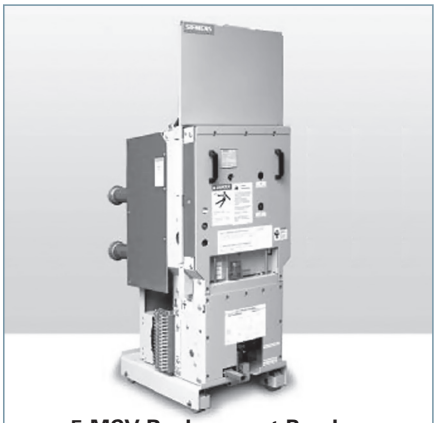
Type GM-SG Metal-Clad Switchgear



5-MSV Replacement Breaker

Type WL Low voltage Metal-Enclosed Switchgear

Scan to connect online to the most up-to-date version of this Section of SPEEDFAX.

contents

Overview

Siemens 5, 7.2, 15 and 38 kV class medium-voltage, one- or two-high vacuum circuit breaker switchgear is of the Metal-Clad type as covered by ANSI/IEEE standard C37.20.2. All parts are completely enclosed within grounded metal barriers. Circuit breakers are the horizontal drawout type. Secondary control devices and primary circuits are isolated from each other by shutters or barriers. Primary circuits of different potential are also separated by barriers. All primary bus work and joints are completely encased with insulation material to suit the voltage class of the equipment.

Single Source Responsibility

Single source responsibility is assured since the complete equipment is designed by Siemens and is manufactured and tested in a single facility. The vacuum circuit breakers are checked in the switchgear cells as part of production testing, and to assure interchangeability.

Features

Siemens Type 3AH3 Operating Mechanism

The types GMSG and 38-3AH3 circuit breakers use the proven Siemens type 3AH3 stored-energy operating mechanism. This operator is an evolution of the type 3A family of operators first introduced in 1976. Over 120,000 type 3AH3 operating mechanisms have been produced since 1998.

Faster Interruption

Standard interrupting time is five-cycles with an option available for three-cycle interrupting time.

Floor Rollout

No lift truck or dolly is needed to insert or remove circuit breakers in the lower cell of the switchgear located at floor level. For indoor switchgear located on a raised housekeeping pad or for outdoor, non-walk-in switchgear, a lift truck is required to handle circuit breakers or drawout fuse trucks.

Closed Door Racking

The circuit breaker can be racked in or out with the cell door open or closed. The mechanism includes an indicator to show the racking mechanism position with the door closed. For racking, a manual drive crank or an optional electric motor drive may be used.

Automatic Shutters

Automatically operated grounded steel shutters are included to allow or block access to the stationary primary disconnects. The shutters are opened by the circuit breaker as it moves toward the connected position. The shutters close as the circuit breaker is racked away from the connected position. The shutters remain closed until they are forced open by insertion of the circuit breaker. This design enhances protection for personnel compared to shutters that are linked to the racking mechanism.

5 through 15 kV Available in One- or Two-High Design

38 kV Available in One-High Design Only

Tested to ANSI/IEEE Standards

Siemens switchgear is tested to meet the requirements of ANSI/IEEE standards. A complete design test program including short-circuit interruption, load-current switching, continuous current, mechanical endurance, close and latch current, short time and momentary withstand, impulse withstand, and the other tests required by the standards has been successfully completed. These tests encompass the complete equipment design, including both the switchgear structure and the circuit breaker removable element. Certified test data can be furnished to customers upon request.

UL or C-UL Listing

When specified, if the component configuration allows, the switchgear can be provided with the UL or C-UL (for use in Canada) Listed label, indicating conformance to the requirements of ANSI/IEEE C37.54 and ANSI/IEEE C37.55.

Quality Systems

Facilities involved with application, engineering, design and production are certified to ISO 9001 requirements.

Siemens Relays, see Relaying section on page 14-28

Type GM-SG 5 - 15 kV Metal-Clad Switchgear

Type GM38 38 kV Metal-Clad Switchgear

Siemens types GM-SG and GM-SG-AR 5, 7.2 and 15 kV and type GM38 38 kV metal-clad power switchgear assemblies with horizontal drawout vacuum circuit breakers take advantage of the latest developments in vacuum interrupter technology. Up to two circuit breakers can be stacked in a single vertical section, allowing significant space savings in the types GM-SG and GM-SG-AR switchgear. In the type GM38 switchgear, circuit breaker are available only in the lower compartment.

The equipment meets or exceeds the latest standards of ANSI, IEEE and NEMA.

Types GM-SG, GM-SG-AR and GM38 switchgear are designed for use in industrial plants, commercial buildings, electric utility systems, cogeneration installations and other electrical systems. It is commonly used for protection and switching of transformers, motors, generators, capacitors, buses, distribution feeder lines and, in general, for protection of any medium-voltage power circuit.

Siemens' experience gained in over 80 years of supplying metal-clad switchgear in the U.S. has been captured in the switchgear designs. The objective has been to incorporate features designed to provide safety, while simplifying operation and maintenance, and minimizing installation cost.

The switchgear structure and the drawout vacuum circuit breaker are an integrated design, with dielectric, thermal and interruption integrity built directly into the basic design, not added as an afterthought.

Siemens Vacuum Interrupters

The vacuum interrupters used in the types GMSG and 38-3AH3 circuit breakers are manufactured by Siemens and have been proven in thousands of installations since 1976. The chrome-copper contact design used in these vacuum interrupters assures low chopping levels, eliminating the need for surge protection on most circuits.

Front Mounted Operating Mechanism

The simple type 3AH3 operating mechanism makes maintenance and inspection easy. The mechanism is located on the front of the circuit breaker, rather than underneath.

Maintenance Intervals

If applied under ANSI "usual service" conditions, maintenance of the circuit breaker mechanism is only needed at 10-year intervals for type GMSG circuit breakers and at five-year intervals for type 38-3AH3 circuit breakers.

Maintenance of the switchgear cubicle is recommended at five-year intervals, and primarily consists of cleaning insulation.

"Universal" Spare Circuit Breaker

The physical configuration and interlock logic allow the use of a single circuit breaker to serve as a "universal" spare breaker at an installation site for up to 50 kA for type GM-SG or type GM-SG-AR, or for up to 40 kA in type GM38 switchgear. The universal spare breaker (63 kA) type GMSG vacuum circuit breaker is designed such that a circuit breaker can be installed in any type GM-SG circuit breaker cell rated 63 kA. Circuit breakers rated 63 kA cannot be used in equipment rated 50 kA and lower. The interlock logic checks the principal rating characteristics (continuous current, maximum voltage, and interrupting current), and allows a circuit breaker to be inserted in any circuit breaker cell, provided that the circuit breaker equals or exceeds the ratings required by the cell.

Full ANSI and IEEE Design Background

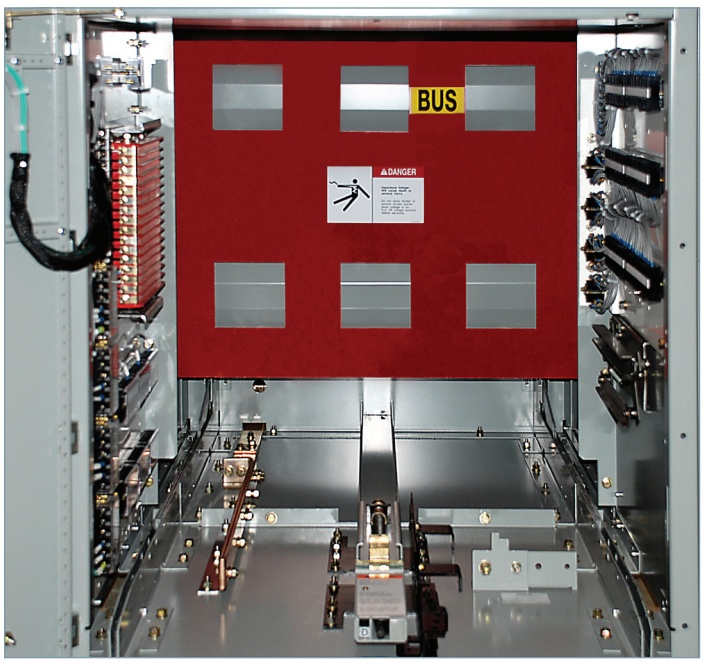
Full design integrity is assured. ANSI C37.09 and C37.20.2 require design tests on circuit breakers and structures together. The 3AH3 operator design is controlled in our global center of competence for circuit breakers in Berlin, and final assembly of both the drawout circuit breaker and the switchgear structures occurs in a single facility. Siemens controls the entire process, from design concept to production. Records are maintained to document compliance with ANSI/IEEE standards.

4,000 A Rating (5 – 15 kV)

Designs are available to 3000A self-cooled, and 4,000 A fan cooled.

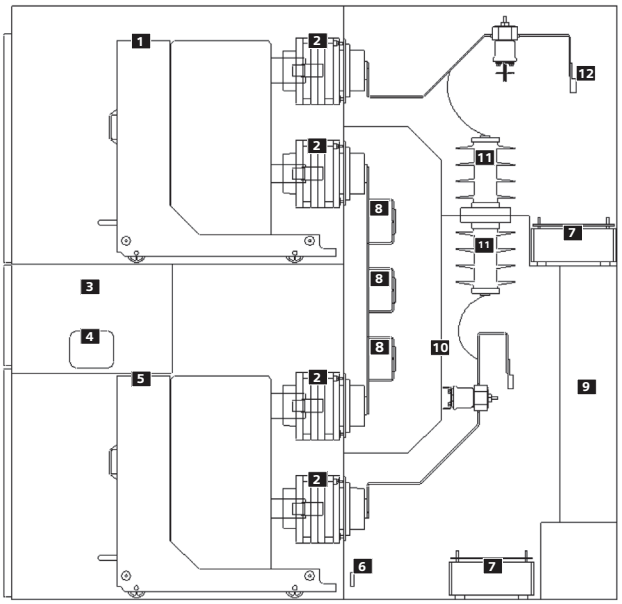
3,000 A Rating (38 kV)

Designs are available to 2,000 A self-cooled and 3,000 A fan cooled.



Type GM-SG Circuit Breaker Cell Interior

Type GM-SG Circuit Breaker Cell (1,200 A or 2,000 A with VT Auxiliary (3,000 A Similar Except Upper Cell Reserved for Fan-Cooling Equipment)



1 Upper type GMSG circuit breaker
2 Standard accuracy current transformers (CTs)-two per bushing
3 Isolated protective relay and instrument compartment
4 Inter-unit wiring
5 Lower type GMSG circuit breaker
6 Ground bar
7 Ground sensor CT
8 Main bus bars
9 Power cable duct
10 Removable barrier
11 Surge arresters
12 Outgoing cable lugs (downfeed shown)

Structural Flexibility for Types GM-SG and GM-SG-AR

Siemens metal-clad switchgear provides enhanced flexibility in locating circuit breaker, auxiliary, and metering cells within the structure layout. Circuit breakers rated 1,200 A and 2,000 A may be located in upper or lower cell positions.

Bus sectionalizing (tie) circuit breaker cells may be located on the upper or lower levels and are located next to an auxiliary cell on the same level for the transition bus work.

The types GM-SG and GMSG-AR offer significant flexibility for stacking breakers. See page 14-12 for more information. The 3,000 A circuit breaker can be used for 4,000 A continuous current applications, with the addition of fan cooling equipment in the auxiliary cell above or below the circuit breaker. This application of fan cooling is well suited if loads above 3,000 A are infrequent, as for example, in the case of a fan-cooled rating on a power transformer.

The type GM-SG-AR arc-resistant design offers significant flexibility compared to the design of other suppliers. The side-mounted, arc duct design for the type GM-SG-AR allows the same flexibility as the type GM-SG non-arc resistant design for mounting voltage transformers, a drawout control power transformer and fuse roll-out trays.

Siemens type GM38 metal-clad switchgear provides enhanced flexibility in locating circuit breaker, auxiliary and metering cells within the structure layout. Circuit breakers are located in the lower cell positions. The upper cell position can be used for voltage transformers with the associated drawout primary fuses.

Each vertical section contains the main bus bar compartment, plus a rear compartment for incoming and outgoing connections. The front portion of the vertical section contains a lower cell for circuit breaker, auxiliary devices, VTs, CPT (if primary fuses are located in upper cell) or drawout primary fuses for a CPT located in the rear of the section.

Instruments, protective relays and power meters along with their secondary wiring and other components are located in the upper cell. The switchgear is normally designed so that additional vertical sections may be added in the future.

Enclosure Design

The switchgear designs include full ANSI/IEEE C37.20.2 Metal-Clad construction. This means complete enclosure of all live parts and separation of major portions of the circuit to retard the spread of faults to other compartments.

The type GM-SG-AR design includes full ANSI/IEEE C37.20.7-2007, accessibility type 2B. The ground bus extends the entire length of the complete switchgear lineup, and to all circuit breaker cells.

Exhaust System for Type GM-SG-AR

The top-mounted pressure relief channel (PRC) is factory-installed for reduced installation time. An outlet from the switchgear room is supplied with each lineup of equipment.

Circuit Breaker Interchangeability

The switchgear cubicle and the removable circuit breaker element are both built to master fixtures so circuit breakers of the same ratings are interchangeable with each other even if the circuit breaker is required for use with a cell with "provisions only" supplied years earlier. A circuit breaker of higher rating can be used in a cell of equal or lower rating. The GMSG circuit breaker is not interchangeable with the older designs. 63 kA rated type GMSG circuit breakers can only be used in 63 kA rated cells and lower rated circuit breakers cannot be used in 63 kA rated cells. The type 38-3AH3 circuit breaker is interchangeable with the type 38-3AF circuit breaker, provided the ratings are equal. The type 38-3AF circuit breaker is not interchangeable with the 40 kA type 38-3AH3.

5, 7.2 and 15 kV Drawout Metal-Clad Indoor Switchgear up to 63 kA

- One-high or two-high construction
- Up to 100 full-fault interruptions
- Universal spare circuit breaker for 50 kA and lower ratings
- Universal spare circuit breaker for 63 kA ratings
- Interlocks permit insertion of higher rated vacuum circuit breaker into lower rated cell but not vice versa
- Front accessible circuit breaker operating mechanism for ease of maintenance
- Closed door racking
- Floor rollout circuit breaker in lower cell without a dolly
- Visible secondary disconnect
- Circuit breaker ships inside of cell, thus reducing installation cost and transit damage
- Pair with Siemens protective relays to match any typical application
- Horizontal drawout type GMSG vacuum circuit breaker with type 3AH3 operating mechanism
- Uses the latest developments in vacuum interrupter technology
- Highly reliable vacuum interrupters - MTTF over 57,000 years
- Common type 3AH3 operator platform for all ratings
- Over 120,000 type 3AH3 operators produced since 1998
- Generator circuit breakers (to IEEE C37.013 optionally available)
- 10,000 operations to overhaul
- Three-cycle interrupting time (optional)
- Meets or exceeds the latest ANSI, IEEE and NEMA standards
- UL or C-UL Listing available

Type GMSG circuit breaker ratings constant kA basis - ANSI/IEEE C37.06-2009

Historic "MVA" class	Maximum design voltage kV	Rated interrupting rating kA	Maximum interrupting and short-time kA	Voltage range factor	Continuous current②	Insulation levels dielectric		Close & latch (kA)	
						60 Hz	BIL	rms 1.55 KI	Peak 2.6 KI
—	4.76	40	40	1.0	1,200, 2,000, 3,000	19	60	62	104
—	4.76	50	50	1.0	1,200, 2,000, 3,000	19	60	78	130
—	4.76	63	63	1.0	1,200, 2,000, 3,000	19	60	98	164
—	8.25	40	40	1.0	1,200, 2,000, 3,000	36	95	62	104
—	15.0	25	25	1.0	1,200, 2,000	36	95	39	65
—	15.0	40	40	1.0	1,200, 2,000, 3,000	36	95	62	104
—	15.0	50	50	1.0	1,200, 2,000, 3,000	36	95	78	130
—	15.0	63	63	1.0	1,200, 2,000, 3,000	36	95	98	164

② 4,000 A fan-cooled available using a 3,000 A circuit breaker together with a modified switchgear structure incorporating fan cooling equipment.

Type GM-SG switchgear available as:

- Indoor (type GM-SG)
- Outdoor non-walk-in (type OGM-SG)
- Outdoor walk-in Shelter-Clad (type SGM-SG)
  - Single-aisle
  - Factory insulated and assembled aisle (optional).
- Available with SIERS - Siemens Integrated Electric-Racking System

5, 7.2 and 15 kV Drawout Metal-Clad Arc-Resistant Indoor Switchgear up to 63 kA

- Arc-resistant to IEEE C37.20.7, up to 63 kA, 0.5 sec, accessibility type 2B
- Application flexible exhaust system
- Top-mounted pressure relief channel factory-installed for reduced installation time
- One-high or two-high construction
- Up to 100 full-fault interruptions
- Universal spare circuit breaker
- Interlocks permit insertion of higher rated vacuum circuit breaker into lower rated cell but not vice versa
- Front accessible circuit breaker operating mechanism for ease of maintenance
- Closed-door racking
- Floor rollout circuit breaker in lower cell without a dolly
- Visible secondary disconnect
- Circuit breaker ships inside of cell, thus reducing installation cost and transit damage
- Instrumentation/controls located in a separate compartment isolated from all primary circuit elements
- Pair with Siemens protective relays to match any typical application
- Horizontal drawout type GMSG vacuum circuit breaker with type 3AH3 operating mechanism
- Uses the latest developments in vacuum interrupter technology
- Highly reliable vacuum interrupters - MTTF over 57,000 years
- Common type 3AH3 operator platform for all ratings
- Over 120,000 type 3AH3 operators produced since 1998
- 10,000 operations to overhaul
- Three-cycle interrupting time (optional)
- Meets or exceeds the latest ANSI, IEEE and NEMA standards
- UL or C-UL Listing available

Type GMSG circuit breaker ratings constant kA basis - ANSI/IEEE C37.06-2009

Historic "MVA" class	Maximum design voltage kV	Rated interrupting rating kA	Maximum interrupting and short-time kA	Voltage range factor	Continuous current②	Insulation levels dielectric		Close & latch (kA)	
						60 Hz	BIL	rms 1.55 KI	Peak 2.6 KI
—	4.76	40	40	1.0	1,200, 2,000, 3,000	19	60	62	104
—	4.76	50	50	1.0	1,200, 2,000, 3,000	19	60	78	130
—	4.76	63	63	1.0	1,200, 2,000, 3,000	19	60	98	164
—	8.25	40	40	1.0	1,200, 2,000, 3,000	36	95	62	104
—	15.0	25	25	1.0	1,200, 2,000	36	95	39	65
—	15.0	40	40	1.0	1,200, 2,000, 3,000	36	95	62	104
—	15.0	50	50	1.0	1,200, 2,000, 3,000	36	95	78	130
—	15.0	63	63	1.0	1,200, 2,000, 3,000	36	95	98	164

② 4,000 A fan-cooled available using a 3,000 A circuit breaker together with a modified switchgear structure incorporating fan cooling equipment.

Type GM-SG-AR switchgear available as:

- Indoor (Type GM-SG-AR)
- Outdoor walk-in Shelter-Clad (Type SGM-SG-AR)
  - Single-aisle
  - Factory insulated and assembled aisle (optional).

Type GMSG Vacuum Circuit Breakers 5, 7.2 and 15 kV

Siemens type GMSG circuit breakers are available in 25 kA through 63 kA "constant kA" interrupting classes, or 250 MVA through 1,000 MVA on the older "constant MVA" rating basis. Continuous current ratings include 1,200 A, 2,000 A, and 3,000 A self-cooled. 4,000 A is available using a 3,000 A circuit breaker together with forced-air (fan) cooling and larger conductors in the switchgear cubicle.

Maintenance Features

Type GMSG circuit breakers incorporate many features designed to reduce and simplify maintenance, including:

- Low maintenance vacuum interrupter
- Ten-year maintenance interval (assuming ANSI "usual service" conditions)
- Floor rollout
- Front-mounted operator
- Common operator family
- Simple outer-phase barriers
- "Universal" spare circuit breaker concept
- Non-sliding current transfer
- Rugged secondary disconnects.

Ten-Year Maintenance Interval on type GMSG Circuit Breaker

When applied under mild conditions (ANSI "usual service" conditions), maintenance is typically needed at ten-year intervals on the circuit breaker. The maintenance interval for the switchgear cubicles is five years.

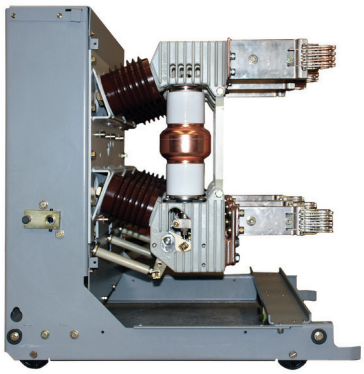
Low-Maintenance Requirements

The vacuum interrupter is a sealed unit, so the only maintenance necessary is to clean off any contaminants and to check the vacuum integrity. The vacuum interrupters can be disconnected from the stored-energy mechanism quickly, without tools, and vacuum integrity inspected by hand; alternatively, a simple high-potential test can be used.

Floor Rollout

When located in the lower cell, the circuit breakers are arranged to rollout directly on the floor in front of the switchgear if the switchgear is not located on a "housekeeping" pad. No adapter, hoist, or lift truck is necessary.

Front



Side (barriers removed)

Rear

Type GMSG Circuit Breaker

Type GMSG and GM-SG-AR Circuit Breaker Ratings (New "Constant kA" Ratings Basis)

These ratings are in accordance with the following standards:

- ANSI/IEEE C37.04-1999 Standard Rating Structure for AC High-Voltage Circuit Breakers
- ANSI C37.06-2009 AC High-Voltage Circuit Breakers Rated on a Symmetrical Current Basis - Preferred Ratings and Related Required Capabilities for Voltages Above 1,000 Volts
- ANSI/IEEE C37.09-1999 Standard Test Procedure for AC High-Voltage Circuit Breakers Rated on a Symmetrical Current Basis
- ANSI/IEEE C37.010-1999 Application Guide for AC High-Voltage Circuit Breakers Rated on a Symmetrical Current Basis

Rated Values		Units	Circuit Breaker Type①							
			5-GMSG-40-xxxx-104	5-GMSG-50-xxxx-130	5-GMSG-63-xxxx-164	7-GMSG-40-xxxx-104	15-GMSG-25-xxxx-65	15-GMSG-40-xxxx-104	15-GMSG-50-xxxx-130	15-GMSG-63-xxxx-164
Maximum Design Voltage (V)②		kV rms	4.76	4.76	4.76	8.25	15.0	15.0	15.0	15.0
Voltage Range Factor (k)③		—	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Withstand Voltage Levels	Power Frequency	kV rms	19	19	19	36	36	36	36	36
	Lightning Impulse (BIL)	kV crest	60	60	60	95	95	95	95	95
Continuous④		A rms	1,200 2,000 3,000 4,000FC	1,200 2,000 3,000 4,000FC	1,200 2,000 3,000 4,000FC	1,200 2,000 3,000 4,000FC	1,200 2,000	1,200 2,000 3,000 4,000FC	1,200 2,000 3,000 4,000FC	1,200 2,000 3,000 4,000FC
Short-Circuit (I)⑤⑥		kA rms sym	40	50	63	40	25	40	50	63
Interrupting Time⑦		ms cycles	83 5	83 5	83 5	83 5	83 5	83 5	83 5	83 5
Permissible Tripping Delay (y)		Sec	2	2	2	2	2	2	2	2
Maximum Symmetrical Interrupting (I)		kA rms sym	40	50	63	40	25	40	50	63
% dc Component		%	47	47	47	47	47	47	47	47
Short-Time Current (I) (Three Seconds)		kA rms	40	50	63	40	25	40	50	63
Closing and Latching (Momentary) Asymmetrical (1.55 x I)		kA rms	62	78	98	62	39	62	78	98
Closing and Latching (Momentary) Peak (2.6 x I)		kA peak	104	130	164	104	65	104	130	164

① "xxxx" in type designation refers to the continuous current rating 1,200 A, 2,000 A, or 3,000 A, as appropriate. The 4,000 A fan-cooled rating is achieved using a 3,000 A circuit breaker, in combination with fan cooling as indicated in Footnote 4.
② Maximum design voltage for which the circuit breaker is designed, and the upper limit for operation.
③ K is listed for informational purposes only. For circuit breakers rated on a "constant kA basis", the voltage range factor is 1.0.
④ 4,000FC indicates that fan cooling is included in the switchgear structure for this rating. 4,000 A rating is not available in outdoor equipment.
⑤ All values apply to polyphase and line-to-line faults.
⑥ Standard duty cycle is O - 0.3s - CO - 3 min. - CO.
⑦ Standard rated interrupting time is five cycles (83 ms)/Optional rated interrupting time of three cycles (50 ms) 63 kA is available (except with 24 Vdc tripping).

Cubicle Dimensions Per Vertical Section①③

Type	Dimensions in Inches (mm)				Weight in lbs. (kg)⑫
	Height	Width	Depth③	Drawout Aisle	
GM-SG	95.3 (2,419)	36.0 (914)	98.7 (2,507)④	72.0 (1,829) recommended⑥	3,300 (1,497)
SGM-SG	114.8 (2,915)	36.0 (914)②	173.4 (4,404)⑤	72.0 (1,829) included	5,000 (2,268)
OGM-SG	113.6 (2,886)	36.0 (914)②	101.9 (2,588)⑤⑩	72.0 (1,829) recommended⑥	3,950 (1,792)
GM-SG-AR	116.4 (2,957)⑨	40.0 (1,016)⑦⑧	102.8 (2,611)④⑨⑪	72.0 (1,829) recommended⑥	4,100 (1,864)
SGM-SG-AR	135.6 (3,444)	40.0 (1,016)⑦⑧	179.8 (4,566)⑤	72.0 (1,829) included	5,900 (2,682)

① Dimensions are approximate.
② Add 6″ (152 mm) to each end of the lineup for aisle extension 12″ (304 mm) total.
③ Dimensions are approximate size of floor footprint.For outdoor equipment, enclosure overhangs floor frame. Refer to Footnote 5.
④ If indoor switchgear is installed on a raised housekeeping pad, the pad must not extend farther than 3″ (75 mm) from the front of the switchgear to avoid interference with the use of the portable lift truck.
⑤ Add for roof and enclosure overhang:
- Rear (cable side):
- Non-walk-in: 3.6″ (92 mm)
- Shelter-Clad: 3.6″ (92 mm).
- Front (drawout side):
- Non-walk-in: 3.7″ (94 mm)
- Shelter-Clad: 1.7″ (43 mm).

⑥ 72″ (1,829 mm) aisle space recommended allows room for interchange of circuit breakers. Minimum aisle space required for handling circuit breaker with lift truck is 65″ (1,651 mm). Minimum aisle space required if all circuit breakers are at floor level is 55″ (1,397 mm).
⑦ Add 9″ (229 mm) to length of the lineup for end trims.
⑧ The switchgear must have at least 6″ (152 mm) horizontal clearance:
- From left and right sides to nearest wall or equipment, and
- From rearmost extension of vents on rear to nearest wall or equipment.

⑨ No obstructions permitted within 10″ (254 mm) of top of switchgear structure.
⑩ Add 4.5″ (114 mm) to depth for front and rear doors.
⑪ Add 1.0″ (25 mm) for GM-SG-AR equipment rated 63 kA.
⑫ Add weight of circuit breakers from Table 13.

Type GMSG vacuum circuit breaker weight in lbs (kg)①②③

Circuit breaker type	Continuous current A		
	1,200	2,000	3,000
5-GMSG-40/5-GMSG-250	440 (200)	650 (295)	665 (302)
5-GMSG-50/5-GMSG-350	455 (206)	665 (302)	670 (304)
5-GMSG-63	809 (368)	819 (372)	824 (375)
7-GMSG-40/7-GMSG-500	455 (206)	665 (302)	675 (306)
15-GMSG-25/15-GMSG-500	430 (195)	640 (290)	–
15-GMSG-40/15-GMSG-750	445 (202))	670 (304)	675 (306)
15-GMSG-50/15-GMSG-1000	460 (209)	675 (306)	680 (308)
15-GMSG-63	819 (372)	829 (377)	834 (379)
5-GMSG-GCB-40/15-GMSG-GCB-40	475 (215)	685 (311)	715 (324)
5-GMSG-GCB-50/15-GMSG-GCB-50	825 (374)	835 (379)	865 (392)
5-GMSG-GCB-63/15-GMSG-GCB-63	875 (397)	900 (408)	930 (427)

① Weight is approximate.
② Approximate circuit breaker (width x depth x height): 32″ (813 mm) x39″ (991 mm) x 36″(914 mm). If packed for shipment separate from switchgear : 42″(1,067 mm) x 47″ (1,194 mm) x 43″ (1,092 mm).
③ Weight estimates are for circuit breaker only. Add 75 lbs (34 kg) if shipped separately packaged.

Stacking versatility

GM-SG non-arc-resistant (up to 63 kA) and GM-SG-AR arc-resistant (up to 50 kA)①-⑦

1,200 A circuit breaker A	1,200 A circuit breaker A	Auxiliary C	1,200 A circuit breaker A	2,000 A circuit breaker A	2,000 A circuit breaker A
Low-voltage panel	Low-voltage panel	Auxiliary D	Low-voltage panel	Low-voltage panel	Low-voltage panel
1,200 A circuit breaker B	Auxiliary E	Low-voltage panel	2,000 A circuit breaker B	1,200 A circuit breaker B	2,000 A circuit breaker B
	Auxiliary F	1,200 A circuit breaker B			

Auxiliary C	2,000 A circuit breaker A	Vented⑦ A	Fan⑦ A	3,000 A circuit breaker A	Auxiliary C
Auxiliary D	Low-voltage panel	Low-voltage panel	Low-voltage panel	Low-voltage panel	Auxiliary D
Low-voltage panel	Auxiliary E	3,000 A⑦ circuit breaker B	3,000 A⑦ circuit breaker B	Vented E	Low-voltage panel
2,000 A circuit breaker B	Auxiliary F			Auxiliary F	Auxiliary E
					Auxiliary F

Footnotes for GM-SG non-arc-resistant (up to 63 kA) and GM-SG-AR arc-resistant (up to 50 kA) :

① Main bus sizes 1,200 A, 2,000 A, 3,000 A or 4,000 A (self-cooled).
② No rollout auxiliaries allowed in upper cell (C or D) if lower cell (B) has 3,000 A circuit breaker. If 3,000 A circuit breaker is located in upper cell (A), one rollout auxiliary may be located in lower cell F.
③ Auxiliary cells (C, D, E or F) may each contain one rollout (except as indicated in Footnotes 2 and 7).
④ Fuse rollout for stationary CPT must be located in lower rollout cell F, if CPT is located in rear or is remote.
⑤ Stacking arrangements are available as shown for all types of equipment in the GM-SG family. Total circuit breaker loading in a vertical unit may not exceed main bus rating. Consult Siemens for specific application assistance regarding total load limits in each unit or refer to ANSI/IEEE C37.20.2.
⑥ Generator circuit breakers (type GMSG-GCB) conform to same stacking rules as standard (nongenerator) circuit breakers.
⑦ For fan-cooled 4,000 A rating, circuit breaker (3,000 A self-cooled, 4,000 A fan-cooled) may be located in lower cell (B) with fan cooling in cell A.

Stacking versatility continued

GM-SG-AR arc-resistant 63 kA ①-⑦

1,200 A circuit breaker A	1,200 A circuit breaker A	Auxiliary D	1,200 A circuit breaker A	2,000 A circuit breaker A	2,000 A circuit breaker A
Low-voltage panel	Low-voltage panel	Low-voltage panel	Low-voltage panel	Low-voltage panel	Low-voltage panel
1,200 A circuit breaker B	Auxiliary B	1,200 A circuit breaker B	2,000 A circuit breaker B	1,200 A circuit breaker B	2,000 A circuit breaker B
Auxiliary D	2,000 A circuit breaker A	Vented[7] A	Fan[7] A	Auxiliary A	
Low-voltage panel	Low-voltage panel	Low-voltage panel	Low-voltage panel	Low-voltage panel	
2,000 A circuit breaker B	Auxiliary B	3,000 A[7] circuit breaker B	3,000 A[7] circuit breaker B	Auxiliary B	

Footnotes for GM-SG-AR arc-resistant 63 kA:
① 1. Main bus sizes 1,200 A, 2,000 A, 3,000 A or 4,000 A (self-cooled).
② No rollout auxiliaries allowed in upper cell (A) if lower cell (B) has 3,000 A circuit breaker.
③ Auxiliary cells (A or B) may each contain one rollout (except as indicated in Footnotes 2 and 7).
④ Fuse rollout for stationary CPT must be located in lower rollout cell B, if CPT is located in rear or is remote.
⑤ Stacking arrangements are available as shown for arc-resistant type GM-SG-AR equipment rated 63 kA. Total circuit breaker loading in a vertical unit may not exceed main bus rating. Consult Siemens for specific application assistance regarding total load limits in each unit or refer to ANSI/IEEE C37.20.2.
⑥ Generator circuit breakers (type GMSG-GCB) conform to same stacking rules as standard (nongenerator) circuit breakers.
⑦ For fan-cooled 4,000 A rating, circuit breaker (3,000 A self-cooled, 4,000 A fan-cooled) may be located in lower cell (B) with fan cooling in cell A.

Accessories

Standard accessories include:

- Manual racking crank
- Spring charging crank
- Drawout extension rails (to enable handling of circuit breakers or auxiliary rollouts in upper cells or above floor level)
- Lift sling (for circuit breakers or rollout trays above floor level)
- Split plug jumper (standard unless test cabinet is furnished)
- Contact lubricant
- Touch-up paint
- Auxiliary rollout tray insertion/ withdrawal rods (arc-resistant up to 50 kA)
- Circuit breaker manual trip rod (arc-resistant up to 63 kA).

Optional accessories include:

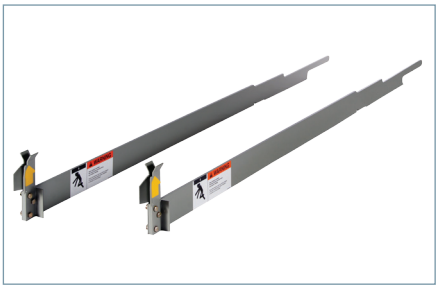
- Circuit breaker lift truck
- Adapter for lift truck, for lifting auxiliary rollout trays for GM-SG (up to 63 kA) or GM-SG-AR (up to 50 kA)
- Test cabinet (in place of split plug jumper)
- Test plugs (if required by devices)
- Portable electric racking motor assembly (to enable racking while operator is at a distance from the switchgear)
- Manual or electrical ground and test device.

Test provisions, either a split plug jumper or a test cabinet, are available for testing the circuit breaker outside its cubicle.

The split plug jumper is used to bridge the secondary disconnects with a flexible cable, so the circuit breaker may be electrically closed and tripped with the control switch on the instrument panel while the circuit breaker is outside of its compartment. The test cabinet, including a control switch, is used for closing and tripping the circuit breaker at a location remote from the switchgear.

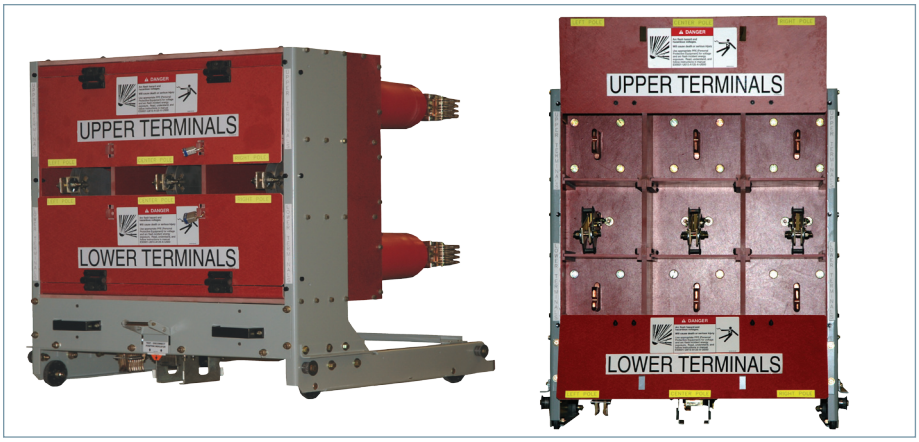
Accessory cabinet

Type GMSG circuit breaker on lift truck



Drawout extension rails

For arc-resistant equipment: rollout tray insertion/ withdrawal tools up to 50 kA and manual trip rod (up to 63 kA)



Type GMSG-MO manually operated ground and test device

Type GMSG-EO electrically operated ground and test device

Note: Due to the special nature of ground and test devices, each user must develop definitive operating procedures for incorporating safe operating practices. Only qualified personnel should be allowed to use ground and test devices.

Manually operated ground and test device (up to 50 kA), type GMSG-MO

The type GMSG-MO ground and test device (up to 50 kA) is a drawout element that can be inserted into a circuit breaker cell rated for a short-circuit current of 50 kA or lower. The type GMSG-MO device opens the shutters, connects to the cell primary disconnecting contacts and provides a means to make the primary disconnect stabs available for testing or grounding. The type GMSG-MO device is suitable for high-potential testing of outgoing circuits of the switchgear main bus or for phase sequence checking. The type GMSGMO device also provides a means to connect temporary grounds to de-energized circuits for maintenance purposes.

The manual ground and test incorporates three-position, single-pole switches (upper stabs to ground, neutral and lower stabs to ground), eliminating the need for userfurnished ground cables. The switches are hookstick operable and, in the closed position, are rated for the full momentary and short-time ratings of the associated switchgear. User-furnished grounding cables and commercially available ground clamps seldom have ratings equal to those of the switchgear.

Separate insulated hinged panels cover the upper and lower stabs and include padlock provisions. The type GMSG-MO device also includes individual hookstick-removable barriers between each single-pole switch and the upper stabs and lower stabs.

Electrically operated ground and test device (for up to 50 kA and for 63 kA), type GMSG-EO

An electrical ground and test device includes a power-operated switch (derived from a type GMSG circuit breaker) arranged to allow grounding one set of disconnect stabs. These devices are able to close and latch against short-circuit currents corresponding to the ratings of the equipment.

The electrically operated ground and test device rated for a short-circuit current of 50 kA can be used in any type GM-SG family circuit breaker compartment rated up to 50 kA.

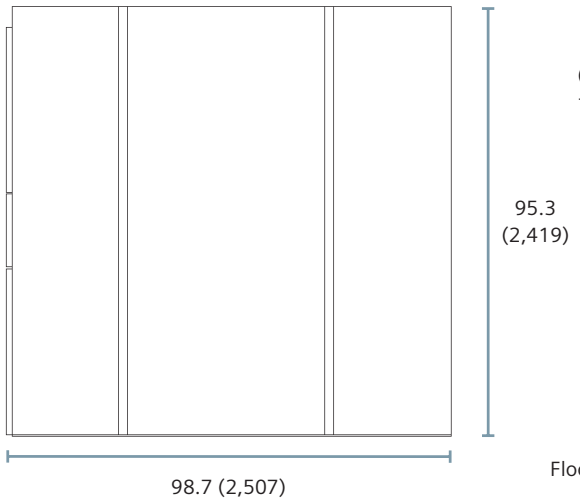
The 63 kA device can be used only in type GM-SG family circuit breaker compartments rated 63 kA.

Neither the 50 kA device nor the 63 kA device require any adapters for use in cells.

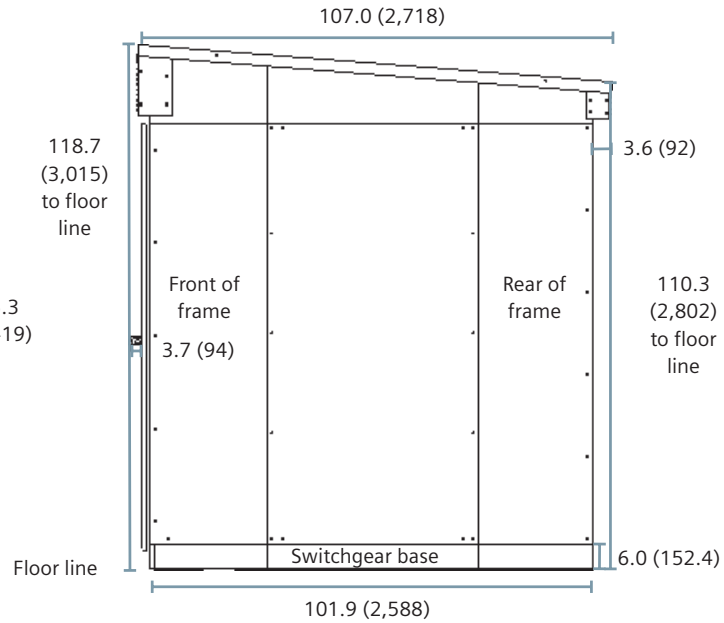
Two devices, one each for the upper and lower stabs, are required if grounding is desired to either side of the unit. The type GMSG-EO device also provides a means of access to the primary circuits for high potential tests or for phase sequence checking.

Due to the unique requirements frequently involved in such devices, all applications of electrically operated ground and test devices should be referred to Siemens for review.

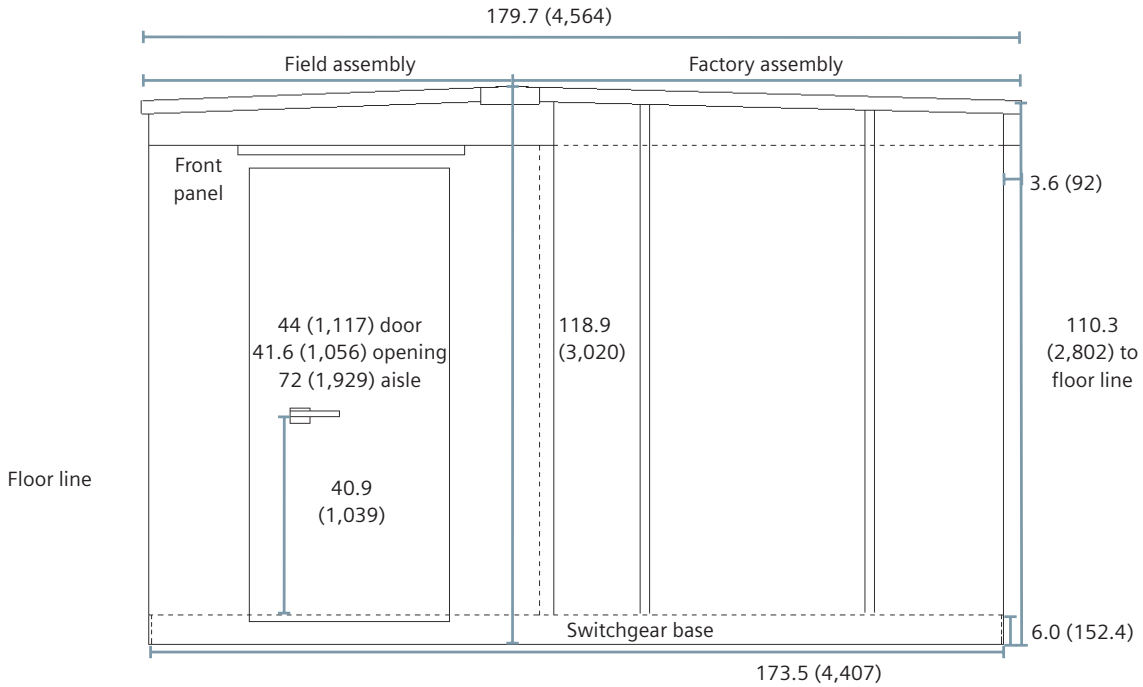
Switchgear Side Views



Type GM-SG Indoor Switchgear

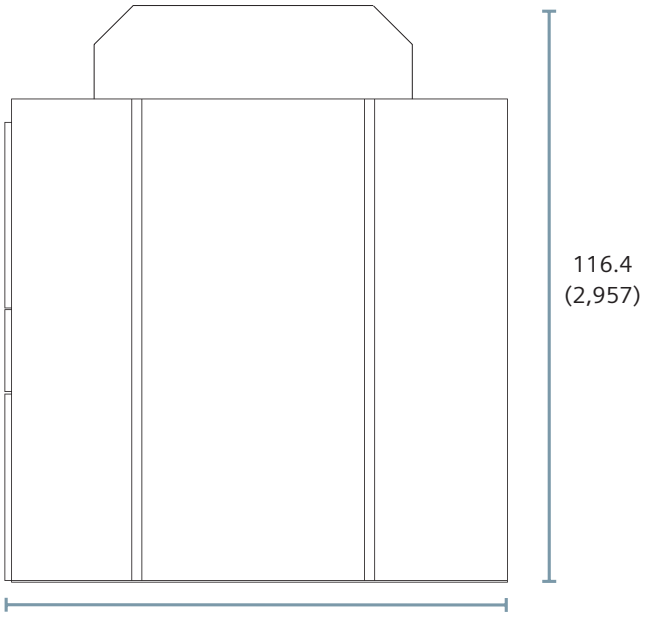


Type OGM-SG Non-Walk-In Outdoor Switchgear

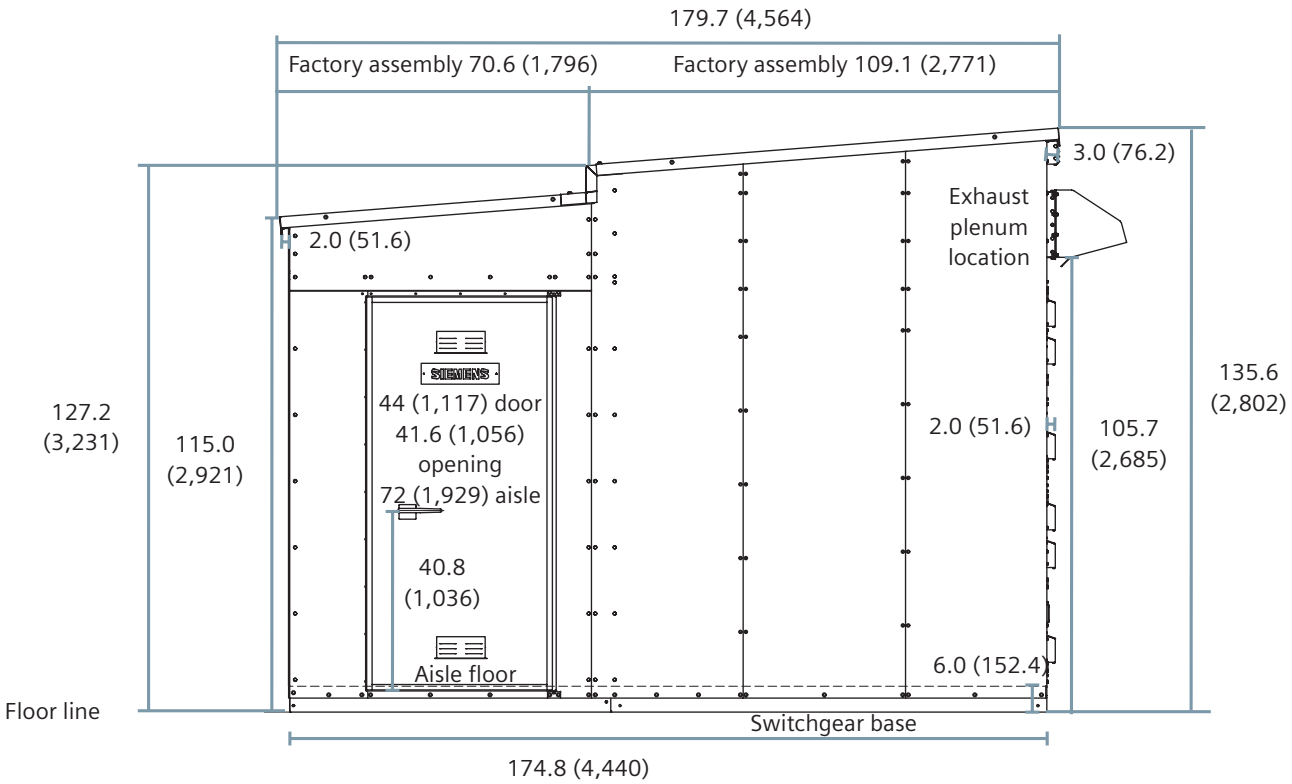


Type SGM-SG Shelter-Clad Single-Aisle Outdoor Switchgear

Switchgear Side Views continued



Type GM-SG-AR indoor switchgear



Type SGM-SG-AR Shelter-Clad single-aisle outdoor switchgear

Drawout Indoor Switchgear

- Horizontal drawout type 38-3AH3 vacuum circuit breaker
- Uses the latest developments in vacuum interrupter technology
- Highly reliable vacuum interrupters – MTTF over 57,000 years
- Up to 50 full-fault interruptions
- Meets or exceeds the latest ANSI, IEEE and NEMA standards
- UL Listing available for 40 kA rating
- Universal spare circuit breaker
- Interlock permits insertion of higher rating vacuum circuit breaker into lower rated cell but not vice-versa
- Front accessible circuit breaker operating mechanism for ease of maintenance
- Closed door racking
- Floor rollout circuit breaker in lower cell without a dolly
- Visible secondary disconnect
- One-high construction
- Pair with Siemens protective relays to match any typical application
- Available with SIERS - Siemens Integrated Electric-Racking System

Type 38-3AH3 Circuit Breaker Ratings

Measured Parameter					Circuit Breaker Type		
					38-3AH3-1500①	38-3AH3-31①	38-3AH3-40①
General	Nominal Voltage Class			kV	38.0	38.0	38.0
	Nominal Three-Phase MVA Class⑨			MVA	1,500	—	—
Rated Values	Rated Voltage	Maximum Design Voltage (V)②		kV rms	38.0	38.0	38.0
		Voltage Range Factor (K)③		K	1.65	1.0	1.0
	Insulation Levels	Withstand Voltage Levels	Power Frequency	kV rms	80	80	80
			Lightning Impulse (BIL)	kV peak	150	150	150
	Rated Current	Continuous④		Amperes	1,200 2,000 3,000FC	1,200 2,000 3,000FC	1,200 2,000 3,000FC
		Short-Circuit (At Rated Maximum Design Voltage) (I)⑤⑥		kA rms sym	21	31.5	40
		Interrupting Time		Cycles/ms	5/83	5/83	5/83
		Permissible Tripping Delay (Y)		Sec.	2	2	2
Related Required Capabilities	Current	Maximum Design Voltage (V) divided by K = (V/K)		kA rms	23	38	38
		Maximum symmetrical (sym) interrupting (K x I)⑦		kA rms sym	35	31.5	40
		Short-Time Current (K x I) (three seconds)		kA rms sym	35	31.5	40
	Closing and Latching (Momentary)	Asymmetrical⑧		kA rms	56	50	62
		Peak		kA peak	95	85	104

① Type 38-3AH3-1500 ratings are in accord with ANSI C37.06-1987. Types 38-3AH3-31 and 38-3AH3-40 ratings conform to ANSI/IEEE C37.06-2009 ratings.
② Maximum voltage for which the circuit breaker is designed and the upper limit for operation.
③ K is the ratio of rated maximum voltage to the lower limit of the range of operating voltage in which the required symmetrical and asymmetrical interrupting capabilities vary in inverse proportion to the operating voltage.
④ 3,000 A ratings are achieved using forced air cooling in the switchgear cubicle.
⑤ To obtain the required symmetrical interrupting capability of a circuit breaker at an operating voltage between 1/K times rated maximum voltage and rated maximum voltage, the following formula shall be used.

$$\text{Required Symmetrical Interrupting Capacity} = \text{Rated Short Circuit Current} \times \frac{\text{Rated Maximum Voltage}}{\text{Operating Voltage}}$$

For operating voltages below 1/K times rated maximum voltage, the required symmetrical interrupting capability of the circuit breaker shall be equal to K times rated short circuit current.
⑥ With the limitations stated in 5.10 of ANSI/IEEE Standard C37.04-1979, all values apply for polyphase and line-to-line faults. For single phase-to-ground faults, the specific conditions stated in 5.10.2.3 of ANSI Standard C37.04-1979 apply.
⑦ Current values in this row are not to be exceeded even for voltages below 1/K times rated maximum voltage. For voltages between rated maximum voltage and 1/K times rated maximum voltage, follow 5 above.
⑧ Current values in this row are independent of operating voltage up to and including rated maximum voltage.
⑨ Included for reference only—not listed in ANSI/IEEE C37.06.

Enclosure Dimensions

Cubicle Dimensions—Per Vertical Section

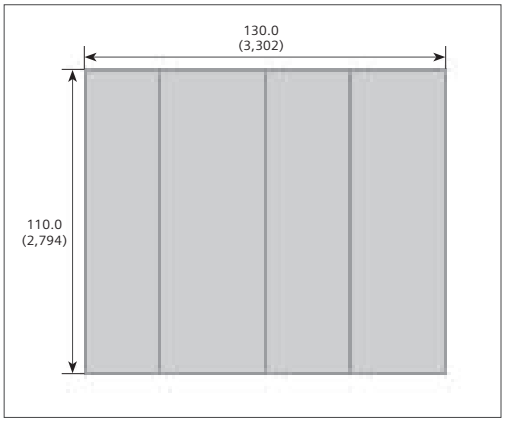
Type		Weight in lbs. (kg)	Dimensions in inches (mm) Height	Width	Depth	Drawout Aisle
Indoor	GM38	5,000 (2,273)	110.0 (2,794)	48.0 (1,219)	130.0 (3,302)	96.0 (2,438) Recommended
Shelter-Clad Single-Aisle	SGM38	6,400 (2,909)	132.5 (3,366)	48.0 (1,219)	234.5 (5,956)	96.0 (2,438) Included
Shelter-Clad Common- Aisle	SGM38	11,700 (5,318)	132.5 (3,366)	48.0 (1,219)	363.75 (9,239)	96.0 (2,438) Included
Aisle-less non-walk-in	OGM38	5,800 (2,636)	130.5 (3,315)	48.0 (1,219)	139.35 (3,539)	96.0 (2,438) Recommended

Add 6" (152 mm) to each end of lineup for aisle extension, 12" (305 mm) total.

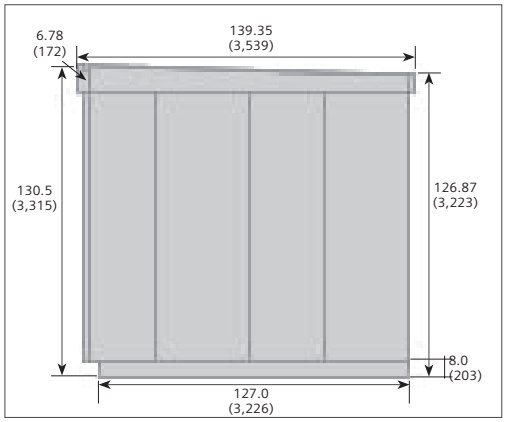
Add for roof overhang	Non-Walk-in	Shelter-Clad
Rear (Cable Side)	3.875" (98 mm)	3.875" (98 mm)
Front	6.875" (175 mm)	1.5" (38 mm)

Type 38-3AH3 Circuit Breaker Weights in lbs. (kg)

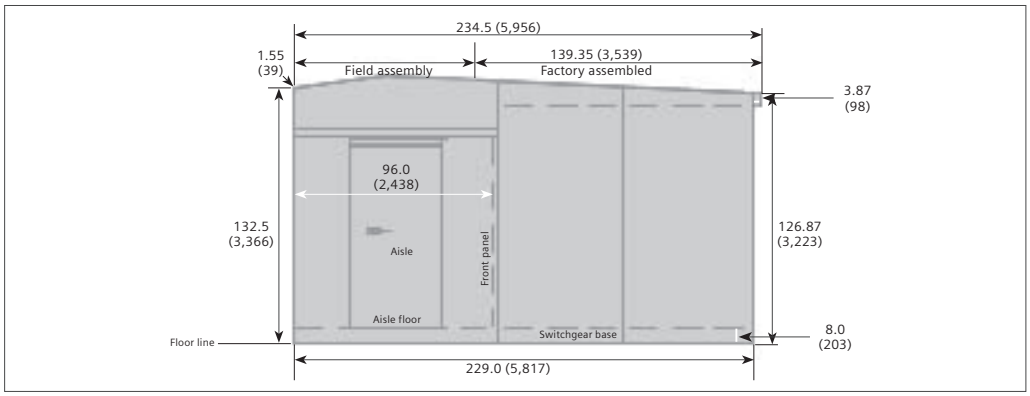
Cont. Current Amps	Circuit BreakerType 38-3AH3-1500	38-3AH3-31	38-3AH3-40
1,200	800 (364)	800 (364)	850 (387)
2,000	900 (409)	900 (409)	950 (432)
3,000	1,000 (455)	1,000 (455)	1,050 (478)



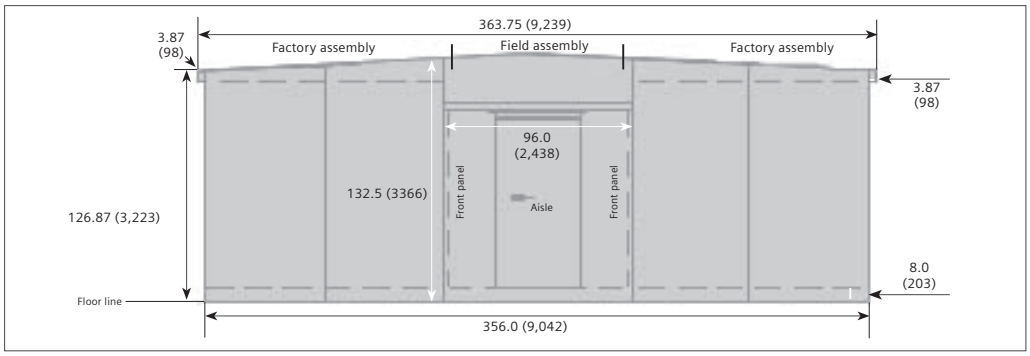
Type GM38 indoor switchgear



Type OGM38 non-walk-in outdoor switchgear

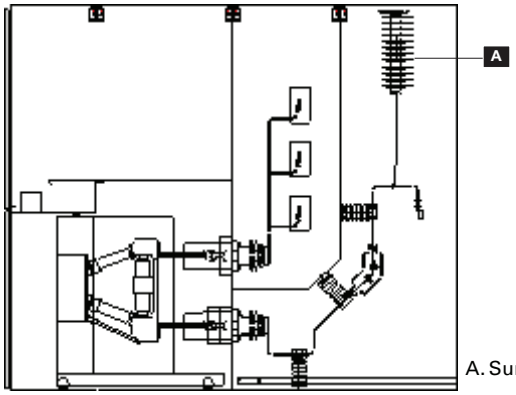


Type SGM38 Shelter-Clad single-aisle outdoor switchgear

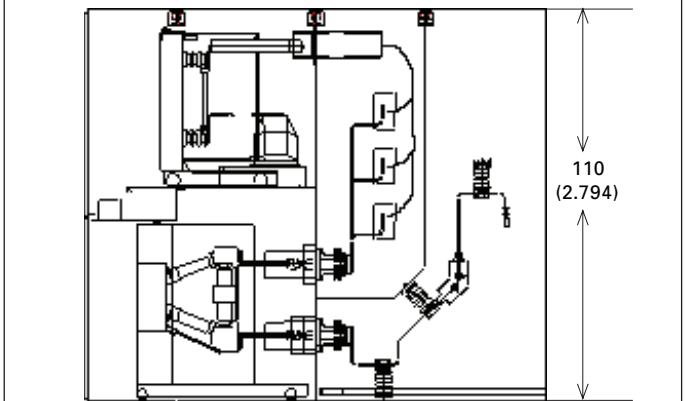


Type SGM38 Shelter-Clad common-aisle outdoor switchgear

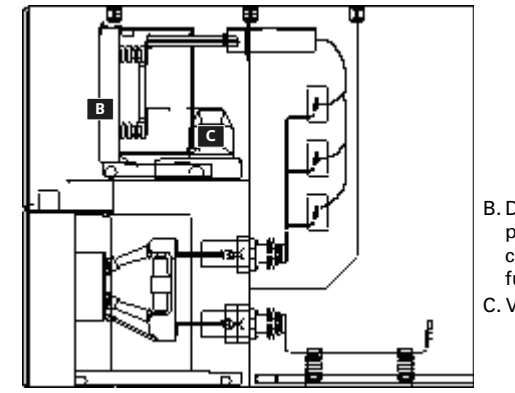
Side Views — 1,200 A, 2,000 A, 3,000 A Circuit Breakers/Auxiliary



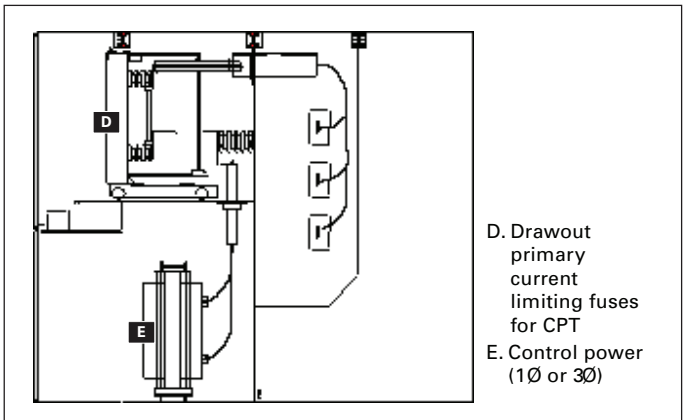
Auxiliary/1,200A, 2,000 A or 3,000 A circuit breaker (no drawout auxiliaries in upper cell for 3,000 A fan-cooled circuit breaker)



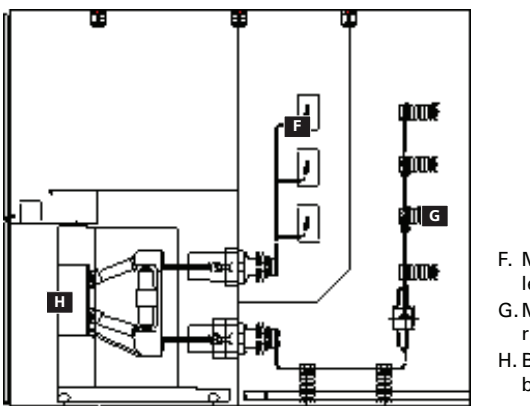
Circuit breaker 1,200 A or 2,000 A with VT auxiliary (downfeed cables)



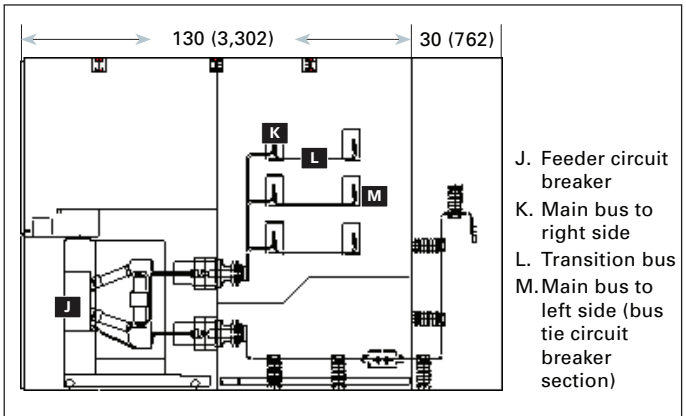
VT auxiliary/1,200 A or 2,000 A circuit breaker (upfeed cables)



CPT fuse truck/stationary CPT (1Ø or 3Ø)



Auxiliary/Bus tie circuit breaker



Auxiliary/feeder circuit breaker (adjacent to right side of bus tie circuit breaker section)

Gas-Insulated Switchgear

Types 8DA10 and 8DB10 medium-voltage, gas-insulated switchgear are gas-insulated, vacuum circuit breaker designs with a voltage range of 4.16 kV to 38 kV. Lightning impulse withstand voltage ratings up to 200 kV BIL and interrupting ratings up to 40 kA are available.

The types 8DA10 and 8DB10 medium-voltage, gas-insulated switchgear designs feature fixed-mounted, vacuum circuit breakers, connectable to the main bus through three-position (closed-open-ready to ground) switches. The position of the switches is externally observable from the front of the unit using a convenient camera system. Medium-voltage, gas-insulated switchgear is suitable for systems where small size, arc resistance, environmental immunity or reduced maintenance needs are important. Depending upon the voltage rating, medium-voltage, gas-insulated switchgear is approximately 1/5th the size of conventional air-insulated switchgear.

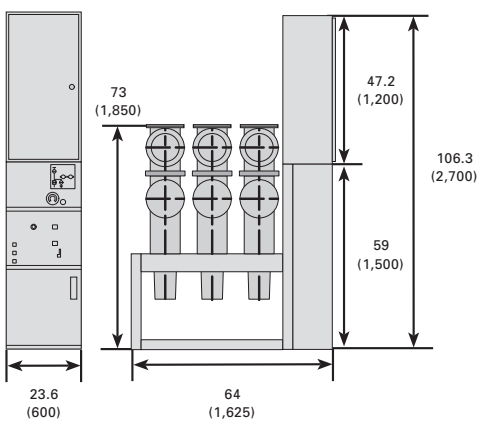
Features include:

- Tested for arc-resistance to IEEE C37.20.7-2007, type 2A
- Significantly reduced PPE needs
- Compact – up to 80% smaller than air-insulated switchgear
- 20-year internal maintenance cycle
- Meets IEEE and IEC standards
- UL or C-UL Listing available
- Single-phase design eliminates phase-to-phase faults
- Meets NEC visible disconnect requirement
- Well suited for contaminated environments
- Pair with Siemens protective relays to match any application.

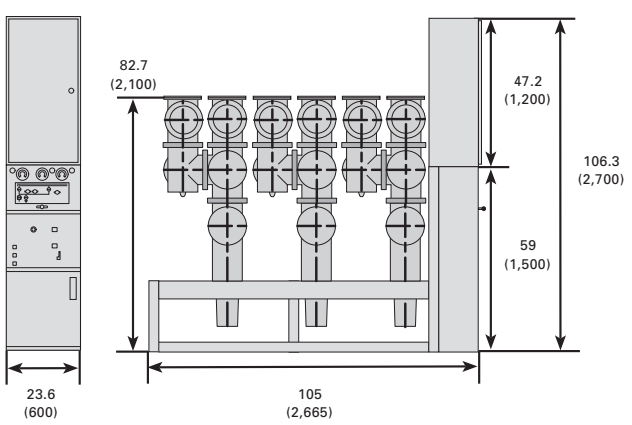
Rated Values					
Maximum Design Voltage	kV	15	27	38	42*
Frequency	Hz	60	60	60	60
Power-Frequency Withstand Voltage (1 min.)	kV rms	36	60	80	80
Lightning Impulse Withstand Voltage	kV peak	95	125	170; 200*	185; 200*
Short-Circuit Interrupting Current	kA	40	40	40	40
Short-Time Withstand Current, 3 s	kA	40	40	40	40
Short-Circuit Making Current (close and latch)	kA peak	104	104	104	104
Peak Withstand Current	kA peak	104	104	104	104
Continuous Current of Main Bus	A	4,000	4,000	4,000	4,000
Continuous Current of Circuit Breakers	A	2,500	2,500	2,500	2,500

* On request. Consult factory

Type 8DA dimensions in inches (mm)



Type 8DB dimensions in inches (mm)

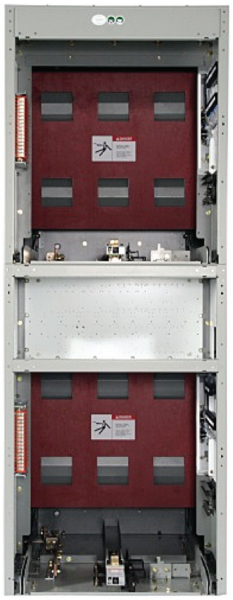


Siemens Medium-voltage (MV) OEM Component Offering

Qualified MV OEM Panel Builders can utilize Siemens' skeleton or cell kit components to build out entire switchgear solutions. A full line up of Non-Arc GM-SG, GM38 ANSI and also select IEC components from Siemens' global portfolio are available:

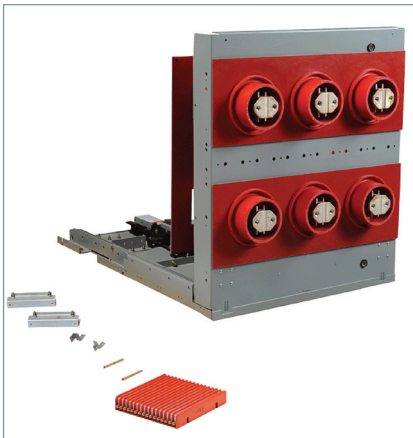
- MV Vacuum Circuit Breakers 5-38kV
- Skeleton
- Cell Kit
- MOC and TOC
- Ground and Test Devices
- Rollouts
- Bus Boots / Insulation Products
- Lifting devices and other accessories

For more information, please contact 1-800-241-4453, email: info.us@siemens.com, or your local sales office.



GMSG Skeleton

SION 3AE5 IEC MV Breaker



GMSG Cell kit

GMSG Breaker

SIEBREAK™ Metal-Enclosed Load Interrupter Switchgear

Standard

- Single, duplex, and selector switch types
- Non-fused or fused
- Indoor type 1 enclosure
- Large 8" x 18" (203 mm x 457 mm) viewing window
- Hinged, grounded metal barrier in front of switch blades
- 11-gauge doors, covers, and barriers
- Silver-plated copper bus
- Provisions for key interlocking
- Mechanical door and switch interlock
- Upper and lower ventilation louvers
- Glass-polyester bus supports
- Non-corrosive nameplate
- Space heater with thermostat
- NEMA CC1 hole patterns for cable termination.
- Meets or exceeds applicable standards from ANSI, IEEE, CSA, EEMAC, and NEMA.

Optional

- UL or C-UL Listing
- Current-limiting or explusion fuses
- Indoor type 2 drip-proof enclosure
- Indoor type 12 dust-resistant enclosure
- Outdoor non-walk-in type 3R enclosure
- Motor-operated mechanism
- Tin-plated copper bus.
- Auxiliary switches (2 NO-2 NC)
- Mimic bus
- Ground studs
- Screens and filters (indoor)

Modular configurations to mount:

- Surge arresters
- Instrument transformers
- Control power transformers
- Power meters
- Other auxiliary equipment.

Applications:

- Standalone bay
- Transformer primary
- Lineups.

SIEBREAK Specifications

Rated voltage	**Type**	5 kV	15 kV
Rated frequency		50/60 Hz	
Rated duration power frequency withstand voltage		19 kV	36 kV
Rated lightning impulse withstand voltage (BIL)		60 kV	95 kV
Fuse short circuit current rating	**Current Limiting**	50 kA	50 kA
	Expulsion	37.5	29.4
Switch rating	**Continuous Current**	600 A and 1200 A	
	Interrupting rms	25 kA and 38 kA	
	Momentary rms	40 kA, 61 kA, 80 kA	
Assembly rating	**Main bus continuous current**	1200 A and 2000 A	
	Short-time 2 second	25kA and 38 kA	

SIMOVAC Medium-voltage Controllers

Siemens experience gained in over 50 years of supplying medium-voltage controllers in the U.S. has been captured in the SIMOVAC and SIMOVAC-AR designs. The objective has been to incorporate features designed to provide safety, while simplifying operation and maintenance, and reducing installation cost. Siemens is committed to providing products that are reliable and high quality. Typical applications include:

- Squirrel-Cage Induction Motors (non-reversing, reversing or multi-speed)
- Reduced-Voltage Starters (solid-state type)
- Synchronous motors (brush-less type)
- Transformer Feeders
- Capacitor Bank Feeders
- Power Bus Feeders (Tie).

The utilization voltage range for the controllers is 2.3 kV through 7.2 kV.

The Siemens SIMOVAC-AR and SIMOVAC medium-voltage controller allows the user to combine vacuum contactors, latched contactors and load-break switches in one lineup. The user can also connect directly to Siemens type GM-SG-AR or GM-SG medium-voltage switchgear with a transition section. This provides extreme flexibility in systems design.

Load-Break Switches (LBS)

Drawout Controllers:

- Full-Voltage Non-Reversing (FVNR)
- Reduced-Voltage Solid State (SSRVS)
- Brushless Synchronous (BL-SYNCH)
- Two-Speed Two-Winding (2S2W)
- Two-Speed One-Winding (2S1W)
- Full-voltage reversing (FVR).

E2 (Fused) Contactors — To meet interrupting capability required for NEMA Class E2 controllers, types 12SVC400 and 12SVC800 contactors are provided with primary current-limiting fuses in each phase. The resulting interrupting ratings are shown in bottom table.

Typical SIMOVAC non-arc-resistant controller

Typical SIMOVAC-AR arc-resistant controller

Controller maximum current capability

Controller type	Type 1 non-arc-resistant; type 2 non-arc-resistant; type 3 outdoor non-arc-resistant	Type 1 arc-resistant	Type 12 non-arc-resistant
Two-high compartment with 12SVC400 controller	340 A top	340 A top	340 A top
	400 A bottom	400 A bottom	380 A bottom
One-high compartment with 12SVC400 controller	400 A top or bottom	400 A top or bottom	380 A top or bottom
One-high compartment with 12SVC800 controller	720 A	720 A	630 A

Controller assembly ratings

Maximum voltage kV	Short-circuit current class E2② kA	Insulation level (impulse)③ kV	Main bus continuous current① A	Short-time current duration (main bus)	Internal arc resistance (SIMOVAC-AR only)
5.0	63④	60	1,200, 2,000, 3,000, 4,000⑤	10 cycles (2-seconds optional)	Accessibility type 2B 0.5 seconds
7.65	63④	60	1,200, 2,000, 3,000, 4,000⑤	10 cycles (2-seconds optional)	Accessibility type 2B 0.5 seconds

① All main bus ratings are on a self-cooled, ventilated basis.
② Short-time duration for controllers without main bus is limited to contactor capability (with fuses).
③ Insulation level is for the controller, with inductive transformers disconnected for testing (per UL 347).
④ 50 kA with certain contactor/ fuse combinations.
⑤ Type 12 up to 2,000 A. Type 3R up to 3,000 A.

Contactor/controller ratings

System voltage	Vacuum contactor	Enclosed continuous ampere rating①	Interrupting capacity		Motor horsepower rating (three-phase)				Transformer loads②	
			Unfused class E1	Fused class E2	Synchronous motors		Induction motors	Max motor fuse rating	Max three- phase	Max fuse rating
kV	Type	A	kA	kA	0.8 PF	1.0 PF	HP		kVA	
2.3	12SVC400	400	4.8	63③	1,500	1,750	1,500	24R③	1,500	450E⑥
2.3	12SVC800	720	7.2	63④	3,000	3,500	3,000	57X④	2,500	900E
4.0	12SVC400	400	4.8	63③	2,500	3,000	2,500	24R③	2,500	450E⑥
4.0	12SVC800	720	7.2	63④	5,500	6,000	5,500	57X④	5,000	900E
4.6	12SVC400	400	4.8	63③	3,000	3,500	3,000	24R③	3,000	450E
4.6	12SVC800	720	7.2	63④	6,000	7,000	6,000	57X④	5,000	900E
6.9	12SVC400	400	4.8	63⑤	4,000	5,000	4,000	24R⑤	2,000 -3,500	200E⑥ -18R
6.9	12SVC800	720	7.2	63④	8,000	10,000	8,000	57X④	4,000-6,000	400E⑥ -57X④

① Refer to Controller maximum current capability table for further detail.
② Based on self-cooled transformer rating.
③ With 24R fuse, interrupting capacity is 50 kA.
④ With 48X or 57X fuse, interrupting capacity is 50 kA.
⑤ Maximum fuse is 18R.
⑥ Fuse shown will not permit transformer forced cooling rating of 133 percent of self-cooled rating.

Arc-resistant, up to 720 A, and 2.4 kV, 4.16 kV and 6.9 kV

Description

A leader in the design of medium-voltage controllers, Siemens offers its advanced arc-resistant medium-voltage controller with enhanced safety for your personnel. Siemens combined its knowledge as a leading manufacturer of motors worldwide and as a world-class supplier of medium-voltage controller innovation and technologies to deliver flexibility and reliability.

Featuress and benefits

- Tested for arc-resistance to IEEE C37.20.7-2007, up to 63 kA, 0.5 s, accessibility type 2B
- UL 347 5th edition/CSA C22.2 No. 253-09
- 400 A bolt-in or plug-in (optional) or 720 A bolt-in vacuum contactor
- 400 A or 720 A non-load-break isolation switch
- 2.4 kV, 4.16 kV and 6.9 kV (up to 7.65 kV) system voltage ratings
- 1,200 A, 2,000 A, 3,000 A or 4,000 A main bus with standard epoxy insulation on bus bars, and with optional boots for insulating joints
- Tin- or silver-plated bus available
- Front accessible
- Main bus and ground bus are supported and braced up to 63 kA two-second short-time capability
- Top-mounted pressure relief channel shipped installed for reduced site installation time
- Isolation switch with visible indication through viewing window to verify that the power cell is isolated from line-side source – no need to open panel door

- Isolation switch mechanically interlocked with the access door to prevent user access to primary compartment when isolation switch is closed
- Low-voltage compartment is isolated from the medium-voltage compartment
- All components are front accessible, facilitating routine inspection or parts replacement
- Current-limiting fuses, contactor assembly and isolating switch assembly are easily removed from the enclosure
- The main bus compartment is top, side and front accessible for easy installation and extension.

General description

The Siemens SIMOVAC controller is an integrated system of contactors and components arranged for convenient access within a common enclosure consisting of one or more free-standing structural sections. SIMOVAC indoor sections are normally 36" (914 mm) wide, 30" (762 mm) deep and 95" (2,413 mm) tall, while SIMOVAC-AR indoor sections are normally 36" (914 mm) wide, 40" (1,016 mm) deep and 112" (2,845 mm) tall) as shown in the figures on the following page. 1,200 A load-interrupter switch sections are similar but are usually 48" (1,218 mm) wide.

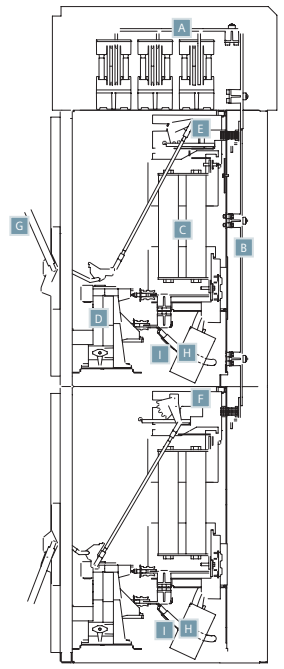
Outdoor controllers are similar except width increases 6" (152 mm) per section, height increases to 107.3" (2,725 mm), and depth increases to 37.4" (950 mm).

The controllers can be arranged to meet specific customer needs and can be configured to accept up to two starters per vertical section as shown in drawing in right column

The modular compartments of the section may contain starters, low-voltage/control devices or space for future starters.

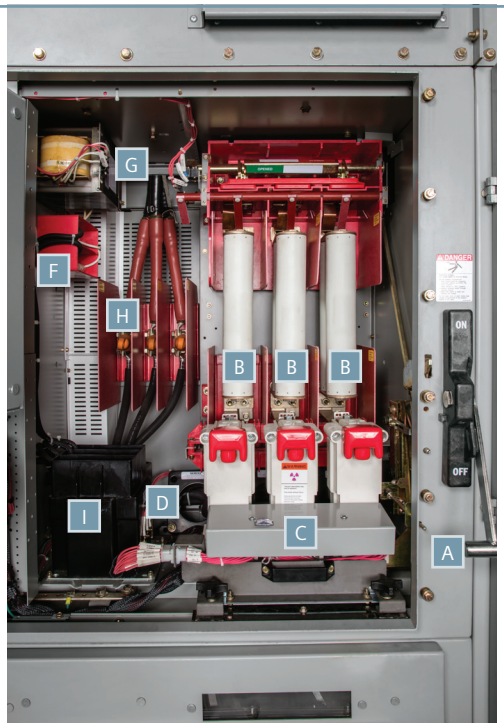
In general, each starter unit is divided into medium-voltage and low-voltage/control compartments each with its own door, and has the following features:

- The low-voltage/control compartment is isolated from the medium-voltage compartment of the section with grounded metal barriers and provides ample space for relays, terminal blocks and other control circuit elements.
- The medium-voltage compartment contains the vacuum contactor, primary fuses, current and voltage transformers (optional), a control power transformer (if applicable), a no-load isolating switch, load connections, and has space for optional surge protection devices such as surge limiters. (Refer to the figure below).

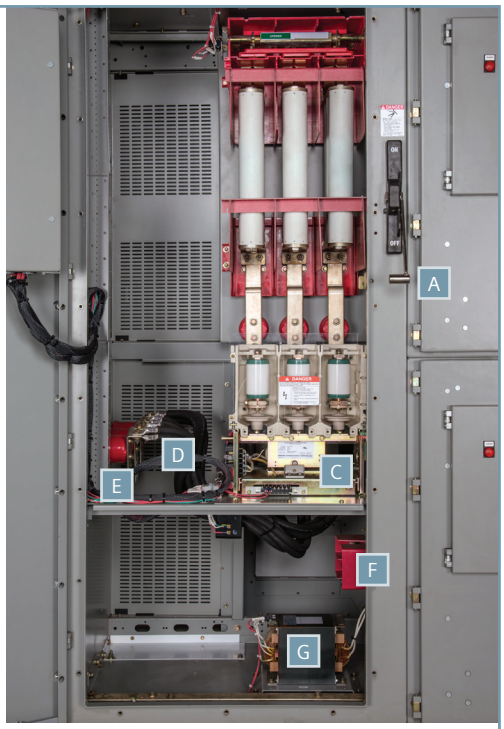


Item	Description
A	Main bus
B	Vertical bus
C	Bolt-in primary fuses
D	12SVC400 contactor (plug-in shown)
E	No-load isolating switch (shown closed)
F	No-load isolating switch (shown open)
G	Isolating switch operating handle
H	Phase current transformers
I	Load cables (internal) to user's terminal pads on left side of compartment

Item	Description
A	Isolating switch operating handle
B	Primary current-limiting fuses
C	Contactor
D	Phase current transformers
E	Ground sensor transformer
F	Primary fuses for control power transformer
G	Control power transformer
H	Outgoing cable terminations (with optional ball-type ground studs)
I	Optional voltage transformers

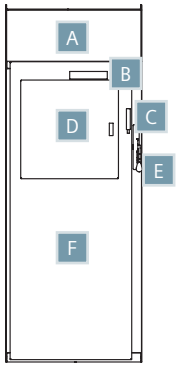


12SVC400

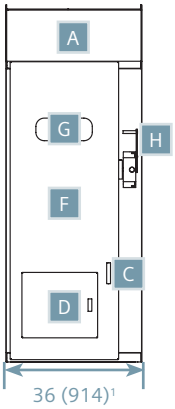


12SVC800

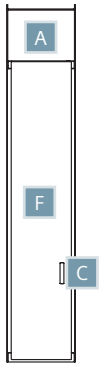
Typical SIMOVAC non-arc-resistant controller configurations②



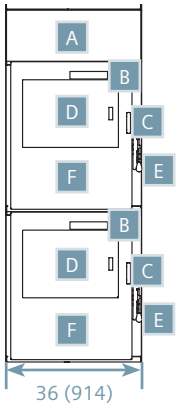
One-high controller



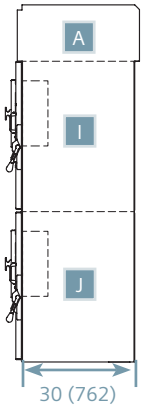
Load-interrupter switch - 600 A



Incoming line



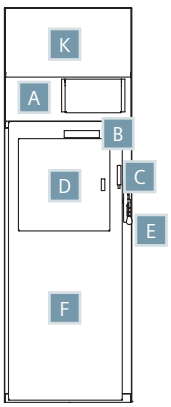
Two-high controllers



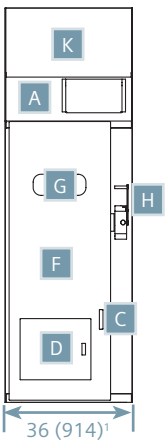
Side view

Item	Description	Item	Description	Item	Description
A	Main bus compartment	E	Isolating switch handle	I	Upper controller compartment
B	Isolating switch blade viewing window	F	High-voltage door	J	Lower controller compartment
C	High-voltage door handle	G	Interrupter switch blade viewing window		
D	Low-voltage door	H	Interrupter switch handle		

Typical SIMOVAC-AR arc-resistant controller configurations

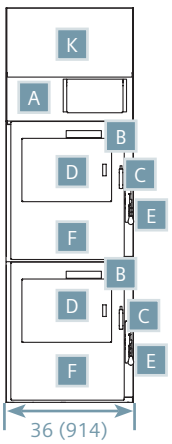


One-high controller

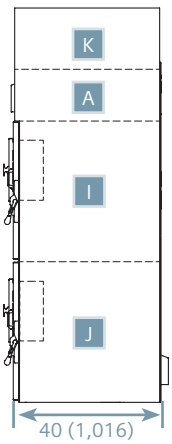


Load-interrupter switch - 600 A

Incoming line



Two-high controllers



Side view

Item	Description	Item	Description	Item	Description
A	Main bus compartment	E	Isolating switch handle	I	Upper controller compartment
B	Isolating switch blade viewing window	F	High-voltage door	J	Lower controller compartment
C	High-voltage door handle	G	Interrupter switch blade viewing window	K	Pressure relief channel
D	Low-voltage door	H	Interrupter switch handle		

① 600 A load-interrupter switches are 36" (914 mm) wide. 1,200 A switches are 48" (1,218 mm) wide.

② For outdoor non-arc-resistant configurations, add 6" (151 mm) per section.

Overload protection – types 3RU or 3RB

Running overcurrent (overload) protection for the motor must also be provided according to NEMA standards. This overload (or longtime) protection can be provided by the Siemens type 3RU (OLR) bimetallic thermal overload relay. This three-phase adjustable relay provides inherent singlephase protection and phase unbalance protection with NEMA class 10 tripping characteristics, providing optimum protection for motors having acceleration times of six seconds or less and allowable hot locked rotor times of five seconds or more. It is equipped with an isolated normally open contact to actuate a remote alarm in the event of an overload trip.

SIPROTEC protective relays

The SIPROTEC protective relay family includes many of the secondary ANSI functions, allowing the user to use one protective relay for motor protection applications.

SIMOVAC and SIMOVAC-AR can also be equipped with the SIPROTEC 5 arc-protection solution that optically detects arcs reliably as they develop. The SIPROTEC 5 protective relay is then able to initiate a command to open an upstream circuit breaker to quickly clear the arcing fault, reducing potential damage to the equipment, and providing better protection for personnel.

Type SIPROTEC 5 relay

Type 3RU overload relay

Type 3RB overload relay

SICAM PAS & PQ Analyzer

SICAM PAS (Power Automation System) is a complete substation automation control and protection system for HV and MV switchgear (i.e., >600 volts) used in electric utility and industrial facility substations. SICAM PAS offers many time and cost saving benefits for entities along the switchgear value chain including, electric utilities, industrial plant owners, switchgear manufacturers, designers, integrators, panel builders, installers and OEMs.

Key Features

- Integrated substation automation system for SCADA monitoring, control and system protection.
- Fully compliant with the IEC 61850 industry design standard.
- Automated Power Quality and protection relay fault record retrieval and data reporting (supports NERC PRC-002 and 005).
- Substation Human Machine Interface (HMI) for visualization, alarm handling and control using graphical displays.
- NERC CIP cyber security compliance tools.
- Redundant server option for greater reliability
- Communications redundancy via Parallel Redundancy Protocol (PRP) and High Availability Redundancy Protocol (HSR)
- Fully complient with IEC 61850 Edition 2

Benefits

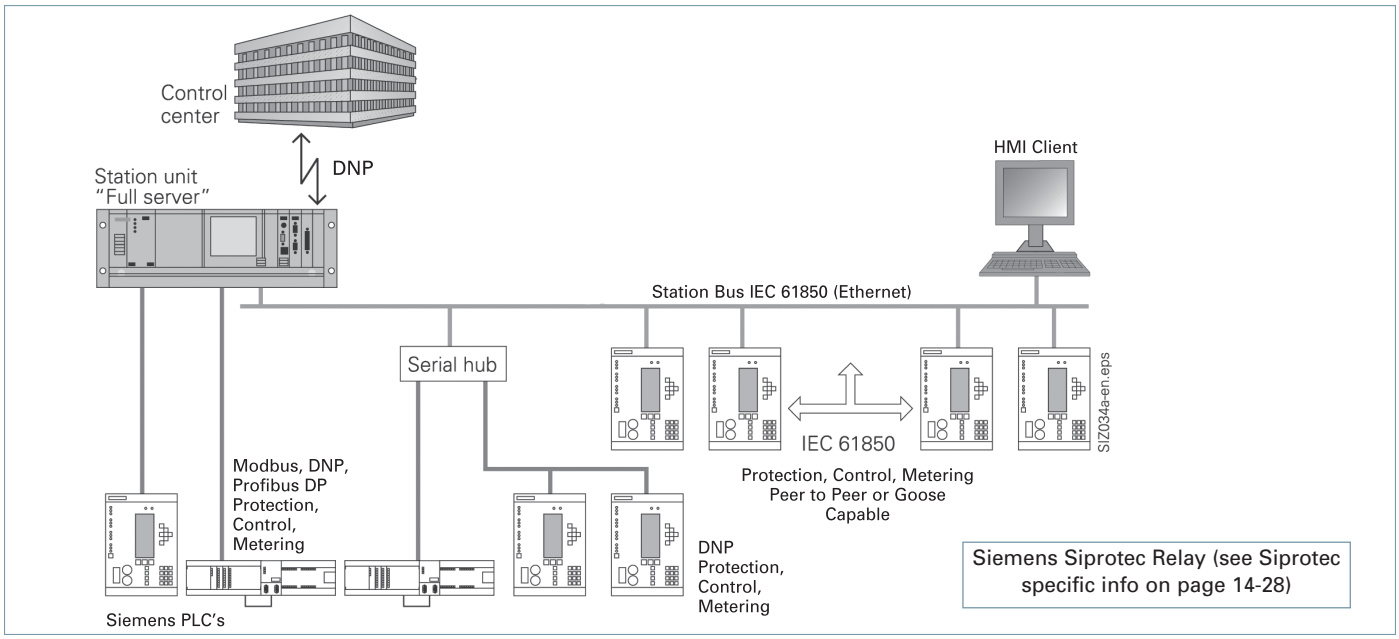
- SICAM PAS saves designers, panel builders and OEMs time and money to deploy standardized and reusable protection and control systems.
- SICAM PAS is interoperable with third-party devices using IEC 61850, DNP, OPC and Modus communication protocols.
- The IEC 61850 design standard results in a a 70% reduction of panel wiring which saves in material costs and installation and test time.
- IEC 61850 also provides the means to bench test and debug the system and protection design before the switchgear is deployed in the substation, which significantly reduces the project schedule and on-site integration risk.
- Plant owners can see savings through automated power quality reporting.

SICAM PAS Substation Server

SICAM PAS works on industrial-standard hardware with the Microsoft Windows operating systems. The advantages of this platform are low hardware and software costs, ease of operation, scalability, flexibility and constantly available support. With the powerful real-time data distribution system, applications can be allocated among several computers, thus boosting performance, connectivity and availability of over 600 intelligent electronic devices. A database system stores and organizes the data basis (e.g. configuration data, administrative status data, etc.). The device master function for communication with Intelligent Electronic Devices (IEDs) supports a large number of well established protocols. The SICAM PAS data normalization function allows conversions such as measured-value filtering, threshold value calculation and linear characteristics.

SICAM PAS CC HMI

SICAM PAS CC is used for process visualization. Specifically designed for energy applications, it assists the operating personnel in optimizing the operations management. It provides quick visualization and response to substation conditions. SICAM SCC is based on SIMATIC WinCC, one of the leading process visualization systems that is used in industrial automation world. The client-server architecture allows for up to 16 client off of a signal server for extensive visualization of the power system throughout the substation and industrial plant.



SIPROTEC Relays: Premier protection with less engineering effort

Engineering for relaying systems costs many times more than the purchase price of the relays themselves. The SIPROTEC line of relays from Siemens is designed and built to simplify design and configuration, while reducing ownership costs.

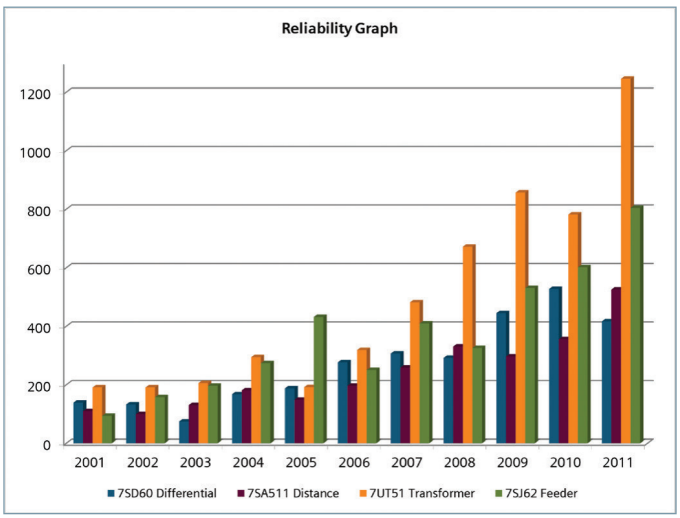
The hardware and firmware design of SIPROTEC relays are proven to stand up to tough substation operating conditions worldwide. Separate design and validation steps provide stable operating systems to minimize in-service firmware upgrades.

Stable firmware process

SIPROTEC relays reduce total ownership cost and engineering effort for firmware upgrades – only one critical firmware upgrade has been required in the past 12 years.

Unmatched reliability

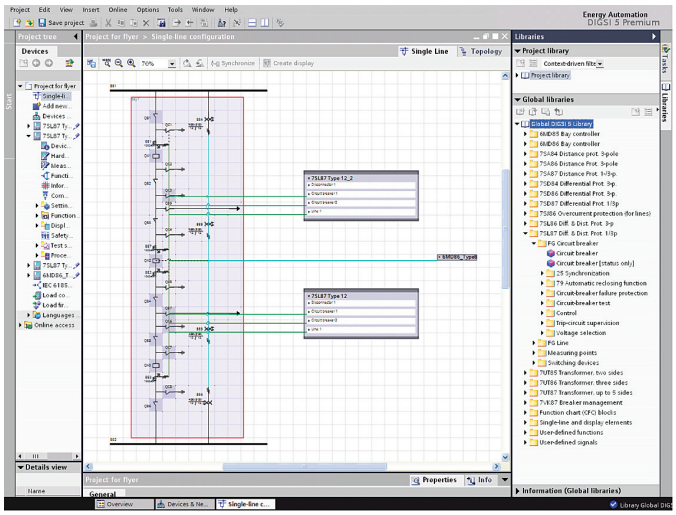
Siemens SIPROTEC protective relays average a 600-year mean time between failures (MTBF), meaning for every 600 relays you own, you can expect one or fewer failures per year. This measurement is the result of over 1.2 million relays installed worldwide, and it includes "out-of-the-box" or "initial" failures.



High reliability measured on more than one million digital relays in service.
Important: SIPROTEC quality data does not exclude "out-of-the-box" or "initial" failures.

Stable, easy and powerful software

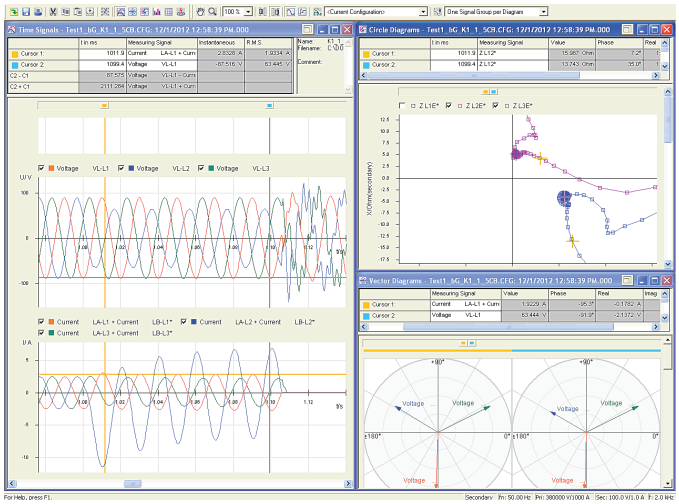
DIGSI setting software simplifies protection and automation configuration to reduce human performance errors. It also reduces total ownership costs with a historical track record of high-stability and low-upgrade frequency, saving on substation trips and upgrade times.



DIGSI software provides intuitive setting and configuration for single or multiple relays

Export to popular CAD systems reduces errors and cost. Powerful CFC logic enables flexible operating arrangements using digital and analog measurements. Pre-configured logic for single and dual-breaker or breaker-and-a-half bus configurations reduces needed settings for faster setup.

SIGRA fault analysis software provides the most advanced tool for relay engineers to identify fault conditions. Users can view multiple events, calculate system impedances, relay values, and other elements to better understand relay and power system performance.

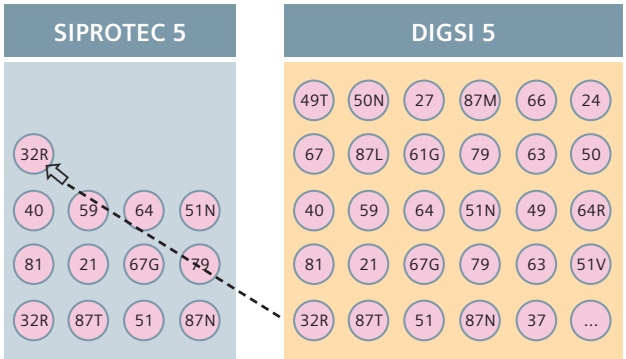


SIGRA event analysis software provides viewing and calculations for Comtrade event files

Easy to upgrade for future applications

n Modular hardware for easy additions and field changes
– Next time your requirements change, simply adjust your expansion modules for communications, I/O, displays, and fault recording memory.
n Change functions to match changing conditions
– Load only the functions needed into the relay
– Add or remove protection elements with drop-and-drag functionality
– Avoid setting and CPU clutter by eliminating unnecessary protection functions

Pre-loaded resident protection elements can be activated, duplicated or de-activated at any time in the future, without changing firmware



This is like a protection "buffet service," where the user self serves by dragging and dropping.

For more information, please visit http://automation.usa.siemens.com/consultant/ or contact your local sales office.

ANSI Selection List for Protective Relays

		Distance		Pilot wire differential	Line differential		Overcurrent									Motor protection	Differential						Generator and motor protection		Breaker management		Breaker failure	Voltage, frequency
ANSI No.*	**Protection functions**	7SA522	7SA6	7SD600	7SD5	7SD610	7SJ45	7SJ46	7SJ600	7SJ602	7SJ80	7SJ61	7SJ62	7SJ63	7SJ64	7SK80	7VH60	7UT612	7UT613	7UT63	7SS60	7SS52	7UM61	7UM62	7VK61	7VE6	7SV600	7RW600
14	Locked rotor protection	—	—	—	—	—	—	—	—	—	—	●	●	●	●	■	—	—	—	—	—	—	■	■	—	—	—	—
21	Distance protection, phase	■	■	—	●	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	■	■	—	—	—	—
21N	Distance protection, earth (ground)	■	■	—	●	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
21FL	Fault locator	■	■	—	●	—	—	—	—	—	●	—	●	●	●	—	—	—	—	—	—	—	—	—	—	—	—	—
24	Overfluxing (V/*f* protection)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	●	●	—	—	■	■	—	—	—	■
25	Synchronizing, synchronism check	●	●	—	●	—	—	—	—	—	●	—	●	—	●	—	—	—	—	—	—	—	—	—	■	■	—	—
27	Undervoltage	●	●	—	●	●	—	—	—	—	●	—	●	●	●	●	—	—	—	●	—	—	■	■	●	●	—	■
27/34	Stator earth-fault 3rd harmonic	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	■	■	—	—	—	—
32	Directional power	—	—	—	—	—	—	—	—	—	●	—	●	—	●	●	—	—	—	●	—	—	—	■	—	—	—	—
32F	Forward power	—	—	—	—	—	—	—	—	—	●	—	●	—	●	●	—	—	●	—	—	—	●	■	—	—	—	—
32R	Reverse power	—	—	—	—	—	—	—	—	—	●	—	●	—	●	●	—	—	●	—	—	—	■	■	—	—	—	—
37	Undercurrent or underpower	—	—	—	—	—	—	—	—	●	■	■	■	■	■	■	—	—	—	—	—	—	—	■	—	—	—	—
40	Loss of field	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	●	■	—	—	—	—
46	Load unbalance, negative phase-sequence overcurrent	—	—	—	—	—	—	—	■	■	■	■	■	■	■	■	—	●	—	●	—	—	●	●	—	—	—	—
47	Phase-sequence voltage	■	■	—	■	—	—	—	—	—	●	—	■	■	■	●	—	—	—	—	—	—	■	■	—	—	—	—
48	Incomplete sequence, locked rotor	—	—	—	—	—	—	—	■	●	—	●	●	●	●	■	—	—	—	—	—	—	●	●	—	—	—	—
49	Thermal overload	—	●	—	■	■	—	—	■	■	■	■	■	■	■	■	—	■	■	■	—	—	■	■	—	—	—	—
49R	Rotor thermal protection	—	—	—	—	—	—	—	■	■	—	■	■	■	■	■	—	—	—	—	—	—	—	■	—	—	—	—
49S	Stator thermal protection	—	—	—	—	—	—	—	■	■	—	■	■	■	■	■	—	—	—	—	—	—	■	■	—	—	—	—
50	Instantaneous overcurrent	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	—	■	■	■	—	●	■	■	■	—	—	—
50N	Instantaneous earth-fault overcurrent	■	■	—	■	■	—	—	■	■	■	■	■	■	■	■	—	■	■	■	—	●	■	■	—	—	—	—
50BF	Breaker failure	●	●	—	■	●	—	—	—	■	■	■	■	■	■	■	—	●	●	●	—	■	■	■	■	—	■	—
51GN	Zero speed and underspeed device	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	■	—	—	—	—
51	Overcurrent-time relay, phase	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	—	■	■	■	—	●	■	■	—	—	—	—
51N	Overcurrent-time relay, earth	■	■	—	■	■	■	■	■	■	■	■	■	■	■	■	—	■	■	■	—	●	■	■	—	—	—	—
51M	Load jam protection	—	—	—	—	—	—	—	—	—	—	●	●	●	●	■	—	—	—	—	—	—	—	—	—	—	—	—
51V	Overcurrent-time relay, voltage controlled	—	—	—	—	—	—	—	—	—	—	—	■	—	■	—	—	—	—	—	—	—	■	■	—	—	—	—
59	Overvoltage	●	●	—	●	●	—	—	—	—	●	—	●	●	●	●	—	—	—	●	—	—	■	■	●	●	—	■
59N	Residual voltage earth-fault protection	●	●	—	●	—	—	—	—	■	●	—	■	■	■	●	—	—	—	—	—	—	■	■	—	—	—	—
59GN	Stator earth-fault protection	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	■	■	—	—	—	—
64	100 % Stator earth-fault protection (20 Hz)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	●	—	—	—	—
64R	Rotor earth fault	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	■	■	—	—	—	—

■ Standard function
● Optional
* ANSI/IEEE C37.2: IEEE Standard Electrical Power System Device Function Numbers

For more information, please visit http://automation.usa.siemens.com/consultant/ or contact your local sales office.

ANSI Selection List for Protective Relays

		Distance		Pilot wire differential	Line differential		Overcurrent									Motor protection	Differential						Generator and motor protection		Breaker management		Breaker failure	Voltage, frequency
ANSI No.*	**Protection functions**	7SA522	7SA6	7SD600	7SD5	7SD610	7SJ45	7SJ46	7SJ600	7SJ602	7SJ80	7SJ61	7SJ62	7SJ63	7SJ64	7SK80	7VH60	7UT612	7UT613	7UT63	7SS60	7SS52	7UM61	7UM62	7VK61	7VE6	7SV600	7RW600
67	Directional overcurrent	—	—	—	—	●	—	—	—	—	●	—	●	●	●	—	—	—	—	—	—	—	■	■	—	—	—	—
67N	Directional earth-fault overcurrent	●	●	—	●	●	—	—	—	■①	●	—	●	●	●	●	—	—	—	—	—	—	■	■	—	—	—	—
67G	Stator earth-fault directional overcurrent	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	■	■	—	—	—	—
68	Power swing detection	●	●	—	●	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	●	—	—	—	—
74TC	Trip circuit supervision	■	■	—	■	■	—	—	■	■	■	■	■	■	■	■	—	●	●	●	—	—	■	■	■	—	—	—
78	Out-of-step protection	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	■	—	—	—	—
79	Auto-reclosure	●	●	—	●	●	—	—	●	●	●	●	●	●	●	—	—	—	—	—	—	—	—	—	■	—	—	—
81	Frequency protection	■	■	—	●	●	—	—	—	—	●	—	●	●	●	●	—	—	—	●	—	—	■	■	—	●	—	■
81R	Rate-of-frequency-change protection	—	—	—	—	—	—	—	—	—	●	—	●	—	—	●	—	—	—	—	—	—	●	●	—	●	—	●
	Vector jump supervision	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	●	●	—	●	—	—
85	Carrier interface/remote trip	■	■	●	■	■	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	■	—	—	—	—	—	—
86	Lockout function	■	■	■	■	■	—	—	—	—	■	■	■	■	■	■	—	■	■	■	■	—	■	■	■	●	—	—
87G	Differential protection generator	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	■	■	■	—	—	—	■	—	—	—	—
87T	Differential protection transformer	—	—	■	●	●	—	—	—	—	—	—	—	—	—	—	■	■	■	■	—	—	—	■	—	—	—	—
87BB	Differential protection busbar	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	■	■	■	■	■	—	—	—	—	—	—
87M	Differential protection motor	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	■	■	■	—	—	—	■	—	—	—	—
87L	Differential protection line	—	—	■	■	■	—	—	—	—	—	—	—	—	—	—	—	■	■	■	—	—	—	—	—	—	—	—
87N	Restricted earth-fault protection	—	—	—	●	●	—	—	—	—	■	■	■	■	■	—	■	●	●	●	—	—	—	●	—	—	—	—

■ Standard function
● Optional
✻ ANSI/IEEE C37.2: IEEE Standard Electrical Power System Device Function Numbers

① Only sensitive directional earth-fault overcurrent (67Ns).

For more information, please visit http://automation.usa.siemens.com/consultant/ or contact your local sales office.

Siemens Protective Relays - Quick Competitor Comparison by Application

Motor Protection

Model	Siemens Equivalent	Typical Catalog Number
GE 239	**7SK80**	**7SK8051-5EC96-3HD0+L0G**
GE 269	**7SK80**	**7SK8051-5EC96-3HD0+L0G**
GE 269+	**7SK80**	**7SK8051-5EC96-3HD0+L0G**
GE 369	**7SK80**	**SIMPRO-100-R-V**
GE 469	**7SK80** and **7SJ601**	**SIMPRO-100-R-V/7SJ6015-4EA01-0AA0**

Feeder Protection

Model	Siemens Equivalent	Typical Catalog Number
ABB CO (4 single phase)	**7SJ45** (1 three phase) 7SJ46 (1 three phase) 7SJ601 (1 three phase)	**7SJ4505-1EA00-1AA1 (1 three phase)** 7SJ4605-1EA00-1AA0 (1 three phase) 7SJ6015-4EA01-0AA0 (1 three phase)
ABB Microshield	7SJ600 7SJ602 **7SJ80** 7SJ61 7SJ62	7SJ6005-4EA00-0DA1 7SJ6025-4EB00-1FA0 **7SJ8041-5EC96-3FC1+L0G** 7SJ6115-5EC90-1FA0+L0D 7SJ6215-5EC90-1FE0+L0D
ABB DPU-1500	**7SJ62** 7SJ63 7SJ64	**7SJ6215-5EC90-1FE0+L0D** 7SJ6315-5EC90-1FE0+L0D 7SJ6405-5EC92-1FE4+L0D
ABB DPU-2000R	7SJ62 7SJ63 **7SJ64**	7SJ6215-5EC90-1FE0+L0D 7SJ6315-5EC90-1FE0+L0D **7SJ6405-5EC92-1FE4+L0D**
Basler BE3-51 (4 single phase)	**7SJ45** (1 three phase) 7SJ46 (1 three phase)	**7SJ4505-1EA00-1AA1** (1 three phase) 7SJ4605-1EA00-1AA0 (1 three phase)
Basler BE1-51 (4 single phase)	**7SJ45** (1 three phase) 7SJ46 (1 three phase) 7SJ601 (1 three phase)	**7SJ4505-1EA00-1AA1** (1 three phase) 7SJ4605-1EA00-1AA0 (1 three phase) 7SJ6015-4EA01-0AA0 (1 three phase)
Basler BE1-851	7SJ600 7SJ602 **7SJ80** 7SJ61	7SJ6005-4EA00-0DA1 7SJ6025-4EB00-1FA0 **7SJ8041-5EC96-3FC1+L0G** 7SJ6115-5EC90-1FA0+L0D
Basler BE1-951	**7SJ62** 7SJ63 7SJ64	**7SJ6215-5EC90-1FE0+L0D** 7SJ6315-5EC90-1FE0+L0D 7SJ6405-5EC92-1FE4+L0D
GE MDP	7SJ45 7SJ46 7SJ601 **7SJ80**	7SJ4505-1EA00-1AA1 7SJ4605-1EA00-1AA0 7SJ6015-4EA01-0AA0 **7SJ8041-5EC96-3FC1+L0G**
GE 735	7SJ600 7SJ602 **7SJ80** 7SJ61	7SJ6005-4EA00-0DA1 7SJ6025-4EB00-1FA0 **7SJ8041-5EC96-3FC1+L0G** 7SJ6115-5EC90-1FA0+L0D
GE 750	**7SJ62** 7SJ63 7SJ64	**7SJ6215-5EC90-1FE0+L0D** 7SJ6315-5EC90-1FE0+L0D 7SJ6405-5EC92-1FE4+L0D
GE F60	**7SJ62** 7SJ63 7SJ64	**7SJ6215-5EC90-1FE0+L0D** 7SJ6315-5EC90-1FE0+L0D 7SJ6405-5EC92-1FE4+L0D
SEL 351A	**7SJ62** 7SJ63 7SJ64	**7SJ6215-5EC90-1FE0+L0D** 7SJ6315-5EC90-1FE0+L0D 7SJ6405-5EC92-1FE4+L0D
SEL 351	**7SJ62** 7SJ63 7SJ64	**7SJ6215-5EC90-1FE0+L0D** 7SJ6315-5EC90-1FE0+L0D 7SJ6405-5EC92-1FE4+L0D
SEL 351S	7SJ62 7SJ63 **7SJ64**	7SJ6215-5EC90-1FE0+L0D 7SJ6315-5EC90-1FE0+L0D **7SJ6405-5EC92-1FE4+L0D**
SEL 501	7SJ600 7SJ602 **7SJ80** 7SJ61	7SJ6005-4EA00-0DA1 7SJ6025-4EB00-1FA0 **7SJ8041-5EC96-3FC1+L0G** 7SJ6115-5EC90-1FA0+L0D
SEL 551	7SJ600 **7SJ602** **7SJ80** 7SJ61	7SJ6005-4EA00-0DA1 **7SJ6025-4EB00-1FA0** **7SJ8041-5EC96-3FC1+L0G** 7SJ6115-5EC90-1FA0+L0D

*Siemens catalog numbers in Bold are the preferred equivalent model.
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For more information, please visit http://automation.usa.siemens.com/consultant/ or contact your local sales office.

General Protection

Model	Siemens Equivalent	Typical Catalog Number
ABB GPU2000	**7UM62**	**7UM6215-5EC90-0BA0+L0D**
Basler BE1- GPS100	7UM61 **7UM62**	7UM6115-5EC90-0CA0+L0D **7UM6215-5EC90-0BA0+L0D**
Beckwith M-3420	7UM61 **7UM62**	7UM6115-5EC90-0CA0+L0D **7UM6215-5EC90-0BA0+L0D**
Beckwith M-3425	**7UM62**	**7UM6215-5EC90-0CA0+L0D**
GE 489	7UM61 **7UM62**	7UM6115-5EC90-0CA0+L0D **7UM6215-5EC90-0BA0+L0D**
SEL 300G	7UM61 **7UM62**	7UM6115-5EC90-0CA0+L0D **7UM6215-5EC90-0BA0+L0D**

Bus Protection

Model	Siemens Equivalent	Typical Catalog Number
ABB HU	**7VH60**	**7VH6002-0EA20-0AA0**
ABB CA	**7VH60**	**7VH6002-0EA20-0AA0**
ABB TPU2000R	7UT513 **7UT612**	7UT5135-4GB11-1AA0 **7UT6125-5EC00-1AA0**
Basler BE1-87	7UT513 **7UT612** (3) 7VH60	7UT5135-4GB11-1AA0 **7UT6125-5EC00-1AA0** 7VH6002-0EA20-0AA0
GE PVD	**7VH60**	**7VH6002-0EA20-0AA0**
GE B30	7UT513 **7UT612**	7UT5135-4GB11-1AA0 **7UT6125-5EC00-1AA0**
SEL 387	7UT513 **7UT612**	7UT5135-4GB11-1AA0 **7UT6125-5EC00-1AA0**

Transformer Protection

Model	Siemens Equivalent	Typical Catalog Number
ABB HU (3)	7UT512 (1) 7UT513 (1) **7UT612 (1)**	7UT5125-4GB11-0AA0 7UT5135-4GB11-1AA0 **7UT6125-5EC00-1AA0**
ABB CA (3)	7UT512 (1) 7UT513 (1) **7UT612 (1)**	7UT5125-4GB11-0AA0 7UT5135-4GB11-1AA0 **7UT6125-5EC00-1AA0**
ABB TPU2000R	7UT512 7UT513 **7UT612**	7UT5125-4GB11-0AA0 7UT5135-4GB11-1AA0 **7UT6125-5EC00-1AA0**
Basler BE1-CDS	7UT513 **7UT612**	7UT5135-4GB11-1AA0 **7UT6125-5EC00-1AA0**
GE 745	7UT513 **7UT612**	7UT5135-4GB11-1AA0 **7UT6125-5EC00-1AA0**
GE T60	7UT513 **7UT612**	7UT5135-4GB11-1AA0 **7UT6125-5EC00-1AA0**
SEL 387	7UT513 **7UT612**	7UT5135-4GB11-1AA0 **7UT6125-5EC00-1AA0**
SEL 587	7UT512 7UT513 **7UT612**	7UT5125-4GB11-0AA0 7UT5135-4GB11-1AA0 **7UT6125-5EC00-1AA0**

Voltage/Frequency Protection

Model	Siemens Equivalent	Typical Catalog Number
Basler BE1-27	**7RW600 and 7RW80**	**7RW60000-4EA00-0DA0 and 7RW8020-5EC96-1DA0+L0G**
Basler BE1-59	**7RW600 and 7RW80**	**7RW60000-4EA00-0DA0 and 7RW8020-5EC96-1DA0+L0G**
Basler BE1-27/59	**7RW600 and 7RW80**	**7RW60000-4EA00-0DA0 and 7RW8020-5EC96-1DA0+L0G**
Basler BE1-81O/U	**7RW600 and 7RW80**	**7RW60000-4EA00-0DA0 and 7RW8020-5EC96-1DA0+L0G**
GE IAV	**7RW600 and 7RW80**	**7RW60000-4EA00-0DA0 and 7RW8020-5EC96-1DA0+L0G**
GE IFV	**7RW600 and 7RW80**	**7RW60000-4EA00-0DA0 and 7RW8020-5EC96-1DA0+L0G**
GE MIV	**7RW600 and 7RW80**	**7RW60000-4EA00-0DA0 and 7RW8020-5EC96-1DA0+L0G**
GE NGV	**7RW600 and 7RW80**	**7RW60000-4EA00-0DA0 and 7RW8020-5EC96-1DA0+L0G**
GE DFF	**7RW600 and 7RW80**	**7RW60000-4EA00-0DA0 and 7RW8020-5EC96-1DA0+L0G**
GE MFF	**7RW600 and 7RW80**	**7RW60000-4EA00-0DA0 and 7RW8020-5EC96-1DA0+L0G**
GE SFF	**7RW600 and 7RW80**	**7RW60000-4EA00-0DA0 and 7RW8020-5EC96-1DA0+L0G**

*Siemens catalog numbers in Bold are the preferred equivalent model.

Ratings from 5–38 kV, 250–1500 MVA, 1200-3000 Amperes

Replacement circuit breakers provide a cost-effective way to upgrade your system capabilities while saving you from costly maintenance and lost productivity and preserving your investment in existing cubicles and cables.

Whether your equipment was originally manufactured by Allis-Chalmers, Westinghouse, GE, Federal Pacific, ITE, or another manufacturer, we will assist you to evaluate the Siemens replacement options which best meet your needs.

Why Replacement Breakers?

- Increased Reliability and Performance
- Reduced Operating and Maintenance Expenditures
- Reduced Downtime, Minimal Changeover Time During Upgrade
- Preserved Investment in Existing Cubicles
- Improved Employee and Environmental Safety

Why Siemens?

Siemens Offers the Best Vacuum Circuit Breaker in the Industry.

- Superior Performance, Longer Service Life

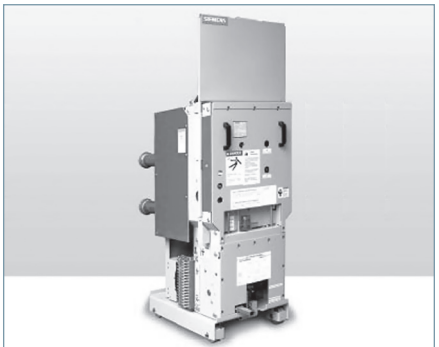
– 10,000 full load operation, 10-year maintenance cycle on replacement circuit breakers with 3AH operator

- Standard Operator on All Siemens Replacement, Medium-voltage Distribution, and Outdoor Vacuum Circuit Breakers
- Extensive Replacement Breaker Experience – 750+ projects since 1983

– Over 400,0000 3AF/H series circuit breakers in service worldwide

– Nuclear Class 1E Rated (350+ breakers)

- Full Range of Service Capabilities by Skilled Factory-Trained Engineers and Technicians



5-MSV (replacement for Allis-Chalmers MA)

Siemens Medium-voltage Replacement Circuit Breakers

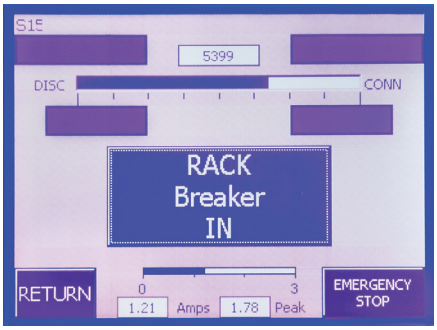
The following circuit breakers are available as pre-engineered designs. Other manufacturers, models, and ratings can be engineered by Siemens.

Transformer Protection

Manufacturer	Model	kV	Ratings MVA	AMP
Allis-Chalmers	AM	5	150	1200, 2000
(All Air-Magnetic)			250	1200, 2000
	MB	7	250	1200, 2000
			500	1200, 2000
	MC/MCV	15	150	1200
			250	1200, 2000
			500	1200, 2000
	MA	5	250	1200, 2000
			350	1200, 2000
	FA	5	350	3000
	FB	7	500	1200, 2000, 3000
	FC/FCV	15	500	1200, 2000
			750	1200, 2000
			1000	1200, 2000, 3000
Siemens	3AF(H2), GMI, GMSG	5	250	1200, 2000
			350	1200, 2000, 3000
		7.5	500	1200, 2000, 3000
		15	500	1200, 2000
			750	1200, 2000
			1000	1200, 2000, 3000
GE	Magneblast (AMH)	4.16	250	600, 1200, 2000
(All Air-Magnetic)	Magneblast (AM)	2.4	100	600, 1200, 2000
			150	600, 1200, 2000
		4.16	100	600, 1200, 2000
			150	600, 1200, 2000
			250	600, 1200, 2000
			350	1200, 2000, 3000
		7.2	500	1200, 2000, 3000
		13.8	250	1200, 2000
			500	1200, 2000
			750	1200, 2000
			1000	1200, 2000, 3000
Westinghouse	DH	5	150	1200, 2000
			250	1200, 2000
			350	3000
		7.5	500	1200, 2000
		15	500	1200, 2000
			750	1200, 2000
			1000	1200, 2000, 3000
	DHP	5	350	1200, 2000
		7.5	500	1200, 2000
		15	500	1200, 2000
			750, 750C	1200, 2000
			1000	1200, 2000
ITE	HV	5	100	600, 1200
			150	600, 1200
			250	600, 1200
	HK	7.5	500	1200, 2000
		15	500	1200, 2000
			750	1200, 2000
			1000	1200, 2000
Federal Pacific	DST2	5	250	1200, 2000
		7.5	500	1200, 2000
		15	500	1200, 2000
			750	1200, 2000
	MOP	27	1000	1200
McGraw Edison	PSD	15	501	1200
			502	2000
			751	1200

In addition to eliminating the need for arc flash suits during racking, SARRACS also streamlines the procedure. First, the unit is positioned and secured. Then, the operator connects the breaker's racking mechanism to SARRACS' Racking Adaptor.

With the Operator's Station in hand, the operator moves to a location safely beyond the flash zone. The object, switchgear and breaker are selected on the touch screen. Next, the starting position is input and the racking operation initiated.



As the breaker is being racked, the operator receives precise real-time location and movement readings. Should a problem occur, fault-indicating screens are displayed, and the racking process is terminated immediately.

SARRACS™ (Safety Remote Breaker Racking System) provides increased protection for your most important assets – your personnel and your equipment

Traditionally, breaker racking on an energized system required that operators work within the arc flash boundary, at risk from intense heat, percussion forces and airborne debris should a fault explosion occur. This led OSHA to establish the current standard that requires personnel to wear full-body flash suits while performing racking procedures within the flash boundary.

Now, with SARRACS, the operator can be positioned safely outside the arc flash boundary while racking any manufacturer's breaker in or out of a live bus – eliminating the need for flash suits. In addition, the advanced technologies Siemens incorporated into SARRACS make racking more efficient, while limiting the potential for damage to electrical equipment during the procedure.

Maximize safety

Via the touch screen on the portable Operator's Station, racking procedures can be controlled from a distance of up to 75 feet.

Streamlining the process improves racking efficiency, reduces downtime

SARRACS shortens breaker racking times by as much as 50% over traditional techniques. In addition, it allows expenses for related safety equipment, including flash suits, to be kept to a minimum.

Siemens components deliver Siemens reliability

SARRACS uses a three-phase gear motor to provide the power needed for racking and a digital encoder for precise position control and sensing. An AC variable-frequency drive operates all speed adjustments, over current limits and ramp functions.

Unmatched control capabilities

The advanced Siemens SIMATIC S7-200 PLC provides the control required to limit damage to the breaker or cell that can be caused by equipment misalignment and jamming. This allows for:

- Precise position tracking and movement monitoring to .001"
- Accurate detection of breaker positions requiring high or low torque

Total flexibility – one unit can take on any breaker

- Simply adjust the elevation of the motor carriage to align the gear motor assembly to the racking mechanism on any manufacturer's breaker
- Profile Torque Protection technology uses the PLC to generate a distinct torque vs. position record for each individual breaker in a lineup. These torque profiles are stored in PLC memory using the Operator's Station and can be easily updated anytime a breaker is being racked.

Easily transport and store this robust yet compact unit

With ball bearing wheels, casters and a transport handle, this lightweight unit (200 lbs.) is easily maneuvered in confined spaces.

Get your operators up to speed in the shortest possible time

Either at your facility or at one of our training centers, Siemens can provide professional training to ensure safe and efficient SARRACS operation.

Start-up Commissioning Services

General

We realize that, even though our Totally Integrated Automation® and Totally Integrated Power® products are designed for quick and easy installation, your schedule may not allow you to allocate the resources and personnel necessary to get this equipment up and running when it is required.

In today's business environment, staff members are frequently overloaded, or they may be dedicated to other projects. Now, when you purchase new equipment from Siemens, you can add startup services at special rates. This will give you the additional help required to meet even the most pressing deadlines... at affordable rates. You can be confident that we will arrive at your door with the installation experience necessary to get your new general purpose drives, motor control center or switchgear properly started up and working when you need it.

Factory-trained engineers will:

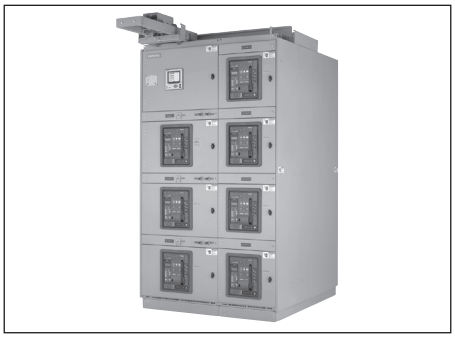
- Startup your newly-purchased Siemens equipment
- Test for operational functionality
- Provide a written report detailing tests and services
- Advise your team on upkeep and maintenance.

In many cases, you will receive a one-year parts warranty extension on your new equipment such as:

- Motor control centers
- General purpose variable speed drives
- Low-voltage switchgear.

Medium-voltage Switchgear Startup Service

- Inspect anchorage, alignment and grounding
- Check tightness of bolted bus joints
- Measure and record critical distances such as contact gap
- Perform mechanical operation tests on the operating mechanism
- Perform a contact resistance test on the breaker vacuum contacts
- Perform insulation resistance tests
- Perform vacuum interrupter integrity (over-potential) tests
- Perform insulation resistance test on all control wiring at 1000 volts DC
- Verify trip, close, trip-free and anti-pump functions
- More



Low-voltage Switchgear Startup Service

- Perform mechanical operational test
- Check cell fit and element alignment
- Check tightness of connections
- Lubricate as required
- Perform a contact resistance test
- Perform an insulation resistance test at 1000 volts DC from pole-to-pole and from each pole-to-ground with breaker closed and across open contacts of each phase
- Perform secondary current injection testing
- More

Switchboards and Power Switching Centers

- Inspect for physical damage and nameplate compliance with single line diagram
- Perform mechanical operational test. (circuit breakers, switches, etc.)
- Check cell fit and element alignment
- Check tightness of connections and lubricate
- Perform a contact resistance test on RL/WL/SB breakers and power switches
- Perform an insulation resistance test at 1000 volts DC from pole-to-pole and from each pole-to-ground with breaker or switch closed and across open contacts of each phase
- Perform Secondary Current Injection Testing (RL/WL/SB breakers)
- More

For more information, please visit http://automation.usa.siemens.com/consultant/ or contact your local sales office.

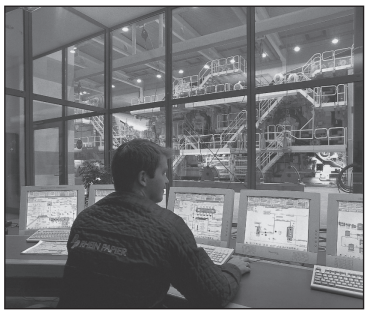
Motor Control Center Startup Service

- Ensure that all protective devices have been properly set and locked
- Review power fuse selection and installation procedures
- Conduct a general physical inspection of MCC power and control connections. Check tightness of connections
- Ensure incoming line power connections comply with UL/NEC requirements where applicable
- Ensure that any special motor starting and running applications have been considered when selecting motor starter controls, and that main metering is functioning properly
- Perform startup on drives, solid state/ soft-start starters and other equipment
- More

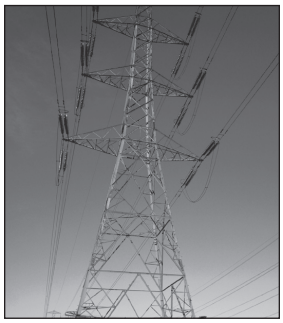
General Purpose Variable Speed Drives Startup Service

- Inspect electrical and mechanical parts after installation and wiring (per drawings)
- Make final adjustments such as speed range, acceleration/deceleration and tuning to motor
- Check starting, stopping, interlocking and sequencing (per drawings)
- Check and adjust for purchased options such as bypass, braking, serial communications, encoder interface, and line filters
- Verify power quality (MM440 units only)
- More

Engineer-by-the-Day for new equipment purchases



*Minimum purchase required. Extended warranty not vailable with Engineer-by-the-Day service.



Now, you can take advantage of the expertise of a Siemens factory-trained engineer to startup your Siemens power distribution and control equipment purchases.

Engineer-by-the-Day is available in complete one-day increments for setup of the following products*:

- ACCESS power monitoring
- Busway
- Dry type transformers
- Insulated case circuit breakers
- Molded case circuit breakers
- Panelboards
- Sensitrip circuit breakers
- Switchboards
- Switches
- More

Siemens Industry is committed to ensuring that your equipment is up and running...when you need it. Siemens Industrial Services provides expert factoryauthorized equipment startup at a special rate when you purchase the service before your product is delivered.

Get your equipment up and running on time. Contact your local distributor or Siemens Industry sales office to learn more.

Short Circuit Study

Power system specialists from Siemens will determine the maximum duty that your system's protective devices, transformers, and interconnections will be subjected to in the event of three phase and/or line-to-ground fault conditions. In addition, we will provide basic information required to establish protective relay settings.

Coordination Study

Under fault conditions, systems should isolate the faulted area to minimize disturbance to the remaining system, and simultaneously limit damage to equipment. We will review the characteristics of your protective devices, then provide the settings necessary to ensure that your system functions optimally should a fault occur.

Harmonic Analysis

As AC drives have become increasingly prevalent in industry, we have seen the introduction of destructive harmonics to many systems. The power quality experts from Siemens will determine the extent and severity of harmonics in your system, then recommend the appropriate means of limiting potential damage.

Transient Stability Study

This study is particularly valuable for facilities that generate their own power, and those with very large motors. Our power system specialists will study the transient response of rotating equipment following system disturbances, and analyze system behavior in relation to the power company tie.

Protective Device Evaluation

With the objective of achieving optimum protection, we will perform the necessary calculations required to select the interrupting rating of power fuses, circuit breakers, and other protective devices.

Power Quality Assessment

With the proliferation of sensitive electronic equipment in recent years, power quality has become a major concern for industry. We perform structured, step-by-step studies with timely diagnosis and expert solutions to the complex challenges of utility and end-user power quality issues.

Arc Flash Study

NFPA 70E recommends that an Arc Flash Hazard Analysis be performed prior to work on electrical equipment. Siemens will determine the incident energy levels, Arc Flash Boundary (AFB), and required level of Personal Protective Equipment (PPE).

Load Flow Study

This steady-state analysis of your system's capability to supply the connected load will produce a listing of real and reactive power flow in each line or branch, and the bus voltages, under both normal and abnormal system conditions.

Voltage Unbalance Study

Voltage flicker and poor voltage regulation are a common concern on systems with large arc furnaces. The experts from Siemens use this study to develop comprehensive solutions that limit the effects of voltage irregularities and protect sensitive equipment.

Grounding Study

With the goal of ensuring proper protection and reducing the possibility of excessive transient overvoltages during line-to-ground faults, our engineers will determine and recommend the most appropriate form of system grounding protection (including solidstate, low resistance, and high resistance).

With power system expertise and experience that comes from real-world successes, the specialized team of professional engineers and certified technicians from Siemens will help you:

- Minimize downtime
- Improve the safety of your operations for employees and sub-contractors
- Optimize your system's performance
- Extend your equipment's life cycle
- Reallocate your valuable internal maintenance resources to your core business
- Maximize the protection of sensitive electronics
- Ensure your facility complies with applicable safety regulations

In addition, the power system specialists from Siemens also provide the following:

Power System Studies on "Equipment Release for Manufacture"

- To ensure adequate interrupting rating, and to ensure that coordination capabilities are recognized

Streamlined Power System Construction Studies (PSCS)

- For devices being installed on construction projects

For more information, please visit http://automation.usa.siemens.com/consultant/ or contact your local sales office.

Arc Flash Hazards

In the fraction of a second that it takes copper to expand to vapor, an arc flash can generate skin-searing heat — four times hotter than the surface of the sun.

Recent revisions to NFPA70E require that an Arc Flash Hazard Analysis be performed prior to working on or near electrical equipment containing exposed energized conductors. The analysis determines the arc flash boundaries (AFB), incident energy levels and the required level of personal protective equipment (PPE). The recommendations in the analysis can be used to determine hazards in your workplace. Implementing the recommendations will help protect your workers and help you satisfy OSHA requirements.

The Siemens solution to minimize risks from arc flash hazards

Working within NFPA and IEEE guidelines, our experienced power systems engineers will perform systematic and accurate Arc Flash Hazard Studies as follows:

1. Short Circuit Calculations
   Siemens will either use your data, or make calculations for you, to identify bolted and arcing fault levels at key points in a power distribution system.
2. Protective Device Coordination
   Using the customer's electrical systems coordination study, Siemens determines the duration of the arcing faults.
3. Arc Flash Hazard Calculations
   The incident energy level, the flash hazard boundary, and the PPE required are then calculated for each location.
4. Documentation
   The information above is compiled for you into a comprehensive report, which contains information necessary to comply with regulatory requirements.
5. Unsafe Work Locations
   The report will identify work locations having incident energy levels in excess of available PPE ratings.
6. Arc Flash Hazard Mitigation
   Recommendations will be made to minimize Arc Flash Hazards by changes in system protection or operational procedures.
7. Arc Flash Hazard Labels
   In addition to the report, our customers will receive a field label containing the flash hazard boundary distance, incident energy level, PPE category and shock hazard for each location.

Implementing recommendations from a Siemens Arc Flash Hazard Study can bring you the following benefits:

- Improve employee safety
- Improve your electrical system
- Provide safety information to subcontractors
- Assist in compliance with regulations
- Provide you with documentation that may bring about reductions in workers compensation and insurance rates

Turn to Siemens for Arc Flash Hazard Studies, comprehensive safety training and other related services that will enhance the safety of your personnel and the reliability of your operation.

SARRACS — Complete arc flash protection for switchgear racking.

After completion of your Arc Flash Hazard Study and Equipment Labeling efforts, why not consider another aspect to your personnel safety initiatives? Why not consider Siemens' SARRACS remote circuit breaker racking system? Racking medium-voltage circuit breakers (>1000V) into and out of a live bus is one instance where the PPE required may not be adequate to protect personnel from arc flash. Siemens SARRACS effectively removes the operator from the arc flash boundary by allowing for remote installation or removal. In addition, SARRACS provides torque monitoring to detect improper breaker connection.

For more information, please visit http://automation.usa.siemens.com/consultant/ or contact your local sales office.

Secondary Unit Substations

Overview

General

Siemens offers a wide variety of unit substation designs to meet customer requirements. A unit substation consists of one or more transformers mechanically and electrically connected to and coordinated in design with one or more switchgear or switchboard assemblies. A secondary unit substation is defined as a unit substation whose outgoing section is rated below 1000 volts.

A typical secondary unit substation consists of three sections:

- Primary: an incoming section that accepts incoming high voltage (2400 to 13,800 volts) line
- Transformer: section that transforms incoming voltage down to utilization voltage (600 volts or less)
- Secondary: an outgoing section that distributes power to outgoing feeders and provides protection for these feeders (600 volts and less)

Standard secondary unit substations consist of:

- Medium-voltage Primary
- Transformer
- Low-voltage Secondary

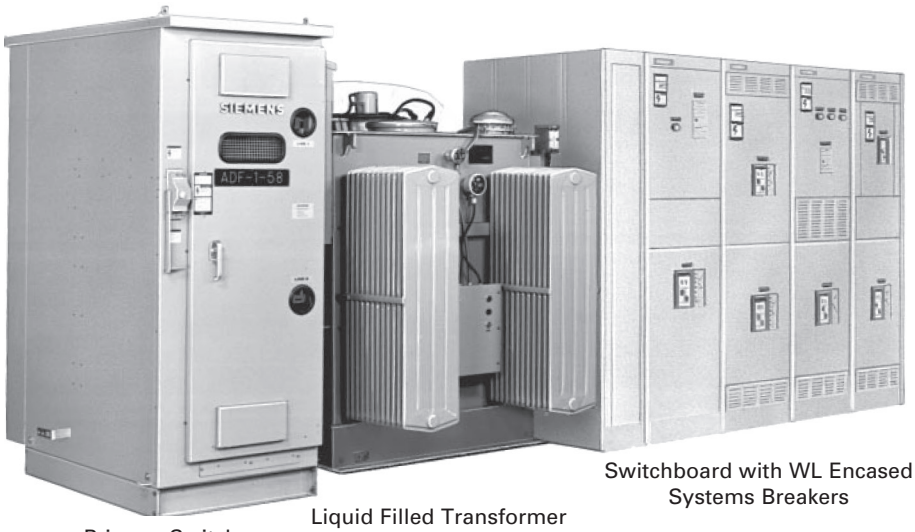
Siemens also offers low-voltage unit substations with:

- Low-voltage Primary
- Transformer
- Low-voltage Secondary

The primary reason for using a secondary unit substation is to bring power as close as possible to the center of the loads. Another reason is that it provides a system design concept incorporating a wide variety of components that permits tailoring equipment to the needs of the application. A secondary unit substation provides

- Reduced power losses
- Better voltage regulation
- Improved service continuity
- Increased functional flexibility
- Lower installation cost
- Efficient space utilization

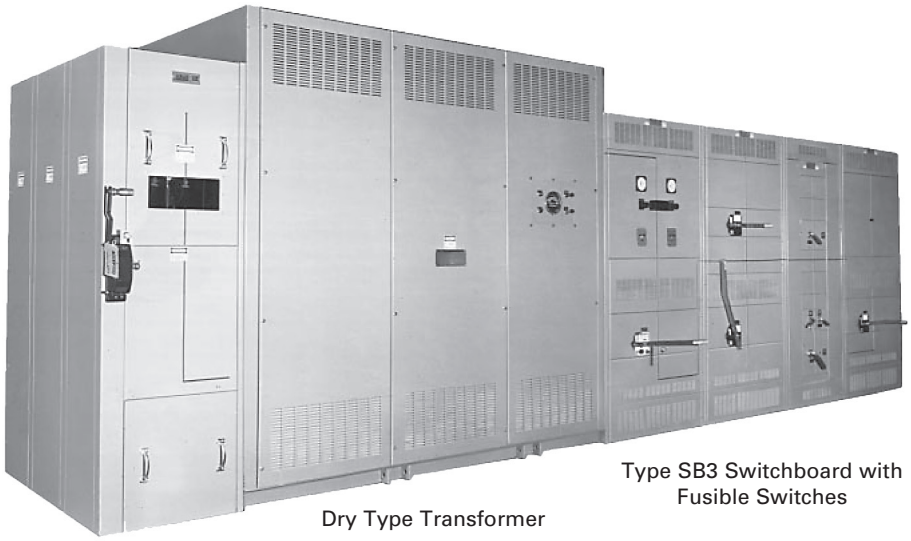
Every component and assembly of secondary unit substations are designed and engineered as an integral part of a complete system.



Primary Switch

Liquid Filled Transformer

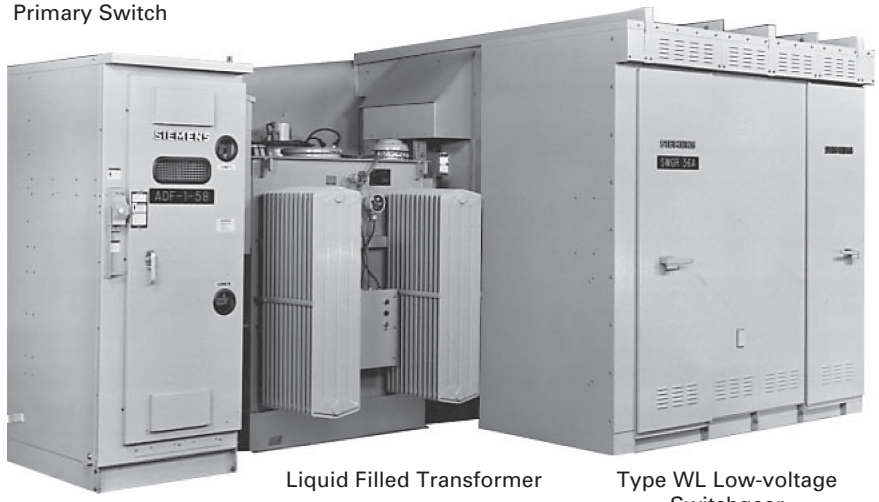
Switchboard with WL Encased Systems Breakers



Primary Switch

Dry Type Transformer

Type SB3 Switchboard with Fusible Switches



Primary Switch

Liquid Filled Transformer

Type WL Low-voltage Switchgear

For more information, please visit http://automation.usa.siemens.com/consultant/ or contact your local sales office.

SIEBREAK Specifications

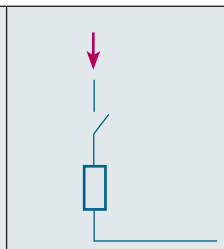
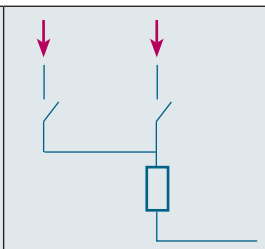
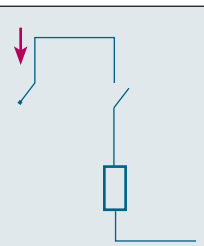
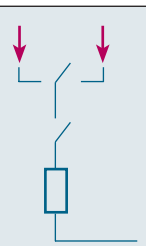
Standard

- Indoor type 1 enclosure
- Large 8" x 18" (203 mm x 457 mm) viewing window
- Hinged, grounded metal barrier in front of switch blades
- Provisions for key interlocking
- Upper and lower ventilation louvers
- Glass-polyester bus supports
- Non-corrosive nameplate
- Space heater with thermostat
- NEMA CC1 hole patterns for cable termination.
- Meets or exceeds applicable standards from ANSI, IEEE, CSA, EEMAC, and NEMA.

Optional

- UL or C-UL Listing
- Current-limiting or explusion fuses
- Indoor type 2 drip-proof enclosure
- Indoor type 12 dust-resistant enclosure
- Outdoor non-walk-in type 3R enclosure
- Motor-operated mechanism
- Tin-plated copper bus.
- Auxiliary switches (2 NO-2 NC)
- Mimic bus
- Ground studs
- Screens and filters (indoor)

Dimensions

		 Single	 Duplex	 Selector③	 Front access③
Indoor①	Width②	36 inches (914mm)	72 inches (1829 mm)	36 inches (914mm)	60 inches (1524 mm)
	Depth	62 inches (1581 mm)	72 inches (1829 mm)		56 inches (1422 mm)
	Height	92 inches (1575 mm)			
Indoor①	Width②④⑤	54 inches (1372 mm)	90 inches (2286 mm)	54 inches (1372 mm)	not available
	Depth	72 inches (1829 mm)			
	Height	105 inches (2667 mm)			

Notes:
① Incoming cables available top or bottom entry
② Transformer connection available left side or right side
③ Auxiliary devices not available with selector and front access
④ Outdoor width include 18-inch (457 mm) liquid-filled transformer termination section
⑤ For outdoor dry type transformer, add 2.67 inches (67 mm) to the width for termination

Technical Data

Rated voltage	**Type**	5 kV	15 kV
Rated frequency		50/60 Hz	
Rated duration power frequency withstand voltage		19 kV	36 kV
Rated lightning impulse withstand voltage (BIL)		60 kV	95 kV
Fuse short circuit current rating	**Current Limiting**	50 kA	50 kA
	Expulsion	37.5	29.4
Switch rating	**Continuous Current**	600 A and 1200 A	
	Interrupting rms	25 kA and 38 kA	
	Momentary rms	40 kA, 61 kA, 80 kA	
Assembly rating	**Main bus continuous current**	1200 A and 2000 A	
	Short-time 2 second	25kA and 38 kA	

Fuse Selection Table

System Voltage	Fuse type①④	Symmetrical Interrupting kA	Equivalent MVA②	500 kVA	750 kVA	1000 kVA	1500 kVA	2000 kVA	2500 kVA	3000 kVA	3750 kVA	5000 kVA
2400	CL-14	50	260	200	250	400	500	600	—	—	—	—
	RBA400	37.5	155	200	250	400	—	—	—	—	—	—
	RBA800	37.5	155	—	—	—	540	720	—	—	—	—
4160	CL-14	50	450	100	125	200	300	500	500	—	—	—
	RBA400	37.5	270	100	150	200	300	400	—	—	—	—
	RBA800	37.5	270	—	—	—	—		540	540	—	—
4800	CL-14	50	520	80	125	200	250	400	450	—	—	—
	RBA400	37.5	310	100	125	200	250	400	400	—	—	—
	RBA800	37.5	310	—	—	—	—	—	—	540	—	—
7200	CL-14	50	620	65	80	125	200	250	300	—	—	—
	RBA400	29.4	365	65	80	125	200	250	300	400	—	—
	RBA800	29.4	365	—	—	—	—	—	—	—	450	—
12470	CL-14	50	1079	40	50	65	100	125	200	200	250	—
	RBA400	29.4	635	40	50	80	100	150	200	200	250	400
	RBA800	29.4	635	—	—	—	—	—	—	—	—	—
13200	CL-14	50	1143	30	50	65	100	125	150	200	250	300
	RBA400	29.4	672	30	50	65	100	125	150	200	250	300
	RBA800	29.4	672	—	—	—	—	—	—	—	—	—
13800	CL-14	50	1195	30	50	65	100	125	150	200	250	300
	RBA400	29.4	702	30	50	65	100	125	150	200	250	300
	RBA800	29.4	702	—	—	—	—	—	—	—	—	—

Notes:
① Incoming cables available top or bottom entry
② Transformer connection available left side or right side
③ Auxiliary devices not available with selector and front access
④ Outdoor width include 18-inch (457 mm) liquid-filled transformer termination section
⑤ For outdoor dry type transformer, add 2.67 inches (67 mm) to the width for termination

Siemens Unit Substation Solutions

Overview

Siemens offers a wide variety of unit substation designs to meet virtually any customer requirement. A unit substation consists of one or more transformers mechanically and electrically connected to, and coordinated with, one or more switchgear or switchboard assemblies. A secondary unit substation is defined as a unit substation whose outgoing section is rated below 1,000 volts.

A typical secondary unit substation consists of three sections:

- **Primary**: depending on the specific application, this section accepts medium-voltage (2,400 to 27,600 volts) incoming power
- **Transformer**: reduces incoming voltage to utilization voltage (600 volts or less)
- **Secondary**: distributes power to, and provides protection for, outgoing feeders (600 volts and less).

The key benefit of a secondary unit substation is that it economically brings power as close as possible to the loads, minimizing power loss and maximizing voltage regulation. It also enhances flexibility, using a system design concept that integrates a wide variety of components to tailor the equipment to the specific needs of each application.

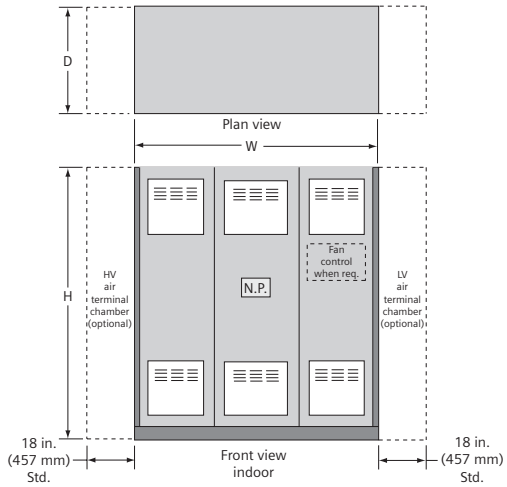
Every component or assembly utilized in secondary unit substations is engineered to be an integral part of a complete system.

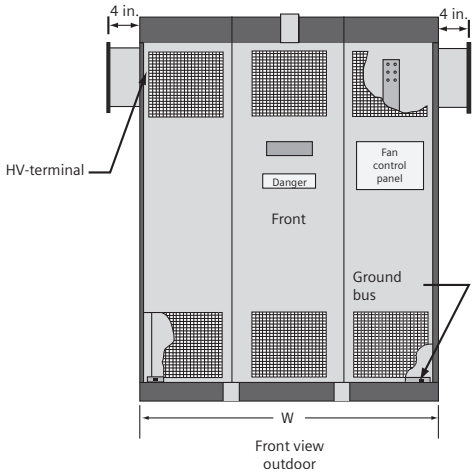
A secondary unit substation helps you:

- Reduce power losses
- Enhance voltage regulation
- Improve service continuity
- Increase functional flexibility
- Lower installation costs
- Minimize space utilization.

Primary Switch **Dry-Type Transformer** **Type SB3 Switchboard**

Primary Switch **Liquid Filled Type Transformer** **Type SB3 Switchboard**





Type = VPI/VPE
Primary Volts = 2400-13800
Sec_Volts = 208-600
Temperature Rise = 150C for Aluminum Windings, 80/115C for Copper Windings
Standard kV BIL (HV/LV) = 60/30 for Aluminum Windings, 95/30 for Copper Windings

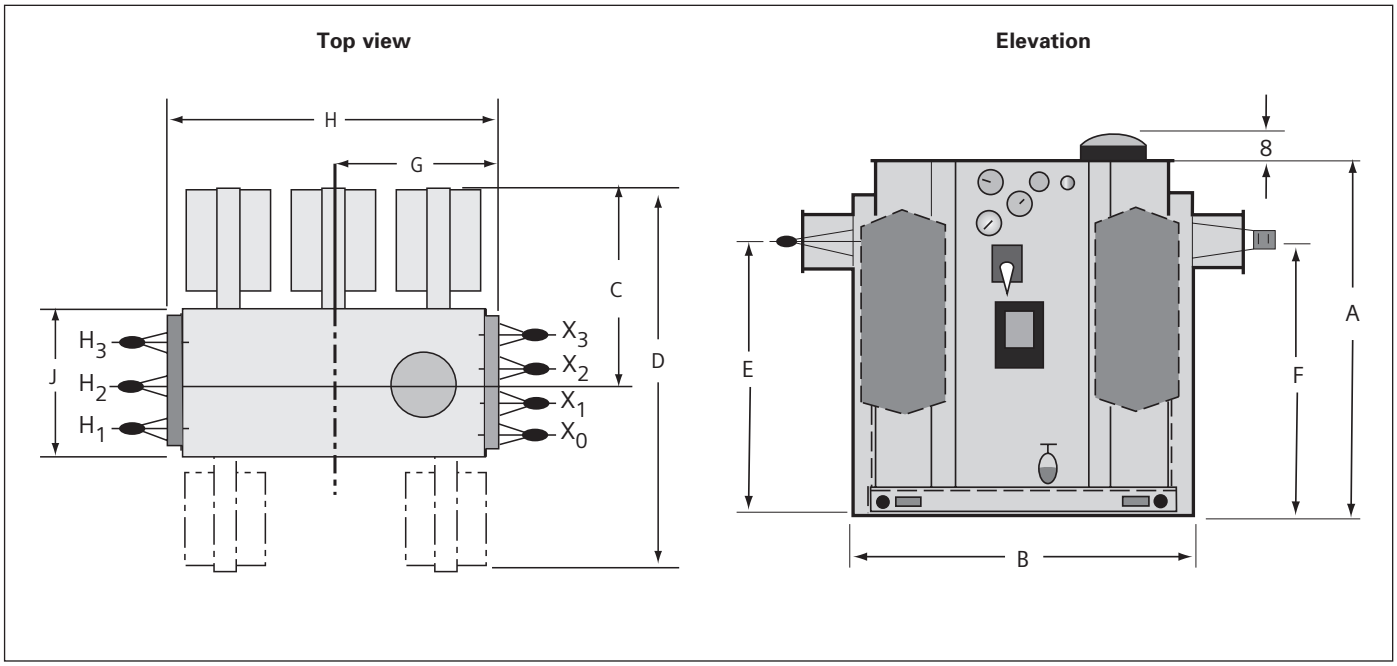
Table 1 Low-voltage Switchgear or Switchboard Coordination

Winding Material	KVA	Height (Inches)	Width (Inches)	Depth (Inches)	Weight (Pounds)
Aluminum	300	90	90	54	4600
Aluminum	500	90	90	54	4800
Aluminum	750	90	90	54	5800
Aluminum	1000	90	102	60	7000
Aluminum	1500	96	102	60	9200
Aluminum	2000	102	102	60	11000
Aluminum	2500	108	112	60	12200
Aluminum	3000	108	118	60	14100
Aluminum	3750	112	126	66	15800
Aluminum	5000	118	132	66	17000
Copper	300	90	90	54	6000
Copper	500	90	96	60	6400
Copper	750	90	102	60	8000
Copper	1000	96	102	60	9700
Copper	1500	102	108	60	13200
Copper	2000	108	112	60	17400
Copper	2500	118	126	60	19000
Copper	3000	118	132	60	22000
Copper	3750	126	132	66	27000
Copper	5000	132	138	66	30000

Type = Cast Coil
Primary Volts = 2400-13800
Sec_Volts = 208-600
Temperature Rise = 80/115C for Both Aluminum & Copper Windings
Standard kV BIL (HV/LV) = 60/30 for Aluminum Windings, 95/30 for Copper Windings

Table 2 Low-voltage Switchgear or Switchboard Coordination

Winding Material	KVA	Height (Inches)	Width (Inches)	Depth (Inches)	Weight (Pounds)
Aluminum	300	90	90	54	5500
Aluminum	500	90	90	54	6300
Aluminum	750	90	96	60	7800
Aluminum	1000	96	102	60	9500
Aluminum	1500	102	108	60	11500
Aluminum	2000	108	112	60	13800
Aluminum	2500	112	126	60	16200
Aluminum	3000	118	132	60	19200
Aluminum	3750	126	138	66	25000
Aluminum	5000	132	144	66	28000
Copper	300	90	90	60	6200
Copper	500	90	96	60	7000
Copper	750	90	102	60	9100
Copper	1000	96	112	60	10600
Copper	1500	102	118	60	14300
Copper	2000	108	118	66	18200
Copper	2500	118	126	66	19500
Copper	3000	126	132	66	23500
Copper	3750	126	144	66	28000
Copper	5000	132	160	66	35000



Unit Type Substation Transformer

Primary Volts = 25kV and below, Secondary Voltage = 5kV and below

Table 3 Liquid-Filled 55/65 °C Rise

	Drawing Dimensions (in.)									Aluminum Windings		Copper Windings	
kVA	A	B	C	D	E	F	G	H	J	Gallons Of Fluid	Approx. Total Weight (lbs.) (With Fluid)	Gallons Of Fluid	Approx. Total Weight (lbs.) (With Fluid)
500	66	51	26	52	45	45	30	60	35	300	5600	310	5900
750	75	59	26	52	55	55	34	68	35	360	7000	370	7400
1000	75	67	26	52	55	55	38	76	35	420	8400	430	8800
1500	75	59	59	80	55	55	34	68	35	400	9500	420	10000
2000	85	67	67	90	55	55	38	76	39	520	12000	500	12800
2500	85	75	68	92	55	55	42	84	41	570	14600	590	14900
3750	85	75	70	120	65	65	42	84	45	790	20500	830	21500
5000	99	87	72	144	65	65	48	96	49	1050	26000	1090	28000
7500	99	95	74	148	75	75	52	104	53	1320	35000	1360	37000
10,000	99	103	76	152	75	75	56	112	57	1740	43000	1780	45000
12,000	99	103	82	164	75	75	56	112	61	1850	49000	1880	50000

Weights, gallons of fluid and dimensions are for reference only, and not for construction.
Please contact Siemens Industry Inc. for exact dimensions

Siemens type WL low-voltage, metal-enclosed switchgear is designed, constructed and tested to provide superior power distribution, power monitoring and control. At the heart of the type WL low-voltage switchgear is the world class Siemens type WL breaker. Siemens type WL low-voltage switchgear can be utilized in the following applications:

- Industrial
- Institutional
- Critical power
- Utility and co-generation
- Commercial.

Product Scope

- Equipment ratings:
  - 635 Vac maximum
  - Three-phase, three-wire
  - Three-phase, four-wire
  - 50/60 Hz
  - 6,000 A maximum horizontal bus
  - 5,000 A maximum vertical bus.
- Enclosure options:
  - NEMA 1 indoor
  - NEMA 3R outdoor walk-in
  - NEMA 3R outdoor non walk-in.

Exclusive features

Generator/utility protection sets 24/7/365 power availability is critical for some systems. On-site generation capabilities are becoming more and more common. Type WL digital electronic trip units allow the system designer to precisely tailor trip settings for the most demanding requirements.

The Siemens type WL 776 trip unit allows one set of trip settings for a fully loaded utility feed and, with a simple contact closure, the trip unit toggles to a second trip set tailored to provide optimal generator protection. The wide range of settings allows the type WL to provide protection for a minimal generator capacity for only essential loads, through full backup for an entire facility. This dual utility/generator protection capability in a single circuit breaker allows the system designer unparalleled, cost effective flexibility.

For more information, visit our web site at: www.usa.siemens.com/switchgear.

Extended instantaneous protection (EIP)

This patent pending type WL trip unit feature allows the system designer to achieve full selective trip coordination up to the short-time rating of the frame, while also allowing application of the circuit breaker up to the interrupting rating of the frame. EIP allows the type WL breaker to be applied up to the full withstand rating of the circuit breaker, for complete coordination, with a minus 0% short-time band tolerance up to 85 kA on Frame Size II and 100 kA on Frame Size III.

Above fault currents of 20-percent higher than the full short-time rating, the type WL circuit breaker is self-protecting, and the EIP function will trip the circuit breaker instantly to protect the frame and the system from these extremely high currents (as high as 150 kA on Frame Size III). An added benefit is that arc flash energy is greatly reduced in this high- current region due to EIP's instantaneous trip response.

Industry standards

Type WL switchgear with power circuit breakers are designed, tested and constructed in accordance with:

- UL 1558—Metal-Enclosed Low-voltage Power Circuit Breaker Switchgear
- ANSI C37.20.1—Metal-Enclosed Low- Voltage Power Circuit Breaker Switchgear.

Type WL drawout circuit breakers are designed for continuous operation at 100-percent of their current rating without the need for external heat sinks, and are in accordance with:

- UL 1066—Low-voltage AC and DC Power Circuit Breakers Used in Enclosures
- ANSI C37.13—Low-voltage AC Power Circuit Breakers Used in Enclosures.

Switchgear Secondary

Note: See Pages 14-52 to 14-72 for complete details concerning WL Low-voltage Switchgear unit substation secondaries.

Product Overview

Siemens modular front connected switchboard design provides a broad range of features and capabilities for a wide range of applications.

Every aspect of design of Siemens switchboards has been aimed at improving layout convenience, reducing installation costs and minimizing the impact and cost of changes to the system.

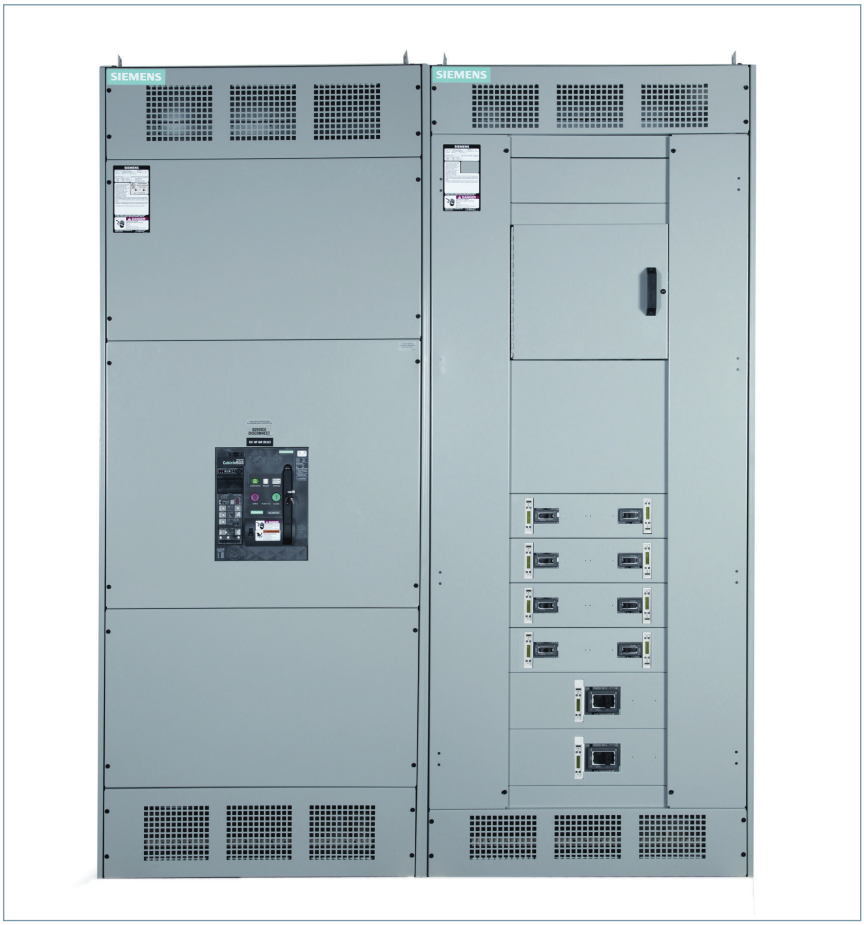
Siemens switchboards provide a rugged design and the flexibility necessary in electrical systems for all types of applications, some examples are:

- Industrial plants
- High-rise complexes
- Hospitals
- Commercial buildings

Standards and Certifications

Siemens switchboards are designed, tested and constructed in accordance with:

- UL891 – Switchboards
- NEMA PB-2
- Seismically qualified
- Other equipment is UL listed as applicable



Features & Benefits

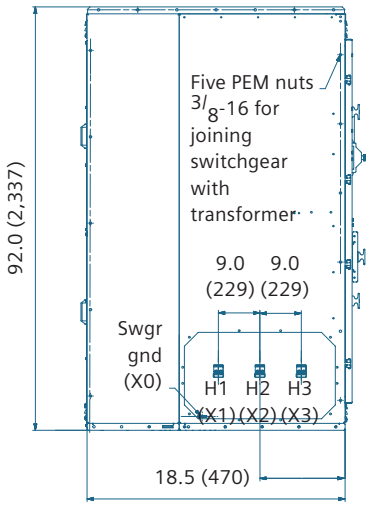
Siemens switchboards ratings and features include:

- Up to 6000 ampere main bus rating
- Up to 600 volts AC
- Bus bracing up to 200KAIC
- Copper or aluminum bussing
- Temperature or density rated bussing
- Type 1 and Type 3R enclosures
- Main and branch circuit breakers and fusible switches
- Thermal magnetic and solid state circuit breakers
- Surge protective devices
- Utility metering provisions
- ACCESS power monitoring on mains and branches
- Ground fault protection on mains and branches
- Busway and transformer connections
- Protective relaying
- Two and three device autothrowover scheme

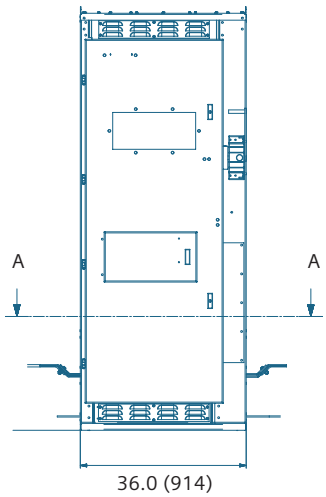
Further Switchboard Information

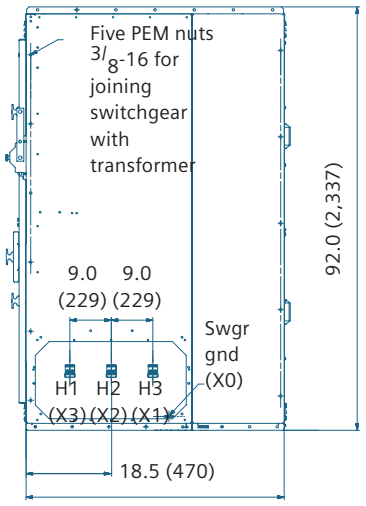
See Section 13 for complete details concerning SB3 front-connected switchboard unit substation secondaries.

Indoor - dry transformer



56.0 (1,422), 62.0 (1,575), 72.0 (1,829), or 82.0 (2,083) transformer to left of switchgear (flush front transformer mounting)



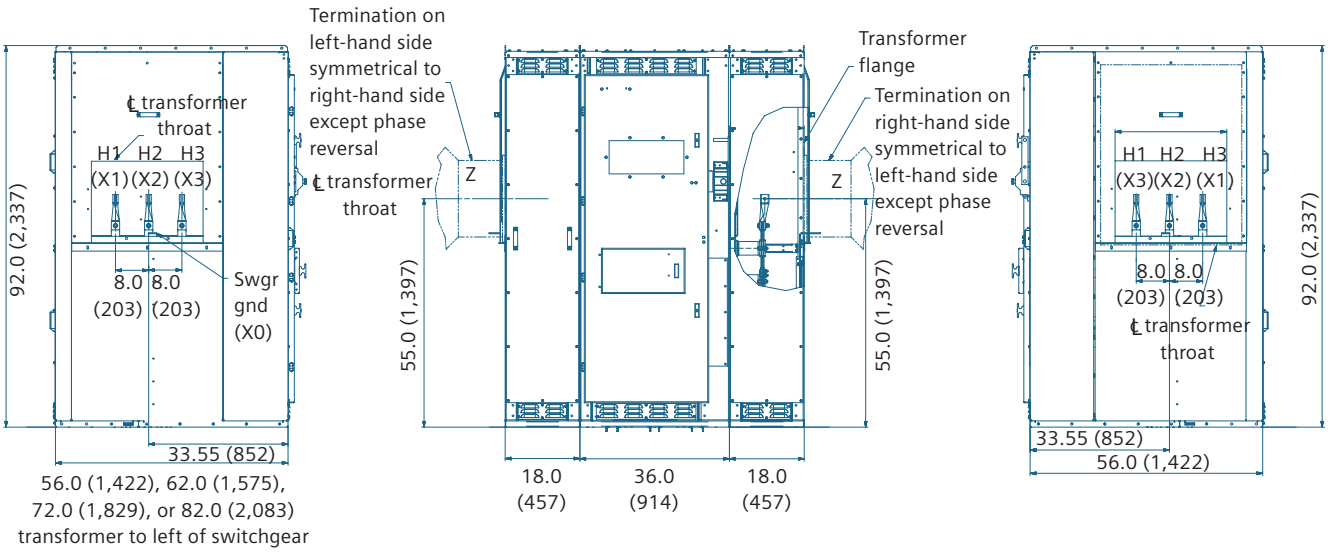


56.0 (1,422), 62.0 (1,575), 72.0 (1,829), or 82.0 (2,083) transformer to left of switchgear (flush front transformer mounting)

Footnotes:

1. This arrangement applies to indoor SIEBREAK switch 5 kV-15 kV up to 1,200 A termination with dry-type transformer termination.
2. Filler strips at the ends of the transformer must be provided by the transformer supplier in case the transformer exceeds 92" (2,337 mm) height and 56" (1,422 mm) depth.
3. If cables are to be used for connections to transformer, transformer supplier to provide and install cable connections including lugs and insulation on terminals if required. Maximum 2 x 500 kcmil cables per phase.
4. If bus bars are to be used for connections to transformer, transformer supplier to provide and install required bus connections. Transformer supplier also to provide and install flex connectors for connections to switchgear as well as insulation for flex connectors.
5. Connect switchgear ground when continuous ground is required.
6. Transformer supplier to provide necessary hardware (except PEM nuts) for joining switchgear with transformer.

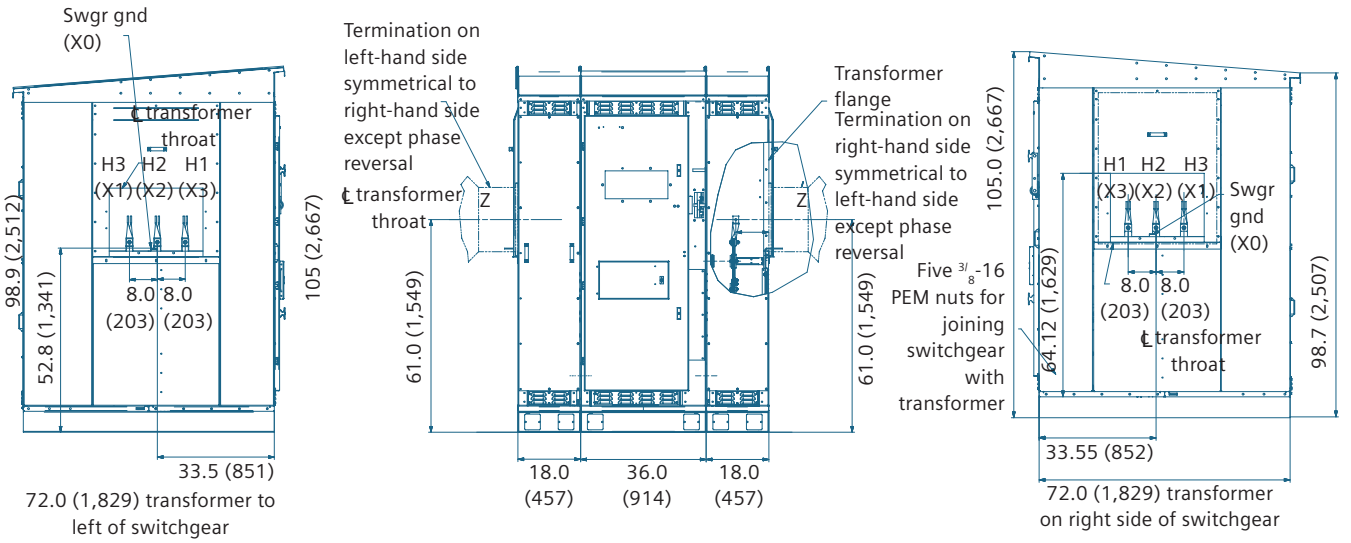
Indoor - liquid-filled transformer



Footnotes:

1. This arrangement applies to indoor SIEBREAK switch 5 kV-15 kV up to 1,200 A termination with liquid-filled type transformer termination.
2. This arrangement applies to bar-type connection to transformer only.
3. Filler strips at the ends of the transformer must be provided by the transformer supplier in case the transformer exceeds 92" (2,337 mm) height and 56" (1,422 mm) depth.
4. Transformer supplier to provide necessary hardware (except PEM nuts) for joining switchgear with transformer.

Outdoor - liquid-filled transformer



Footnotes:

1. This arrangement applies to outdoor SIEBREAK switch 5 kV-15 kV up to 1,200 A termination with liquid-filled type transformer termination.
2. This arrangement applies to bar-type connection to transformer only.
3. Transformer supplier to provide necessary hardware (except nuts) for joining switchgear with transformer.

Type WL Low-voltage Metal-Enclosed Switchgear

Siemens Type WL low-voltage metal-enclosed switchgear is designed, constructed and tested to provide superior power distribution, power monitoring and control. At the heart of the Type WL low-voltage switchgear is the World Class Siemens WL breaker.

Siemens Type WL low-voltage switchgear can be utilized in the following applications:

- **Industrial**
  Semiconductor
  Petrochemical
  Automotive
  Biotech
  Pharmaceutical
- **Institutional**
  Water treatment
  Airports
  Universities
  Medical facilities
  Correctional facilities
- **Critical power**
  Data Processing
  Continuous industrial process
  Hospitals
- **Utility and co-generation**
- **Commercial**
  Large office buildings
  Distribution centers
  Large warehouses

Type WL Low-voltage Metal-Enclosed Switchgear

Product Scope:

- Equipment ratings
  635VAC Maximum
  3 Phase 3 Wire,
  3 Phase 4 Wire
  50/60 Hz
  6000 amp maximum horizontal bus
  6000 amp maximum vertical bus
- Enclosure options
  NEMA 1 Indoor
  NEMA 3R Outdoor Walk-In
  NEMA 3R Outdoor Non Walk-in

Siemens WL breakers can be manually or electrically operated, fused or unfused and are available in the following rating designations – N, S, H, L, M and F. Refer to tables on Page 13 for interrupt and withstand ratings for each rating designation.

Industry Standards

Type WL switchgear with power circuit breakers are designed, tested and constructed in accordance with:

- UL 1558 — Metal-Enclosed Low-voltage Power Circuit Breaker Switchgear
- ANSI C37.20.1 — Metal-Enclosed Low-voltage Power Circuit Breaker Switchgear
- ANSI C37.50 — Test Procedure for Low-voltage AC Power Circuit Breakers Used in Enclosures
- ANSI C37.51 — Conformance Testing of Metal-Enclosed Low-voltage AC Power Circuit Breaker Switchgear Assemblies
- NEMA SG5 - Power Switchgear Assemblies
- Applicable requirements of the National Electric Code (NEC)

WL drawout circuit breakers are in accordance with:

- UL 1066 — Low-voltage AC and DC Power Circuit Breakers Used in Enclosures
- ANSI C37.13 — Low-voltage AC Power Circuit Breakers Used in Enclosures
- ANSI C37.16 — Preferred Ratings, Related Requirements, and Application for Low-voltage Power Circuit Breakers and AC Power Circuit Protectors
- ANSI C37.17 — Trip Devices for AC and General Purpose DC Low-voltage Power Circuit Breakers
- NEMA SG3 - Low-voltage Power Circuit Breakers

Features and modifications required by NEC are incorporated when the assembly is designated as "Service Equipment."

UL Listing

Underwriters' Laboratories listing mark (UL) is supplied for each vertical section provided all devices within a vertical section are UL Listed or UL Recognized and suitable for the intended use. All circuit breaker drawout elements are UL Listed.

Optional CSA compliance with cUL labeling is available.

Arc Resistant

Optional Type WL arc resistant low-voltage switchgear is available and is UL listed to ANSI/IEEE C37.20.7. Type 2B arc resistant accessibility rating with maximum internal acring short-circuit current rating of 100kA @508V and 85kA @ 635V.

Seismic Qualification

Seismic qualification to all major seismic construction standards (IBC, UBC, CBC, SBC, BOCA and IEEE 693) is available.

General
The Siemens Type WL switchgear assembly consists of one or more metal-enclosed vertical sections. The end sections are designed to allow installation of future sections.

Each vertical section consists of up to four individually enclosed breaker or auxiliary compartments which are sized to provide uniform height.

Included in each assembly are various components such as circuit breakers, instrumentation and control equipment, transformers, relays, three-phase bus work, and all internal wiring, connectors, and other supporting equipment.

In accordance with ANSI C37.20.1, the maximum temperature for parts that are handled is 50°C. The main bus maximum temperature rise is 65°C above 40°C ambient. The temperature rise of the air surrounding the cable connection points is limited to 45°C above 40°C ambient.

Finish
During construction, the structural steel parts, panels, and compartments are all prepared for painting by a five-stage wash system.

Standard finish color is light gray ANSI 61. The standard painting process is a UL approved electrostatic powder coat paint system utilizing a polyester powder coat paint. The completed finish has a nominal 2 mils dry film thickness.

Assembly Construction
Siemens Type WL metal-enclosed low voltage switchgear is constructed of a rigid internal frame structure that minimizes the possibility of damage during shipment and supports multiple installation methods – rolling or lifting. Lifting eyes are integrated into the internal frame design and ensure the structural integrity of the lifting assembly is always adequate for the weight of the total structure.

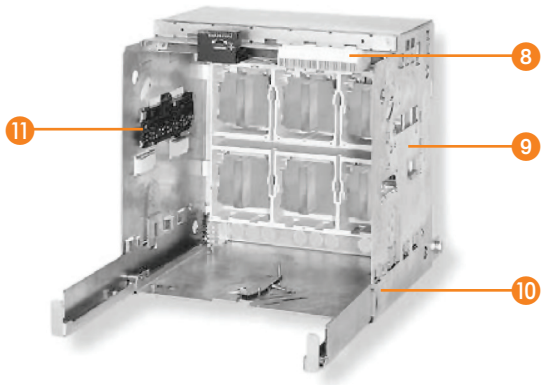
If requested in advance, the switchgear structure can be shipped so that the unit can be tilted onto its back during installation. This is an option that must be specified at order entry.

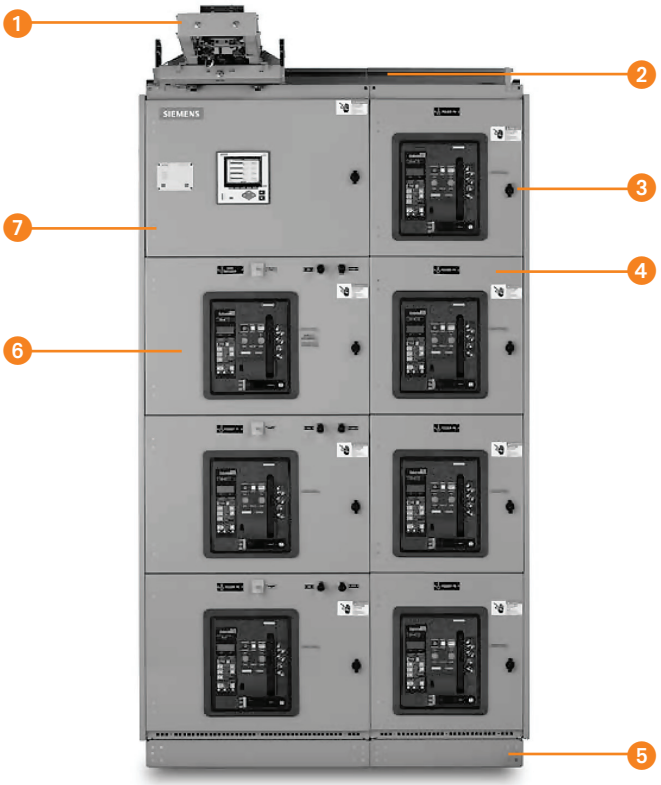
Each complete vertical section contains three compartments.
(1) Front compartment containing breakers and/or auxiliary equipment
(2) Bus compartment containing horizontal and vertical bus
(3) Rear cable compartment containing the load side runbacks connecting the load side of the breaker to the load cable terminals

Within the front compartment, each breaker is barriered and compartmented from all other breakers in the front compartment. This design also isolates the breakers in the front compartment from the bus compartment.

Optional barriers can be supplied to isolate the bus compartment from the rear cable compartment. Other optional barriers include: (1) Full depth section barriers to isolate one section from the adjacent section(s). (2) Barriers to isolate the incoming line side connections to the main breaker(s) from the load side bus and connections in the switchgear section. (Line/load barriers are provided as a standard feature for service equipment main breakers.)

1. Breaker Hoist and Track
2. Ventilation and Lifting Structure
3. Quarter Turn Door Latch
4. Secondary Disconnect Access Door
5. Channel Sill Base (Optional)
6. Breaker Compartment
7. Auxiliary Instrument Compartment
8. Secondary Disconnect
9. Breaker Cradle (Guide Frame)
10. Breaker Drawout Rail
11. TOC Switch Operator





Main and Ground Bus
The standard main bus is silver-plated copper. Tin-plated copper bus is optionally available. Vertical and horizontal bus bar utilize a channel shape design to maximize short circuit withstand capability and minimize heat rise. All bus joints include Grade 5 bolts and conical spring washers. Provisions for future extension of the main bus include plated joints and high tensile strength steel hardware.

The main three-phase horizontal bus is arranged vertically one phase above the other with edge-to-edge alignment to provide high, short circuit strength. Insulated main bus with isolated vertical bus is optional.

Vertical bus ratings available are 1600, 2000, 3200, 4000, 5000 and 6000 amperes continuous current. Horizontal bus ratings available are 1600, 2000, 3200, 4000, 5000 and 6000 amperes. A neutral bus is furnished when specified, and can be rated 1600, 2000, 3200, 4000, 5000 or 6000 amperes continuous current.

A 1/4" X 3" standard copper ground bus extends through all sections. Cable lugs are mounted to the ground bus in each section.

Standard short-circuit withstand (4 cycle) and short-time withstand (60 cycle) bus bracing is 100,000 amperes. Higher shortcircuit withstand bus bracings (150kA and 200kA) are available. Load side runbacks for feeder circuits are copper construction, are insulated with sleeve tubing in the main bus area, and are supported by high-strength bus bracing.

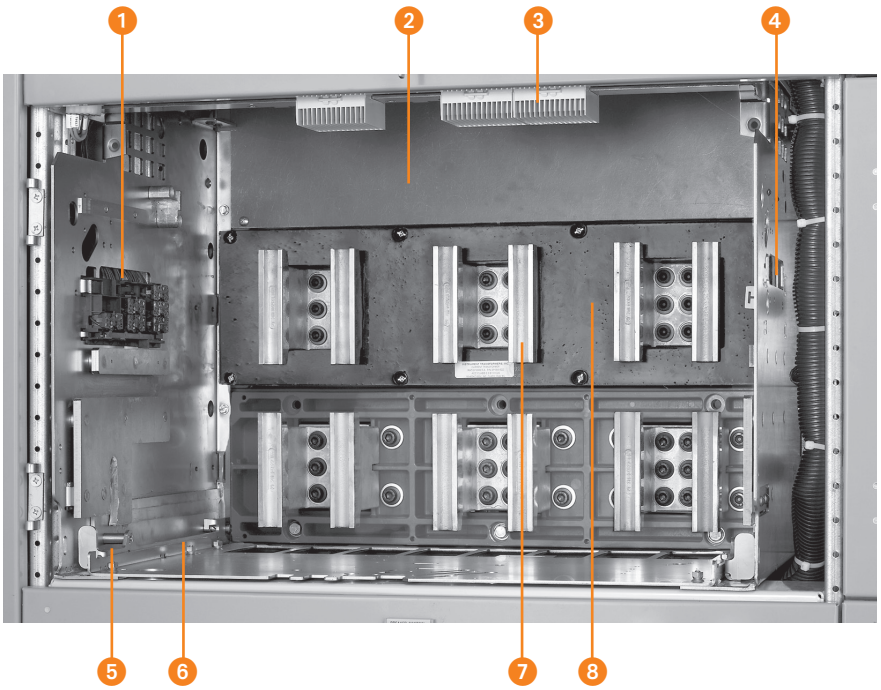
Control and Communication Wiring
Standard control and communication wiring is #14 AWG extra-flexible, stranded copper type SIS. Control and communication wiring is installed and accessed from the front of the switchgear structure. Each breaker compartment has a dedicated horizontal and vertical wireway.

For devices not having screw-type terminals, pressure terminals are used.

Insulation
The insulation used is a UL recognized thermoset material that has excellent heat resistance, flame retardance, dimensional stability and low moisture absorption.

Circuit Breaker Compartments
Typical circuit breaker compartments include primary disconnects, drawout rails, secondary disconnects, vertical wireway, horizontal wireway and, if applicable, TOC switch operator, MOC switch operator and associated interlocks. Draw-out rails allow the breaker to be withdrawn from the compartment without additional extensions or adapters. Up to six (2 sets of three) current transformers for metering or relaying can be mounted in each compartment.

A variety of auxiliary devices such as breaker control switches, indicating lights and pushbuttons can be mounted on the breaker compartment door.



1. TOC Switch Operator
2. Breaker Compartment Rear Barrier
3. Secondary Disconnect
4. Vertical Wireway
5. Interference Interlock
6. Drawout Rails
7. Primary Disconnect
8. Cradle Mounted Current Transformer

Circuit Breaker Cell Interior

Options

Switchgear Mounted Hoist
The integrally mounted hoist, standard on walk-in outdoor and optional on indoor switchgear enclosures, travels along rails on top of the switchgear to assist in breaker handling.

TOC and MOC Switches
The Truck Operated Cell (TOC) Switch provides interlocking control or remote indication of the breaker racking position. The cubicle mounted auxiliary switch or Mechanism Operated Cell (MOC) switch provides interlocking control or remote indication based on the main contact position (open or closed).

Shutters
These provide protection against accidental contact with primary disconnects in a compartment when the breaker is removed. Shutters automatically close when the breaker is withdrawn and are pad-lockable and field installable.

Key Interlock
This provides a mechanical means for operating circuit breakers and other devices only when predescribed conditions are met.

Test Set
A portable breaker test set is available as an option and supports testing the full range of functions and protective settings supplied with the breaker trip unit.

Metering and Auxiliary Compartments
Compartments are available to house devices such as voltage transformers, metering, control power transformers, and supervisory devices.

Instrument and Control Transformers
Voltage transformers and control power transformers are mounted in auxiliary compartments. These transformers are protected by primary pull-out type current-limiting fuses and secondary fuses. Current transformers are normally mounted on the compartment primary disconnect studs where they are readily accessible. See Tables on Page 31 for available ratings.

Miscellaneous
- Each switchgear lineup includes a breaker lifting device that is adjustable for use with Size II and Size III breakers.
- An optional portable breaker hoist is available if the integrated breaker hoist and track is not specified.
- A test cabinet is also available as an option. The test cabinet is wall mounted necessary equipment for testing electrically-operated breakers that have been removed from the breaker compartment. The test cabinet doesn't include or replace a breaker trip unit tester.
- A WL remote breaker racking device (RBRD) is available as an optional accessory that allows maintenance personnel to safely rack Siemens Type WL breakers into the Connect, Test and Disconnect positions from up to 30 feet away from the breaker. This allows the operator to be outside the arc flash hazard boundary and thereby providing additional personnel protection.
- 4" high formed steel channel sills are available for indoor switchgear enclosures.

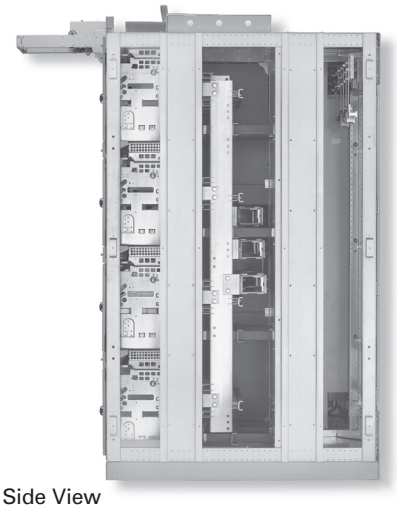
Outdoor Switchgear
Type WL switchgear is available in two outdoor (NEMA 3R) enclosures. Walk-in and non walk-in versions are available to meet your particular application.

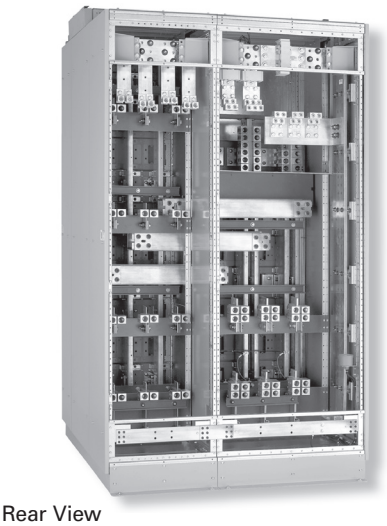
For protection from snow, rain and other foreign matter, both outdoor enclosures rest on a six-inch high, formed steel base which provides rigid support and a tight bottom seal. A heavy duty protective under-coating is applied to the underside of all outdoor enclosures to protect against moisture and corrosion. Shielded ventilation housings permit proper air circulation while excluding dirt and foreign matter.

In the walk-in outdoor enclosure a lighted, unobstructed service aisle is provided at the front of the switchgear allowing inspection and maintenance without exposure to the elements. An access door equipped with an emergency bar release is located at each end of the aisle.

The following features are standard with walk-in outdoor enclosures.
(1) Space heaters in breaker compartment and bus compartment.
(2) Screens and filters for exterior door ventilation louvers.
(3) Incandescent lighting receptacle with three-way switch at each aisle access door.
(4) Duplex receptacle with ground fault protection at each aisle access door.
(5) Load center for power distribution to lights, receptacles, switches and heaters.

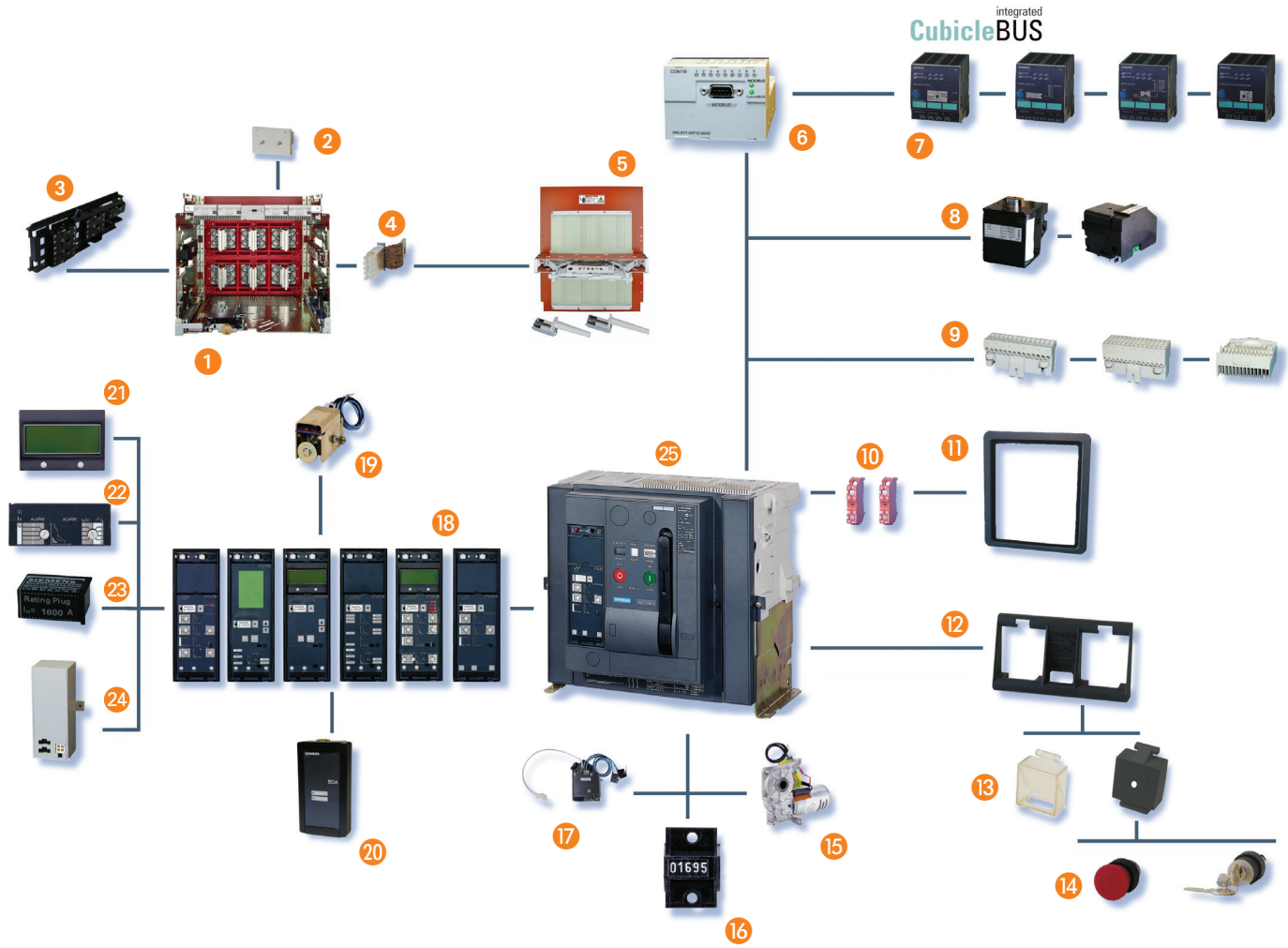
For non walk-in outdoor enclosures, space heaters and screens/filters for ventilation louvering are standard with lighting, receptacles, switches and load centers offered as options.


Side View


Rear View

WL Circuit Breaker

Superior individual products for low-voltage power distribution systems



1 Guide Frame (for drawout version only)
2 Vertical to Horizontal BUS Connector
3 Position Signaling Switch (TOC)
4 Breaker / Guide Frame Grounding Contact
5 Shutter (locking)
6 MODBUS or PROFIBUS Communications
7 External CubicleBUS I/O Module
8 Plug-In Open and Closed Solenoids
9 Multiple Secondary Connections
10 Auxiliary Switch Block
11 Door Sealing Frame
12 Interlocking Set Base Plate
13 Protective Cover for OPEN/CLOSE Buttons
14 Multiple Key Locking Accessories
15 Single Bolt Motor Operator Installation
16 Operations Counter
17 Breaker Status Sensor (BSS)
18 Complete Trip Unit Family
19 Remote Reset
20 Breaker Data Adapter (BDA) for Internet Connection
21 Multi Angle LCD Module
22 Ground Fault Protection Module
23 Rating Plug
24 Metering Function (+ wave forms and harmonics)
25 Circuit Breaker

Electronic Trip Units

During development of our electronic trip units we have consistently striven to ensure modularity. The following are just some of the modules that are simple to retrofit at any time:

- Ground fault protection
- Communication
- Metering function
- Displays
- Rating plugs

This enables fast local adaptation to new system conditions. At the same time, the ETUs are provided with new, innovative functions, and all trip units are completely interchangeable independent of breaker ratings.

Rating Plug

The Rating Plug is a replaceable module that enables users to reduce the rated device current for optimum adaptation to the system; e.g. during startup of a plant section. The Rating Plug should be selected so that it corresponds to the rated current of the system.

Switch-selectable I2t or I4t Characteristic Curve Improved Overload Protection

The best possible protection is assured when all protective devices in the system are optimally coordinated. To achieve optimum selectivity and coordination, the long-time characteristic can be switched between I2t and I4t.

Switchable Parameter Sets

To allow the protection to adapt to changes in system needs such as switching between utility and generator feeds, WL Circuit Breakers support ETUs with two independent parameter sets. Switching between the parameter sets occurs in less than 100 ms and can be done remotely or via a contact input to an optional CubicleBUS module.

Extended Instantaneous Protection

The electronic trip units designed for use with the WL circuit breaker provide a feature we call "Extended Instantaneous Protection" (Patent Pending).

It allows the WL breaker, as a family, across the entire range of ampacities to be applied at the withstand rating of the breaker with minus 0% tolerance; that means no instantaneous override. EIP further enables the circuit breaker to be applied up to the full interrupting rating of the breaker on systems where the available fault current exceeds the withstand rating, even with LS-only trip units. Why is this feature important? The answer is reliable power.

The coordination of the main breaker and the first level of feeder breakers is especially important because of the wide spread outage that will occur if one of these breakers trips unnecessarily.

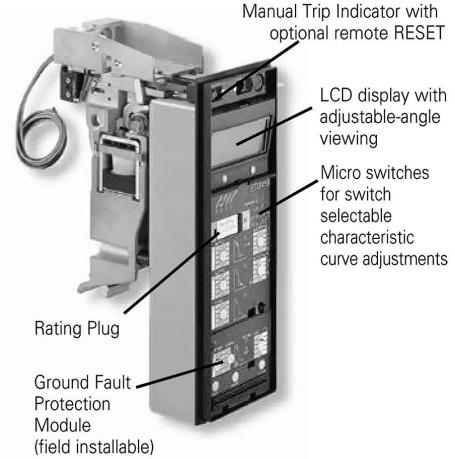
Conventional practice is to specify electronic trip beakers with "LS" type trip units in critical power systems. These 'Long-Time' and 'Short-Time' only trip units forgo the fast tripping times given by an 'Instantaneous' function. The justification for this delay is the benefit of allowing a downstream breaker to open first to clear a high magnitude fault. The main or feeder stays closed to keep the remainder of the loads operating.

However, a circuit breaker with an LS-only trip unit may never be applied on a system capable of delivering fault current higher than the breaker's withstand rating, commonly 85kA or less. Where the available fault current is above this level, a breaker with an additional function must be used — an instantaneous override. This instantaneous override function trips the breaker instantly when the fault current reaches a pre-determined level below the withstand rating, usually around 20% lower. The benefit of this override is to allow application of the breaker up to the interrupting rating, which may be as high as 150kA. The disadvantage is that it compromises the coordination benefit because the main will probably trip at the same time as a downstream branch breaker in that 20% lower override window.

This is where the Extended Instantaneous Protection feature of the WL can offer the next level of coordination and protection functionality. Unlike an instantaneous override, Extended Instantaneous Protection (EIP) allows the full withstand rating — in fact up to the tolerance of plus 20% higher. Of course, EIP still provides the ability of the breaker to be applied at the interrupting level, as high as 150kA in a Frame Size III, non-fused breaker. This unique combination enables the system designer to achieve the highest possible level of coordination in the industry and also allows application of the WL on modern power systems with extremely high levels of available fault current.

A further benefit offered by EIP, over a standard LS trip unit equipped breaker, is that it provides an extra measure of protection in the event that the available fault current increases at some time during the life of the system beyond the withstand level. This would typically be due to a utility transformer change but could also be due to the addition of generators or large motors that contribute fault current. EIP provides the breaker the ability to react in an instantaneous fashion to a high level fault instead of having to rely on the slower reaction time of the short-time function.

Sample Configuration of an ETU745



Selection Criteria for WL Circuit Breakers

The basic criteria for selecting circuit breakers is:

Maximum Available Short Circuit at the installation point. This value determines the short circuit current interrupting rating or short circuit current withstand rating of the circuit breaker.

Rated Current In which is to flow through the respective circuit breaker continuously. This value may not be greater than the maximum rated current of the circuit breaker. The rated current for the WL is determined by the rating plug, up to the maximum frame rating.

Ambient Temperature of the circuit breaker.

Design of the circuit breaker.

Protective Functions of the circuit breaker.These are determined by the selection of the appropriate trip unit.

Dynamic Arc-Flash Sentry (Patent Pending) A unique feature of the WL trip unit allows the system designer to achieve lower levels of arc flash energy and delayed tripping for selective trip coordination purposes.

Dynamic Arc-Flash Sentry (DAS) employs the unique dual protective setting capability of the 776 trip units, coupled with the ability to easily toggle to a lower arc flash parameter set. A normal operation parameter set can be optimized for selective trip coordination, while the second set is optimized for lower arc flash energy levels. The dynamic action comes from the ability to switch from the normal operation set to the arc flash limiting set based on the presence of personnel as they approach the flash protection boundary. A wide variety of switching methods may used based on the needs of a particular facility. The capabilities range from fully automatic switching using appropriate occupancy sensors to manual switching via a key operation.

Electronic Trip Units

Basic Protective Functions		**ETU745**	**ETU748**	**ETU776**
Long-time overcurrent protection	L	●	●	●
Short-time delayed overcurrent protection	S	●	●	●
Instantaneous overcurrent protection	I	●	–	●
Neutral protection	N	●	●	●
Ground fault protection	G	❍	❍	❍
Additional Functions				
Selectable neutral protection		●	●	●
Defeatable short-time delay		●	●	●
Defeatable instantaneous protection		●	–	●
Selectable thermal memory		●	●	●
Zone selective interlocking		❍	❍	❍
Selectable I^2t or fixed short-time delay		●	●	●
Adjustable instantaneous pick-up		●	–	●
Selectable I^2t or I^4t long-time delay		●	●	●
Adjustable short-time delay and pick-up		●	●	●
Selectable and adjustable neutral protection		●	●	●
Dual protective setting capability		–	–	●
Extended instantaneous protection		●	●	●
Parameterization and Displays				
Parameterization by rotary switches (10 steps)		●	●	–
Parameterization by communication (absolute values)		●	●	●
Parameterization by menu/keypad (absolute values)		–	–	●
Remote parameterization of the basic functions			–	●
Remote parameterization of the additional functions		–	–	●
Alphanumeric LCD		❍	❍	–
Graphical LCD		–	–	●
Metering Function				
Metering function **Plus**		❍	❍	❍
Communication				
CubicleBUS		●	●	●
Communication via PROFIBUS-DP		❍	❍	❍
Communication via the MODBUS		❍	❍	❍
Communication via the Ethernet (BDA)		❍	❍	❍

● standard – not available ❍ optional

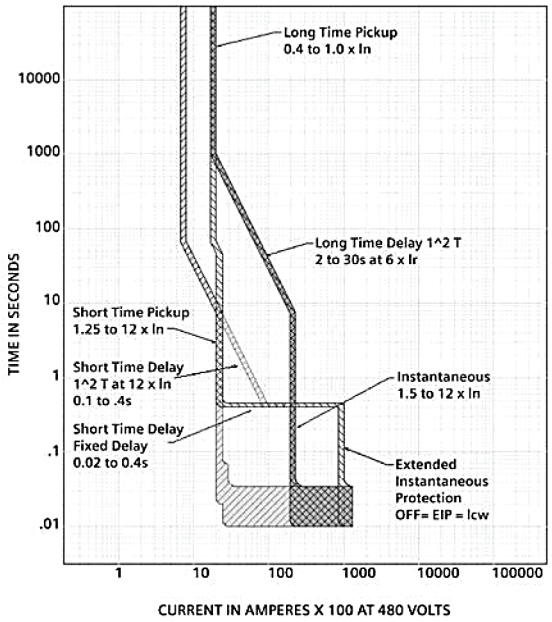
Tripping Characteristics

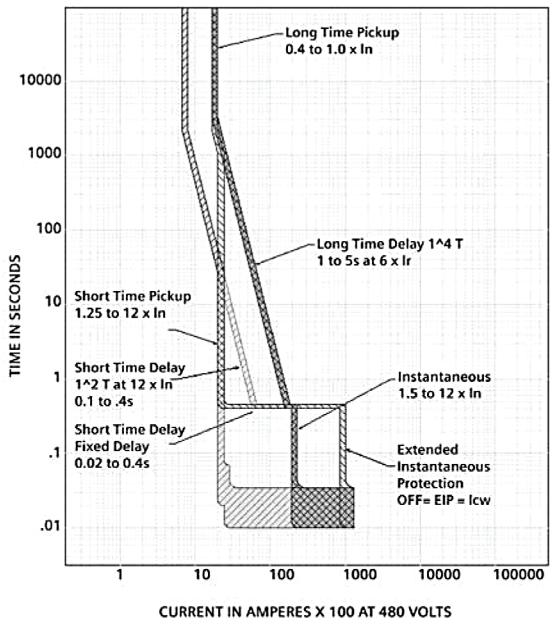
Every trip unit and every trip function has its own characteristic. You will find just a small section of these illustrated below. The characteristics show the respective greatest and smallest setting range of WL Circuit Breakers.

To obtain a complete release characteristic, the appropriate characteristic functions must be determined.

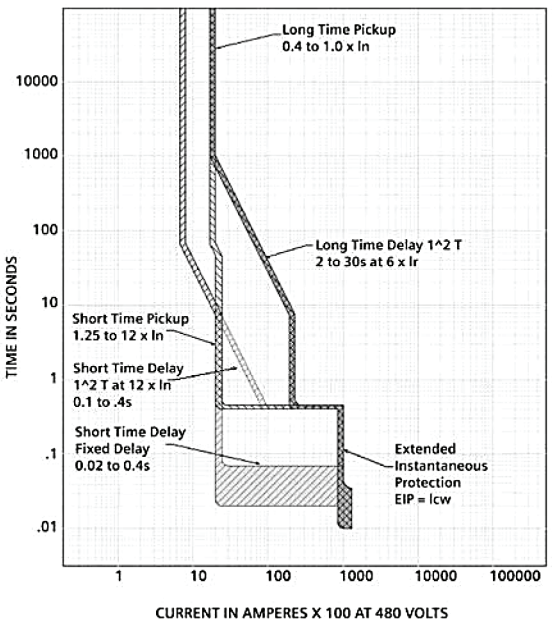
The characteristics show the behavior of the overcurrent release when it is activated by a current already flowing before tripping. If the overcurrent trip takes place immediately after closing and the overcurrent release is therefore not yet activated, the opening time is prolonged by about 3 to 10 ms, depending on the value of the overcurrent.

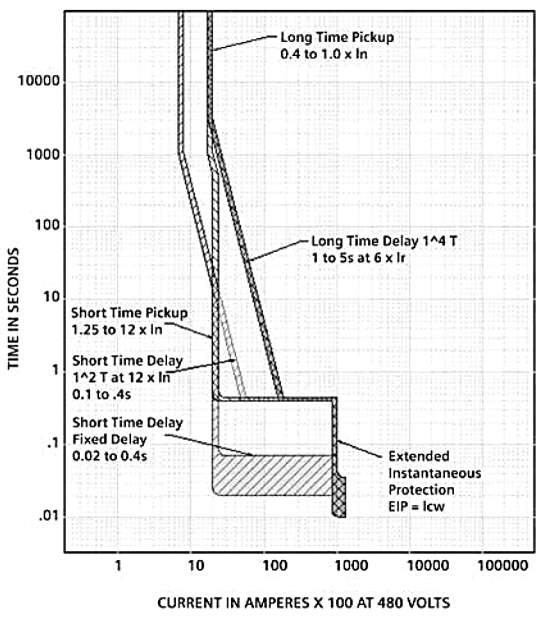
ETU745





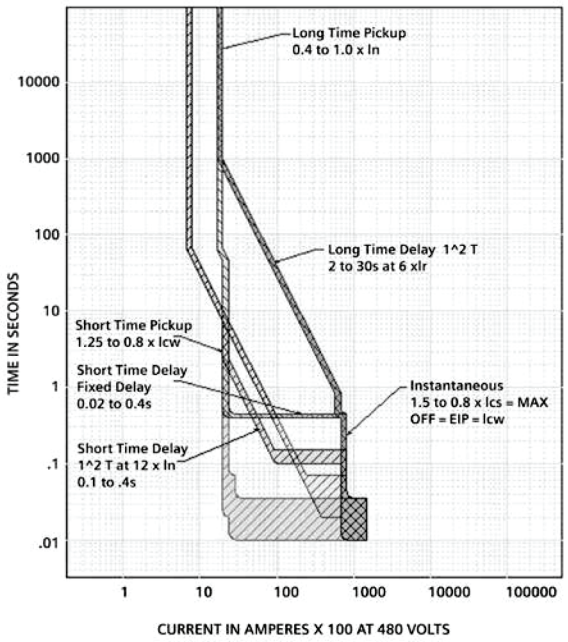
ETU748

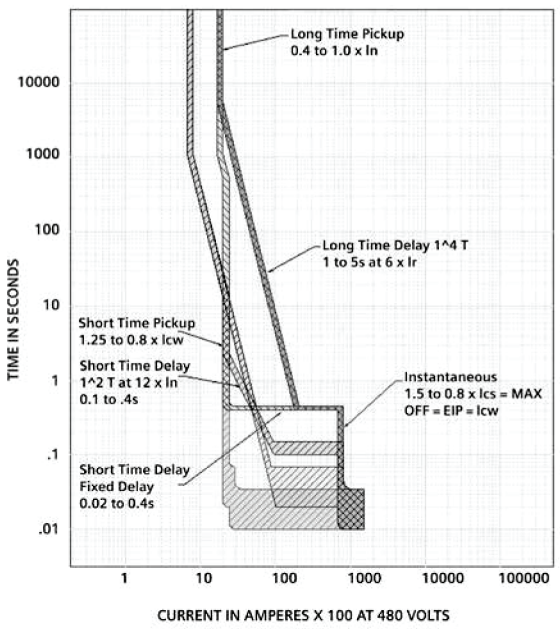




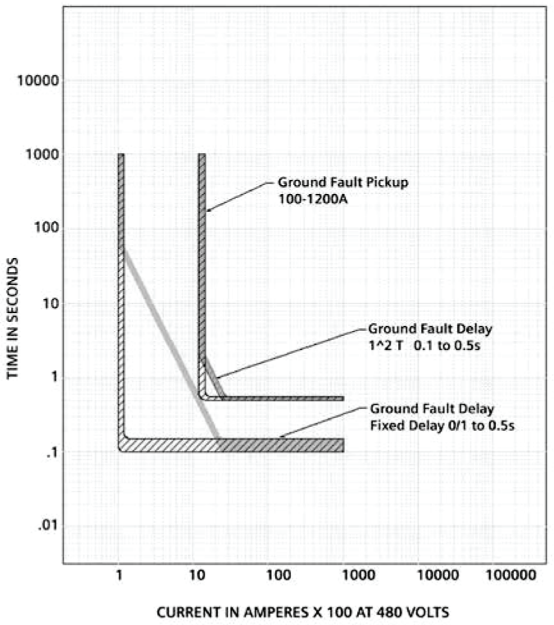
Tripping Characteristics

ETU776





Ground Fault Curve for ETU745, 748, and 776



WL Circuit Breakers ANSI / UL 1066

Breaker Ratings

Frame Rating / Rating Class		Frame Size II																
		800					1600					2000				3200		
		N	S	H	L	F	N	S	H	L	F	S	H	L	F	S	H	L
Instantaneous Short-circuit Current[1] (kA RMS) 50/60 Hz	254VAC	50	65	85	100	200	50	65	85	100	200	65	85	100	200	65	85	100
	508VAC	50	65	85	100	200	50	65	85	100	200	65	85	100	200	65	85	100
	635VAC	50	65	65	85	200	50	65	65	85	200	65	65	85	200	65	65	85
Short-time Withstand Current I_{cw} (kA RMS) 50/60 Hz	0.5s	50	65	65	85	—	50	65	65	85	—	65	65	85	—	65	65	85
Extended Instantaneous Protection (kA RMS -0% to +20%)		50	65	65	85	—	50	65	65	85	—	65	65	85	—	65	65	85
Close and Latch Ratings (kA RMS) 50/60 Hz		50	65	65	85	65	50	65	65	85	65	65	65	85	65	65	65	85
Rating Plug Range		200, 225, 250, 300, 315, 350, 400, 450, 500, 600, 630, 700, 800 amps					200, 225, 250, 300, 315, 350, 400, 450, 500, 600, 630, 700, 800, 1000, 1200, 1250, 1600 amps					200, 225, 250, 300, 315, 350, 400, 450, 500, 600, 630, 700, 800, 1000, 1200, 1250, 1600, 2000 amps				200, 225, 250, 300, 315, 350, 400, 450, 500, 600, 630, 700, 800, 1000, 1200, 1250, 1600, 2000, 2500, 3000, 3200 amps		
Endurance Rating (switching operations with maintenance) [2]	Mechanical	15,000					15,000					15,000				15,000		
	Electrical	15,000					15,000					15,000				15,000		

Frame Rating / Rating Class		Frame Size III												
		3200		4000				5000				6000		
		M	F	H	L	M	F	H	L	M	F	H	L	M
Instantaneous Short-circuit Current[1] (kA RMS) 50/60 Hz	254V AC	150	200	85	100	150	200	85	100	150	200	85	100	150
	508V AC	150	200	85	100	150	200	85	100	150	200	85	100	150
	635V AC	85	200	85	85	85	200	85	85	85	200	85	85	85
Short-time Withstand Current I_{cw} (kA RMS) 50/60 Hz	0.5 s	100[2]	–	85	100[3]	100[2]	–	85	100	100[3]	–	85	100	100[3]
Extended Instantaneous Protection (kA RMS -0% to +20%)	254V AC													
	508V AC	150				150				150				150
	635V AC	85	–	85	100	85	–	85	100	85	–	85	100	85
Close and Latch Ratings (kA RMS) 50/60 Hz		100[2]	85	85	85	100[2]	85	85	85	100[2]	85	85	85	100[2]
Rating Plug Range		800. 1000. 1200. 1250, 1600, 2000, 2500, 3000, 3200 amps		800, 1000, 1200, 1250, 1600, 2000, 2500, 3000, 3200, 4000 amps				800,1000, 1200, 1250, 1600, 2000 2500, 3000, 3200, 4000, 5000 amps				800,1000, 1200, 1250, 1600, 2000 2500, 3000, 3200, 4000, 5000, 6000 amps		
Endurance Rating (switching operations with maintenance) [2]	Mechanical	10,000		10,000				10,000				10,000		
	Electrical	10,000		10,000				10,000				10,000		

1 Maximum rated voltage for fused breakers is 600VAC
2 Maintenance means: replacing main contacts and arc chutes (see operating instructions)
3 Short-time withstand rating is 85kA RMS at 635VAC

WL Non-Automatic Switches ANSI / UL 1066

Ratings

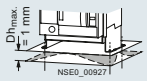
		Frame Size II							Frame Size III					
Frame Rating		**800**		**1600**		**2000**		**3200**	**3200**	**4000**		**5000**		**6000**
Rating Class		**L**	**F** [1]	**L**	**F** [1]	**L**	**F** [1]	**L**	**F** [1]	**L**	**F** [1]	**L**	**F** [1]	**L**
Short-time Withstand Current (kA RMS) 50/60 Hz	0.5 s	85	20	85	20	85	20	85	40	100	40	100	40	100
Breaking Capacity with External Relay (kA RMS) 635Vac , 50/60 Hz, max time delay	0.5 s	85	20	85	20	85	20	85	40	100	40	100	40	100

WL Circuit Breakers

		Frame Size II				Frame Size III			
Frame Rating		**800**	**1600**	**2000**	**3200**	**3200**	**4000**	**5000**	**6000**
Rated current I_n									
at 40°C, at 50/60Hz	A	800	1600	2000	3200	3200	4000	5000	6000
Rated operational (nominal) voltage	VAC	600	600	600	600	600	600	600	600
Rated maximum voltage	VAC	635	635	635	635	635	635	635	635
Permissible ambient temperature operation (for operation with LCD max 55°C)	°C	-25 / +70	-25 / +70	-25 / +70	-25 / +70	-25 / +70	-25 / +70	-25 / +70	-25 / +70
Storage (observe special conditions for LCD)	°C	-40 / +70	-40 / +70	-40 / +70	-40 / +70	-40 / +70	-40 / +70	-40 / +70	-40 / +70
Power loss at Rated Current with 3-phase[2] symmetrical load	W	85 130 (fused)	320 520 (fused)	500 850 (fused)	1150	700	1100	1650	2475
Operating times									
Make-time	ms	35	35	35	35	35	35	35	35
Break-time (with active ETU)	ms	34	34	34	34	34	34	34	34
Break-time (without active ETU)	ms	50	50	50	50	50	50	50	50
Total clearing time (with active ETU)	ms	50	50	50	50	50	50	50	50
Total clearing time (without active ETU)	ms	65	65	65	65	65	65	65	65
Make-time, electrical (via closing solenoid)	ms	50	50	50	50	50	50	50	50
Break-time, electrical (via shunt trip)	ms	40	40	40	40	40	40	40	40
(via instantaneous UVR)	ms	73	73	73	73	73	73	73	73

1 Interrupting rating is equal to 200kA based on the rating of the fuse
2 Consult factory for fuse carriage power loss

WL Circuit Breakers

		Frame Size II				Frame Size III			
Frame Rating		**800**	**1600**	**2000**	**3200**	**3200**	**4000**	**5000**	**6000**
Endurance									
Mechanical (without maintenance)	operating cycles	12,500	12,500	10,000	10,000	5,000	5,000	5,000	5,000
Mechanical (with maintenance) [1]	operating cycles	15,000	15,000	15,000	15,000	10,000	10,000	10,000	10,000
Electrical (without maintenance)	operating cycles	7,500	7,500	4,000	4,000	2,000	2,000	2,000	2,000
Electrical (with maintenance) [1]	operating cycles	15,000	15,000	15,000	15,000	10,000	10,000	10,000	10,000
Switching frequency	1/h	60	60	60	60	60	60	60	60
Minimum interval between breaker trip and next closing of the circuit breaker (when used with the automatic mechanical reset of the bell alarm)	ms	80	80	80	80	80	80	80	80
Mounting position									
Auxiliary secondary wire size (Cu) max # of aux. connecting leads x cross section (solid or stranded)	Bare wire pressure terminal	1 x AWG 14 or 2 x AWG 16	1 x AWG 14 or 2 x AWG 16	1 x AWG 14 or 2 x AWG 16	1 x AWG 14 or 2 x AWG 16	1 x AWG 14 or 2 x AWG 16	1 x AWG 14 or 2 x AWG 16	1 x AWG 14 or 2 x AWG 16	1 x AWG 14 or 2 x AWG 16
	Tension spring terminal	2 x AWG 14	2 x AWG 14	2 x AWG 14	2 x AWG 14	2 x AWG 14	2 x AWG 14	2 x AWG 14	2 x AWG 14
	Ring tongue terminal (standard)	2 x AWG 14 1 x AWG 10[2] 2 x AWG 16	2 x AWG 14 1 x AWG 10[2] 2 x AWG 16	2 x AWG 14 1 x AWG 10[2] 2 x AWG 16	2 x AWG 14 1 x AWG 10[2] 2 x AWG 16	2 x AWG 14 1 x AWG 10[2] 2 x AWG 16	2 x AWG 14 1 x AWG 10[2] 2 x AWG 16	2 x AWG 14 1 x AWG 10[2] 2 x AWG 16	2 x AWG 14 1 x AWG 10[2] 2 x AWG 16
TOC wire connection size (Cu) max # of aux connecting leads x cross section (solid or stranded)	Bare wire pressure terminal	1 x AWG 14	1 x AWG 14	1 x AWG 14	1 x AWG 14	1 x AWG 14	1 x AWG 14	1 x AWG 14	1 x AWG 14
Weight [3]									
Circuit Breaker	kg/lb	72/159	72/159	75/165	95/209	155/341	155/341	155/341	155/341
Guide Frame	kg/lb	51/112	51/112	60/132	69/152	139/306	139/306	139/306	139/306
MOC wire connection size (Cu) max # of aux. connecting leads x cross section (solid or stranded)	Bare wire pressure terminal	1 x AWG 14	1 x AWG 14	1 x AWG 14	1 x AWG 14	1 x AWG 14	1 x AWG 14	1 x AWG 14	1 x AWG 14

[1] Maintenance consists of replacing main contacts and arc chutes (see operating instructions)

[2] For use only with Siemens supplied ring terminals (WL10RL)

[3] Fused Breaker Weights

(kg/lb)	Frame Size II (fused)	Frame Size III (fused)
Breaker	103/227	same as table above
Guide Frame	68/150	130/275
Fuse Carriage	–	102/225

WL Circuit Breaker Accessory Ratings

Manual Operating Mechanism with Mechanical Closing				
Closing/charging stored energy mechanism				
	Maximum actuating force required on hand lever		52 lbs	
	Number of hand lever strokes required		9	
Manual Operating Mechanism with Mechanical and Electrical Closing				
Charging stored-energy mechanism				
Closing solenoid and Shunt Trip	Coil voltage tolerance		24V DC	14 - 28V DC
			48V DC	28 - 56V DC
			120V AC / 125V DC	70 - 140V DC
				104 - 127V AC
			240V AC / 250V DC	140 - 280V DC
				08 - 254V AC
				180Y / 104V AC
				220Y / 127V AC
	Power consumption (5 % duty cycle)			120 W
	Minimum closing solenoid actuation signal required			50 ms
Motor Operating Mechanism with Mechanical and Electrical Closing				
Spring charging motor				
	Motor voltage tolerance at 120V AC, 240V AC			85 - 110%
	Extended tolerance for battery operation at 24V DC, 48V DC, 125V DC, 250V DC			70 - 126%
	Power consumption of the motor			110 W
	Time required for charging the stored-energy mechanism			≤ 10 s
Closing solenoid				
For motor and closing solenoid short-circuit protection				
	Short-circuit protection			
	Standard slow-blow cartridge fuse		24 - 60 V	6A
			110 - 250 V	3A
Auxiliary Release				
Undervoltage release (UVR)	Operating		≥ 85% (circuit breaker can be closed)	
			35 - 70% (circuit breaker opens)	
	AC Coil voltage tolerance at 120V AC, 240V AC			85 - 110%
	DC Extended tolerance for battery operation at 24V DC, 48V DC, 125V DC, 250V DC			85 - 126%
	Rated control supply voltage	AC 50/60Hz	V	120, 240
		DC	V	24, 48, 125, 250
	Power consumption (inrush / continuous)	AC	VA	200 / 5
		DC	W	200 / 5
	Opening time of the circuit breaker for AC / DC		ms	200
	UVR (no time delay), 2 settings			
	Setting 1		ms	80
	Setting 2		ms	200
	UVR (with time delay)			
	Adjustable delay		s	0.2 to 3.2
	Reset by additional NC direct opening		ms	≤ 100

WL Circuit Breaker Accessory Ratings

Auxiliary Contacts and Mechanism Operated Contacts (MOC)					
Contact rating	Alternating current				
	50/60 Hz	Rated operational voltage	240V		
		Rated operational current, continuous	10A		
		Rated operational current, making	30A		
		Rated operational current, breaking	3A		
	Direct current	Rated operational voltage	24V, 125V, 250V		
		Rated operational current, continuous	5A		
		Rated operational current, making	1.1A at 24V, 1.1A at 125V, 0.55A at 250V		
		Rated operational current, breaking	1.1A at 24V, 1.1A at 125V, 0.55A at 250V		
Bell Alarm Switch and Ready-to-Close Signal Contact					
Contact rating	Alternating current				
	50/60 Hz	Rated operational voltage	240V		
		Rated operational current, continuous	5A		
		Rated operational current, making	8A		
		Rated operational current, breaking	5A		
	Direct current	Rated operational voltage	24V, 48V, 125V		250V DC
		Rated operational current, continuous	0.4A		0.2A
		Rated operational current, making	0.4A		0.2A
		Rated operational current, breaking	0.4A		0.2A
Shunt Trip, UVR and Blown Fuse Signaling Contacts					
Contact rating	Alternating current				
	50/60 Hz	Rated operational voltage	127V, 240V		
		Rated operational current, continuous	3A		
		Rated operational current, making	5A		
		Rated operational current, breaking	6A		
	Direct current	Rated operational voltage	24V, 48V, 125V		125V DC (IEC Rating Only)
		Rated operational current, making	1.0A		0.5A
		Rated operational current, breaking	1.0A		0.5A
Position Signal Contact on the Guide Frame (TOC)					
Breaker position:	Connected position		3 form C	1 form C	6 form C
	Test position		2 form C or	1 form C or	0 form C
	Disconnected position		1 form C	1 form C	0 form C
Contact rating	Alternating current				
	50/60 Hz	Rated operational voltage	120V		240V
		Rated operational current, continuous	10A		10A
		Rated operational current, making	6A		3A
		Rated operational current, breaking	6A		3A
	Direct current	Rated operational voltage	24V	48V, 125V	250V
		Rated operational current, continuous	6A	1A	1A
		Rated operational current, making	6A	0.22A	0.11A
		Rated operational current, breaking	6A	0.22A	0.11A

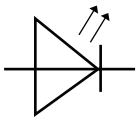
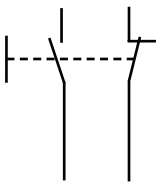
Function Overview of the Electronic Trip Units

Basic Functions		ETU745
	Long-time overcurrent protection	✓
	Function can be switched ON/OFF	–
	Setting range $I_R = I_n$ x ...	0.4, 0.45, 0.5, 0.55,0.6, 0.65, 0.7, 0.8, 0.9, 1
L	Switch-selectable overload protection (I^2t or I^4t dependent function)	✓
	Setting range of time delay class t_R at I^2t (seconds)	2, 3.5, 5.5, 8, 10, 14, 17, 21, 25, 30
	Setting range of time delay t_R at I^4t (seconds)	1, 2, 3, 4, 5
	Thermal memory	✓ (via slide switch)
	Phase loss sensitivity	at t_{sd}=20ms (M)
	Neutral protection	✓
N	Function can be switched ON/OFF	✓ (via slide switch)
	N-conductor setting range $I_N = I_n$ x ...	0.5 ... 1
	Short-time delayed overcurrent protection	✓
	Function can be switched ON/OFF	✓ (via rotary switch)
	Setting range $I_{sd} = I_n$ x ...	1.25, 1.5, 2, 2.5, 3, 4, 6, 8, 10, 12
S	Setting range of time delay t_{sd}, fixed (seconds)	0.02 (M), 0.1, 0.2, 0.3, 0.4, OFF
	Switch-selectable short-time delay short-circuit protection (I^2t dependent function)	✓ (via rotary switch)
	Setting range of time delay t_{sd} at I^2t (seconds)	0.1, 0.2, 0.3, 0.4
	Zone Selective Interlocking (ZSI) function	per CubicleBUS module
	Instantaneous overcurrent protection	✓
I	Function can be switched on/off, Extended Instantaneous Protection is enabled when OFF	✓(via rotary switch)
	Setting range $I_i = I_n$ x ...	1.5, 2.2, 3, 4, 6, 8, 10, 12 0.8 x I_{cw} = max, OFF=I_{cw}=EIP [1]
	Ground fault protection [2]	☆ (field installable module)
	Trip and alarm function	✓
	Detection of the ground fault current by residual summing method	✓
	Detection of the ground fault current by direct summing method	✓
G	Setting range of the I_g for trip	A, B, C, D, E
	Setting range of the I_g for alarm	A, B, C, D, E
	Setting range of the time delay (seconds)	0.1, 0.2, 0.3, 0.4, 0.5
	Switch-selectable ground fault protection (I^2t / fixed)	✓
	Setting range time delay t_g at I^2t	0.1, 0.2, 0.3, 0.4, 0.5
	ZSI ground function	per CubicleBUS module

1 Extended Instantaneous Protection (EIP) allows the WL breaker to be applied at the withstand rating of the breaker with minus 0% tolerance; that means no instantaneous override whatsoever. EIP further enables the circuit breaker tobe applied up to the full instantaneous rating of the breaker on systems where the available fault current exceeds

✓ available
– not available

Function Overview of the Electronic Trip Units

Basic Functions		ETU745
Parameter sets		
	Selectable between parameter set A and B	–
LCD		
	LCD, alphanumeric (4-line)	❍
	LCD, graphic	–
Communication		
	CubicleBUS integrated	✓
	Communication capability via MODBUS or PROFIBUS	✓
Metering function		
	Metering function capability with Metering Function PLUS	✓
Display by LED		
	Trip unit active	✓
	Alarm	✓
	ETU error	✓
	L trip	✓
	S trip	✓
	I trip	✓
	N trip	✓
	G trip	✓ (only with ground fault module)
	G alarm	✓ (only with ground fault module)
	Tripped by extended protection or protective relay function	✓
	Communication	✓
Signal contacts with external CubicleBUS modules (Opto or relay)		
	Overcurrent warning	✓
	Load shedding OFF/ON	✓
	Early signal of long time trip (200ms)	✓
	Temperature alarm	✓
	Phase unbalance	✓
	Instantaneous trip	✓
	Short-time trip	✓
	Long-time trip	✓
	Neutral conductor trip	✓
	Ground fault protection trip	✓ (only with ground fault module)
	Ground fault alarm	✓ (only with ground fault module)
	Auxiliary relay	✓
	ETU error	✓

Step for Settings via Communications or ETU Key Pad

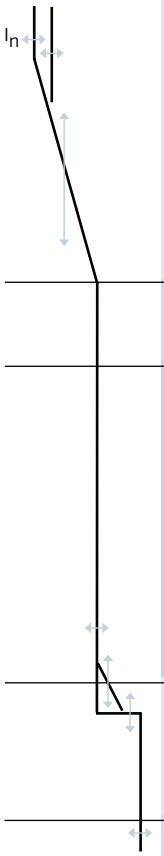
from ... to	step	from ... to	step
0 ... 1	0.1	1000 ... 1600	50
1 ... 100	1	1600 ... 10000	100
100 ... 500	5	10000 ... max	1000
500 ... 1000	10		

Setting range of the I_g

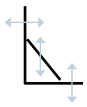
	Frame Size II	Frame Size III
A	100 A	400 A
B	300 A	600 A
C	600 A	800 A
D	900 A	1000 A
E	1200 A	1200 A

✓ available
– not available
❍ optional

Function Overview of the Electronic Trip Units



Basic Functions		ETU748	ETU776
	Long-time overcurrent protection	✓	✓
	Function can be switched ON/OFF	–	–
	Setting range $I_R = I_n$ x ...	0.4, 0.45, 0.5, 0.55, 0.6, 0.65, 0.7, 0.8, 0.9, 1	0.4 ... 1 (step: 1A)
L	Switch-selectable overload protection (I^2t or I^4t dependent function)	✓	✓
	Setting range of time delay class t_R at I^2t (seconds)	2, 3.5, 5.5, 8, 10, 14, 17, 21, 25, 30	2 ... 30 (step: 0.1s)
	Setting range of time delay t_R at I^4t (seconds)	1, 2, 3, 4, 5	1 ... 5 (step: 0.1s)
	Thermal memory	✓ (via slide switch)	✓ (on/off via key pad or communications)
	Phase loss sensitivity	at t_{sd}=20ms (M)	✓ (on/off via key pad or communications)
	Neutral protection	–	✓
N	Function can be switched ON/OFF	–	✓ (via slide switch)
	N-conductor setting range $I_N = I_n$ x ...	–	0.5 ... 1
	Short-time delayed overcurrent protection	✓	✓
	Function can be switched ON/OFF	✓ (via rotary switch)	✓ (via key pad or communications)
	Setting range $I_{sd} = I_n$ x ...	1.25, 1.5, 2, 2.5, 3, 4, 6, 8, 10, 12	1.25 ... 0.8 x I_{cw} = max (step: 10A)
S	Setting range of time delay t_{sd}, fixed (seconds)	M, 0.1, 0.2, 0.3, 0.4	M, 0.08 ... 0.4, OFF (step: 0.001s)
	Switch-selectable short-time delay short-circuit protection (I^2t dependent function)	✓ (via rotary switch)	✓ (via key pad or communications)
	Setting range of time delay t_{sd} at I^2t (seconds)	0.1, 0.2, 0.3, 0.4	0.1 ... 0.4 (step: 0.001s)
	Zone Selective Interlocking (ZSI) function	per CubicleBUS module	per CubicleBUS module
	Instantaneous overcurrent protection	✓	✓
I	Function can be switched ON/OFF, Extended Instantaneous Protection is enabled when OFF	–	✓ (via key pad or communications)
	Setting range $I_i = I_n$ x ...	– $I_i = I_{cw}$ = EIP [1]	1.5 x I_n ... 0.8 x I_{cs} = max, OFF=I_{cw}=EIP [1]
	Ground fault protection [2]	❍ (field installable module)	❍ (field installable module)
	Trip and alarm function	✓	✓ (via key pad or communications)
	Detection of the ground fault current by residual summing method	✓	✓
	Detection of the ground fault current by direct summing method	✓	✓
G	Setting range of the I_g for trip	A, B, C, D, E	A ... E (step: 1A)
	Setting range of the I_g for alarm	A, B, C, D, E	A ... E (step: 1A)
	Setting range of the time delay t_g (seconds)	0.1, 0.2, 0.3, 0.4, 0.5	0.1 ... 0.5 (step: 0.001s)
	Switch-selectable ground fault protection (I^2t / fixed)	✓	✓
	Setting range time delay t_g at I^2t	0.1, 0.2, 0.3, 0.4, 0.5	0.1 ... 0.5 (step: 0.001s)
	ZSI ground function	per CubicleBUS module	per CubicleBUS module



1 Extended Instantaneous Protection (EIP) allows the WL breaker to be applied at the withstand rating of the breaker with minus 0% tolerance; that means no instantaneous override whatsoever. EIP further enables the circuit breaker to be applied up to the full instantaneous rating of the breaker on systems where the available fault current exceeds the withstand rating.

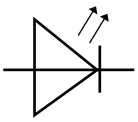
2 Ground Fault Module cannot be removed after installation.

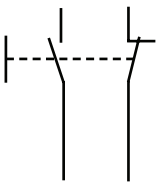
✓ available
– not available
❍ optional

Notes: **M** = Motor protection setting (20 ms)
Communications = Setting the parameters of the trip unit via the Breaker Data Adapter, MODBUS, or PROFIBUS
Key pad = Direct input at the trip unit

Function Overview of the Electronic Trip Units

Basic Functions		ETU748	ETU776
Parameter sets			
	Selectable between parameter set A and B	–	✓
LCD			
	LCD, alphanumeric (4-line)	❍	–
	LCD, graphic	–	✓
Communication			
	CubicleBUS integrated	✓	✓
	Communication capability via MODBUS or PROFIBUS	✓	✓
Metering function			
	Metering function capability with Metering Function PLUS	✓	✓
Display by LED			
	Trip unit active	✓	✓
	Alarm	✓	✓
	ETU error	✓	✓
	L trip	✓	✓
	S trip	✓	✓
	I trip	-	✓
	N trip	✓	✓
	G trip	✓ (only with ground fault module)	✓(only with ground fault module)
	G alarm	✓ (only with ground fault module)	✓ (only with ground fault module)
	Tripped by extended protection or protective relay function	✓	✓
	Communication	✓	✓
Signal contacts with external CubicleBUS modules (Opto or relay)			
	Overcurrent warning	✓	✓
	Load shedding OFF/ON	✓	✓
	Early signal of long time trip (200ms)	✓	✓
	Temperature alarm	✓	✓
	Phase unbalance	✓	✓
	Instantaneous trip	✓	✓
	Short-time trip	✓	✓
	Long-time trip	✓	✓
	Neutral conductor trip	✓	✓
	Ground fault protection trip	✓ (only with ground fault module)	✓ (only with ground fault module)
	Ground fault alarm	✓ (only with ground fault module)	✓ (only with ground fault module)
	Auxiliary relay	✓	✓
	ETU error	✓	✓



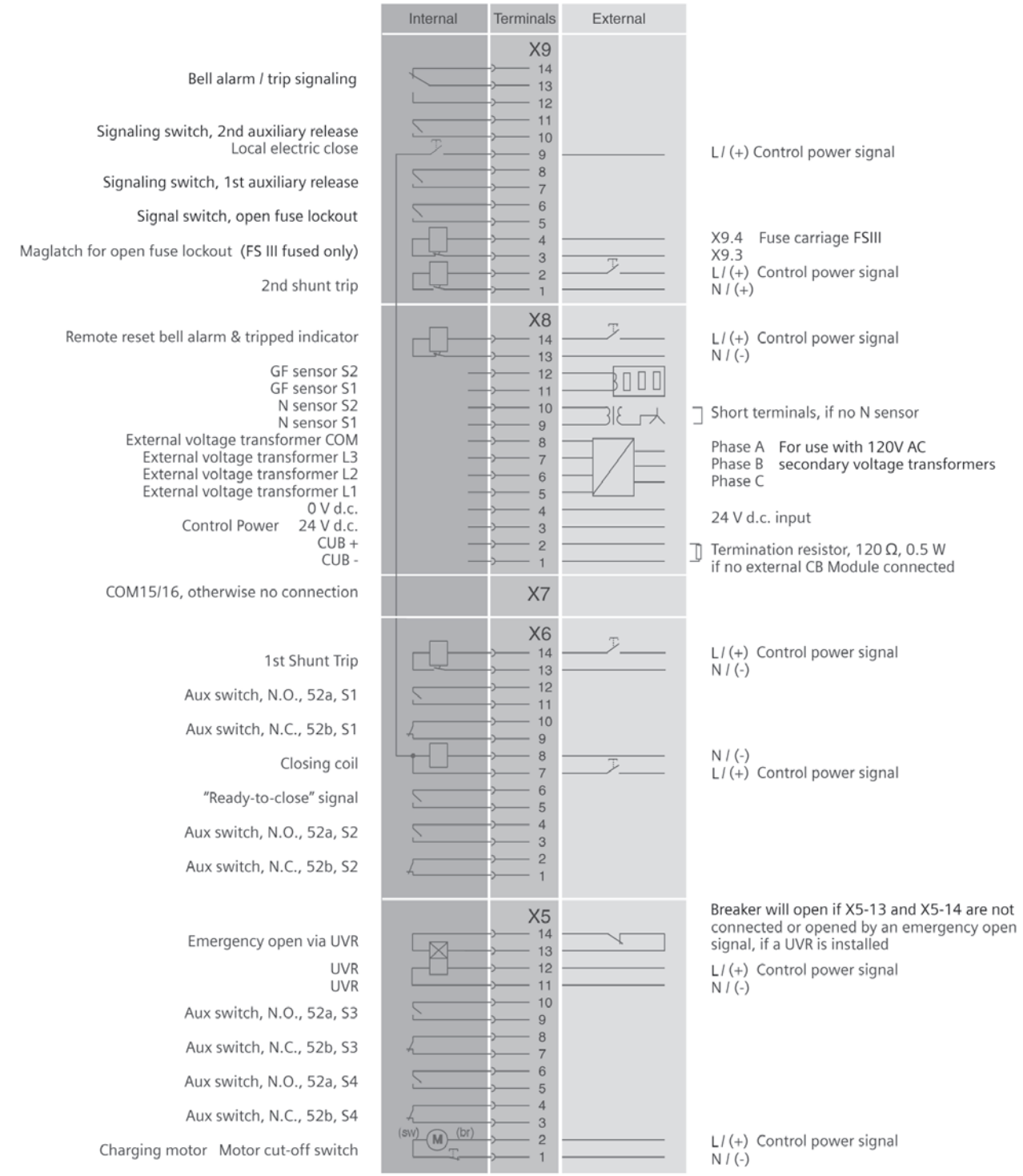


Metering and Protective Relaying Accuracies

Protective Relaying	Pick-up Accuracy
Phase Unbalance (I)	2% (5...50% I_n)
Phase Unbalance (V)	2% (5...50% V_n)
THD (I) (up to 29th)	+/- 3% (80...120% V_n)
THD (V) (up to 29th)	+/- 3% (80...120% V_n)
Overvoltage	+/- 2% (80...120% V_n)
Undervoltage	+/- 2% (80...120% V_n)
Under/Over Frequency	+/- 0.1 Hz

Metering Values	Accuracy
(I) at 1 x I_n	+/- 1%
(V) at 1 x V_n	+/- 0.5%
(P) at 1x I_n	+/- 3%
(S) at 1 x I_n	+/- 2%
(Q) at 1 x I_n	+/- 3%

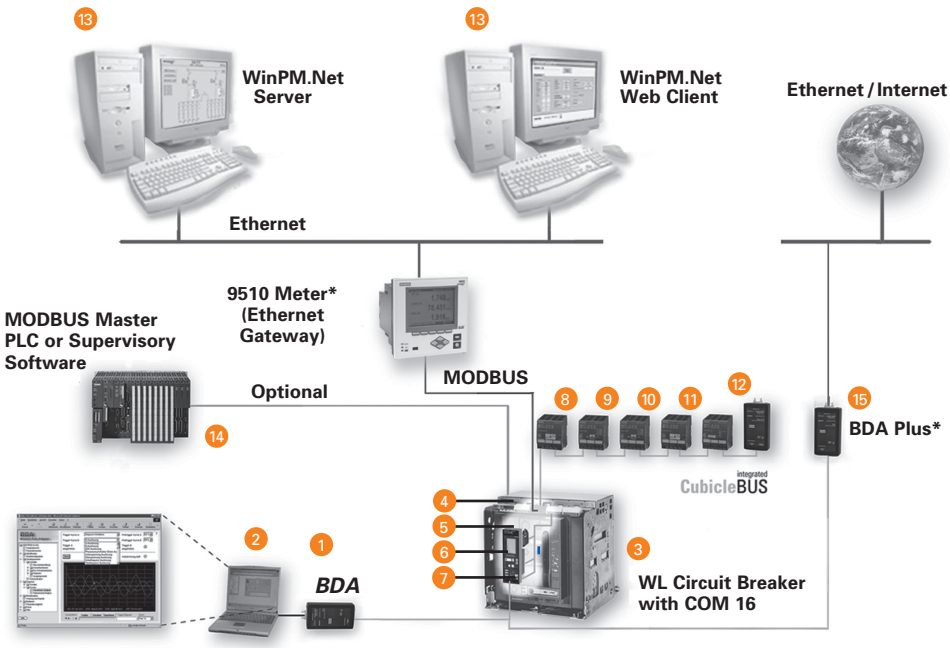
WL Secondary Terminal Assignments



WL Communication Overview

Connection Diagram

1. Breaker Data Adapter (BDA)
2. Browser-capable input and output device (e.g. notebook)
3. WL Circuit Breaker
4. COM 16 MODBUS module or COM 15 PROFIBUS module
5. Breaker Status Sensor (BSS)
6. Electronic Trip Unit
7. Metering function PLUS
8. Zone Selective Interlocking (ZSI) module
9. Digital output module with relay or optocoupler outputs
10. Digital output module with relay or optocoupler outputs, remotely configurable
11. Analog output module
12. Digital input module
13. WinPM.Net on PC
14. PLC (e.g. SIMATIC S7)
15. BDA Plus



* The Siemens BDA Plus or meters, 9330, 9350, 95/9610 can be used as a gateway to enable Ethernet communication to the WL Circuit Breaker.

Features

- Industry standard MODBUS or PROFIBUS communication available on all WL breakers from 200A to 6000A.
- The high modularity of the WL Circuit Breakers and accessories allows simple retrofitting of all communication components.
- The ability to connect additional input and output modules to the breaker internal CubicleBUS of the WL opens up a range of opportunities to reduce secondary device count and wiring and to increase functionality implemented in switchgear.
- Innovative software products for local configuration, operation, monitoring and diagnostics of WL Circuit Breakers using MODBUS, PROFIBUS or via Ethernet/ Intranet/Internet.
- Complete integration of WL Circuit Breakers in all Totally Integrated Power and Totally Integrated Automation Solutions.

General Notes:

- A blank/instrument compartment can always be substituted for a breaker compartment.
- Any 22" wide section can be 32" wide if more conduit working room is needed.
- For bus duct connections – if incoming is top, Compartment A must be blank/instrument, if incoming is bottom, Compartment D must be blank/instrument.
- Bussed transition section is 22" wide
- For close coupled transformer connections, Compartment A must be blank/instrument.
- Utility metering is always in a separate section. Section width is dependent on utility.

Switchgear Depth Dimensional Information
(Dimensions below are for internal frames – not total structure depth)

- Non-fused indoor – 60" standard, 70" and 80" optional
- Fused indoor – 65" standard, 75" and 80" optional
- Non-fused non-walk-in outdoor – 60" standard and 75" optional
- Fused non-walk-in outdoor – 65" standard and 75" optional
- Non-fused walk-in outdoor – 60" standard and 75" optional
- Fused walk-in outdoor – 65" standard and 75" optional
- Walk-in outdoor aisle is 42" deep
- Sections with cable connected main, tie and/or feeder breakers that are 3200 amp or greater must be minimum depth of 70" for unfused breakers and 75" for fused breakers.

Note 1 – If a 4000 amp feeder breaker is installed in Compartment C, Compartment D must be a Blank or Instrument Compartment.

Note 2 – If a 4000 amp breaker is installed in Compartment B, Compartment A must be a Blank or Instrument Compartment.

Note 3 – If incoming is bottom, feeder breakers can mount in compartments A and/or B.

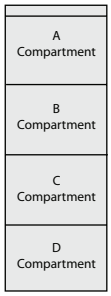
Note 4 – If a 3200 amp breaker is installed in Compartment B, the middle level through bus is not available.

Note 5 – If a 3200 amp breaker is installed in Compartment D, the lower level through bus is not available.

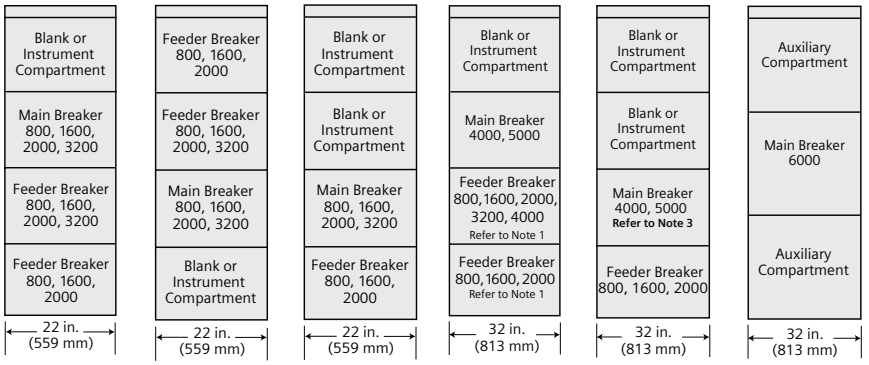
Note 6 – Only one 800, 1600, 2000 amp feeder breaker can be mounted per section. If the horizontal main bus is at the top of the section, the 800, 1600, 2000 amp feeder breaker can go in the A compartment and a blank/instrument compartment must go in the D compartment. If the horizontal main bus is a the bottom of the section, the 800, 1600, 2000 amp feeder breaker can go in the D compartment and a blank/instrument compartment must go in the A compartment.

Note 7 – Any feeder section (or bus transition section) with 6000 amp vertical bus must be 32" wide.

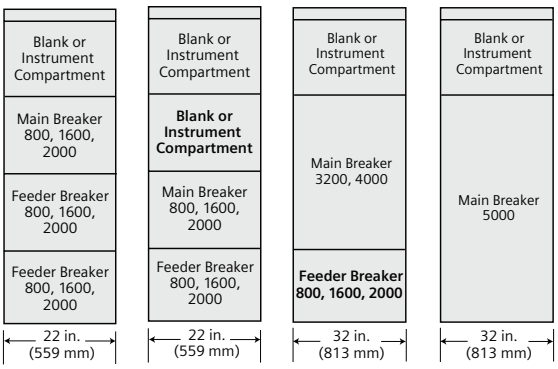
Section Compartment Arrangement



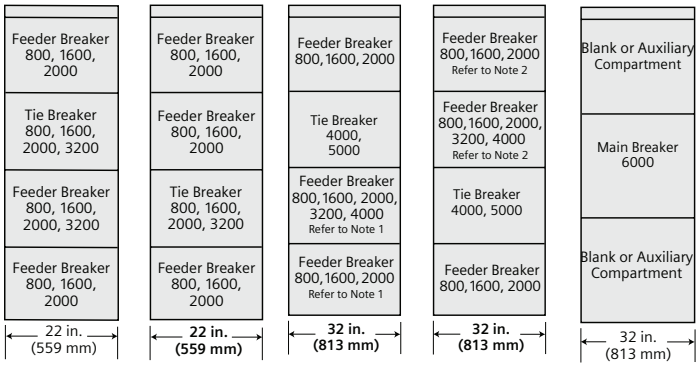
Main Sections – Non-Fused Breakers



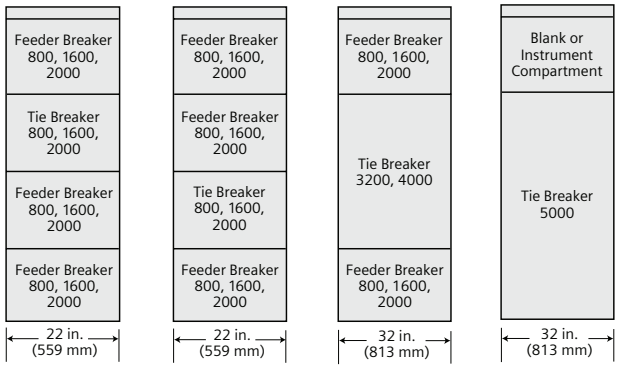
Main Sections – Fused Breakers



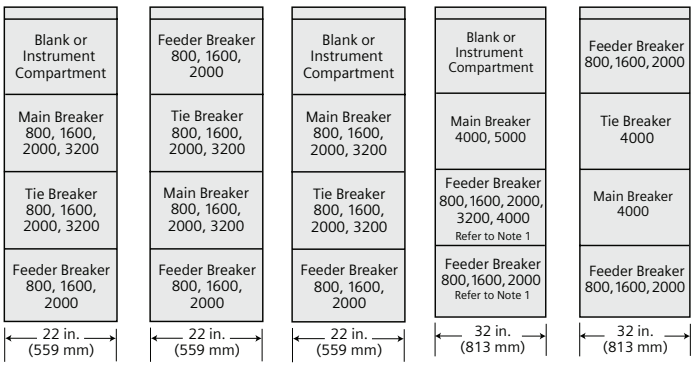
Tie Sections – Non-Fused Breakers



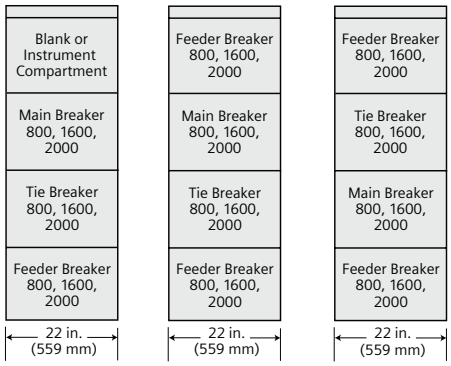
Tie Sections – Fused Breakers



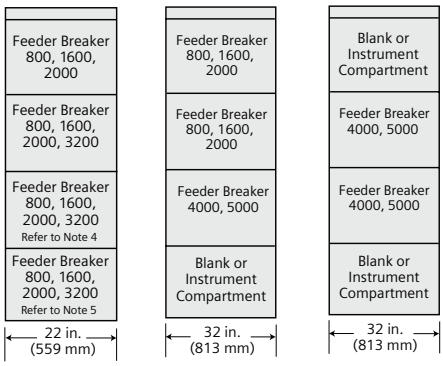
Main and Tie Sections – Non-Fused Breakers



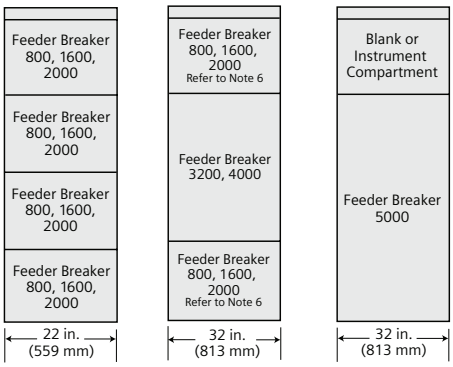
Main and Tie Sections – Fused Breakers



Feeder Sections – Non-Fused Breakers (see Note 7 on page 24)



Feeder Sections – Fused Breakers (see Note 7 on page 24)



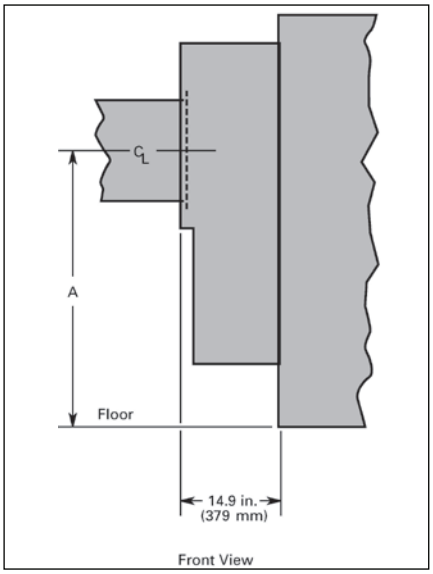
Siemens Type WL Low Voltage Switchgear can be configured in many ways by combining different section types. Up to five vertical sections plus a transition section can be shipped together as a unit. Maximum shipping split length for indoor structures is 110 in. (2794 mm). If all vertical sections are not to be shipped as a unit, specifications need to be provided that describe the limiting factors (e.g., low door or narrow hallway).

Normal indoor vertical sections are 96 in. (2438 mm) high and a minimum 60 in. (1524 mm) deep for non-fused breakers and 65 in. (1651 mm) deep for fused breakers. A top-mounted hoist, which is shipped as an accessory in a separate container, adds 6.2 in. (157 mm) for a total installed height of 102.2 in. (2596 mm).

The outdoor switchgear assembly contains the indoor assembly in an outdoor housing. The overall height is 112.8 in. (2865 mm) for non walk-in designs and 114 in. (2896 mm) for walk-in designs. The depth of a non walk-in outdoor assembly with a 60 in. (1524 mm) internal structure is 82.3 in. (2090 mm) and the depth of a walk-in outdoor assembly with a 60 in. (1524 mm) internal structure is 110.7 in. (2812 mm). Maximum shipping split length for outdoor structures is 66 in. (1676 mm).

The major assembly sections include:

- Transition Sections — used as transition to liquid filled transformer or to outdoor dry type transformers.
- Auxiliary Sections — used as incoming bus duct or cable entrance when a main breaker is not used.
- Main Sections — used to contain main breaker and may house metering and feeder breakers.
- Feeder Sections — used to contain feeder breakers and other equipment such as instrumentation.
- Tie Sections — used to contain tie breaker and other equipment such as feeder breakers.



Transition Section For Liquid Filled and Outdoor Dry Type Transformers

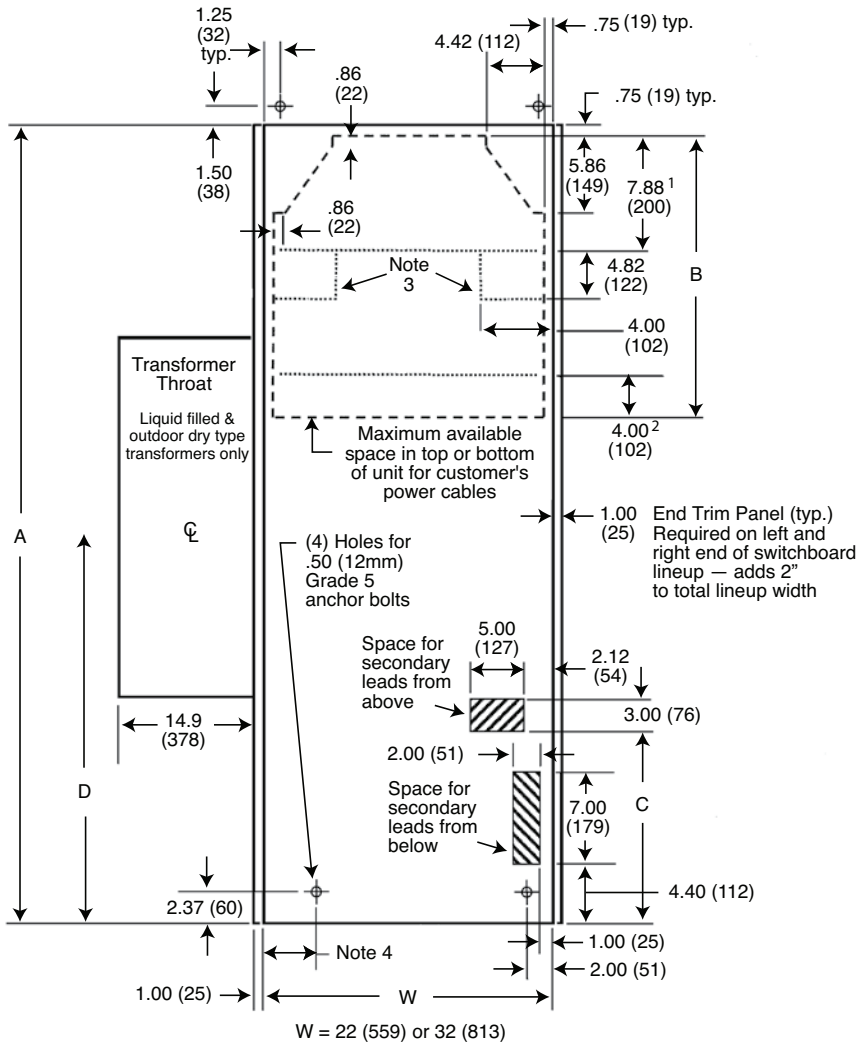
	Dimension A in inches (mm)	Weight in lbs. (kg)
Indoor	55 (1397)	500 (227)
Outdoor	61 (1549)	550 (250)

Approximate Weight – Lbs.

Section Type	22" Indoor	22" Outdoor	32" Indoor	32" Outdoor	38" Indoor	38" Outdoor	48" Indoor	48" Outdoor
Auxiliary	1000 (450)	2000 (900)	1300 (585)	2500 (1125)	1800 (810)	3200 (1440)	N/A	N/A
Utility Metering	N/A	N/A	N/A	N/A	2100 (945)	3500 (1575)	2600 (1170)	4500 (2025)
Breaker	1400 (630)	2400 (1080)	2000 (900)	3300 (1485)	N/A	N/A	N/A	N/A

Weights shown in pounds and ( ) kilograms.
Weights shown do not include weight of circuit breaker removeable element (but does include cradle).
Add 400 lbs for hoist and track.
On outdoor switchgear, add 500 lbs for end walls (weight is for both ends). Refer to shipping documents for actual weights.

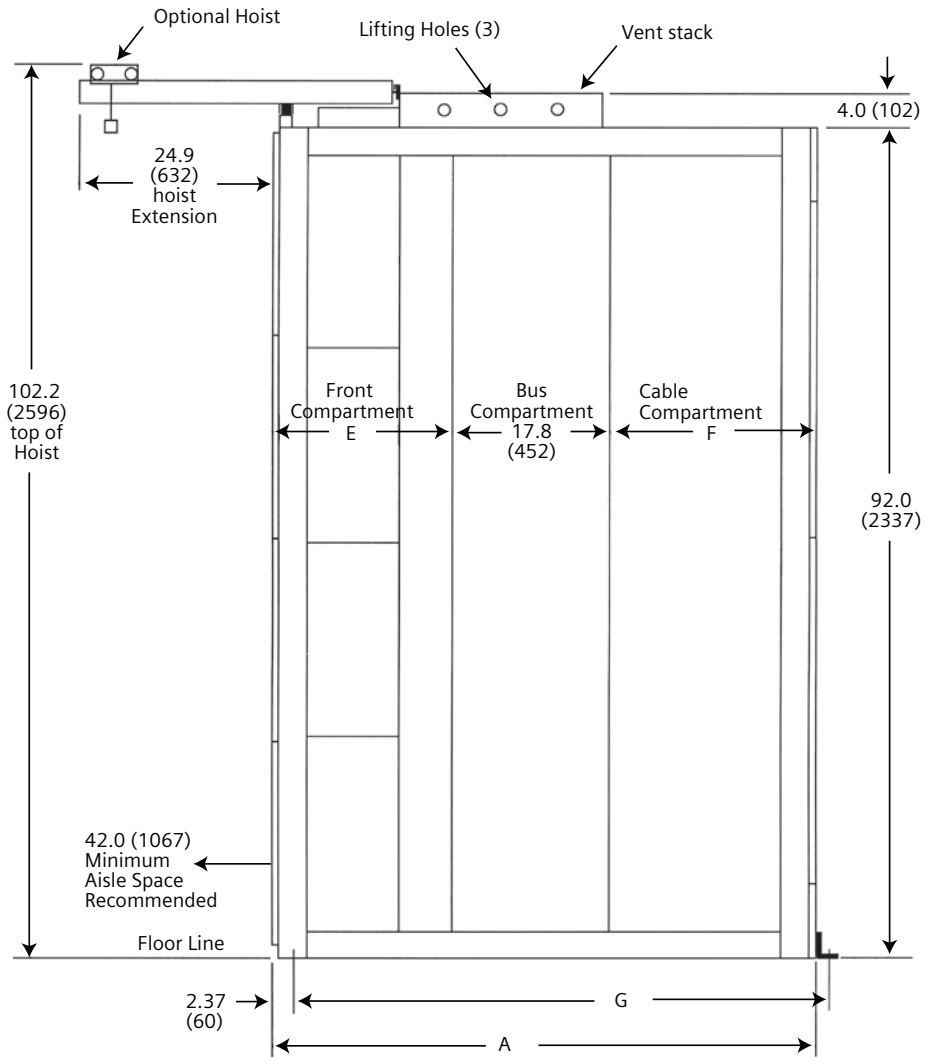
Indoor Floor Plan and Cable Space Details



A Equipment Depth	Direction of Cables	B	C	D
60" Non-Fused with (N, S, H or L-Class Breakers) OR 65" Fused with (F-Class Breakers)	Below	21.50 (546) [1 2]	13.88 (353)	32.59 (828)
	Above	21.25 (540) [1]	18.88 (480)	37.59 (955)
70" Non-fused with (N, S, H or L-Class Breakers) OR 75" Fused with (F-Class Breakers)	Below	31.50 (800) [1 2]	13.88 (353)	32.59 (828)
	Above	31.25 (794) [1]	18.88 (480)	37.59 (955)
80" Non-fused with (N, S, H or L-Class Breakers)	Below	41.50 (1054) [1 2]	13.88 (353)	32.59 (828)
	Above	41.25 (1048) [1]		
80" Fused with (F-Class Breakers)	Below	36.50 (927) [1 2]	18.88 (480)	37.59 (955)
	Above	36.25 (921) [1]		

Note: Dimensions shown in inches and (mm).
1 Reduce by 7.88" if upper neutral is present with cables above or if a lower neutral is present with cables below.
2 Reduce by 4.00" if an 800-3200A breaker is located in the bottom compartment.
Reductions per notes 1 & 2 are additive. Example: cables below + lower neutral + 2000A breaker in bottom compartment = B-11.88.
3 Reduce cable space by 4.00" x 4.82" if Neutral Riser is present. (Consult Factory).
4 4.10 (104) if W=22; 4.60 (117) if W=32.

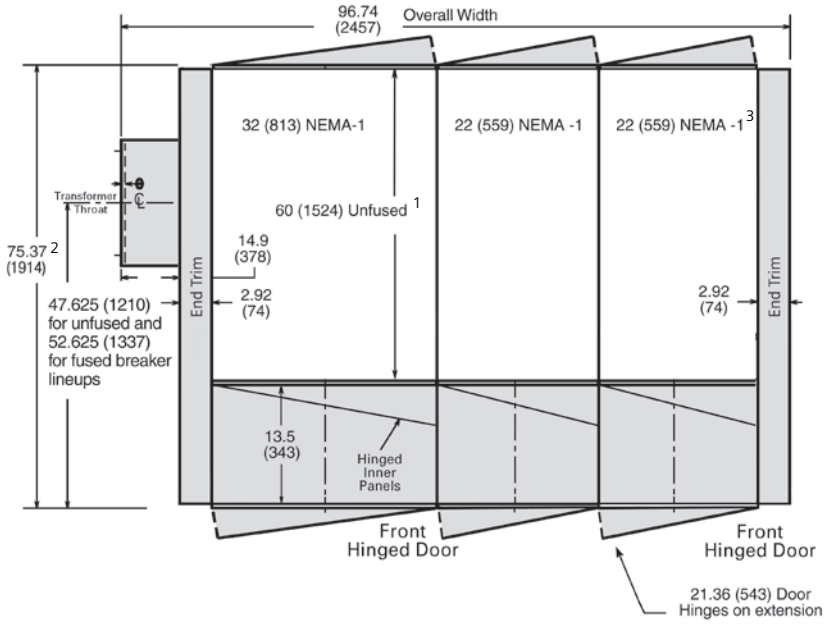
Indoor Side View



A Equipment Depth	E Breaker Compartment Depth	F Rear Compartment Depth	G Anchor Bolt Spacing
60 (1524) Non-fused breakers	19.8 (503)	22.4 (569)	59.13 (1502)
65 (1651) Fused breakers	24.8 (630)	22.4 (569)	64.13 (1629)
70 (1778) Non-fused breakers	19.8 (503)	32.4 (823)	69.13 (1756)
75 (1905) Fused breakers	24.8 (630)	32.4 (823)	74.13 (1883)
80 (2032) Non-fused breakers	19.8 (503)	42.4 (1077)	79.13 (2010)
80 (2032) Fused breakers	24.8 (630)	37.4 (950)	79.13 (2010)

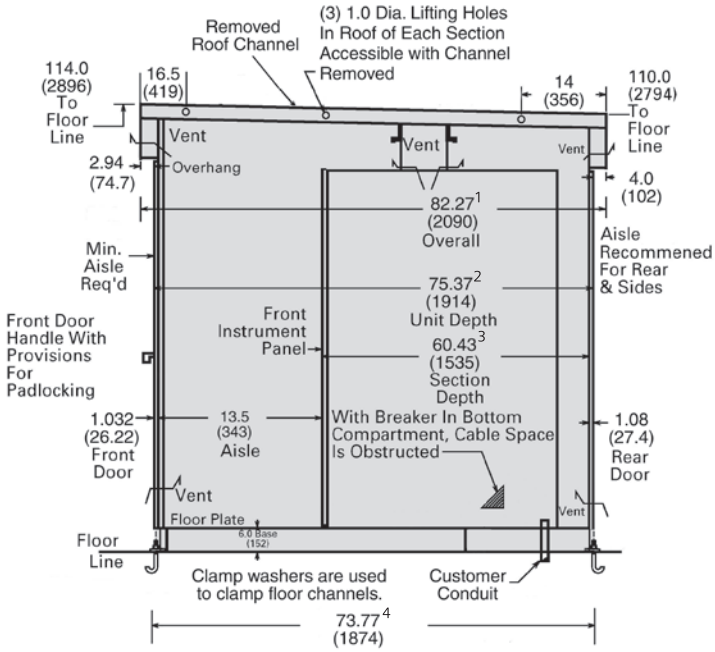
Note: Dimensions shown in inches and (mm).

Outdoor Non-Walk-in Floor Plan



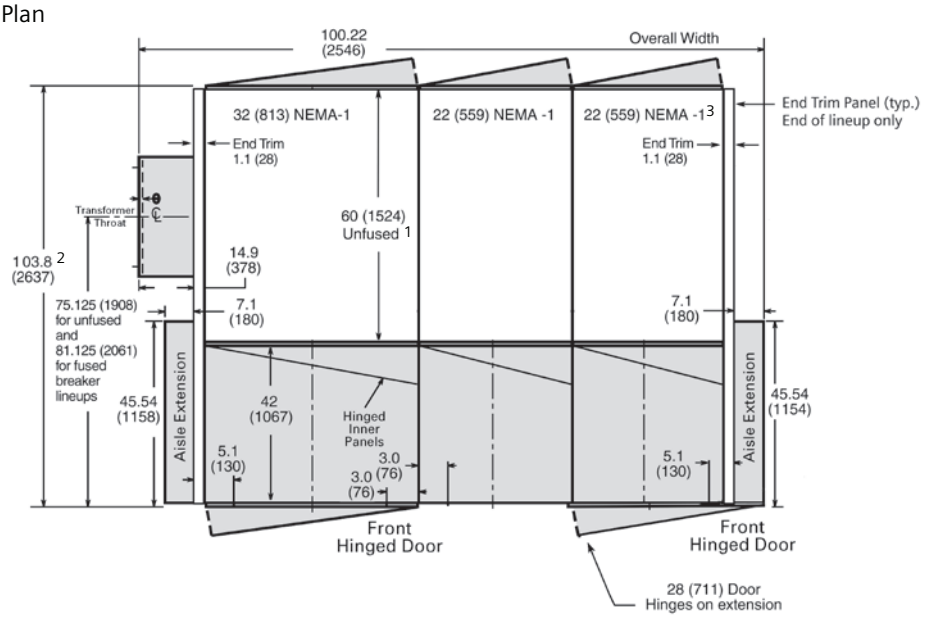
1 60″ is representative for a 60″ deep switchgear internal structure. For other internal structure depths (65 or 75) add extra depth to 60″ that is shown.
2 75.37 is representative for a 60″ deep internal structure. For other internal structure depths (65 or 75) add extra depth to 75.37 that is shown.
3 Refer to appropriate indoor plan view for available customer conduit information.

Outdoor Non Walk-in Side View



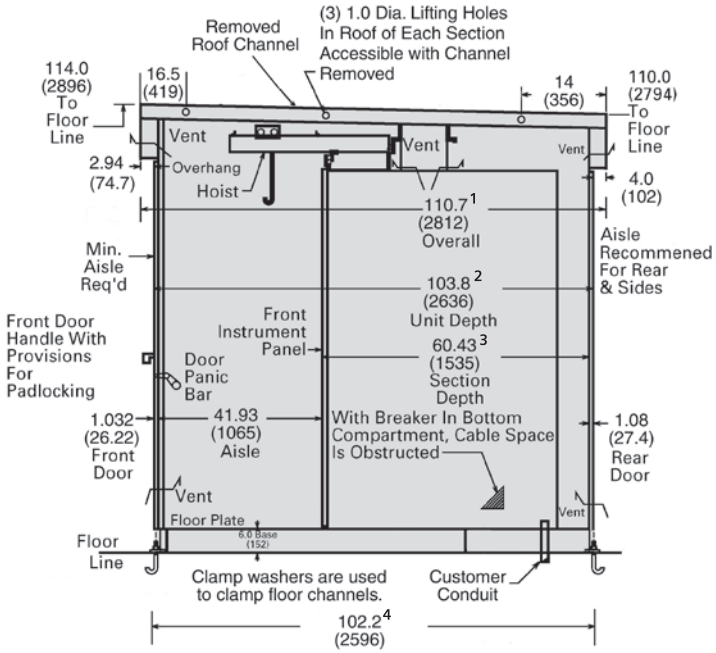
Dimensions shown in inches (mm)
1 82.27 dimension is based on 60″ internal frame structure and if a deeper internal frame structure is used (65 or 75) the extra depth should be added to the 82.27 dimension.
2 75.37 dimension is based on 60″ internal frame structure and if a deeper internal frame structure is used (65 or 75) the extra depth should be added to the 75.37 dimension.
3 60.43 dimension is based on 60″ internal frame structure and if a deeper internal frame structure is used (65 or 75) the extra depth should be added to the 60.43 dimension.
4 73.77 dimension is based on 60″ internal frame structure and if a deeper internal frame structure is used (65 or 75) the extra depth should be added to the 73.77 dimension.

Outdoor Walk-in Floor Plan



1 60″ is representative for a 60″ deep switchgear internal structure. For other internal structure depths (65 or 75) add extra depth to 60″ that is shown.
2 103.8″ is representative for a 60″ deep internal structure. For other internal structure depths (65 or 75) add extra depth to 103.8″ that is shown.
3 Refer to appropriate indoor plan view for available customer conduit information.

Outdoor Walk-in Side View



Dimensions shown in inches (mm)
1 110.7 dimension is based on 60″ internal frame structure and if a deeper internal frame structure is used (65 or 75) the extra depth should be added to the 110.7 dimension.
2 103.8 dimension is based on 60″ internal frame structure and if a deeper internal frame structure is used (65 or 75) the extra depth should be added to the 103.8 dimension.
3 60.43 dimension is based on 60″ internal frame structure and if a deeper internal frame structure is used (65 or 75) the extra depth should be added to the 60.43 dimension.
4 102.2 dimension is based on 60″ internal frame structure and if a deeper internal frame structure is used (65 or 75) the extra depth should be added to the 102.2 dimension.

Voltage Transformers – External Metering and Relaying

Ratio	Accuracy Class at 60 Hz Burden W	X	Y	Volt-Amp Rating	Thermal Rating VA	Hertz
600:120	0.6	1.2	1.2	100	150	50/60
480:120	0.6	1.2	1.2	100	150	50/60
288:120	0.6	1.2	1.2	100	150	50/60

Control Power Transformers – 115°C Rise

kVA	Phase	Primary Voltage	Secondary Voltage
3 5 10 [1] 15 [1]	Single	240/480	120/240

Current Transformers for FSII WL Breaker Applications - External Metering and Relaying [2]

Ratio	Accuracy at 60 Hz Metering Burden (ohms) B-0.1	B-0.2	B-0.5	B-0.9	B-1.8	Class
100.5	1.2	—	—	—	—	C5
150.5	1.2	—	—	—	—	C7
200.5	1.2	—	—	—	—	C9
250.5	1.2	—	—	—	—	C12
300.5	0.6	0.6	—	—	—	C15
400.5	0.6	0.6	1.2	—	—	C20
500.5	0.6	0.6	1.2	—	—	C25
600.5	0.3	0.3	0.6	1.2	1.2	C21
800.5	0.3	0.3	0.6	0.6	1.2	C29
1000.5	0.3	0.3	0.6	0.6	1.2	C35
1200.5	0.3	0.3	0.3	0.6	0.6	C20
1500.5	0.3	0.3	0.3	0.3	0.6	C25
1600.5	0.3	0.3	0.3	0.3	0.6	C27
2000.5	0.3	0.3	0.3	0.3	0.3	C34
2500.5	0.3	0.3	0.3	0.3	0.3	C20
3000.5	0.3	0.3	0.3	0.3	0.3	C21
3200.5	0.3	0.3	0.3	0.3	0.3	C20

Current Transformers for FSIII WL Breaker Applications – External Metering and Relaying [2]

Ratio	Accuracy at 60 Hz Metering Burden (ohms) B-0.1	B-0.2	B-0.5	B-0.9	B-1.8	Class
2000.5	0.3	0.3	0.3	0.3	0.3	C20
2500.5	0.3	0.3	0.3	0.3	0.3	C20
3000.5	0.3	0.3	0.3	0.3	0.3	C20
3200.5	0.3	0.3	0.3	0.3	0.3	C20
4000.5	0.3	0.3	0.3	0.3	0.3	C20
5000.5	0.3	0.3	0.3	0.3	0.3	C20
6000.5	0.3	0.3	0.3	0.3	0.3	C20

[1] Requires complete compartment.
[2] Breaker compartment will accept 1 set of CT's each on top and bottom primary disconnects.

Switchboard Monitoring

Take control of your gear from your smart device

Remotely monitor, configure, and control using mobile phone or tablet (wireless or hardwired)

Arc flash safety

- Remotely open/close breakers from outside arc flash hazard zone – no longer need dedicated control panel
- Remotely activate breaker maintenance mode from outside arc flash hazard zone
- Remotely view breaker status from outside arc flash hazard zone

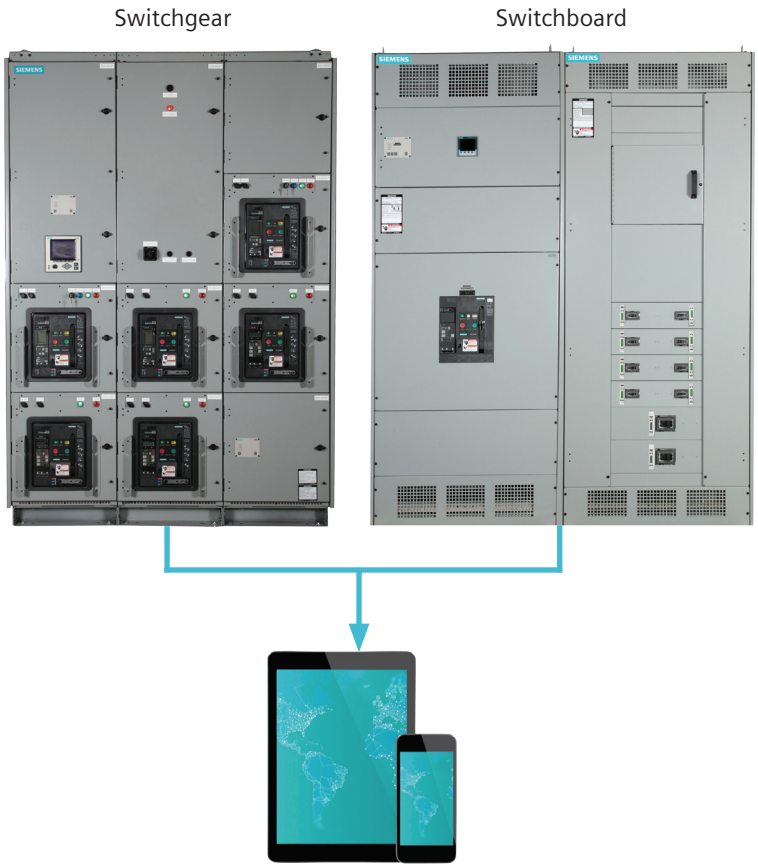
Ease of commissioning

- Set breaker settings via touchscreen using mobile phone or tablet

Security

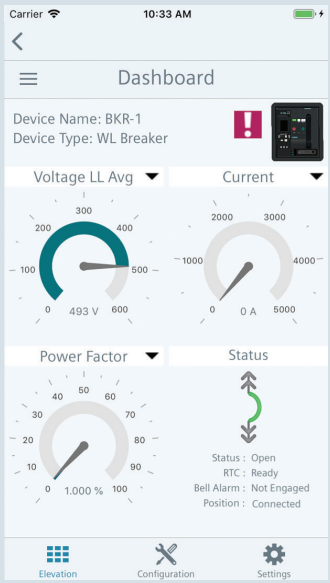
- Local security enabled WPA2 WIFI network only allowing local access

MindSphere (IoT) capable

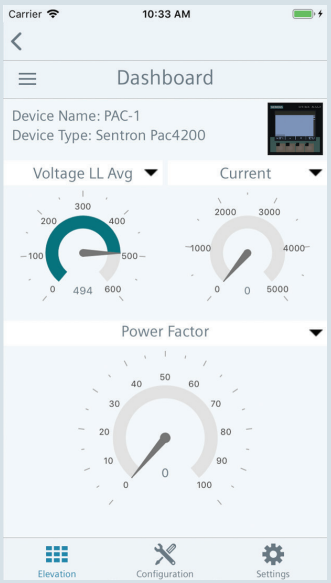


Intelligence and control at your fingertips

Elevation Screen

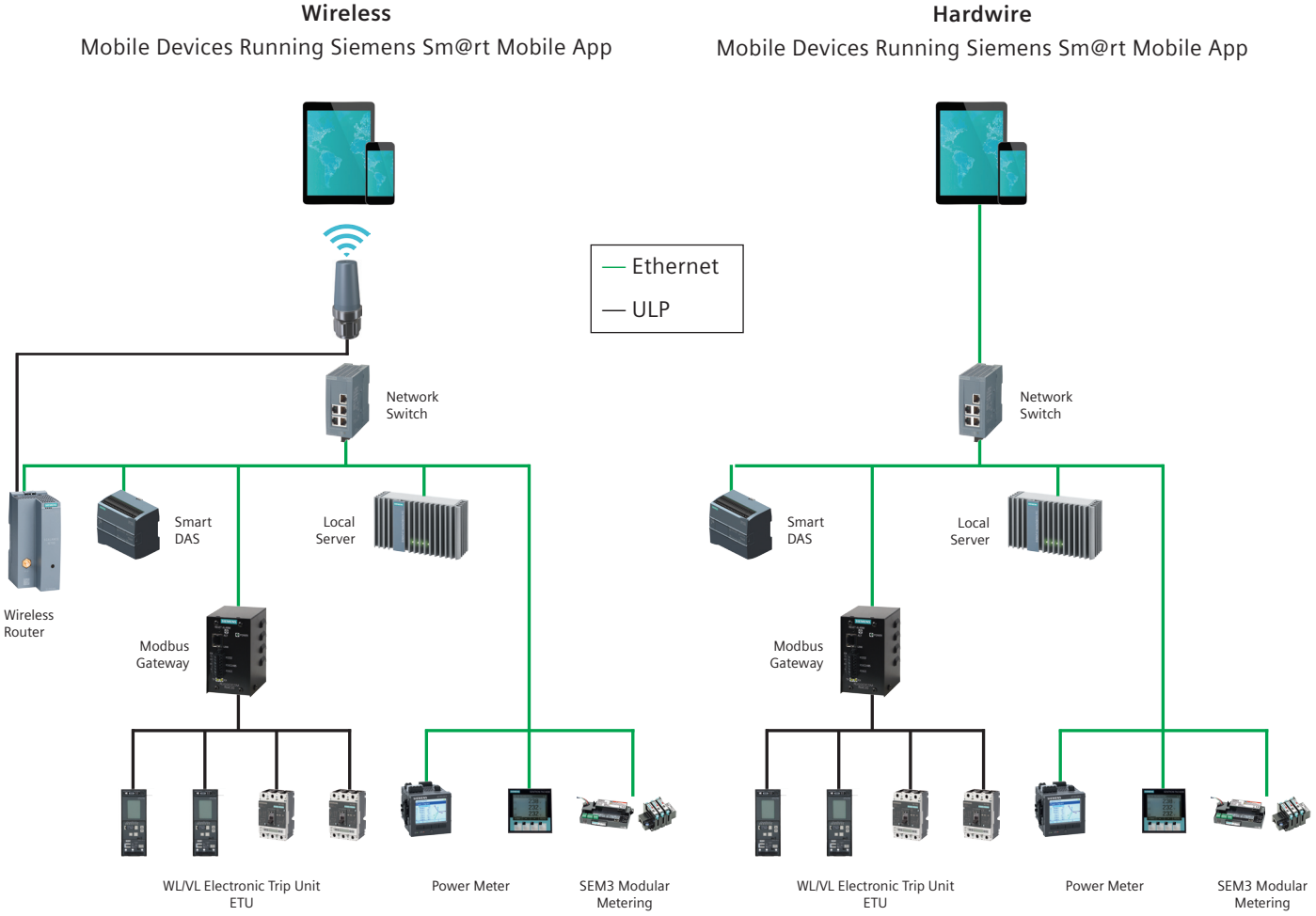


WL Breaker Dashboard



PAC 4200 Dashboard

Sm@rtGear Mobile Network Topology



Sm@rtGear™ Mobile Standard Features

- Available in Type WL LV Switchgear, SB Switchboards and P4/P5 Power Panelboard
- Integrates with Siemens application using phone or tablet
- Ethernet switch and WIFI access point with WPA2 encryption

Power/Insulated Case Circuit Breaker Feature

- ETU 776 with Sm@rt Dynamic Arc Sentry (DAS)
- MODBUS communication
- Protective settings and alarm functions
- Current and voltage monitoring
- Power metering functions
- Electrically operated breakers
- Remote open/close

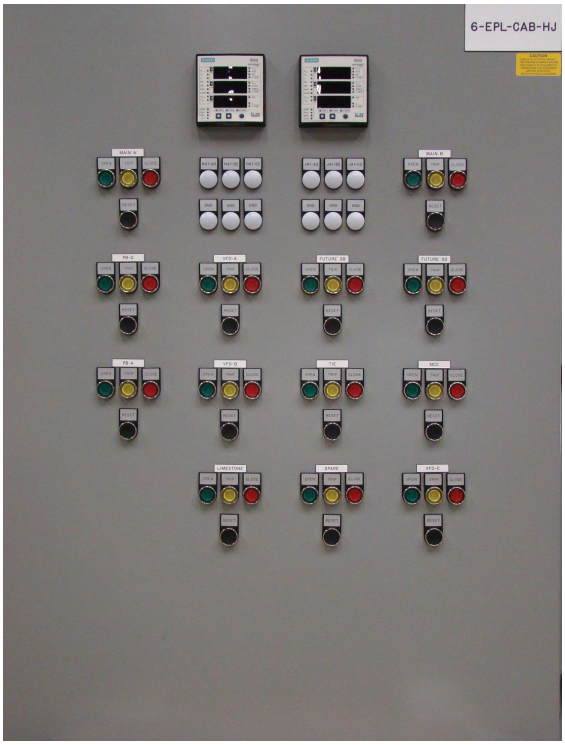
Molded Case Circuit Breaker Features

- ETU 586 with Smart DAS
- MODBUS communication
- Protective settings and alarm functions
- Current monitoring
- Breaker status

Sm@rtGear™ Mobile Optional Features

- PAC Digital meter integration
- SEM3™ submetering integration
- Siemens MindSphere IoT integration

Sm@rtGear™ LVS System Architecture



The past

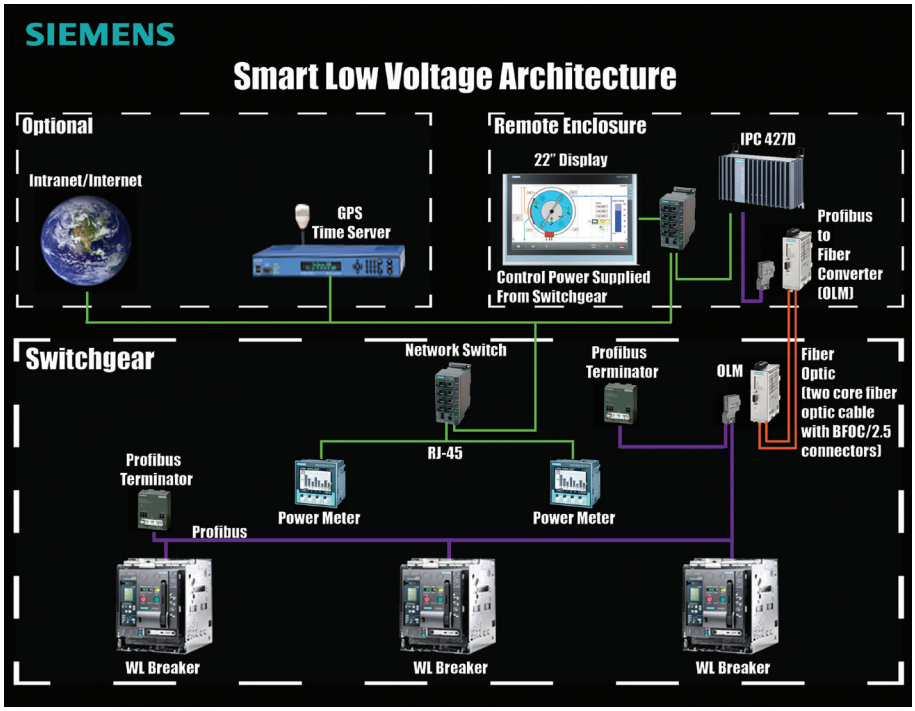
The future

Why settle for partial control when you can have total control and pay less? Traditional hard wired remote control panels provide additional safety for your personnel but Siemens Sm@rtGear™ LVS can provide the same breaker remote control plus remote monitoring and configuration of all embedded intelligent devices.

Siemens Sm@rtGear™ LVS is pre-configured and pre-programmed low-voltage metal-enclosed switchgear that provides out-of-the-box remote monitoring, configuration and control of embedded intelligent devices.

All of the Sm@rtGear™ LVS communication backbone is installed and tested at the Siemens factory and the user only has to physically connect the three communication cables that connect the low-voltage switchgear to the remotely mounted touch screen interface panel (HMI).

The remote HMI allows the user to access the intelligent devices embedded in the low-voltage switchgear. Using the HMI, the user can monitor, configure and control the intelligent devices. The Sm@rtGear™ LVS CPU acts as the local master and can also be a remote slave tied into an upstream supervisory system.



Sm@rtGear™ LVS standard features

- PC with pre-programmed software to remotely monitor, configure and control embedded intelligent devices and structural monitoring devices.
- 22" touch screen HMI pre-configured and programmed with application specific graphical user interface (application specific elevation and one-line drawings) that act as user home page.
- Communication backbone linking embedded intelligent devices, CPU and HMI.
- ETU776 trip units in all breakers with Dynamic Arc Flash Sentry (DAS) that supports arc flash incident energy reduction.
- Electrically operated breakers with spring charge motor, shunt trip and remote closing coil.
- Metering and protective relaying functionality in all breakers.

Sm@rtGear™ LVS standard functionality includes:

- LVS one-line view
- LVS elevation view
- User Administrator
- Cell Blocking
- WL breaker control (Password or hardware enabled/disabled)
- WL breaker monitoring
- WL breaker configuration Documentation

Sm@rtGear™ LVS optional functionality includes:

- WL breaker monitoring
- Digital meter monitoring (provided at no additional cost if digital meter is supplied)
- TPS 6 SPD monitoring (provided at no additional cost if SPD is supplied)
- High Resistance Grounding (HRG) (provided at no additional cost if HRG is supplied)
- LVS structural monitoring
- Custom Maintenance Reports

Siemens Type WL Low-voltage Switchgear for Marine and Offshore Applications

Siemens offers low-voltage switchgear for marine and offshore applications. Siemens Type WL Low-voltage Switchgear can be manufactured to meet ABS, USCG, DNV and Lloyd's of London standards. Additionally all Siemens Type WL Low-voltage Switchgear is built to the applicable UL, ANSI and IEEE standards.

Equipment Ratings

- 635V AC maximum
- 3 phase 3 wire, 3 phase 4 wire
- 50/60 Hz
- 6000 amp maximum horizontal bus
- 6000 amp maximum vertical bus
- Silver plated copper bus standard – tin plated copper optional
- Standard bus bracing 100kA –optional up to 200kA

Seismic Qualification

Seismic qualification to all major seismic construction standards (IBC, UBC, CBC, SBC, BOCA and IEEE 693) is available.

For additional Type WL low-voltage switchgear product information, including configuration information, refer to the WL Low-voltage Metal-Enclosed Switchgear Selection and Application Guide – Siemens Document No. LVSA-LVMES-0313.

Additional Industry Standards Compliance

Type WL switchgear with power circuit breakers are designed, tested and constructed in accordance with:

- **UL 1558** — Metal-Enclosed Low-voltage Power Circuit Breaker Switchgear
- **ANSI C37.20.1** — Metal-Enclosed Low-voltage Power Circuit Breaker Switchgear
- **ANSI C37.50** — Test Procedure for Low-voltage AC Power Circuit Breakers Used in Enclosures
- **ANSI C37.51** — Conformance Testing of Metal-Enclosed Low-voltage AC Power Circuit Breaker Switchgear Assemblies
- **NEMA SG5** — Power Switchgear Assemblies
- **NEC** — Applicable requirements of the National Electric Code (NEC)
- **CSA** — Optional CSA compliance with cUL labeling is available.
- **ANSI C37.20.7** — Optional Type WL arc resistant low-voltage switchgear is available and is UL listed to ANSI/IEEE C37.20.7. Type 2B arc resistant accessibility rating with maximum internal arcing short-circuit current rating of 100kA @508V and 85kA @ 635V

WL Drawout Circuit Breakers are in accordance with:

- **UL 1066** — Low-voltage AC and DC Power Circuit Breakers Used in Enclosures
- **ANSI C37.13** — Low-voltage AC Power Circuit Breakers Used in Enclosures
- **ANSI C37.16** — Preferred Ratings, Related Requirements, and Application for Low-voltage Power Circuit Breakers and AC Power Circuit Protectors
- **ANSI C37.17** — Trip Devices for AC and General Purpose DC Low-voltage Power Circuit Breakers
- **NEMA SG3** — Low-voltage Power Circuit Breakers

WL Arc Resistant Low-voltage Switchgear Features, Benefits and Ratings

Enhanced Safety

Siemens now offers arc resistant, metal-enclosed, low-voltage switchgear designed to provide an additional degree of protection for personnel performing normal operating duties in proximity to the energized equipment. Such duties include opening or closing circuit breakers, closed door circuit breaker racking, reading instruments, or other activities that do not require cover removal or opening doors (other than auxiliary/ instrument compartment doors).

Why Arc Resistant Switchgear

Standard metal-enclosed switchgear is designed to withstand the mechanical forces generated by bolted faults on the load terminals until a power circuit breaker or other protective device can interrupt the flow of fault current. This capability is verified by short-circuit and short-time withstand tests on the equipment and interruption tests on the power circuit breakers. During a bolted fault, the voltage at the fault location is essentially zero and the fault energy is dissipated throughout the power system. The arc generated within the power circuit breaker during interruption is cooled and extinguished by the circuit breaker arc chutes. The minimal out gassing of arc byproducts from the arc chutes is contained by the switchgear as verified by interruption tests.

Siemens arc resistant low-voltage switchgear provides an added degree of protection over standard metal-enclosed switchgear. In addition to bolted faults, Siemens WL arc resistant low-voltage switchgear is designed and performance tested to ANSI/IEEE C37.20.7 to provide protection from the hazards of internal arcing faults. An internal arcing fault can be caused by insulation degradation, insulation contamination, entrance of vermin, foreign objects coming into contact with the energized bus, or any other unplanned condition that creates an electrical discharge path through air. During an arcing fault, the voltage at the fault location is essentially the system voltage and the fault energy is focused within the switchgear enclosure. Arc temperatures can exceed 20,000 degrees Kelvin, rapidly heating the air and vaporizing metal parts. The expanding plasma creates severe mechanical and thermal stress in the equipment which can blow open doors and covers and burn through or fragment the enclosure.

Standard Features

- ANSI/IEEE Type 2B Arc Resistant to protect personnel at the front, back and sides of the equipment.
- UL Listed, performance tested and classified as arc resistant in accordance with ANSI/IEEE C37.20.7.
- Reinforced enclosure to withstand pressure from internal arcing faults.
- Internal venting system with pressure dams and pressure vents to channel the flow of arc fault gases and vent these gases out the top of the gear and away from personnel.
- Reinforced and gasketed front doors with additional hinges and latching means.
- One piece circuit breaker compartment doors with insert panels for control devices such as fuses, indicating lights and circuit breaker control switches when required.
- Reinforced bolted rear covers.
- Insulated/Isolated bus bar system.
- Integrally designed circuit breaker door sealing frame that allows the user to rack a circuit breaker to connect, test or disconnect position without having to install additional hardware (bellows, shrouds, etc) and still maintain arc resistant rating of the apparatus.
- Shutters in circuit breaker compartments.
- Riser Base with integrated arc plenum.
- Four high power circuit breaker stacking capability. No additional stacking/configuration restrictions.
- All section configurations available. Available in solidly grounded or resistance grounded configurations.
- Non-fused non current-limiting circuit breakers allow full power coordination.

Recommended Optional Features

Overhead plenum with exhaust duct. The system is designed to transfer the byproducts of the arcing event (smoke, particulate matter, heat, etc.) away from the immediate vicinity of the low-voltage switchgear when an internal arcing fault occurs. Typically, the

exhaust duct will vent the byproducts to a location usually outside of the room in which the low-voltage switchgear is located. The overhead plenum is attached to the roof of the low-voltage switchgear, and can be exhausted in any direction ((left, right, forward, backward) away from the switchgear assembly or unit substation.

Dynamic Arc Flash Sentry (DAS). DAS employs the unique dual parameter setting capability of the ETU776 trip unit, coupled with the ability to easily toggle to a lower arc flash parameter set. A normal operation parameter set can be optimized for selective trip coordination, while the second set is optimized for lower arc flash energy levels. The dynamic action comes from the ability to switch from the normal operation set to the arc flash limiting set based on the presence of personnel as they approach the flash protection boundary.

Zone Selective Interlocking (ZSI). If WL circuit breakers are arranged in several levels and minimum delays are desired, it is advisable to use the ZSI module. The circuit breakers are interconnected by these modules. In the event of a short-circuit, all circuit breakers communicate to determine and isolate the exact short-circuit location. Thus, only the closest upstream circuit breaker will be opened. The ZSI module provides the complete range of selectivity with the short delay time of tzsi = 50 ms. By shortening the delay time, the ZSI module significantly reduces arc duration, stress and damage in the event of a short-circuit in the switchgear.

High resistance grounding. Reduces available fault current during ground faults thereby reducing arc energy.

Ratings

- ANSI/IEEE Type 2B accessibility
- Maximum internal arcing short-circuit current: 100kA @ 508V and 85kA @ 635V
- WL power circuit breaker frames range from 800A to 6000A
- 3 and 4 pole WL power circuit breakers
- Maximum arcing duration: 500 msec
- Vertical bus continuous current ratings to 6000A
- Horizontal bus continuous current ratings to 6000A
- Maximum voltage: 635V
- 3 Phase 3 Wire, 3 Phase 4 Wire
- 50/60 Hz

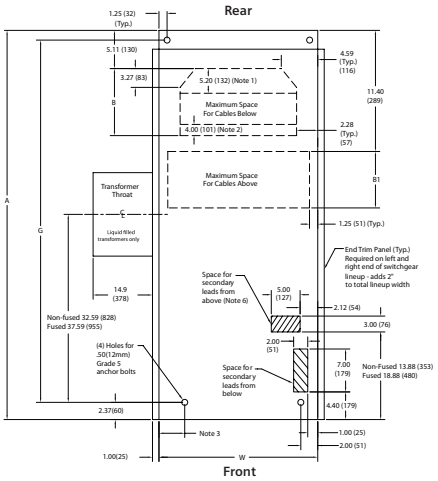
Enclosure Type

- NEMA 1 indoor

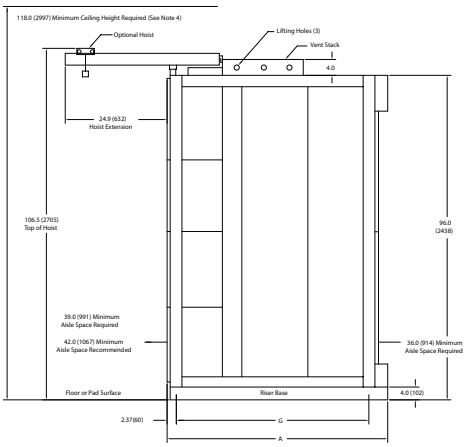
Industry Standards

- UL-1558
- ANSI/IEEE C37.20.1
- ANSI C37.51
- ANSI/IEEE C37.20.7

Dimensional Data



Plan View (WL Arc Resistant Switchgear without Optional Overhead Plenum)



Side View

A = Equipment Depth +2.6 (66)

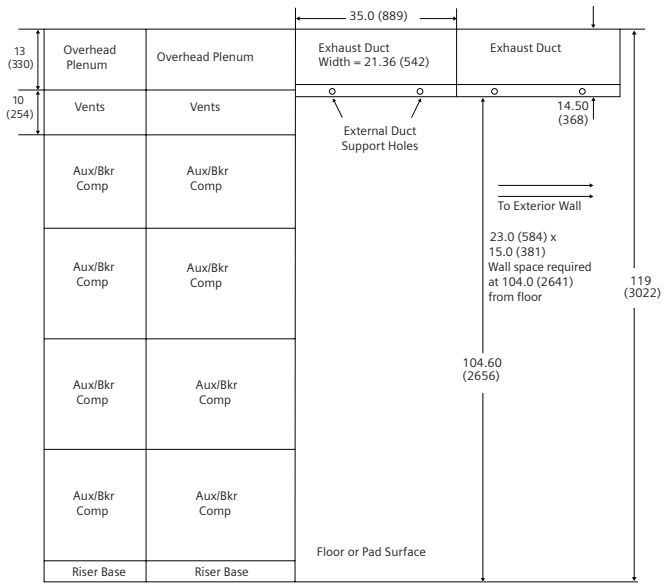
Anchor Bolt Spacing
G = Equipment Depth – 0.88 (22)

	Equipment Minimum Width W
3 Pole FS2	22 (559)
3 Pole FS3	32 (813)
4 Pole FS2	32 (813)
4 Pole FS3	40 (1016)

Equipment Depth	Cable Direction Below B	Cable Direction Above B1
60 (1524) Non-fused	20.00 (508)①	13.68 (347)
65 (1651) Fused	20.00 (508)①	13.68 (347)
70 (1778) Non-fused	30.00 (762)①	23.68 (601)
75 (1905) Fused	30.00 (889)①	23.68 (728)
80 (2032) Non-fused	40.00 (1016)①	33.68 (855)
80 (2032) Fused	35.00 (889) ①	28.68 (728)

① Space available for cables below is reduced by 5.20 inches when a lower neutral bus is present.

Dimensional Data



Front View: WL Arc Resistant Switchgear with Overhead Plenum

Note: Dimensions shown in inches and (mm).
Drawings are not to scale.

1. Space available for cables below is reduced by 5.20 inches when a lower neutral bus is present.
2. Space available for cables below is reduced by 4.00 inches if an 800-3200A circuit breaker is located in the bottom compartment. Reductions per notes 1 & 2 are additive. Example: cables below + lower neutral + 2000A circuit breaker in bottom compartment = B – 9.20
3. 4.10 (104) if W = 22; 4.60 (117) if W = 32, W = 40
4. 118 (2997) minimum room ceiling height is required for ventilation of arc products for LV Arc resistant switchgear without overhead plenum.
5. 120 (3048) minimum room ceiling height is required for LV Arc resistant switchgear with overhead plenum.
6. Not applicable for Overhead plenum application. Consult Factory for guidelines for secondary leads from above solutions.
7. Custom designed exhaust duct is provided when the exit is towards the front to clear the overhead hoist. Cross-sectional area of the exhaust duct remains same as shown in figure. Wall cutout required is same at 104 (2641) from floor.
8. Siemens to provide weatherproof box to be installed outside the exterior wall over the exhaust duct exit.
9. The area outside the exhaust duct vent needs to be kept clear of personnel and equipment due to the potential for pressurized exhaust gases being expelled in the area as a result of arc fault in the switchgear. An area of 4 feet X 4 feet centered on exhaust duct vent needs to be clear at all times.
10. Exhaust duct is not self supporting, recommended support every 6 linear feet minimum. The duct supports are not supplied by Siemens and must be supplied by the purchaser or the installing contractor.
11. LV Arc Resistant switchgear with and without overhead plenum should be installed on a solid surface to maintain the arc ratings.

Guide Form Specifications

A. This section supplements Section 16435 – Low-voltage Switch gear unless otherwise noted.
B. Comply with requirements of latest revision of ANSI/IEEE C37.20.7 – Guide for Testing Metal-Enclosed Switchgear Rated up to 38kV for Internal Arcing Faults.
C. Arc Resistant Electrical Ratings:
   1. Nominal System Voltage: [600 V] [480 V] [240 V] [208 V]
   2. Maximum Design Voltage: [635 V] [508 V] [254 V]
   3. Accessibility Type: 2B
   4. Internal Arcing Short-Circuit Current: [85kA @ 635V] [100 kA@ 508V]
   5. Arcing Duration: 100 msec, 500 msec
D. Arc Resistant General Construction:
   1. Indoor NEMA 1 enclosure
   2. Riser Base with arc plenum
   3. Insulated/Isolated bus bar system
   4. [Removable rear panels with captive screws.] [Hinged rear doors with captive hardware.]
   5. Devices connected to the primary bus such as: surge arresters, potential transformers, control power transformers and their associated current limiting fuses must be locatedin the rear of the switchgear in the bus/cable compartment and not in auxiliary compartments.
   6. Shutters in power circuit breaker compartments.
   7. One piece circuit breaker compartment doors with insert panels for fuses, indicating lights and control switches when required.

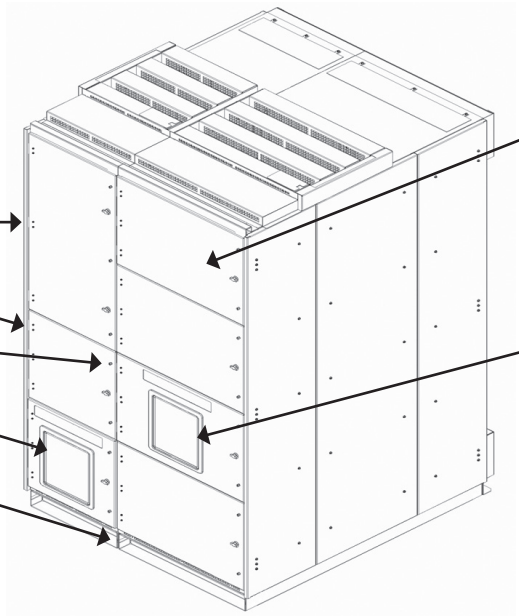
WARNING: This equipment contains hazardous voltages. Death, serious personal injury, or property damage may result if safety instructions are not followed. Only qualified personnel should work on or around this equipment after becoming thoroughly familiar with all warnings, safety notices, and maintenance procedures provided with the equipment. The successful and safe operation of this equipment is dependent upon proper handling, installation, operation and maintenance.

Arc Resistant Switchgear

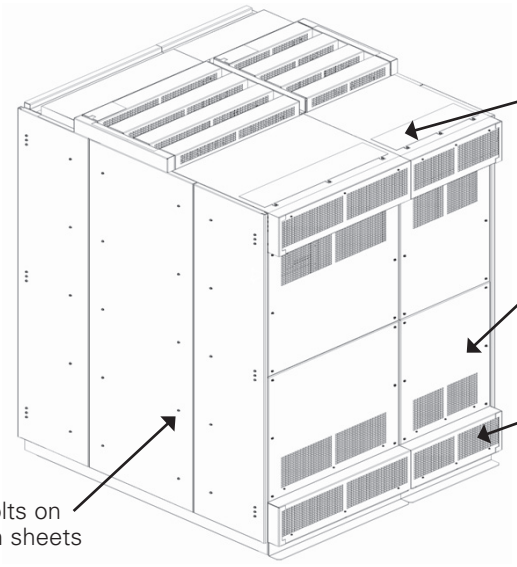
- Insulated and isolated bus
- Separation barriers and top venting
- Breaker shutters

Arc resistant metal-enclosed low-voltage switchgear is an optional product offering that contains and channels internal arcing fault energy. This new switchgear construction provides an additional degree of protection to the personnel performing normal operating duties in close proximity to the equipment while the equipment is operating under normal conditions. In each of the descriptions below, additional design features are indicated, all of which aid in directing faults upward away from personnel or reduce the chances of a fault by insulating and isolating live parts.

Front view



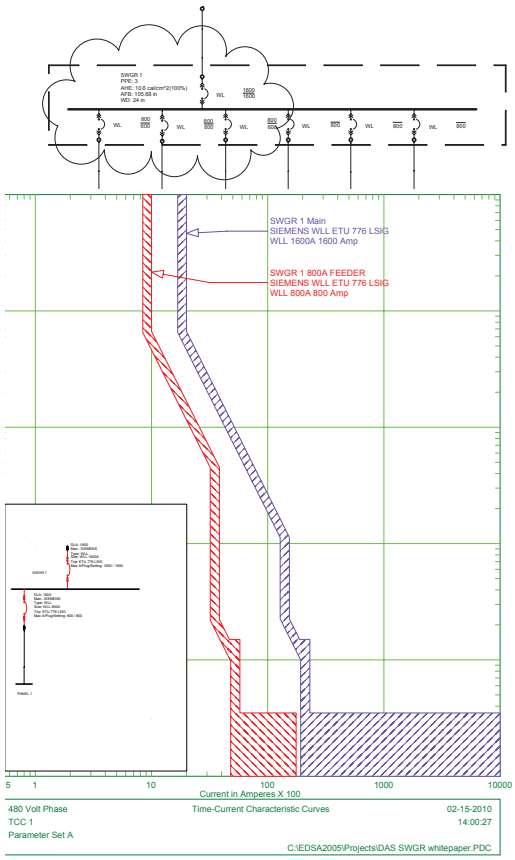
Rear view



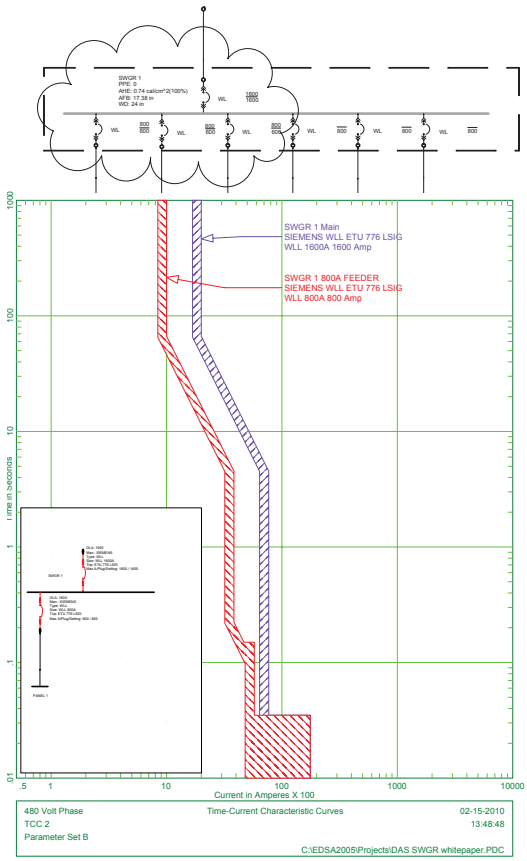
Dynamic Arc Sentry

One of the trip units available for the Siemens WL Family of breakers is the ETU 776. It offers dual parameter sets that enable the trip unit to automatically lower the instantaneous setting and thereby lower the available energy in a fault condition. Commonly referred to as "maintenance mode", making a breaker trip faster while engaged in any form of maintenance or just by being in proximity to energized equipment is an effective way to minimize arc flash dangers. If one is concerned about the effects of temporarily inhibiting selectivity, then rest assured that with the ETU 776 single step changes are possible giving engineers the ability to clear faults faster with minimum effect on coordination. In the example below the effects of the DAS system may be seen.

Example 1

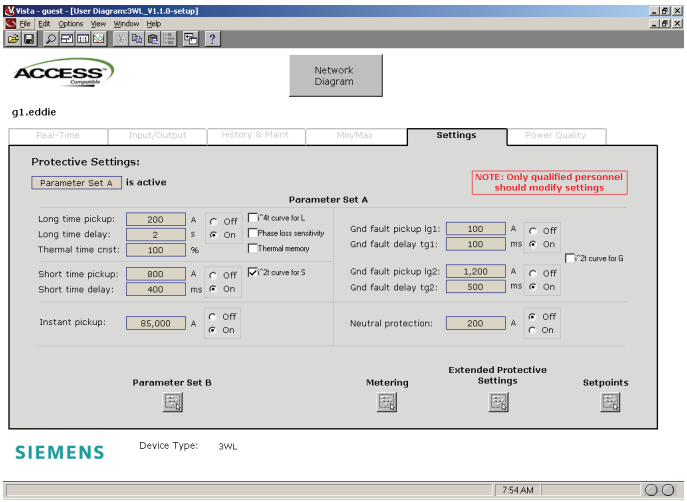


Parameter set "A"



Parameter set "B"

WL Breaker with ETU 776

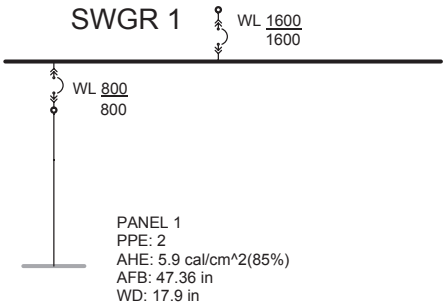


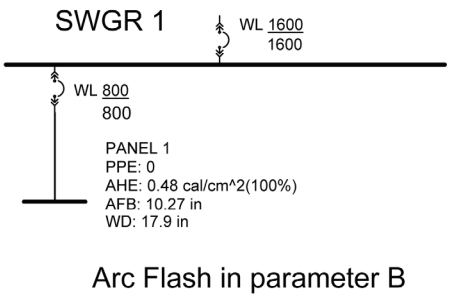
Dual Parameter sets enable "maintenance mode" - can be set remotely via software or automatically via digital input.

Under normal conditions, the switchgear's calculated arc flash energy will require PPE level 3 protection for anyone within the arc flash boundary. Incorporating the features built into the DAS system, and using the ETU776 trip unit, the system changes to parameter set B. In the second figure the instantaneous has been changed to a lower setting and the calculation shows a reduction of arc flash energy. The resultant PPE level has been reduced to 0.

Below is another example of the benefit of the DAS, or even manual switching, of breaker parameter set. The reduced settings set available in the ETU 776 can also be used to reduce the arc flash energy at downstream equipment. In the first figure on the left with normal settings the arc energy at panel 1 requires PPE level 2. After switching to the parameter B settings, the PPE level at Panel 1 is reduced to 0.

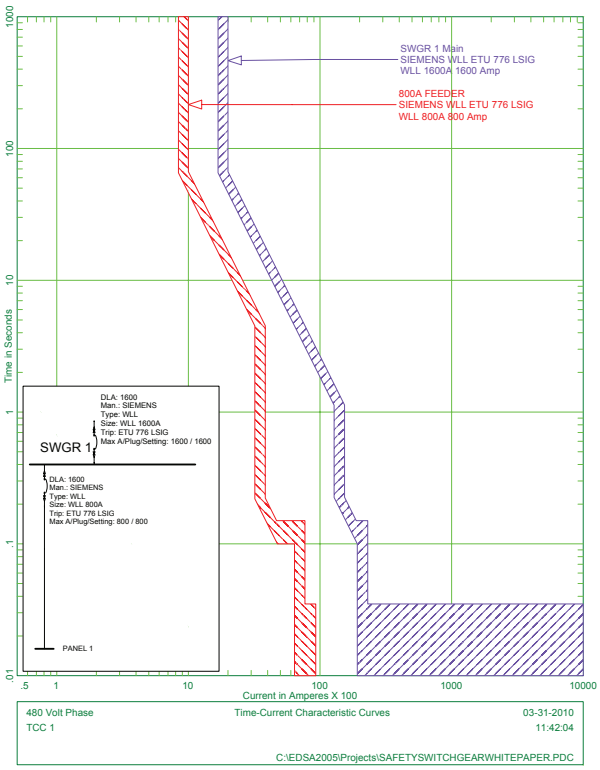
Example 2



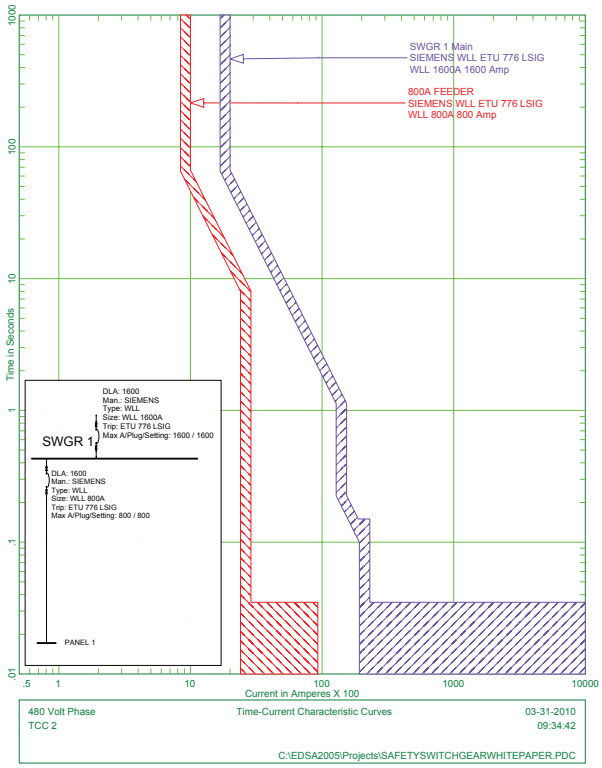


Arc Flash in parameter B

Arc Flash in parameter A



Arc Flash in parameter B



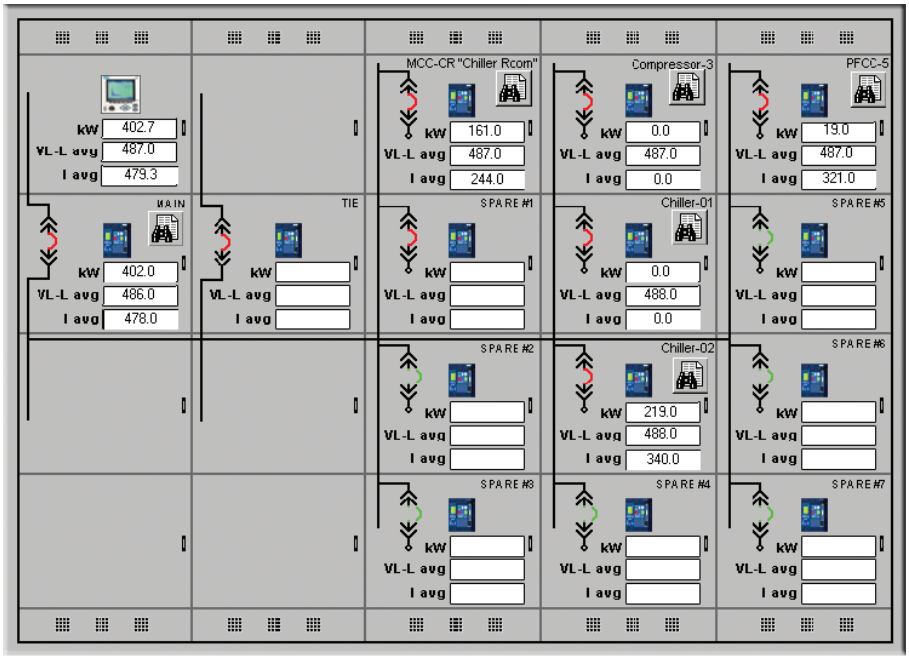
Remote operation and monitoring

- Remote Monitoring for temperature, metering and maintenance data.
- Remote Control via communications with or without interposing relays.
- Remote Racking feature.
- Remote Operation for opening and closing via local hand held pendant station.

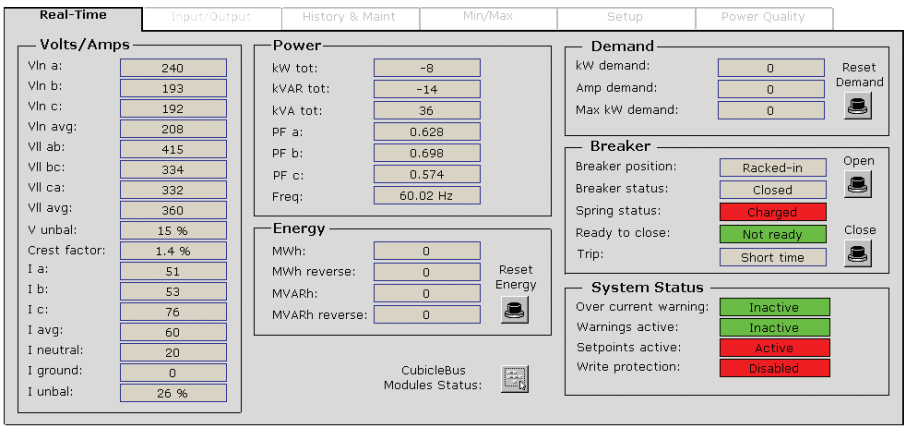
Remote Monitoring is an effective way to maintain separation between personnel and energized electrical equipment. With the latest equipment from Siemens, this is now easier and more cost effective than ever. Maintenance personnel and engineers can now view real-time electrical parameters, operating conditions (like temperature in the breaker and number of operations), and open and close breakers remotely. The WinPM.Net software with its Web Enabled interface allows multiple users to access only the information they are interested in from the convenience of their desks. Accountants can access cost allocation and utility billing information to enforce accountability for electrical resources and verify utility bills. Trip settings and other parameters for the LV power breakers can be modified and monitored remotely as well.

In addition, WL breakers with appropriate electrical controls and communication components, can be opened and closed through communications directly or with the use of interposing relays.

Unit sub #5 elevation



Real-time data from WL breakers with remote open/close capability



Remote Racking Device

Although it is always preferable to work on equipment that has been de-energized, in some cases it may not be practical. Siemens now offers the Remote Breaker Racking Device. This product uses an integral torque overload sensing mechanism and allows users to safely rack our WL breakers into the Connect, Test and Disconnect position from up to 30 feet away.

This allows the operator to be outside the arc flash boundary thereby providing additional personnel protection and reducing the PPE requirements. This system can be retrofitted to existing Siemens WL switchgear lineups.

Remote Racking Device

Remote Operator Pendant

This hand held pendant allows a user to remotely operate (open/close) a WL breaker without being in front of the switchgear. Standard cable lengths are 30 feet with other lengths available. This pendant, along with the Remote Racking device, can be used to improve personnel safety by putting operators outside the arc flash boundary. Maintenance personnel can remotely open breakers and close breakers, without being in front of the equipment. The Remote Operator Pendant can be used in combination with the Remote Racking Device for added personnel safety.

Remote Operator Pendant

Control port on WL Switchgear

Other protection options

- Infrared Viewing ports
- Zone Selective Interlocking
- High Resistance Grounding

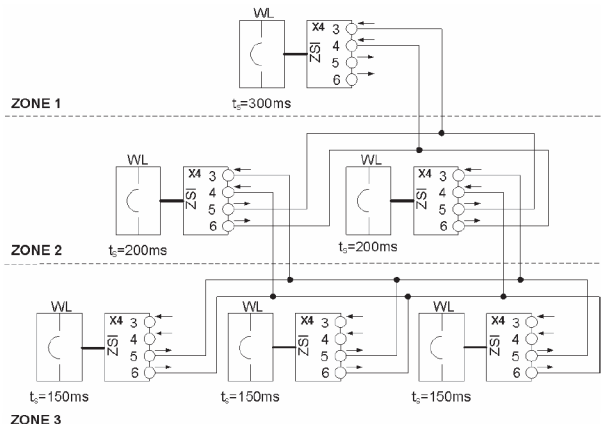
Infrared Viewing Ports

Infrared viewing ports allow maintenance personnel to monitor temperatures of the cable and bus connection points in the rear of the gear while it is energized and under load. Excessive temperatures can be an indication of a problem with a connection.

Infrared viewing ports

Zone Selective Interlocking

Zone Selective Interlocking eliminates any intentional time delay in the event a fault occurs between two breakers in adjacent zones. In the schematic to the right, representative time delay values are shown for the breakers in each zone. If a fault occurs on the load side of the downstream breaker, the ZSI system enables the upstream breaker's delay and allows the downstream device more time to independently clear the fault. If the fault occurs on the line side of the downstream breaker (between two zones), the delay in the upstream breaker will not occur. This allows the fastest tripping time for faults and will reduce the amount of arc energy which may be released. The ZSI function is available for short time delays and ground fault delays.



Zone Selective Interlocking

High Resistance Grounding

Research has shown that a high percentage of arc faults start as a phase to ground fault. High resistance grounding systems minimize the available phase to ground arcing current.

A high resistance grounding system reduces the magnitude of phase to ground faults. This will reduce the mechanical stress on equipment for the most common of faults and will reduce the magnitude of energy released.