A		B		C		Weight	
	IN.	mm	IN.	mm	IN.	mm	Lbs.	kg.
500	84	2134	90	2286	54	1372	6000	2722
750	96	2438	90	2286	54	1372	7000	3175
1000	112	2845	118	2997	55	1397	12500	5670
1500	112	2845	118	2997	55	1397	15000	6804
2000	112	2845	118	2997	55	1397	17000	7711

Dimensions subject to change without notice.

Dual Dimensions: INCHES
Millimeters



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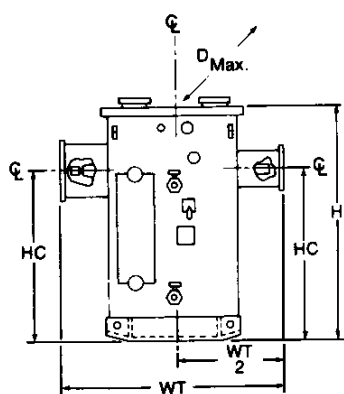
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POWER-ZONE® LOAD CENTER UNIT SUBSTATIONS

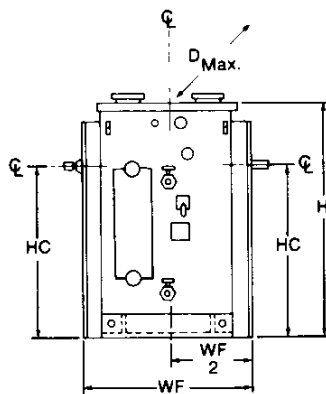
JUNE, 1984

DIMENSIONS (APPROXIMATE DIMENSIONS—NOT FOR CONSTRUCTION)

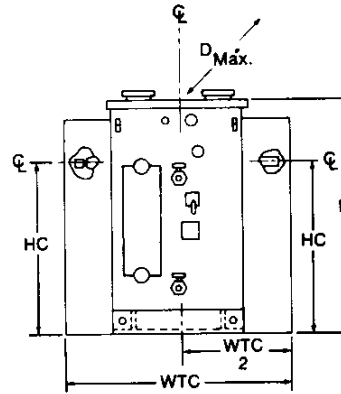
LIQUID FILLED TRANSFORMER (MINERAL OIL) 5 kV and 15kV



TRANSFORMER WITH
HIGH AND LOW VOLTAGE
THROATS



TRANSFORMER WITH
HIGH AND LOW VOLTAGE
FLUSH END



TRANSFORMER WITH
HIGH AND LOW VOLTAGE
FULL HEIGHT TERMINAL
CHAMBERS

- D —Depth —Front to Rear
DT —Depth —Front to Center Line of Transformer Tank
H —Height —Floor to Max. Height
HC —Height —Floor to Electrical Connection Point
WT —Width —Throat to Throat Overall
WF —Width —Flush End to Flush End Overall
WTC —Width —Terminal Chamber to Terminal Chamber

Dimensions are based on 3-phase, oil-filled transformers 65°C. rise, 60 Hz, with NEMA standard taps and accessories, primary volts 13.8KV maximum, secondary volts 600 V maximum with Delta-Delta, Delta wye or wye wye connections.

OIL TRANSFORMER DIMENSIONAL DATA 5,000 and 15,000 Volt Class

KVA Rating	Width												Height				Depth				Weight	
	WF		WF/2		WF		WF/2		WTC		WTC/2		HC		H		D		DT		Lbs.	Kg.
	IN.	mm	IN.	mm	IN.	mm	IN.	mm	IN.	mm	IN.	mm	IN.	mm	IN.	mm	IN.	mm	IN.	mm		
225	70	1778	35	889	51	1295	25.5	648	74	1880	37	940	55	1397	71	1803	42	1067	17.5	444	3835	1740
300	73	1854	36.5	927	54	1372	27	686	77	1956	38.5	978	55	1397	71	1803	48	1219	17.5	444	4240	1923
500	75	1905	37.5	953	56	1422	28	711	87	2210	43.5	1105	55	1397	71	1803	50	1270	18.5	470	5147	2335
750	75	1905	37.5	953	56	1422	28	711	87	2210	43.5	1105	55	1397	76	1930	58	1473	18.5	470	7465	3386
1000	78	1981	39	991	59	1499	29.5	749	90	2286	45	1143	55	1397	76	1930	60	1524	19.5	496	8945	4057
1500	83	2108	41.5	1054	64	1626	32	813	95	2413	47.5	1207	55	1397	88	2235	73	1854	21	533	11853	5288
2000	86	2184	43	1092	67	1702	33.5	851	98	2489	49	1245	55	1397	88	2235	73	1854	21	533	13669	6200
2500	89	2261	44.5	1130	70	1778	35	889	101	2565	50.5	1283	55	1397	88	2235	76	1930	22.5	572	15864	7196

*If station or intermediate class lightning arresters are required in terminal chamber add 32" to WTC, 16" to WTC/2, for 225 and 300 KVA transformers; 24" to WTC, 12" to WTC/2, for all other KVA sizes.

Dual Dimensions: INCHES
Millimeters

Dimensions subject to change without notice.

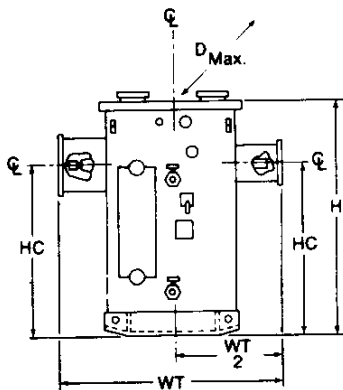


POWER-ZONE® LOAD CENTER UNIT SUBSTATIONS

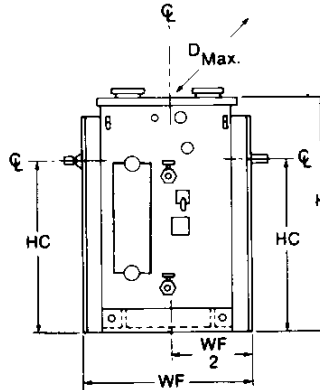
**CLASS
6020**

DIMENSIONS (APPROXIMATE DIMENSIONS—NOT FOR CONSTRUCTION)

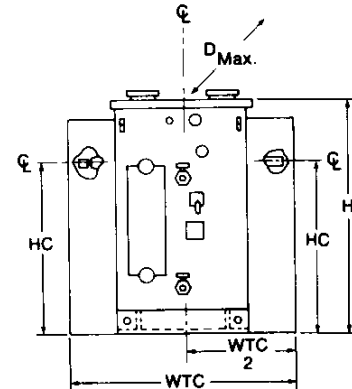
LIQUID FILLED TRANSFORMER (RTEmp)

5 kV and 15 kV


TRANSFORMER WITH
HIGH AND LOW VOLTAGE
THROATS



TRANSFORMER WITH
HIGH AND LOW VOLTAGE
FLUSH END



TRANSFORMER WITH
HIGH AND LOW VOLTAGE
FULL HEIGHT TERMINAL
CHAMBERS

D —Depth —Front to Rear
DT —Depth —Front to Center Line of Transformer Tank
H —Height —Floor to Max. Height
HC —Height —Floor to Electrical Connection Point
WT —Width —Throat to Throat Overall
WF —Width —Flush End to Flush End Overall
WTC —Width —Terminal Chamber to Terminal Chamber

Dimensions are based on 3-phase, RTEmp-filled transformers 65°C. rise, 60 Hz, with NEMA standard taps and accessories, primary volts 13.8KV maximum, secondary volts 600 V. maximum with Delta-Delta, Delta-wye or wye-wye connections.

RTEmp TRANSFORMER DIMENSIONAL DATA 5,000 and 15,000 Volt Class

KVA Rating	Width												Height				Depth				Weight	
	WT		WT/2		WF		WF/2		WTC		WTC/2		HC		H		D		DT		Lbs.	Kg.
	IN.	mm	IN.	mm	IN.	mm	IN.	mm	IN.	mm	IN.	mm	IN.	mm	IN.	mm	IN.	mm	IN.	mm		
225	70	1778	35	889	51	1295	25.5	648	74	1880	37	940	55	1397	73	1854	36	965	17.5	444	3871	1756
300	73	1854	36.5	927	54	1372	27	686	77	1956	38.5	978	55	1397	73	1854	38	965	17.5	444	4286	1944
500	75	1905	37.5	953	56	1422	28	711	87	2210	43.5	1105	55	1397	73	1854	50	1270	18.5	470	5240	2377
750	75	1905	37.5	953	56	1422	28	711	87	2210	43.5	1105	55	1397	78	1981	58	1473	18.5	470	7623	3558
1000	78	1981	39	991	59	1499	29.5	749	90	2286	45	1143	55	1397	78	1981	73	1524	32.5	826	9115	4135
1500	83	2108	41.5	1054	64	1626	32	813	95	2413	47.5	1207	55	1397	90	2286	73	1854	21	533	11989	5438
2000	86	2184	43	1092	67	1702	33.5	851	98	2489	49	1245	55	1397	90	2286	73	1854	21	533	14004	6352
2500	89	2261	44.5	1130	70	1778	35	889	101	2565	50.5	1283	55	1397	90	2286	76	1930	22.5	572	16097	7302

*If station or intermediate class lightning arresters are required in terminal chamber add 32" to WTC, 16" to WTC/2, for 225 and 300 KVA transformers; 24" to WTC, 12" to WTC/2, for all other KVA sizes.

Dual Dimensions: **INCHES**
Millimeters

Dimensions subject to change without notice.


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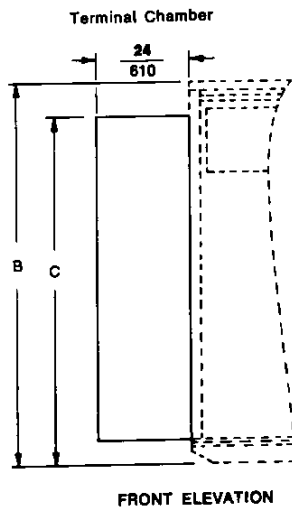
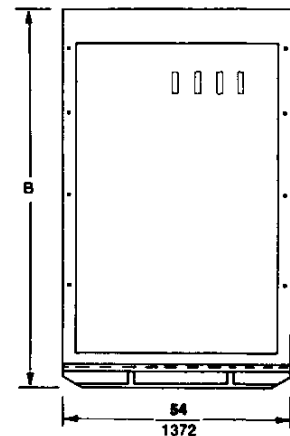
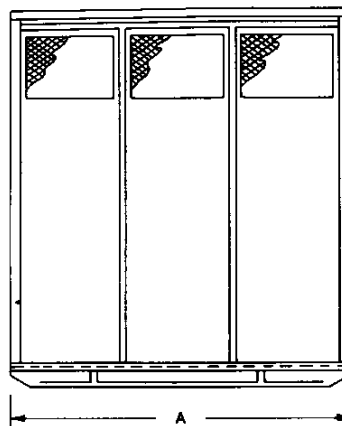
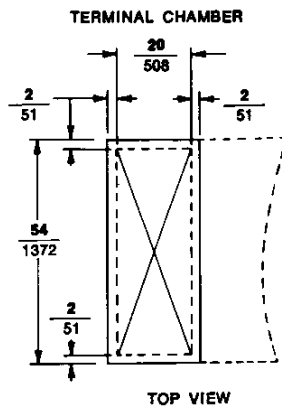
POWER-ZONE® LOAD CENTER UNIT SUBSTATIONS

JUNE, 1984

(APPROXIMATE DIMENSIONS — NOT FOR CONSTRUCTION)

INDOOR CAST RESIN TRANSFORMER

5 kV and 15 kV



Represents Suggested Conduit
Entrance Area

INDOOR CAST RESIN TRANSFORMER DIMENSIONAL DATA

KVA Rating	5000 and 15000 Volt Class									
	A		B		C		Weight Copper Windings		Weight Aluminum Windings	
	IN.	mm	IN.	mm	IN.	mm	Lbs.	kg	Lbs.	kg
500	96	2438	92	2337	92	2337	6450	2926	4910	2227
750	96	2438	92	2337	92	2337	6700	3039	5740	2604
1000	96	2438	92	2337	92	2337	9000	4082	7150	3243
1500	107	2717	100	2540	92	2337	10800	4999	9080	4119
2000	107	2717	100	2540	92	2337	12150	5511	11180	5071
2500	112	2845	100	2540	92	2337	16200	7348	11740	5325

Available in copper windings (Power Cast®)
and aluminum windings (Power Cast II®)

Dimensions subject to change without notice.

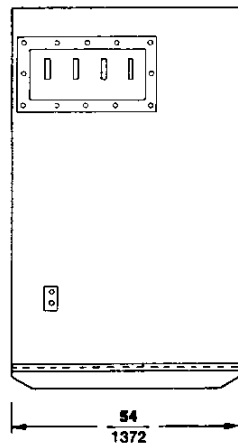
POWER-ZONE® LOAD CENTER UNIT SUBSTATIONS

6020

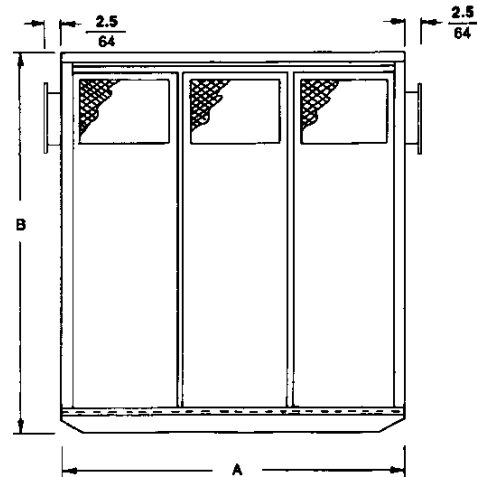
(APPROXIMATE DIMENSIONS — NOT FOR CONSTRUCTION)

OUTDOOR CAST RESIN TRANSFORMER

5 kV and 15 kV



LEFT END ELEVATION



FRONT ELEVATION

 Available in copper windings (Power Cast®)
and aluminum windings (Power Cast II®)

OUTDOOR CAST RESIN TRANSFORMER DIMENSIONAL DATA

KVA Rating	5000 and 15000 Volt Class							
	A		B		Weight Copper Windings		Weight Aluminum Windings	
	IN.	mm	IN.	mm	Lbs.	kg	Lbs.	kg
500	96	2438	82	2337	6450	2926	4910	2227
750	96	2438	82	2337	6700	3039	5740	2604
1000	96	2438	82	2337	9000	4082	7150	3243
1500	107	2718	100	2540	10800	4899	9080	4119
2500	107	2718	100	2540	12150	5511	11180	5071
2000	112	2845	100	2540	16200	7348	11740	5325

Dimensions subject to change without notice.

 Dual Dimensions: INCHES
 Millimeters

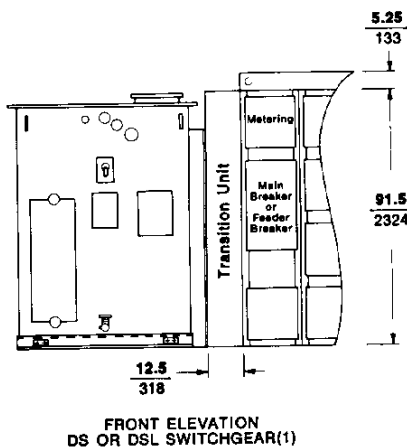
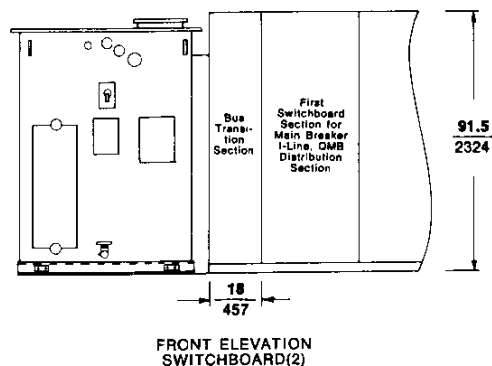
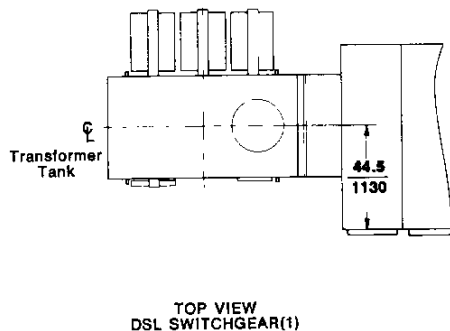
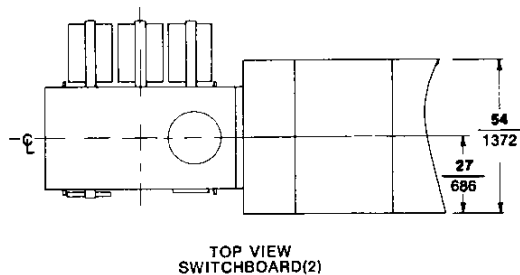
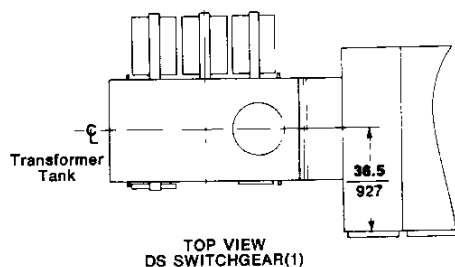

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POWER-ZONE® LOAD CENTER UNIT SUBSTATIONS

JUNE, 1984

(APPROXIMATE DIMENSIONS — NOT FOR CONSTRUCTION)
INDOOR LIQUID TRANSFORMER CONNECTIONS
TO LOW VOLTAGE DISTRIBUTION SECTIONS



- NOTE:
- (1) For dimensional data on DS and DSL switchgear see Catalog Class 6030.
 - (2) For dimensional data on Power Style switchboards, see Catalog Class 2760.
 - For dimensional data on MCDO switchboards, see Catalog Class 2770.
 - For dimensional data on MCDO II switchboards, see Catalog Class 2775.
 - (3) For low voltage terminal chamber, see Catalog Class 6020, page 26 or 27.

All dimensions subject to change without notice.

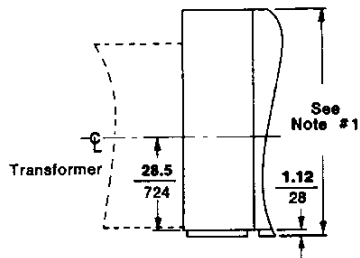
Dual Dimensions: $\frac{\text{INCHES}}{\text{Millimeters}}$



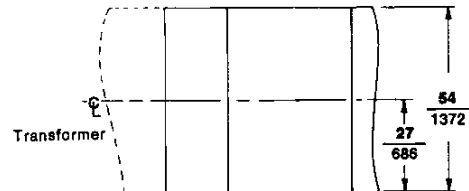
POWER-ZONE® LOAD CENTER UNIT SUBSTATIONS

CLASS
6020

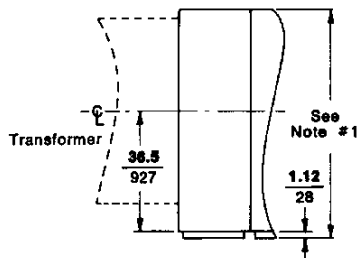
(APPROXIMATE DIMENSIONS — NOT FOR CONSTRUCTION)
 INDOOR STANDARD DRY TYPE TRANSFORMER CONNECTIONS
 TO LOW VOLTAGE DISTRIBUTION SECTIONS



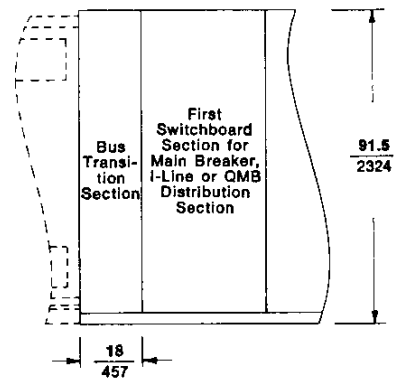
TOP VIEW
DS SWITCHGEAR(1)



TOP VIEW
SWITCHBOARD(2)

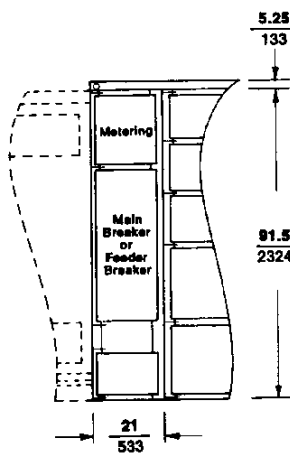


TOP VIEW
DSL SWITCHGEAR(1)



FRONT ELEVATION
SWITCHBOARD(2)

(Transition Section Only
Required if Connecting
to MCDO Construction)



FRONT ELEVATION
DS OR DSL SWITCHGEAR(1)

NOTE:

- (1) For dimensional data on DS and DSL switchgear see Catalog Class 6030.
- (2) For dimensional data on Power Style switchboards, see Catalog Class 2760.
For dimensional data on MCDO switchboards, see Catalog Class 2770.
For dimensional data on MCDO II switchboards, see Catalog Class 2775.
- (3) For low voltage terminal chamber, see Catalog Class 6020, page 24.

All dimensions subject to change without notice.

Dual Dimensions: **INCHES**
Millimeters



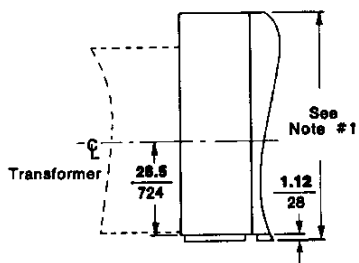
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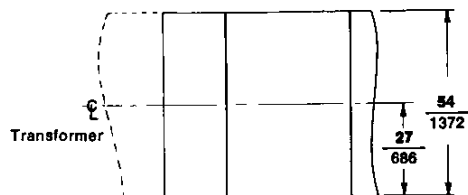
POWER-ZONE® LOAD CENTER UNIT SUBSTATIONS

JUNE, 1984

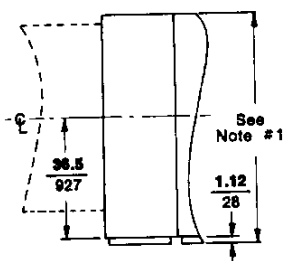
(APPROXIMATE DIMENSIONS — NOT FOR CONSTRUCTION)
INDOOR POWER CAST TRANSFORMER CONNECTIONS
TO LOW VOLTAGE DISTRIBUTION SECTIONS



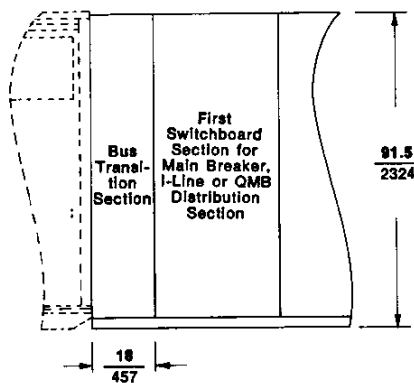
TOP VIEW
DS SWITCHGEAR



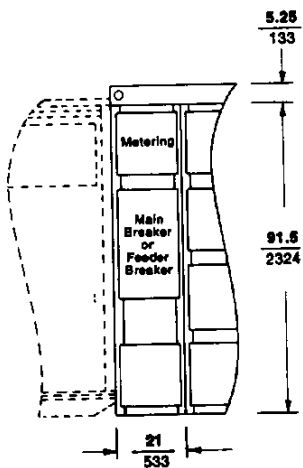
TOP VIEW
SWITCHBOARD



TOP VIEW
DSL SWITCHGEAR



FRONT ELEVATION
SWITCHBOARD
(Transition Section Only
Required if Connecting
to MCDO Construction)



FRONT ELEVATION
DS OR DSL SWITCHGEAR

NOTE:

- (1) For dimensional data on DS and DSL switchgear see Catalog Class 6030.
- (2) For dimensional data on Power Style switchboards, see Catalog Class 2760.
For dimensional data on MCDO switchboards, see Catalog Class 2770.
For dimensional data on MCDO II switchboards, see Catalog Class 2775.
- (3) For low voltage terminal chamber, see Catalog Class 6020, page 28.

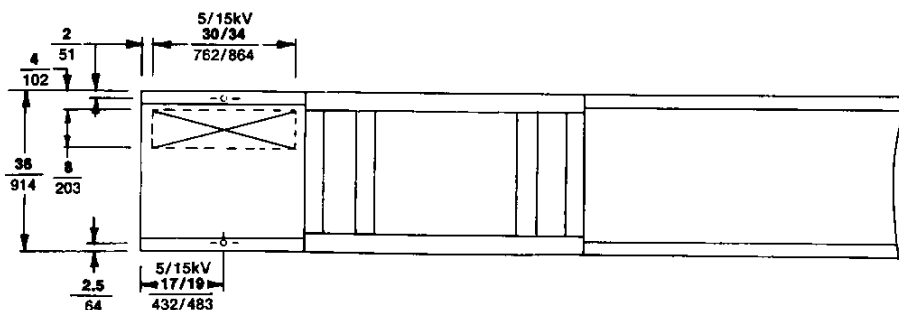
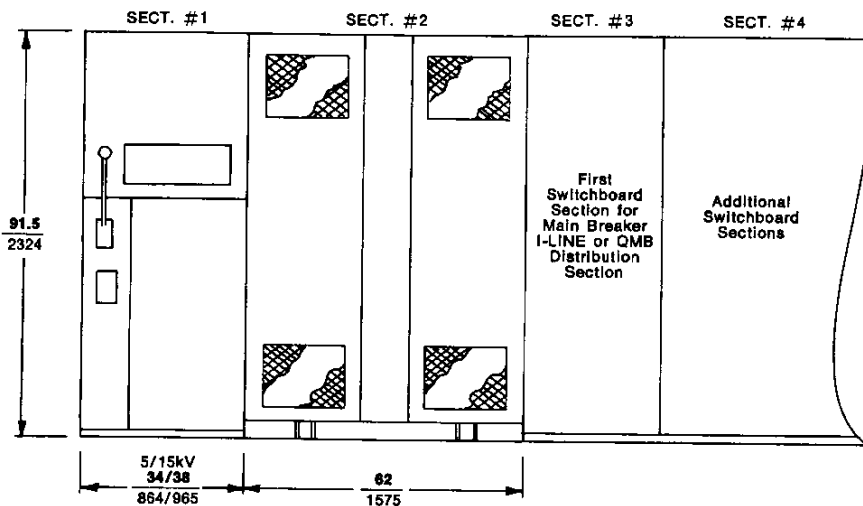
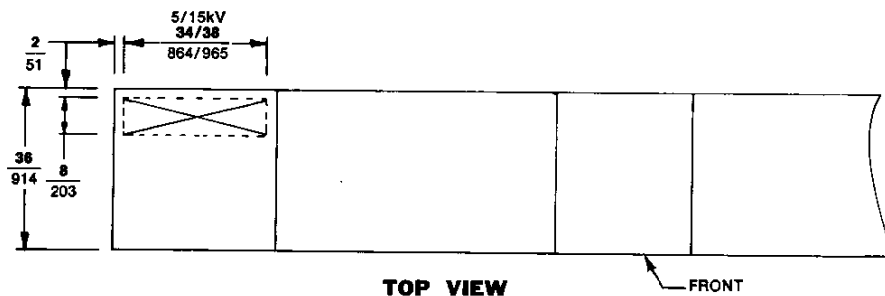
All dimensions subject to change without notice.

POWER-ZONE® LOAD CENTER UNIT SUBSTATIONS

CLASS
6020

DIMENSIONS
(APPROXIMATE DIMENSIONS—NOT FOR CONSTRUCTION)

INDOOR COMPACT SECTIONAL UNIT SUBSTATIONS 5 & 15 kV Class — 225 thru 750 kVA



*NOTE:

(1) For dimensional data on 36" Deep Switchboards, see Catalog Class 2720.

Dual Dimensions: INCHES
Millimeters

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POWER-ZONE®
LOAD CENTER UNIT SUBSTATIONS

JUNE, 1984

SUGGESTED SPECIFICATIONS**Unit Substation — General**

These specifications and the associated drawings describe one (indoor) (outdoor) _____ KVA, 3 phase, 60 cycle, unit substation complete from the _____ volt incoming line connection to the _____ volt outgoing feeder connections. Any items not specifically mentioned but obviously necessary for proper operation are implied in this description.

The Unit Substation shall be a Square D POWER-ZONE® Unit Substation or approved equal, designed, manufactured and tested in accordance with applicable standards of NEMA, ANSI and IEEE. It shall consist of a high voltage incoming line section, a transformer section and a low voltage section each separated from the others by steel barriers but electrically connected and physically joined to form a single, metal enclosed structure. The enclosure frame and internal barriers shall be fabricated of code gauge steel and finished with medium gray (ANSI #49) paint applied over a rust inhibiting phosphate primer. Construction shall prevent entry of rodents into the substation interior.

The equipment shall be totally adjusted and tested at the factory and sectionalized for shipment so that the largest section does not exceed _____ inches wide, _____ inches deep, and _____ inches high to enable installation at the job site. Installation and connection of the unit substation shall not require removal or disassembly of any factory mounted stationary high voltage devices (except potheads). Prominent nameplates bearing equipment ratings, tap changing information, manufacturer identification and reference serial numbers shall be mounted on the front of the unit substation.

The sound level of the unit substation shall not exceed _____ db when the transformer is self-cooled and _____ db when cooling fans are running as measured in accordance with latest NEMA test procedures. Over-all floor space dimensions shall not exceed _____ long and _____ deep.

Equipment construction shall allow movement of the unit substation on rollers through a doorway _____ high and _____ wide, and shall allow installation and operation in an area having a ceiling height of _____ inches.

High Voltage Incoming Line Section

The incoming line section shall terminate the incoming (and outgoing) _____ volt feeder. This section and all components therein shall be designed and coordinated to have a single short circuit rating, comprising any switch fault closing rating, short time ratings and fuse interrupting rating, of not less than _____ amperes Asymmetrical or _____ MVA Symmetrical at the system voltage. The basic insulation impulse level (BIL) of the

entire assembly shall be not less than (60) (75) (95) (125) (150) kV per NEMA testing procedure. The incoming line section shall consist of an air insulated steel enclosure separated from the transformer section by steel barriers and containing: (select A or B)

A) Air Terminal Chamber

(1) (2) — (Set of lugs) (pothead) to terminate (1) (2), 3 phase, _____ conductor, cable feeders entering from the (top) (bottom).

3 — Lightning arresters — (distribution) (intermediate) (station) type for (grounded) (ungrounded) system, connected to the incoming cable terminals.

B) Load Break Air Interrupter Switch (select 1 or 2)

1) 1 — Load break air interrupter switch, 3 pole, 2 position — open/closed, 600 amperes continuous current and suitable for interrupting 600A. A stored energy spring mechanism shall provide quick closing and opening of the switch independent of the handle speed. The fault closing and short time ratings of the switch (with fuses) shall not be less than the high voltage section short circuit rating.

2) 1 — Load break air interrupter duplex switch, consisting of two 3 pole, 2 position — open/closed air interrupter switches with the load sides connected together, 600 amperes continuous current and suitable for interrupting 600A. A stored energy spring mechanism shall provide quick closing and opening of the switch independent of the handle speed. The fault closing and short time ratings of the switch (with fuses) shall not be less than the high voltage section short circuit rating. Supply key interlocks between the two switches (and the fuse compartment door) so only one switch can be closed at any time (and access to the fuses can be gained only when both switches are open).

3) Fuses with continuous current rating to best coordinate with transformer and secondary devices. Fuse interrupting capacity shall not be less than the high voltage section short circuit rating. (Select 1 or 2)

1 — Fuses shall be current limiting type which do not produce hot gas, flame, noise or pressure. Fuses shall be applied so that indication of a blown fuse shall be visible without opening the enclosure.

2 — Fuses shall be replaceable boric acid refill type mounted so as to direct any flame or gas downward away from the components and away from the front of the equipment.

High voltage fuses shall be connected to the load side of the switch and de-energized when the switch is open. They shall be located to prevent their accidentally falling into energized parts during replacement.



POWER-ZONE® LOAD CENTER UNIT SUBSTATIONS

 CLASS
6020

SUGGESTED SPECIFICATIONS

The high voltage fuses and fuse mountings shall be completely visible and easily accessible through a door (mechanically interlocked with the high voltage switch to insure that the switch is open when the fuses are accessible). No energized parts shall be within normal reach of the opened doorway. Construction shall allow convenient fuse replacement with a fuse handling tool.

Four single full length track resistant polyester inter-phase barriers shall isolate the 3 phases of the switch (and fuse combination) from each other and from the enclosure.

A viewing window shall be provided in the high voltage switch enclosure of sufficient size and located to enable visible inspection from outside the enclosure of all open or closed switch poles and installed fuses, within the enclosure.

The handle of the high voltage switch shall be permanently mounted and operable from the front of the unit substation. Design shall allow the handle to project no more than 6" from the enclosure when switch is in the open or closed position. An upward motion of the handle shall close and a downward motion shall open the switch. The handle position in conjunction with prominent nameplates shall clearly indicate whether the switch is open or closed. The handle shall be located on the front of the switch (and fuse) enclosure.

Convenient and positive means for padlocking the switch in the open (and) (but) not closed position shall be supplied. (Padlocking means for the fuse compartment door shall be provided.)

Transformer Section (Ventilated Dry) — Conventional

The transformer shall be 3-phase, 60 hertz, air cooled dry type mounted in a suitable ventilated enclosure and barriered from the high voltage and low voltage sections. Self cooled capacity shall be _____ KVA: primary voltage _____ volts delta; secondary voltage _____ (delta) (wye) (3) (4) wire. Primary taps shall be full capacity, with a minimum of 2-2½% above and below rated voltage.

The transformer shall have a 150°C ambient, (or 115°C temperature rise above a 40°C ambient) (or 80°C temperature rise above 40°C ambient). 115°C transformers shall be capable of carrying a 15% continuous overload without exceeding 150°C rise in a 40°C ambient. 80°C rise transformers shall be capable of carrying a 30% continuous overload without exceeding a 150°C rise in a 40° ambient. All insulating materials used shall be in accordance with NEMA ST20 or NEMA TR27 Standards for a 220°C insulation system. The temperature rise shall be designated on the transformer nameplate.

Two types of coil design are used in the manufacture of our high voltage transformers, either may be specified.

1. The standard modified disc winding to provide the most

efficient, reliable, and compact type of coil in this type of design.

2. The special barrel-type winding for areas where greater than normal amounts of non-conductive dust, dirt or lint might be encountered. This winding with its vertical air ducts and smooth surface would require less maintenance than a disc type winding.

The completed coils shall be pre-heated, vacuum-impregnated with non-hygroscopic, thermosetting insulating varnish, and then thoroughly baked. This process shall completely seal the coils against moisture, and eliminate any voids which could create hot spots, or cause corona formation.

The transformer cores are to be constructed of high grade, non-aging silicon steel laminations with high magnetic permeability, and low hysteresis and eddy current losses. Magnetic flux densities are to be kept well below the saturation point. The core laminations shall be clamped together with heavy, structural steel angles.

The basic impulse levels (BIL) shall be a minimum of 60 KV for the 15 KV class, 45 KV for the 8.66 KV class, 30 KV for the 5 KV class, and 20 KV for the 2.5 KV class.

The enclosure shall be constructed of heavy gauge sheet steel. All ventilating openings shall be in accordance with NEMA and National Electrical Code standards for ventilated enclosures. Large enclosures are to be provided with lifting devices bolted or welded to the base structure, and shall have jacking pads designed to be flush with the enclosure. The base is to be constructed of structural steel members to permit skidding or rolling in any direction. The enclosure is to be cleaned, phosphatized, primed and finished with medium gray (ANSI #49) paint.

MOV type Distributor Class lightning arresters, or equivalent, shall be installed by the manufacturer on the high voltage side of the transformer to provide additional protection against high voltage lightning or switching surges.

When fan cooling is specified, provide a Sorgel Model 80, solid state, temperature control system with factory calibrated and pre-set thermistors in each phase of the transformer. These thermistors are to be installed in the transformer windings to continuously monitor the hot-spot temperature. If the temperature rises beyond normal, a relay is activated to start the fans. If the temperature continues to rise, a second relay operates to sound an audible alarm and lights a red warning light. The fan control panel is to consist of a green "Power On" light, an amber "Fans On" light with a manual/automatic selector switch, and a red "High Temperature" light with an audible alarm. An alarm silencing button is to be provided to silence the alarm, but allow the red light to remain on until the temperature decreases to normal. Necessary fusing and transformers for higher than 120 volts are to be provided as part of the complete package. Multiple cooling fans are to be installed at the bottom of each coil with a minimum of six for 3 phase, and four for single phase transformers.



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POWER-ZONE® LOAD CENTER UNIT SUBSTATIONS

JUNE, 1984

SUGGESTED SPECIFICATIONS

If visual temperature indication is required a temperature indicator shall be provided and mounted on the front panel of the transformer.

The sound levels shall be guaranteed by the manufacturer not to exceed the following values:

151 to 300 KVA — 58DB; 301 to 500 KVA — 60DB;
501 to 700 KVA — 62DB; 701 to 1000 KVA — 64DB;
1001 to 1500 KVA — 65DB; 1501 to 2000 KVA — 66DB;
2001 to 3000 KVA — 68DB.

(NOTE: Lower sound levels may be desirable for critical areas such as hospitals, schools, or office areas. Contact your local Square D field sales office for recommendations.)

Provisions shall be made to completely isolate the core and coil from the enclosure. There shall be no metal-to-metal contact. Rubber vibration isolating pads shall be installed by the manufacturer between the core and coil and the enclosure. The core shall then be visibly grounded to the ground bus or ground pad by means of a flexible grounding conductor sized in accordance with applicable NEMA, ANSI, and NEC Standards.

(NOTE: For Compact Sectional Unit Substations specify barrel-type windings only. 115°C temperature rise and 80°C temperature rise are available thru 500 KVA in the compact design.)

Transformer Section (Ventilated Dry) — Cast Resin

The transformer(s) shall be of Dry-Type, Cast-Resin construction; mounted in a suitable, ventilated enclosure.

The transformer(s) shall be rated _____ KVA; Primary voltage _____ volts, delta; Secondary voltage _____ volts (Wye) (delta), (3) (4) wire 60Hz. Primary taps shall be full capacity, with two 2.5% above and below rated voltage.

Impedance shall be (____%) (Manufacturer's Standard Impedance) Sound level shall not exceed (____db) (NEMA Standard maximum db for the applicable KVA size of Dry-Type transformers as set forth in NEMA publication TR 1-1980).

(Select A or B)

A) Power Cast Construction

Both HV and LV windings shall be of copper conductors.

The average temperature rise of the transformer windings shall not exceed 80°C, when the transformer is operated at full nameplate rating. The transformer(s) shall be capable of carrying 100% of nameplate KVA rating in a 40°C maximum ambient temperature.

Impulse rating of the low voltage winding must be (at least 25KV for LV 1.2KV class and below), (45KV for 2.5KV secondaries), (60KV for 5KV secondaries).

Forced Air Cooling (Optional)

Shall increase the continuous self cooled rating of units as follows:

SELF COOLED RATING	PER CENT INCREASE
500 — 750 KVA 1000 — 5000 KVA	33 1/3 % 50 %

The above indicated increase shall be possible with forced cooling without exceeding the maximum design temperatures at 40°C maximum ambient.

B) Power Cast II Construction

Both HV and LV windings shall be of aluminum conductors.

The average temperature rise of the transformer windings shall not exceed 115°C, when the transformer is operated at full nameplate rating. The transformer(s) shall be capable of carrying 100% of nameplate KVA rating in a 40°C maximum ambient temperature.

Forced Air Cooling (Optional)

Shall increase the continuous self cooled rating of units as follows:

SELF COOLED RATING	PER CENT INCREASE
500 — 750 KVA 1000 — 5000 KVA	33 1/3 % 50 %

The above indicated increase shall be possible with forced cooling without exceeding the maximum design temperatures at 40°C maximum ambient.

General:

The forced air cooling shall be regulated automatically by sensors placed in the LV air ducts. Forced air cooling shall include: thermal sensors, fan(s), control wiring, control box with test switch, current limiting fuses, indicating lights, alarm, alarm silencing relay and push buttons.

Provisions for future forced air cooling on all units shall be optional. Provisions for future forced air cooling shall include mounting provisions only for fan(s) and busing sized to the fan-cooled rating.

HV and LV windings shall each be separately cast as one rigid tubular coil, and arranged coaxially. Each cast coil shall be fully reinforced with glass cloth, and cast under vacuum to assure complete, void-free resin impregnation throughout the entire insulation system. Coils shall be supported by cast epoxy bottom supports and spacer blocks and spring loaded top blocks, and shall have no rigid mechanical connection between them.



POWER-ZONE® LOAD CENTER UNIT SUBSTATIONS

 CLASS
6020

SUGGESTED SPECIFICATIONS

The windings must not absorb moisture, and shall be suitable for both storage and operation in adverse environments, including prolonged storage in 100% humidity at temperatures of from -40°C to $+40^{\circ}\text{C}$, and shall be capable of immediately being switched on after such storage without predrying.

The transformer(s) must be free of partial discharge up to at least 1.2 times the rated line-to-ground voltage. Each coil shall be subjected to a partial discharge test to verify its partial discharge.

Impulse rating of the high voltage winding must be equal to the Basic Impulse Level specified by ANSI for Oil Filled Transformers of the same voltage class, without the use of supplemental surge arresters.

The transformer core shall be constructed of high grade, grain oriented silicon steel laminations, with high magnetic permeability. Magnetic flux density is to be kept well below the saturation point. The cores shall be cruciform in shape, with mitered joints to keep core losses, exciting current and noise level at a minimum. The outside surfaces of the core shall be protected against corrosion by a resin coating not less than 1mm thick.

The enclosures shall be constructed of heavy gauge sheet steel. All ventilating openings shall be in accordance with NEMA and the National Electrical Code standards for ventilated enclosures. Large enclosures shall have jacking pads designed to be flush with the enclosure. The base shall be constructed of structural steel members, to permit skidding or rolling in any direction.

The core shall be visibly grounded to the frame by means of a flexible grounding strap in accordance with applicable NEMA and NEC standards.

Transformer Section (Non-Ventilated Dry)

The transformer shall be _____ KVA, 3 phase, 60 cycles. Primary taps shall be full capacity taps, with a minimum of $2\frac{1}{2}\%$ above and below rated voltage.

Transformer shall be 115°C rise above a 40°C ambient. (Transformer shall be capable of carrying a 15% continuous overload without exceeding a 150°C rise.) All insulating materials used shall be in accordance with NEMA TR 27 — 1965 Standards for 220°C insulation system.

The basic impulse level (BIL) shall be a minimum of 94kV for the high voltage winding for units in the 15kV insulation class.

The enclosure shall be constructed of heavy gauge sheet steel and meet the requirements of NEMA Type 12 for indoor and NEMA Type 3R for an outdoor enclosure to make it dust-tight and rainproof respectively. The enclosure should be provided with lifting devices secured to the base structure and have jacking pads designed to be flush with the enclosure. The base is to be constructed of structural steel members to permit skidding or rolling in any direction. The enclosure is to be cleaned, phosphatized, primed and finished with medium gray (ANSI #49) paint.

The enclosure is to have adequate surface area to limit the maximum temperature rise of the enclosure to 50°C above a 40°C ambient at full load and rated voltage.

Low flash-over, rotating machinery type or equivalent lightning arresters shall be installed by the manufacturer in the high voltage compartment to provide additional protection against high voltage lightning or switching surges.

The transformer shall be designed to deliver rated KVA without benefit of internal fans to circulate the air.

An internal fan cooling system shall be provided to increase the KVA rating by a minimum of 25%. The fan cooling system shall consist of a solid state, temperature controlled system. This system is to consist of calibrated and preset thermistors installed in the windings of each phase to continuously monitor the hot-spot temperature. Pilot lights are to indicate power on (green), fans operating (amber), high temperature (red). An alarm and alarm silencing button shall also be included. Necessary fusing and transformers for higher than 120 volts are to be provided. The necessary fans should be located at the base of each coil to direct the air flow through the interior of the coil. The control panel is to be mounted on the front exterior of the transformer and factory wired.

Provisions shall be made to completely isolate the core and coil from the enclosure. There shall be no metal-to-metal contact. Rubber vibration isolating pads shall be installed by the manufacturer between the core and coil and the enclosure. The core should then be visibly grounded to the enclosure by means of a flexible grounding conductor sized in accordance with applicable NEMA and NEC Standards.

Transformer Section (Liquid Filled)

(1)(2) Transformer section(s) (each) containing:

_____ KVA 3 phase, 60 Hertz, (oil) (RTemp®) (silicone) immersed transformer, suitable for (indoor) (outdoor) application, self-cooled (55) (55/65) (65) degree C. temperature rise, primary _____ volts (delta) (wye), _____ wire _____ BIL, secondary _____, volts (delta) (wye), _____ wire _____ BIL, four $2\frac{1}{2}\%$ full capacity taps in primary winding, two above and two below rated primary voltage, including standard ANSI and NEMA accessories. Transformer to have (provisions only for future forced air cooling) (forced air cooling from top of liquid temperature) (forced air cooling from winding temperature indicator) (complete provisions for forced air cooling less fans and motor(s)).

Forced air cooling (optional) shall increase the continuous self-cooled rating of units as follows:

SELF-COOLED RATING	FORCED AIR COOLING PER CENT INCREASE
2500 KVA 750, 1000, 1500, 200 KVA	15% 25%



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Provisions for future forced air cooling shall be standard on all units with self-cooled ratings of 750 KVA and larger.

The transformer shall meet all of the latest applicable NEMA, ANSI, and IEEE Standards for power transformers.

SELECT A or B:

A) Oil or RTemp® Immersed Transformer

Transformers shall be built with a five-legged wound core. The five-legged core design shall eliminate tank enclosure heating which results from ferro resonance and enable the transformer to be used in a wye-wye connected configuration.

Transformer cores are to be constructed from accurately cut, burr free, low loss, high electrical grade, grain oriented silicon steel. Core laminations shall be coated, insulated and rigidly clamped to provide a low loss symmetrical flux path.

The transformer tank enclosure(s) are to be of welded construction using plate steel. Tanks shall be equipped with lifting lugs and jacking pads welded to the tank. Tank base must be capable of skidding or rolling in all directions. Tank covers shall be welded in place to provide insulating fluid protection from contamination. Radiators of the panel type shall be used.

Transformer(s) shall be designed to withstand 7½ PSI pressure per ANSI and NEMA Standards.

Finish on transformer tank(s) shall be a three stage wash consisting of steam cleaning, phosphatizing wash and rinse. Units shall be painted with a long lasting vinyl paint.

B) Silicone Immersed Transformer

Transformers shall be built with a three-legged wound core.

Transformer cores are to be constructed from accurately cut, burr free, low loss, high electrical grade, grain oriented silicon steel. Core laminations shall be coated, insulated and rigidly clamped to provide a low loss symmetrical flux path.

Transformer tank enclosure(s) are to be of welded construction using steel plate. The tank is to be equipped with lifting lugs and jacking pads welded to the tank. Tank base must be capable of skidding or rolling in all directions. Tank covers shall be welded in place to provide insulating fluid protection from contamination. Radiators of the tube type shall be used.

Transformer(s) shall be designed to withstand 7½ PSI pressure per ANSI and NEMA Standards.

Finish on tank(s) shall consist of a cleaning, phosphatizing wash and rinse, a primer coat to inhibit rust for-

mation, an intermediate coat of finished color, and a final coat for attractive appearance.

**Low Voltage Section
(With Low Voltage Drawout Switchgear)**

The Low Voltage Section shall be POWER-ZONE® II 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 (service entrance label) (and) UL label for Metal-Enclosed Low Voltage Power Circuit Breaker type Switchgear Assemblies when UL recognized components are specified.)

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. 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. Provide each breaker cell with a hinged door equipped with a flush satin chrome finish handle and an external trip button. No large opening shall be allowed in the door. When equipped with a breaker, a double steel barrier will exist between operating personnel and the breaker mechanism and live part. The breaker will be safe to operate with the outer steel door open.



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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. All contact surfaces at bolted joints 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 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.

As a safety precaution to prevent accidental contact with the main bus 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 grounded metal barriers.

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.) Settings are to be continuous between calibrated points. Provisions for testing and calibrat-

ing 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 contact. 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 (2) (3) pole, (manually) (electrically) operated. Set trip at _____ amperes.
- Type DS-_____ tie breaker, _____ ampere frame, (2) (3) pole, (manually) (electrically) operated. Set trip at _____ amperes.
- Type DS-_____ feeder breaker(s), _____ ampere frame, (2) (3) pole, (manually) (electrically) operated. Set trip at _____ amperes.
- Type DS-_____ feeder breaker(s), ampere frame, (2) (3) pole, (manually) (electrically) operated. Set trip at _____ amperes.

Metering Components (Main Bus)

- (1)(2) — Voltmeter and 3-phase selector switch with OFF position.
- (1)(2) — Ammeter and 3-phase selector switch with OFF position.
- (1)(2) — Watthour meter, (2) (2½) (3) element type, (with) (without) (15 minute) (30 minute) demand register.
- Current transformer, suitable ratio.
- Potential transformer, suitable ratio.

Feeder Circuits

- Ammeter and 3-phase selector switch with OFF position.
- Current transformer, suitable ratio.

A portable testing and calibration device shall be provided.

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



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SPECIFICATIONS**Low Voltage Section**
(With MCDO II Switchboards)**General**

The specifications and associated drawings describe the indoor Low Voltage Metal-Enclosed Drawout Switchboard 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.

The switchboard shall be MCDO II Drawout Insulated Case Circuit Breaker Switchboard, as manufactured by the Square D Company, or approved equal, designed, manufactured and tested in accordance with UL 891 and NEMA PB 2 Standards for circuit breakers and metal-enclosed switchboards. (Equipment shall be equipped with (UL) (service entrance) label where qualified. Front and rear accessibility shall be required.

Enclosure

The enclosure and internal barriers shall be fabricated of steel members in accordance with UL and NEMA Standards. The enclosure construction shall prevent the entry of rodents into the switchgear interior. Ventilation openings on the switchboard 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 enclosure shall be finished with medium gray ANSI #49 enamel applied over a rust inhibiting phosphate primer.

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.

The front compartment is to contain the drawout circuit breaker elements, each mounted in its own barriered cell. Active or future use cells equipped to accept circuit breakers are to be complete. Provide each breaker cell with a hinged steel door equipped with a flush chrome finish handle and an external trip operator. Horizontal steel barriers shall separate breakers in a common section.

The bus compartment is to contain the section riser and main cross bus which is to be rated for a 65° Centigrade temperature rise. The main cross bus shall be rated for _____ continuous amperes. All main and riser bus is to be (aluminum) (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.)

Size the cable compartment to accommodate all incoming and outgoing cables required within each vertical switchboard section. Cable lugs are to be mounted on the load side (or line side as applicable) phase (and neutral) run-back bus which is extended into this compartment from the bus compartment. This compartment shall also contain a plated (aluminum) (copper) ground bus. The incoming line and center bus compartments shall be barriered from the rear cable compartment.

Circuit Breakers

The circuit breakers shall be of the drawout type, manually or electrically operated type 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 all positions. Secondary control connections shall be through a multi-point semi-automatic control connector. Provide interlocks to insure the breaker is open before it can be moved from any position or when it is between positions.

The circuit breaker trip device is to be of a solid-state design 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.) Provisions for testing shall be provided. (Indicators for overload, short circuit, or ground trip shall be provided.)

The breaker operating mechanism is to be of the two-step stored energy quick-make, quick-break type. First step operation of the charging handle or breaker motor is to charge the closing springs. A second step 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 portable testing device shall be provided.)

(A top mounted travelling breaker listing device shall be provided.)



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Low Voltage Section (With MCDO Switchboards)

General

Furnish and install the circuit breaker distribution switchboard as herein specified and shown on the associated electrical drawings. The switchboard(s) shall meet the latest requirements of Underwriters' Laboratories Standard #891, NEMA PB-2 and the National Electrical Code. The switchboard(s) shall be furnished with an Underwriters' Laboratories Label.

Enclosure Construction

The switchboard shall be dead front with front and rear accessibility required. The switchboard framework shall consist of a completely self-supporting structure with steel channels welded or bolted to the frame to rigidly support the entire shipping section for moving on rollers or floor mounting. The framework is to be of formed code gauge steel, rigidly welded and bolted together to support all cover plates, bussing, and component devices during shipment and installation.

Each switchboard section shall have an open bottom and an individually removable top plate for installation and termination of conduit. Top and bottom conduit areas are to be clearly shown and dimensioned on the shop drawings.

All front covers over the circuit breakers shall be hinged with removable hinge pins. All closure plates shall be screw removable and small enough for easy handling. The paint finish shall be medium gray ANSI #49 enamel over a rust inhibiting phosphate pre-treatment.

Bussing

The switchboard bussing shall be (tin plated aluminum) (plated copper) of sufficient cross sectional area to continuously conduct rated full load current without exceeding the maximum temperature rise limits set by Underwriters' Laboratories Dead-Front Switchboard Standard, #891.

The main horizontal bussing shall consist of vertically stacked conductors in a plane parallel to the front of the switchboard. Vertical and horizontal bussing compartment shall be isolated. With all insulation barriers in place, there shall be free air space between horizontal and vertical bus-

ing. Bussing connection and support bolts shall be accessible for periodic maintenance. Vertical bussing bolts shall have captive heads with break-away torque caps.

The main horizontal bus bar shall be located in the middle of the switchboard section vertically stacked with ABC bus arrangement top to bottom. The main bus compartment will be completely barriered from the rest of the switchboard. Switchboards of more than one shipping section shall be provided with spliced bars of a rating equivalent to the main bus rating with Grade 5 hardness bolts, nuts, Belleville washers and installation instructions.

The maximum short circuit current rating shall be 100,000 RMS symmetrical amperes of fault current at 600 VAC.

A ground bus and lug shall be firmly secured to each switchboard section and shall extend the entire length of the switchboard.

Load side bus bars shall extend to the rear of the switchboard and shall be fully insulated. The load side lug compartment shall be designed so that it is not necessary to reach across or near any line side bus bars or connections. Load side lugs shall be marked with appropriate phase identification.

The main lug compartment, where furnished, shall be barriered from the line side bussing and circuit breaker compartment. Lug pads shall be tin plated and shall be suitable for either copper or aluminum (mechanical) (crimp) lugs mounted on the pads.

(Provisions shall be available when busway is used as the incoming service.)

Circuit Breaker Compartment

Each circuit breaker shall be individually isolated in its own compartment. All circuit breakers shall be draw-out mounted with standard trip on removal. There shall be no exposed live components in the circuit breaker compartment. Line and load connections up to 800A will utilize LoRes™ connectors.

NOTE: When more than one option or feature is available, the choice can be made by selecting the appropriate word(s) or number(s) in the parentheses and crossing out the rest.



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Low Voltage Section (With Power Style Switchboards)

The low voltage section shall terminate the outgoing feeder cables and contain the circuit protective devices, metering equipment, and auxiliary components described herein and on the drawings.

All low voltage bussing, devices, and connections shall be braced to withstand the maximum short circuit current available from the transformer.

Short Circuit Current Rating

Each switchboard as a complete unit, shall be given a single short circuit current rating by the manufacturer. Such rating shall be established by actual tests by the manufacturer, in accordance with UL specifications, on equipment constructed similarly to the subject switchboard.

Enclosure Construction

The switchboard shall be dead-front with (front and rear accessibility) (front accessibility) required. The switchboard framework shall consist of steel channels bolted to the frame to rigidly support the entire shipping section for floor mounting or moving on rollers. The framework is to be formed of code gauge steel, rigidly welded and bolted together to support all cover plates, bussing and component devices.

Each section shall have an open button and an individual removable top plate for installation and termination of conduit. Top and bottom conduit areas are to be clearly shown and dimensioned on the shop drawings. The wireway front covers shall be hinged to permit easy access to the branch fusible switch load side terminals. The paint finish shall be medium light gray, ANSI #49.

(A NEMA 3R enclosure for the switchboard shall be provided.)

Bussing

The switchboard bussing shall be sufficient cross-sectional area to meet UL Standard 891 on temperature rise. Through bus shall be (plated copper) (plated aluminum) (extruded aluminum plated by the Alstan 70 or 80* process) the through bus shall have an ampacity of (1200) (2000) (3000) (4000) (5000) (copper only) amperes and shall be braced to have a short circuit rating of (50,000) (100,000) (200,000) RMS symmetrical amperes. (The through bus shall have provisions for the addition of future sections.) The through bus supports, connections and joints are to be bolted with hex head bolts and Belleville washers to minimize maintenance requirements.

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Select appropriate device specification, as listed below:

Protective Devices

DEVICE	CIRCUIT BREAKER	FUSIBLE SWITCH
Main Devices	A, B	C
Tie	A, B	C
Branch Feeder	B, D	C, E

A) Stored Energy Solid State Trip Circuit Breakers (main or tie only).

The circuit breaker shall be of the (fixed mounted) (drawout type), (manually) (electrically) operated as shown on the associated drawings or as listed in the equipment tabulation. The breaker operating mechanism is to be of the two-step stored energy quick-make, quick-break type. First step operation of the charging handle or breaker motor is to charge the closing springs. A second step 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. The trip unit shall be provided with (L,S) (L,S,I) (L,I) (L,S,G) (L,S,I,G) (L,I,G) adjustable parameters.

B) Molded Case Circuit Breakers (main, tie or feeder).

The circuit breakers shall be individually mounted with a (thermal magnetic) (electronic) trip device. Each breaker is to be furnished with an externally operable mechanical means to trip the circuit breaker, enabling maintenance personnel to verify the ability of the circuit breaker trip mechanism to operate as well as to exercise the circuit breaker operating mechanism. The electronic trip version shall be provided with (L,S,I) (L,S,I,G) trip parameters.

C) Bolted Pressure Contact Switches (Main or Tie)

The (main switch) (main and branch switches) shall be of the fusible bolted pressure contact type with ratings as shown on the associated drawings.

Pressure contacts are to be made by firmly bolting blades to both top and bottom stationary contacts. The switches shall have quick-break kinematic-action mechanisms, inter-phase barriers and arcing equipment. (Switches shall be manually operated and have an electric trip mechanism which is piloted by the output of ground fault sensing circuitry. Power for the electric trip circuit shall be obtained from a control transformer connected from phase to phase on the line side of the switch. The electric trip coil shall be designed to operate at 55% of rated voltage.

In accordance with UL Standard 977, switches shall have an interrupting rating of 12 times the continuous rating. The operating mechanism shall permit closure of the switch only after the opening mechanism has



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been charged, to assure that the electrical tripping means shall immediately be in a condition to open the switch. Switches shall be Bolt-Loc as manufactured by Square D Company.

D) Circuit Breakers (Feeder Only)

Group mounted molded case circuit breakers are to be totally front accessible. The circuit breakers are to be mounted in the switchboard to permit installation, maintenance and testing without reaching over any line side bussing. The circuit breakers are to be removable by the disconnection of only the load side cable terminations and all line and load side connections are to be individual to each circuit breaker. No common mounting brackets or electrical bus connectors will be acceptable. Line side circuit breaker connections are to be jaw type plug-on.

Each circuit breaker is to be furnished with an externally operable mechanical means to trip the circuit breaker, enabling maintenance personnel to verify the ability of the circuit breaker trip mechanism to operate as well as exercise the circuit breaker operating mechanisms.

E) Fusible Switches

The fusible switches shall be quick-make, quick-break and shall be group mounted in panel-type construction. Switches of 30-200 amperes shall have plug-on line side connections and shall have built in fuse pullers (30-100A units). Each switch is to be contained in a separate steel enclosure. The enclosure will employ a hinged cover for access to the fuses which will be interlocked with the operating handle to prevent opening the cover when the switch is in the "On" position. This interlock shall be constructed so that it can be released with a standard electrician's tool for testing fuses without interrupting service. The units shall have padlocking provisions in the "Off" position and the operating handle position shall give positive indication, i.e.: red for "On" and black for "Off". Switches shall pass industry standard I²t withstandability tests and fuse tests as described elsewhere in the specifications.

F) Ground Fault Relays (applies to device specifications B — thermal magnetic only, C and D, as stated above.)

The ground fault protection system shall include a

current sensor and appropriate relaying equipment. The current sensor shall enclose all phase (and neutral, if present) conductors of the circuit to be monitored. The current sensor shall be so constructed that one leg can be opened to allow removal of the sensor without disturbing the cables or requiring drop-links in the bussing. A test winding shall be provided to simulate the flow of ground fault current through the current sensor, in order to test the complete system, including sensor pick-up, relaying equipment and electric trip mechanism of the switch.

The ground fault relay shall be solid state construction and have adjustable pick-up for ground fault currents from 200 amperes to 1200 amperes. Settings for individual relays shall be (as shown on the plans) (_____ amperes). Time delay provided by the ground fault relay circuitry shall be nominally (.1 second) (.2 second) (.3 second) (.5 second) and shall be permanently calibrated to preclude tampering with after installation.

The following secondary equipment shall be provided:

- _____ Type (MA) (ME) (MH) (PA) (PC) (PE) (PH) (SE) main circuit breaker, _____ ampere frame (2) (3) pole; interrupting capacity _____ A. Symmetrical at system voltage.
- _____ Type (FA) (FH) (KA) (KH) (LA) (LH) (MA) (ME) (MH) (PA) (PC) (PE) (PH) (SE) feeder circuit breaker, _____ ampere frame, (2) (3) pole; interrupting capacity _____ A. Symmetrical at system voltage.
- _____ A/(2) (3) pole (main) (feeder) bolt-loc bolted-pressure contact fusible switch.
- _____ A/(2) (3) pole feeder QMB fusible switch.

METERING COMPONENTS

- (1)(2) — Voltmeters and 3-phase selector switch with "Off" position.
- (1)(2) — 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.





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