Spectra Series™ Power Panelboards

EN-OPTION DESIGN CUTS COST

BENEFITS ACROSS THE BOARD.

For the distributor. The panelboard's modular design dramatically reduces the number of stock-keeping units – and simplifies configuration and ordering. All to better compete in the quick-ship, short-cycle market.

For the contractor. Simple configuration and fewer parts mean faster delivery, quicker installation, while oversized gutters mean easier wiring.

For the consulting engineer. Superior connections offer high performance and ensure reliability you can depend on. Universal system fits wide application range. Modular components offer easy adaptation.

For the end user. Fewer components mean easier maintainability. Superior connections ensure greater reliability. Panel modularity means speedy change-outs and maximum panel uptime.

INTRODUCING THE WORLD'S FIRST UNIVERSAL POWER PANELBOARD.

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GE'S NEW OP

GE's new Spectra Series™ Power Panelboard can meet just about any application you may have. It's so versatile and simple, a number of patents are pending for its innovative design.

Here are just a few things that make Spectra Series Power Panelboards so special:

- Universal interior. You can mount breakers, main lugs, main-fusible switches, main breakers, or branch-fusible switches on the same interior. Additionally, fusible and breaker devices can be mixed in the same panel.
- Unique bolt-down, pressure-locking connectors assure fast, confident mounting of breakers and switches to the bus bars.
- Easier to maintain and reconfigure. Field changes can be made in minutes – minimizing panelboard downtime.
- Because of its unique design and pre-engineered specifications, all components are UL Listed – whether factory-installed or field-assembled.

DOWN THE LINE.

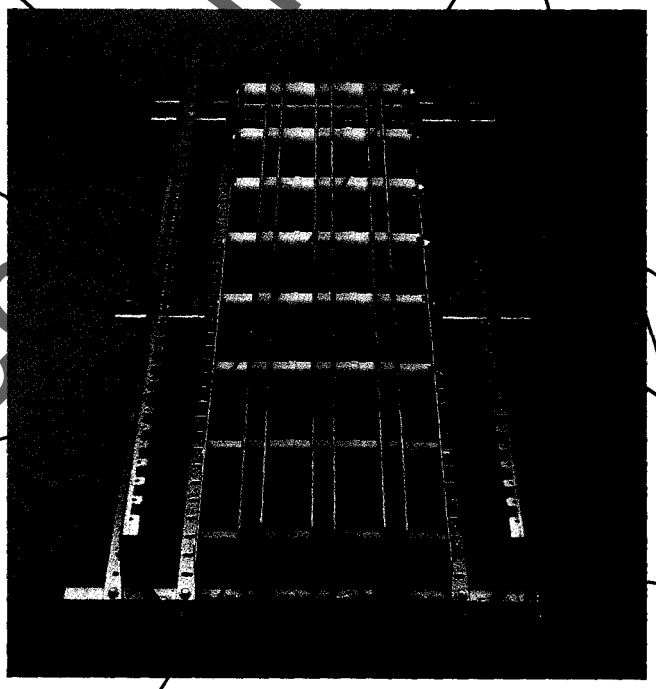
Item	Spectra Series™ Power Panelboard	Spectra Series™ Lighting Panelboard (formerly A-Series® Panelboard)
Maximum Voltage	600 Vac 250 Vdc	480Y/277 Vac 240 Vac
Maximum Main Rating – Amperes – Lug Only – Fusible Switch – Breaker	 1200A 1200A 1200A	 600A – 600A
Branch Rating Amperes – Fusible Switch – Breaker	 30A-1200A 15A-1200A	 – 15A-225A
Enclosures	NEMA 1 NEMA 3R/12	NEMA 1 NEMA 3R/12

Interior

MODULAR BUILDING BLOCK APPROACH

General Electric has designed a universal bus bar interior for use in all Spectra Series™ Power Panelboards and group-mounted switchboards. One style interior fits all applications.

The interior is the basic building block, designed for use with either fusible switches or molded case circuit breakers, or both. In addition, any main device (lugs only, fusible switch, or circuit breaker) can be installed in the factory or at the construction site.



Interior mounting holes at four corners for ease of installation onto studs in box.

Mounting support brackets between bus support rails and mounting rails.

Double-insulated system consisting of bus support assemblies of molded, glass-filled polyester insulation and insulating tubes over high-strength steel bolts spaced on seven-inch centers prevent bus bars from distorting during short-circuit conditions.

Mounting rails (2) with means for positioning, engaging and grounding pressure-locking connections.

Interior cross-member supports for mounting rails and bus support rails.

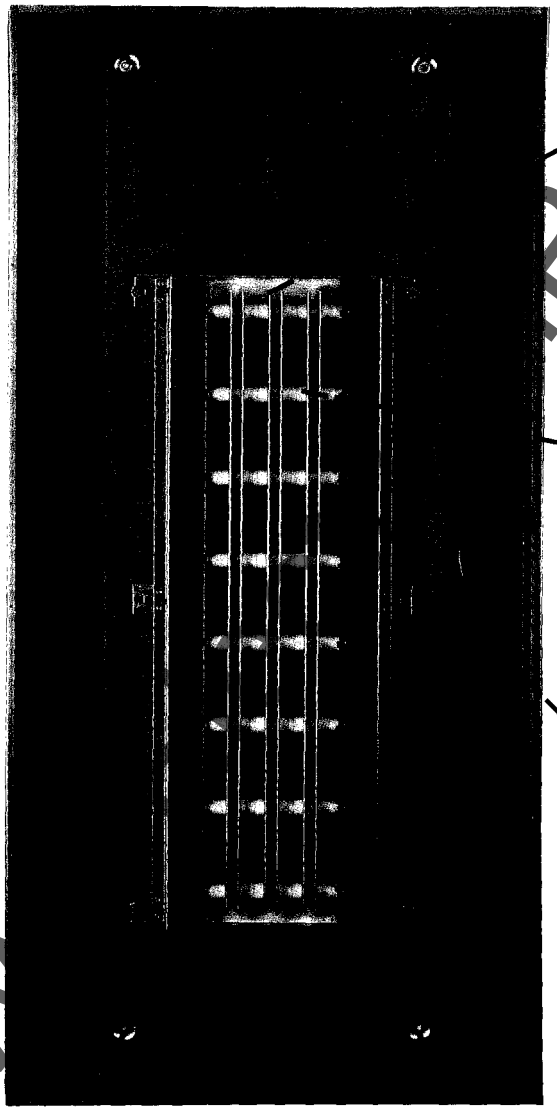
Isolated bus support rails (2).

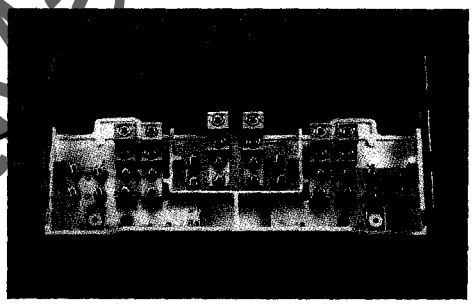
Silver-plated vertical bus bars. Aluminum with copper option.

This modularity is possible because the interior is designed to accept the spring-reinforced jaws with pressure-locked connections. The jaws and connections are an integral part of the main and branch modules.

The interior is fully rated; therefore, large amperage devices can be installed at either the top or bottom of the interior.

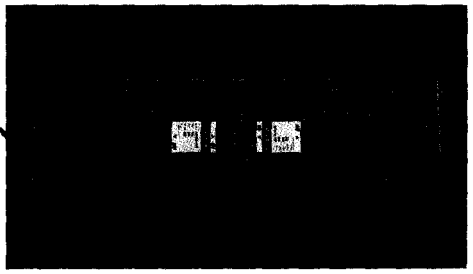
The vertical design of the bus maximizes convective heat transfer. The bus bar insulator system provides short-circuit protection, 600-volt spacing (without having to add baffles), and eliminates the need for any additional insulation.





Main modules include lugs only (mechanical shown, compression optional), fusible switch, units or molded case circuit breakers.

Circuit breaker modules accept standard off-the-shelf GE breakers for single- or double-branch mounting without any modifications, assuring proper phase arrangement.



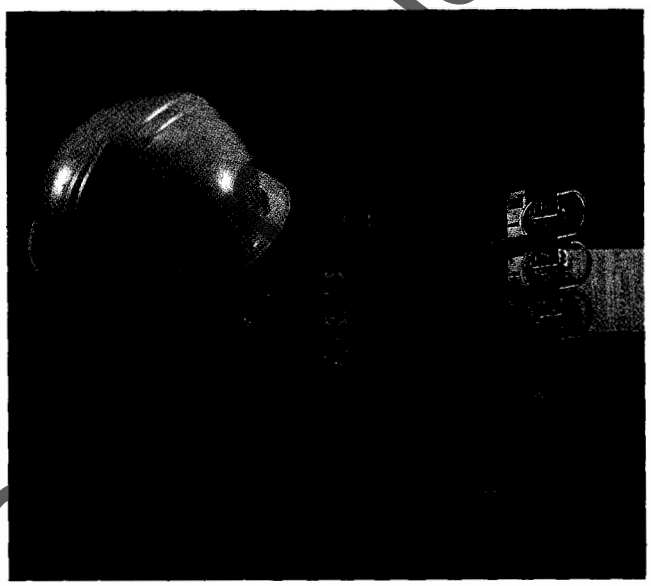
Branch fusible modules can be single-(all) or double-(through 200 amp) mounted, two- or three-pole.

Component Modules

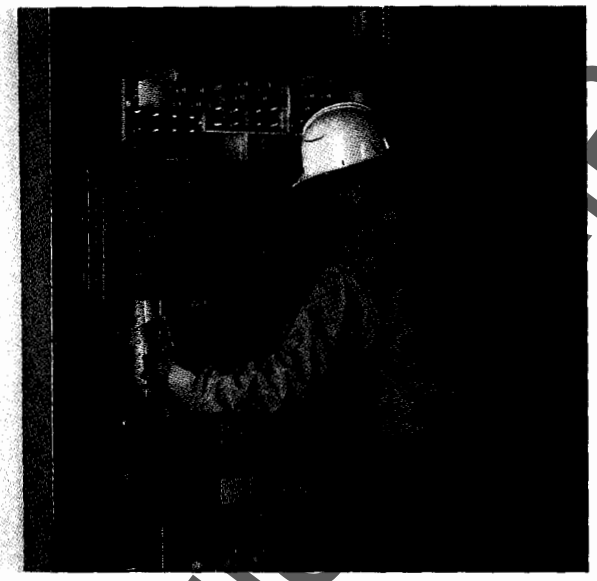
CONSTRUCTION

The universal interior has made possible a new family of modular components that provide the flexibility unique to the Spectra Series product line. By combining bolt-on construction, modular assembly, and pressure-locked connections to the interior – maintenance and tests are easier and faster.

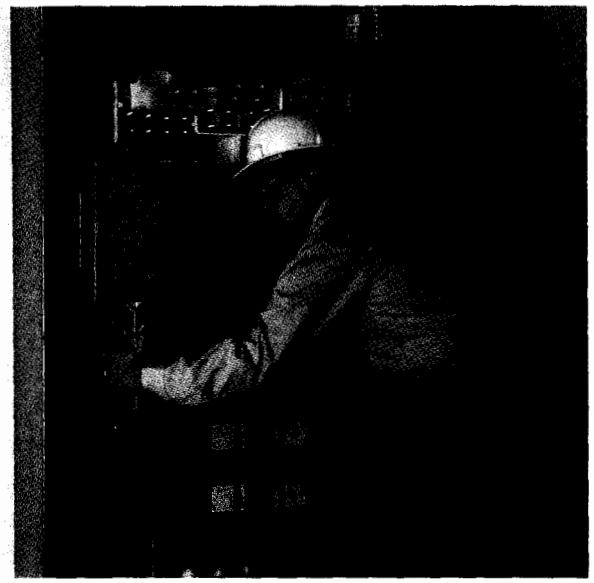
This innovative design approach also facilitates field reconfiguration. A main lug panel can be converted to a main breaker panel. Branch fusible units can be removed and circuit breaker units substituted.



All of the precise, time-consuming maintenance and test requirements to upgrade or change the devices can be done on a workbench.



After de-energizing the panel, a fusible switch or molded case circuit breaker module can be quickly removed from the panel. The panel can be re-energized (after filling space with proper filler plate) while the module and its devices are maintained.



When all of the bolted connections on the switch units or circuit breakers are tightened, the panel is shut down for a few minutes, the module is reinserted, the locked pressure connections are engaged, and the panel's power is turned back on.

Fusible switch and circuit breaker modules each consist of two assemblies: the protective device (fusible switch unit or molded case circuit breaker) and a connecting mechanism.

The connecting mechanisms are the intermediate electrical/mechanical connections between the protective device and the bus structure in the interior. There are two distinct designs. The fusible connecting mechanism switch is in the same housing as the fusible switch unit. The molded case circuit breaker connecting mechanism is separate from the breakers and is designed to accept standard GE circuit breakers.

Both types contain spring-reinforced jaws, housed in insulation, for engaging the bus bars. The jaws are bolted to copper bars within the mechanism. The fusible switch unit (or the breaker) is, in turn, bolted to these bars.

A positive, self-aligning, spring-loaded locking device is bolted to each side of the mounting module. This mechanism springs into place, and the locking latches are thus positively engaged in the interior mounting rails.

To prevent unauthorized personnel from accidentally releasing the locked pressure connections, the handles are bolted to each side of the module.

The circuit breaker mounting module has provisions for bolting various breaker ratings in place, and barriers to divert ionized gases away from line terminals of opposite devices on the same module.

Both types of connector-mounting modules are UL Listed.

ENGAGING FUSIBLE MODULE

FUSIBLE MODULE MOUNTED ON INTERIOR

Component Modules

BRANCH MODULES

Spectra Series™ Branch Modules include both fusible switch units and molded case circuit breakers. All circuit breaker and fusible switch modules (through 600 Amp) utilize a positive, spring-loaded locking device. To facilitate installation of the heavier 800 amp and 1200 amp fusible switch modules, bolted bus bar connections are used in lieu of the spring-loaded locking device.

All Spectra Series fusible switch units are quick-make, quick-break. The powerful mechanisms are over-center types. When operated, stored energy opens the blades quickly, interrupting the circuit. Contacts and blades are self-aligning and spring-reinforced. The design of the switch takes advantage of the magnetic forces during short-circuit to prevent popping of the contacts while the fuse clears the circuit.

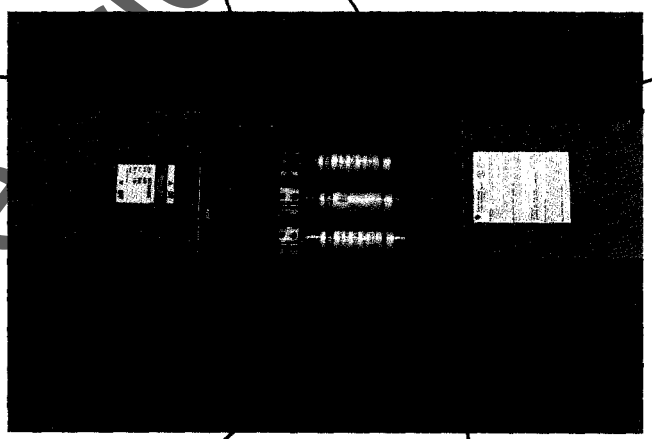
The 30 amp through 200 amp switches are double-break designs that allow internal and external visible proof of contact separation. The blades of the switch are mounted in a single rotor to insure simultaneous multipole operation. The 100 amp through 200 amp designs have two blades per pole, a feature of the GE heavy-duty safety switch. The bright red handgrip is highly visible. Fuse pullers are a standard feature.

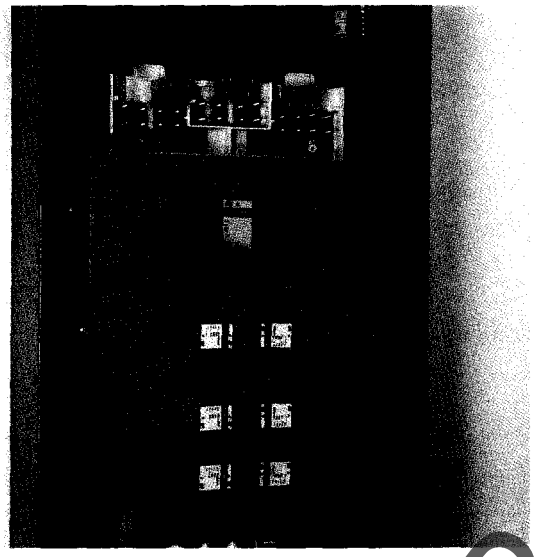
The 400 amp through 1200 amp designs are modular with heavy copper blades. The contact separation is visible. The long, rotary handle makes these high-amp switches easy to throw. All fuse types available in these switches are bolted in place and easily removable.

All current-carrying parts are tin or silver-plated. Wiping action insures clean, cool-running contact surfaces.

Fusible switches are available installed in factory-ordered power panelboards or off the shelf, to be easily installed in the field. 30 amp through 200 amp switches have double-branch capability for all fuse types.

Single-branch 30 amp through 100 amp (and 200 amp as an option) modules have a fusible switch unit on one side and a blank space on the other. Larger units are single-branched switches.



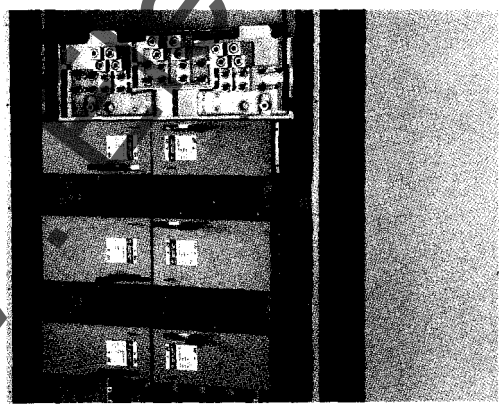


Family of branch fusible switch modules: 600 amp single branch, and 200 amp, 100 amp, and 30 amp double-branch

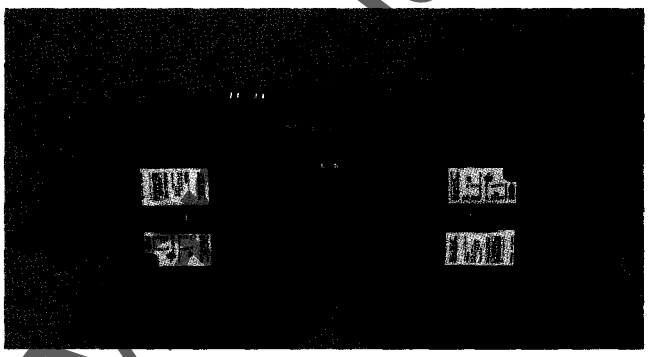
A narrow T-fused 200 amp double-branch module is available as the same width as the 30 amp module, it saves panel space.

Fuse provisions available in the switches include H, J, K, L, R, and T.

Molded case circuit breaker modules are available in a 15 amp through 1200 amp range.



Spectra Series Power Panel with intermixed circuit breaker and fusible feeders.



Double-branch module shows two circuit breakers without filler plates.

Family of fuses (200A) Spectra Series fusible switch units are available for all fuse types.

Component Modules

Spectra Series Power Panelboards permit easy changes in the field. For example, customers have the flexibility to make immediate field changes by removing a fusible or circuit breaker module and replacing it with a similar-sized (or smaller) module. This flexibility allows future branch circuits to have different amperages without major panel reconfiguration.

GE has eliminated a space penalty: different amperage fusible switch units can be mounted across from each other. The same is true for circuit breakers, as long as they are the same frame size.

Phase-balancing is easily accomplished by moving one of the spring-reinforced jaws from the A or C phase (as shipped) to the B phase. This enables panelboard load balancing when multiple two-pole modules are installed.

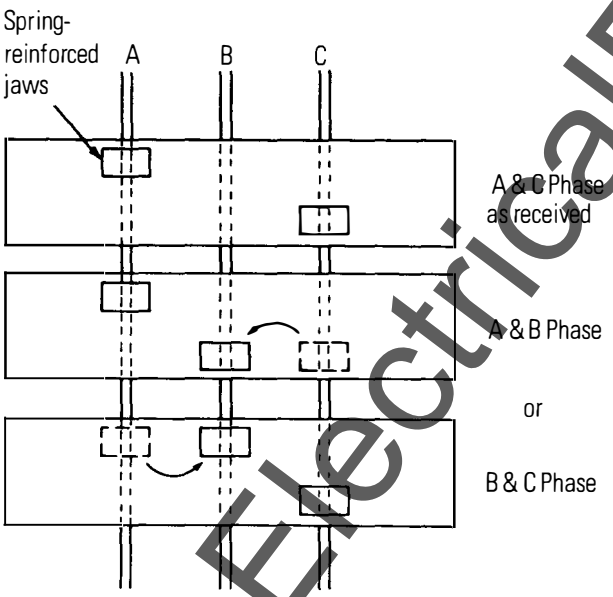
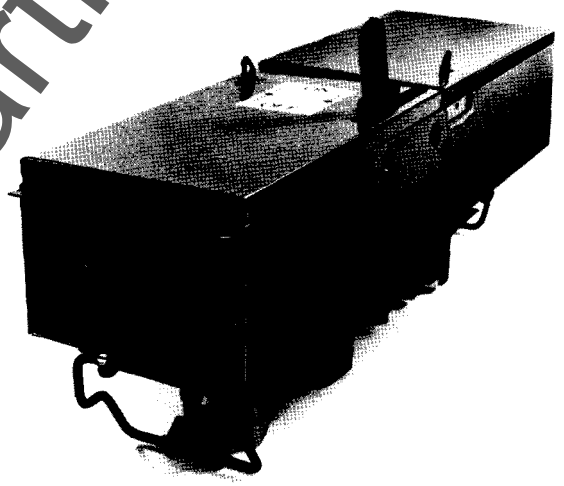
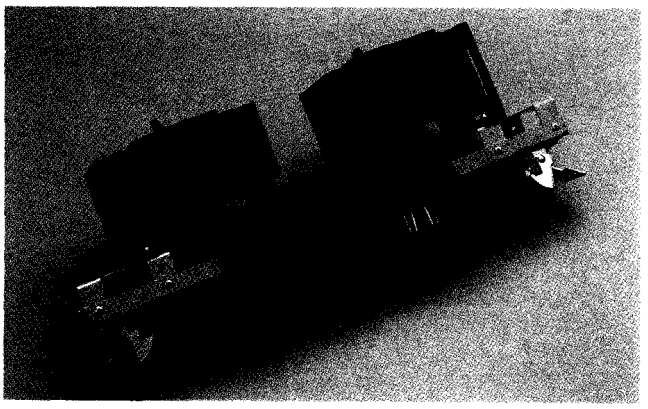


Fig. 8.1 Three-pole module has three sets of jaws; these jaws can be moved in a two-pole module to balance panelboard load (balance phases).

Expansion kits are available for 30 amp through 200 amp switches. These kits allow the conversion of double-branch units that have a blank space for an extra switch unit. The expansion units for the 30 amp, 60 amp, and 100 amp switches consist of switch assembly, mechanism, and load base mounted on a common plate for ease of assembly. In the larger 200 amp kit, the load base is not mounted on the plate.

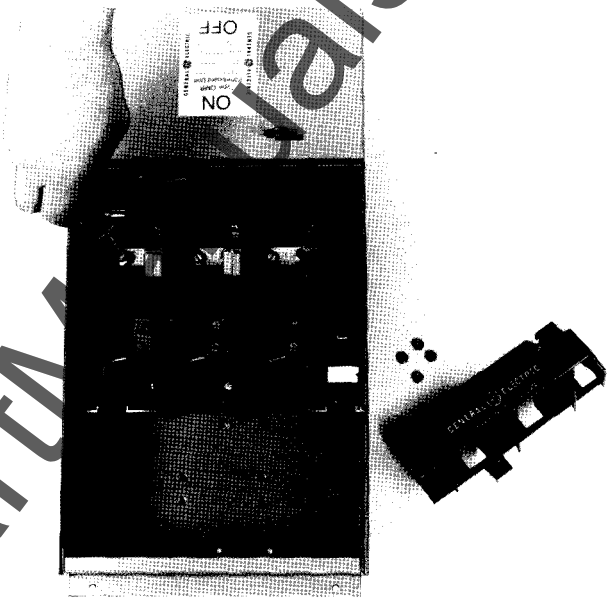


200 Amp/Blank fusible switch unit removed from panelboard.

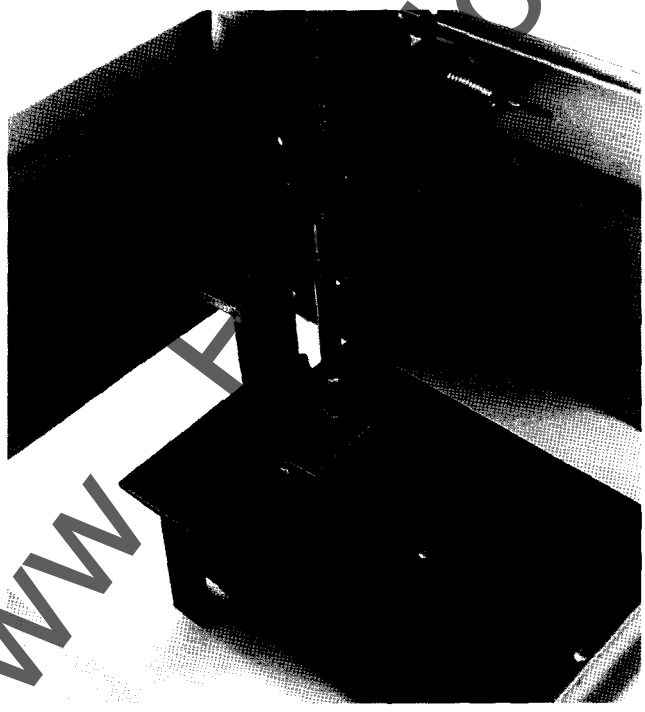


E-Frame circuit breakers mounted on Spectra Series breaker module.

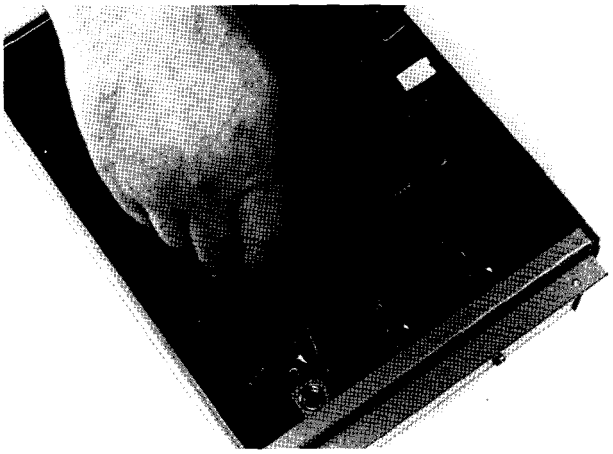
Preparing Blank section to receive expansion switch kit components.



Fastening expansion plate over connecting straps.



Installing connecting straps.



Installing load base.

Completed 200 amp/200 amp fusible switch unit.

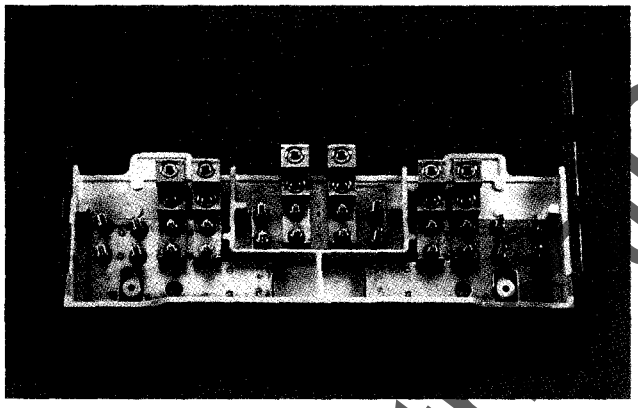
Component Modules

MAIN MODULES

Spectra Series™ Main Modules consist of lugs only, fusible switch, and molded case circuit breakers. They are either factory-installed or can be assembled in the field. Fusible switch and circuit breaker main modules are similar to the branch modules.

Main lug modules are available in ratings from 250 amp to 1200 amp and can be mounted at the top or bottom of the panel.

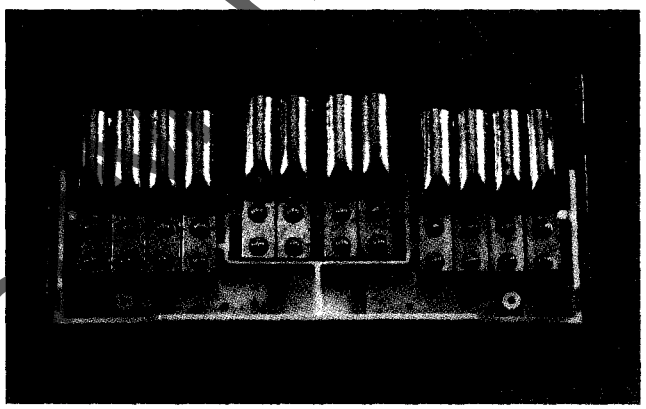
Main lug modules are 4X or 6X high. Mechanical lugs are aluminum/copper as standard. Compression and/or oversized lugs are optional.



Standard mechanical lugs on main lug module.

Optional compression and standard mechanical lugs.

Optional dual main lug modules are available to facilitate a feed-through application where an additional lug module is not desirable, 250 amp through 600 amp dual main lug modules are the same size as standard.



Dual main lug module with optional compression lugs.

NEUTRAL AND EQUIPMENT GROUNDING MODULES

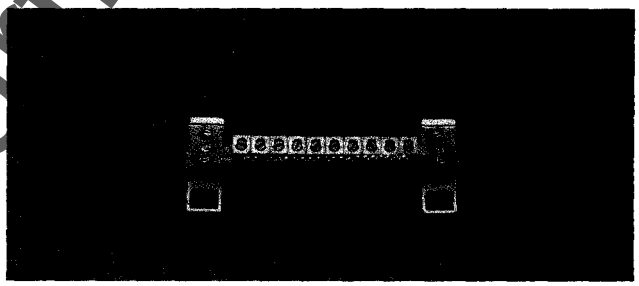
Neutral bar assemblies are available in ratings from 250 amps to 1200 amps. These neutrals have provisions for bonding and grounding when required. The number of circuits has been pre-engineered, depending on the amp rating. They can be mounted in either corner of the enclosure according to where the main is installed. The neutrals are fully rated.

In special applications where harmonic distortion is a concern, a second neutral can be installed providing a 200% rating. The two neutrals can then be connected with wires.

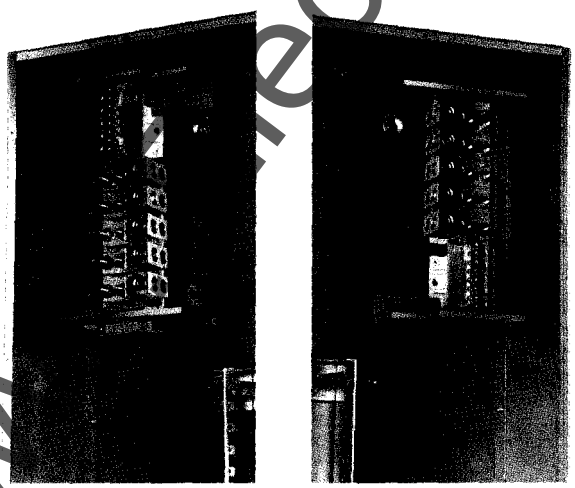
Mechanical lugs are aluminum/copper as standard. Compression, oversized lugs, and copper only are optional.

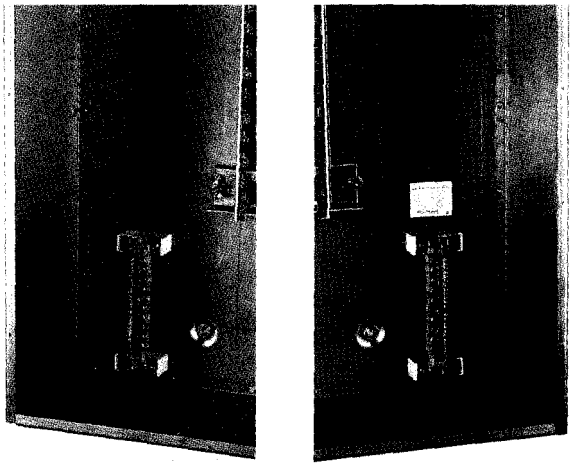
Equipment-grounding modules are available either as bonded or isolated (refer to the National Electrical Code Article 250-74, Exception 4).

Neutral assembly.



Equipment ground assembly.



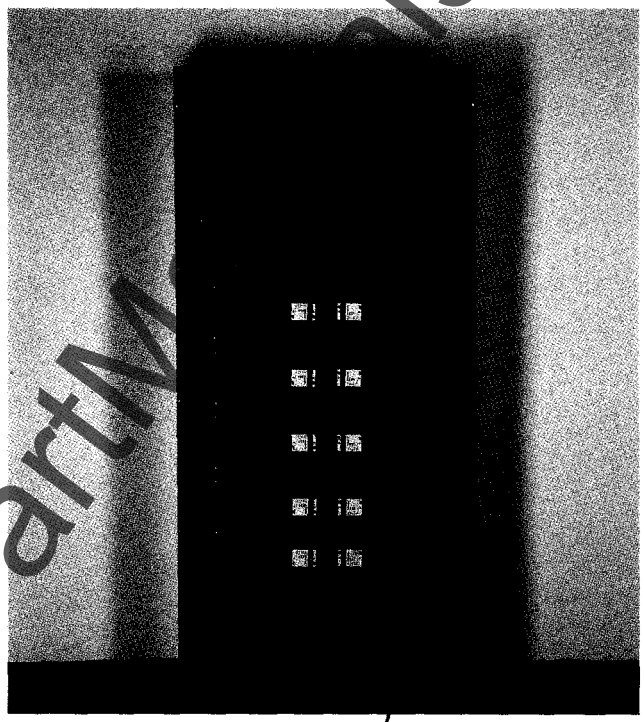


Alternate locations shown for neutral and equipment ground assemblies in a top-feed application.

Enclosures

All Spectra Series™ Panelboard Enclosures are galvannealed sheet-steel boxes with removable endwalls and screw-on fronts meeting UL Standard 50. They have heavy-duty box studs for accurate positioning and easy alignment of the interior. The standard four-piece surface fronts also meet UL Standard 50 and are painted ANSI 61 gray. Gutters are larger than Underwriters Laboratories' requirements for oversized wires to ease installation.

Branch circuit labels are available to assure quick circuit identification and lessen the possibility of switching the wrong circuit.



Removable trim allows quick access to wiring, without exposing bus bar interior to inadvertent contact.

Heavy-duty box studs for accurate positioning and easy alignment of interior.

Code-gauge galvannealed sheet steel five-piece box meets UL Standard 50. Full-flanged for strength and rigidity.

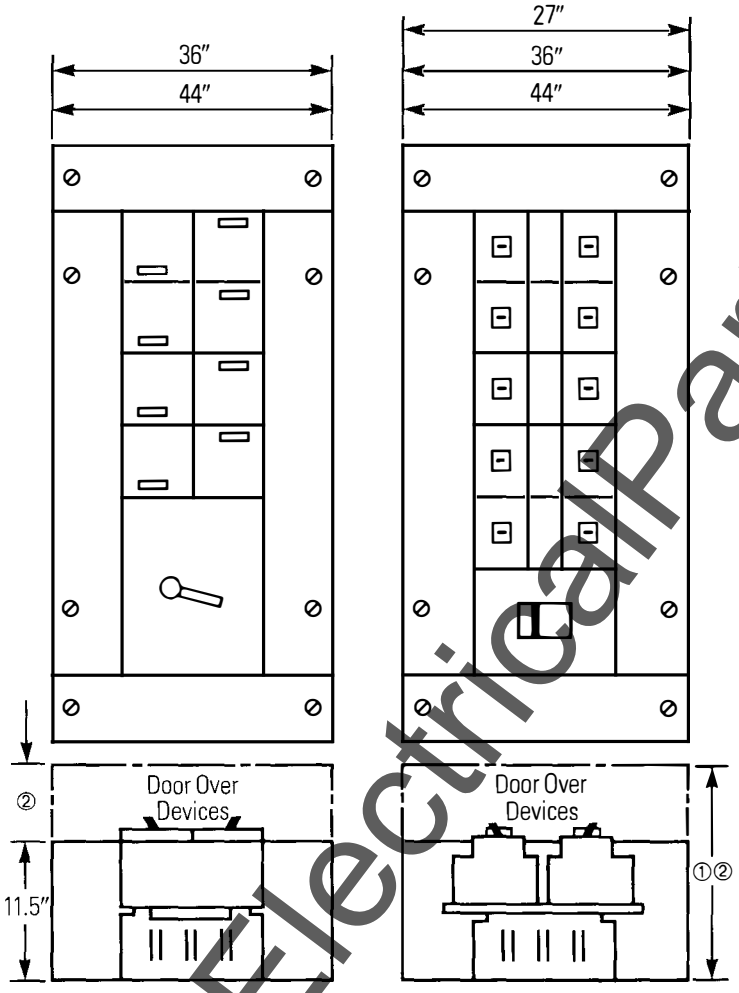
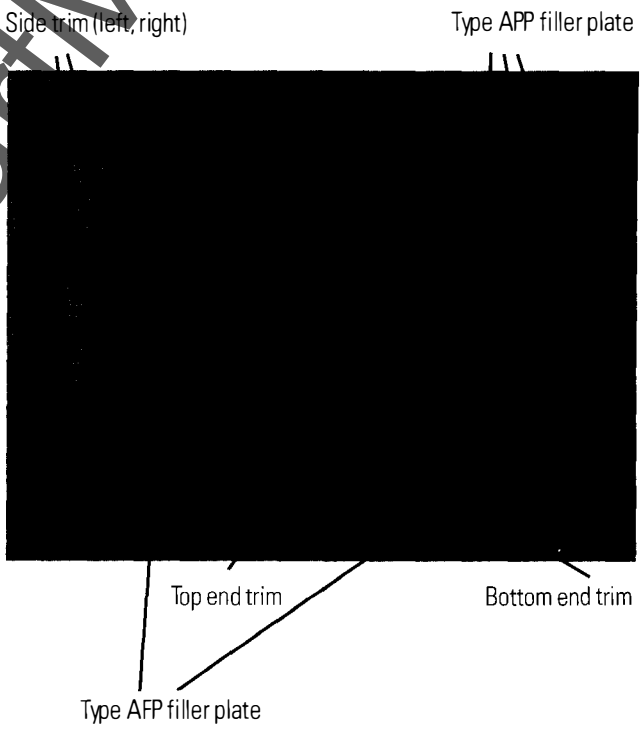
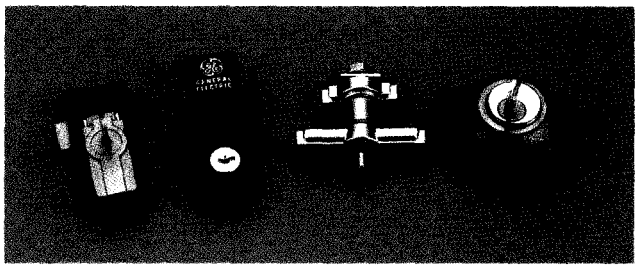


Fig. 13.1 Front and side views of enclosures containing all fusible switches (left) and all molded case circuit breakers (right).

① 27″ wide circuit breaker panel enclosures are 14.25″ deep and include door over devices as standard.
② 36″ and 44″ wide enclosures do not include a door and are 11.5″ deep. When doors are required, panelboard is 16.25″ deep.

Spectra Series Power Panelboards have numerous accessories that reinforce the flexible design concept. For example, Type AFP filler plates enable fusible switches of different widths to still align with the side trim. The Type APF side trim can be quickly removed to check wiring. And Type APP filler plates enable switches of differing heights to be installed in the future. All accessories are available in kit form.





Door locks that are available include an optional Corbin lock (far left), standard GE lock, optional T-handle and optional Yale lock.

Electrical Data

STANDARDS

All GE panelboards meet the latest revision of the following standards except where otherwise noted:

- UL 50, Cabinets and Boxes, Electrical
- UL 67, Panelboards
- UL 98, Enclosed and Dead Front Switches
- UL 489, Circuit Breakers, Molded Case, and Circuit Breaker Enclosures
- UL 512, Fuseholders
- UL 1446, Insulating Material
- UL 746D, Polymeric Materials – Fabricated Parts
- UL 746B, Polymeric Materials – Long-Term Property Evaluations
- UL 746A, Polymeric Materials – Short-Term Property Evaluations
- UL 746C, Polymeric Materials – Use in Electrical Equipment Evaluations
- UL 510, Tape, Insulating
- UL 486A, Wire Connectors and Soldering Lugs for Use with Copper Conductors
- UL 486B, Wire Connectors for Use with Aluminum Conductors
- UL 891, Dead Front Switchboards
- UL 969, Marking and Labeling
- Article 384, National Electrical Code
- NEMA PB1, Panelboards; NEMA KS1, Switches
- Federal Specifications:
  Panelboards, W-P-115a.
  Molded Case Circuit Breakers, WC-357B/GEN.
  Fusible switches, W-S-865c.

Note: Only panelboards containing all UL Listed devices can be UL labeled.

In addition to meeting or exceeding all applicable standards shown above, Spectra Series Power Panels meet GE's more stringent internal requirements, offering a greater margin of performance and safety.

APPLICATION

The following classifications and limitations of panelboards have been established by the Underwriters' Laboratories and the National Electrical Code. Note: An overcurrent protective device is a circuit breaker pole or single fuse.

Lighting Panelboards

- More than 10 percent of panelboard circuits are rated 30 amps or less, for which neutral connections are provided.
- Maximum 42 overcurrent protective devices per panel (including subfeeds but not main overcurrent protective devices). If more than 42 are required, two or more separate panelboards must be used. Example: A 2-pole device is considered as two overcurrent devices.
- When two or more separate panelboards are used, subfeed lugs or thru-feed lugs (of same capacity as incoming mains) must be included in all sections except the last one. Cables or bus bars for interconnection are not included.

Power (or Distribution) Panelboards

There is no limitation as to the number and rating of branch circuits, except as determined by available enclosures.

SERVICE ENTRANCE EQUIPMENT

- Must be located near the point of entrance of building supply conductors.
- Lighting and appliance panels must have one, but not more than two, main disconnections with a current rating equal to or less than panelboard rating.
- Power panelboards may have up to six operating handles to entirely disconnect panelboard from the source.
- Must include connector for bonding and grounding neutral conductor.
- A service entrance-type UL label must be factory-installed and will be provided on the equipment (when specified).

INTERRUPTING RATINGS – CIRCUIT BREAKERS

Panelboards have integrated short-circuit ratings. When fully rated, the rating is that of the lowest-rated device in the panelboard. When series-connected rated, the rating is that of the main and branch-tested/UL Listed combination.

SHORT-CIRCUIT RATINGS – FUSIBLE SWITCH UNITS

The short-circuit or interrupting rating of the fusible switch is the lower of the fuse or the switch rating. Spectra Series switches have a 200,000 amp short-circuit rating.

Table 15.1 Fuse Classification

UL Class	Available Amp Rating	Maximum Short-Circuit Rating in Sym. RMS Amps	Max. Voltage	Application
H	30-600	10,000	250/600	One-time general purpose
J	30-600	200,000	600	Fast-acting rejection sizing mains & feeders, current limiting
K	30-600	50,000 100,000 200,000	250/600	Dual element no rejection means, motor starting current limiting
L	800-1200	200,000	600	Rejection means available in two forms ▪ Fast-acting mains & feeders ▪ Time-delay motor starting current limiting.
R	30-600	100,000 200,000	250/600	Dual element rejection means, motor starting current limiting
T	100-600	200,000	250/600	Fast-acting small physical size mains & feeders, current limiting

Table 15.2 Maximum Horsepower ① Fusible Switch

Rating in Amps①	Volts, ac							Volts, dc	
	2-Pole				3-Pole			2-Pole	2-Pole
	120	240	480	600	240	480	600	125	250
	With Standard Fuses								
30	½	1½	3	3	3	5	7½	2	5
60	1½	3	5	10	7½	15	15	5	10
100	–	7½	10	15	15	25	30	–	20
200	–	15	25	30	25	50	60	–	40
400	–	–	–	–	50	100	125	–	50
600	–	–	–	–	75	150	200	–	50
	With "Time-delay" Fuses								
30	2	3	7½	10	7½	15	20	3	–
60	3	10	20	25	15	30	50	–	–
100	–	15	30	40	30	60	75	–	–
200	–	15	50	50	60	125	150	–	–
400	–	–	–	–	125	250	350	–	–
600	–	–	–	–	200	400	500	–	–

① Ratings are based on latest revision of the National Electrical Code Article 430. Horsepower ratings for switches with Standard Class H fuses are based on one-time fuses having minimum time-delay. When time-delay fuses are used, the horsepower ratings are maximum for the switches.

Table 16.1 Molded-Case Circuit Breakers Interrupting Ratings

Molded Case Circuit Breakers						Federal Specs C/B Class W-C-375B	UL Listed Interrupting Ratings in Thousand Amps								
				Rated Volts			rms Symmetrical ac Volts							dc Volts	
Construction	Frame	Trip Range (Amps)	No. Poles	ac	dc		120	120/240	240	277	480Y/277	480	600	125	250
HQ Frames	THQB	15-70	1	120/240	–	12a	10	10	–	–	–	–	–	–	–
		15-125	2	120/240	–	12a	–	10	–	–	–	–	–	–	–
		15-100	2,3	240	–	12b	–	–	10	–	–	–	–	–	–
HHQ Frames	THHQB	15-70	1	120/240	–	14a	22	22	–	–	–	–	–	–	–
		15-125	2	120/240	–	14a	–	22	–	–	–	–	–	–	–
		15-100	2,3	240	–	14b	–	–	22	–	–	–	–	–	–
XQ Frames	TXQB	15-30	1,2	120/240	–	15a	–	65	–	–	–	–	–	–	
		15-30	3	240	–	15b	–	–	65	–	–	–	–	–	–
Standard Frames	TEY	15-100	1	277	125	–	–	–	65	14	–	–	–	10	–
		15-100	2,3	480Y/277	250	–	–	–	65	–	14	–	–	–	10
	TEB	15-100	1	120	125	12a	10	10	–	–	–	–	–	5	–
	TEB	15-100	2	240	250	12b	–	–	10	–	–	–	–	–	5
		15-100	3	240		12b	–	–	10	–	–	–	–	–	–
	TED	15-100	1	277	125	13a	–	–	–	14	–	–	–	10	–
	TED4	15-50①	1	480	250	13b	–	–	–	14	–	14	–	–	–
	TED4	15-100	2	480	250	13b	–	–	18	–	–	14	–	–	10
	TED4	15-150	3	480	–	13b	–	–	18	–	–	14	–	–	10
	TED6	15-100	3	600	–	18a	–	–	18	–	–	14	14	–	–
	TED6	110-150	3	600	–	N/A	–	–	18	–	–	14	14	–	–
	TQD	125-225	2,3	240	–	12b	–	–	10	–	–	–	–	–	–
	TFJ	70-225	2	480	250	20a	–	–	25	–	–	22	–	–	10
	TFK	70-225	2	480	250	20a	–	–	25	–	–	22	–	–	10
	TFJ	70-225	3	600	–	20a	–	–	25	–	–	22	18	–	–
	TFK	70-225	3	600	–	20a	–	–	25	–	–	22	18	–	–
	TJD	250-400	2,3	240	250③	14b	–	–	22	–	–	–	–	–	10
	TJJ	125-400	2,3	600	250③	21a	–	–	42	–	–	30	22	–	10
	TJK4	125-400	2,3	600	250③	21a	–	–	42	–	–	30	22	–	10
	TJK6	250-600	2,3	600	250③	21a	–	–	42	–	–	30	22	–	10
	TKM8	300-800	2,3	600	250③	21a	–	–	42	–	–	30	22	–	10
	TKM12	600-1200	2,3	600	–	21a	–	–	42	–	–	30	22	–	–
Hi-Break® Frames	THED	15-30	1	277	125	13a	–	–	–	65	–	–	–	20②	–
	THED4	15-100	2	480	250③	22a	–	–	65	–	–	25	–	–	20②
	THED4	110-150	3	480	–	–	–	–	42	–	–	25	–	–	–
	THED6	15-100	3	600	–	22a	–	–	65	–	–	25	18	–	–
	THED6	110-150	3	600	–	N/A	–	–	42	–	–	25	18	–	–
	THQD	125-225	2,3	240	–	N/A	–	–	22	–	–	–	–	–	–
	THFK	70-225	2,3	600	250③	20a	–	–	65	–	–	25	18	–	20②
	THJK4	125-400	2,3	600	250③	23a	–	–	65	–	–	35	25	–	20②
	THJK6	250-600	2,3	600	250③	23a	–	–	65	–	–	35	25	–	20②
	THKM8	300-800	2,3	600	250③	23a	–	–	65	–	–	35	25	–	20②
	THKM12	600-1200	2,3	600	–	23a	–	–	65	–	–	35	25	–	–
Hi-Interrupting Circuit Breakers	TEL	15-150	3	600	–	–	–	–	100	–	–	65	25	–	–
	TFL	70-225	3	600	–	–	–	–	100	–	–	65	25	–	–
	TLB4	225-400	3	480	–	–	–	–	85	–	–	65	–	–	–
Current Limiting Circuit Breakers	THLC1	15-150	3	480	–	–	–	–	200	–	–	150	–	–	–
	THLC2	125-225	3	480	–	–	–	–	200	–	–	150	–	–	–
	THLC4	225-400	3	480	–	–	–	–	200	–	–	150	–	–	–
Molded Case Circuit Breakers w/Micro-Versa Trip® 4-Function	TJ4V	150-600	3	600	–	21a	–	–	42	–	–	30	22	–	–
	TK4V	800-1200	3	600	–	21a	–	–	42	–	–	30	22	–	–
	THJ4V	150-600	3	600	–	23a	–	–	65	–	–	35	25	–	–
	TJL4V	150-600	3	600	–	23a	–	–	100	–	–	65	42	–	–
	TKL4V	800-1200	3	600	–	23a	–	–	100	–	–	65	42	–	–

①UL Listed for only 100,000 AIC when internally mounted accessories are used. ② DC ratings above 10,000 AIC are not UL Listed.
③3-pole devices are not dc rated.

SERIES-CONNECTED RATING

UL permits assigning a short-circuit rating to a combination of molded case circuit breakers or fuses and molded case circuit breakers connected in series that is higher than the lowest-rated protective device of the combination. This is defined as series-connected ratings. The combination rating cannot exceed the rating of the protective device furthest upstream, although it will exceed the rating of the downstream protector.

The upstream protector can be a molded case breaker or fuse. Device combinations are not limited to those in the same equipment. They can be in different equipments such as a switchboard feeder or a panelboard main versus panelboard branches. Any distance between devices in different equipment is permitted. Total fault current magnitude must flow through both protectors; thus, fault current contribution from motors, as well as power source fault current, must flow through upstream and downstream protectors.

Molded case circuit breakers may be applied as fully rated or series connected.

In a fully rated system, Fig. 19.1, the short-circuit rating of all protective devices is equal to, or exceeds, the circuit short requirement, and if mounted in equipment, the bus short-circuit withstand rating and equipment short-circuit rating exceed the circuit available.

In a series-connected system, Fig. 19.2, the short-circuit rating of the upstream protector is fully rated, but the downstream protector is not fully rated.

Systems employing series-connected ratings should not be used where selectivity between devices is required. The principle behind series-connected ratings requires both protectors to open; therefore, when applying series-connected ratings, loss of service to all circuits downstream from the main protective device must be acceptable. Examples where selectivity is desirable include:

- Buildings where a panelboard or a switchboard supplies important loads such as elevators, emergency lighting, etc.
- Manufacturing facilities where loss of power can result in economic loss due to production downtime or damage to equipment or work.
- Hospitals where life support is critical.

Fig. 17.1

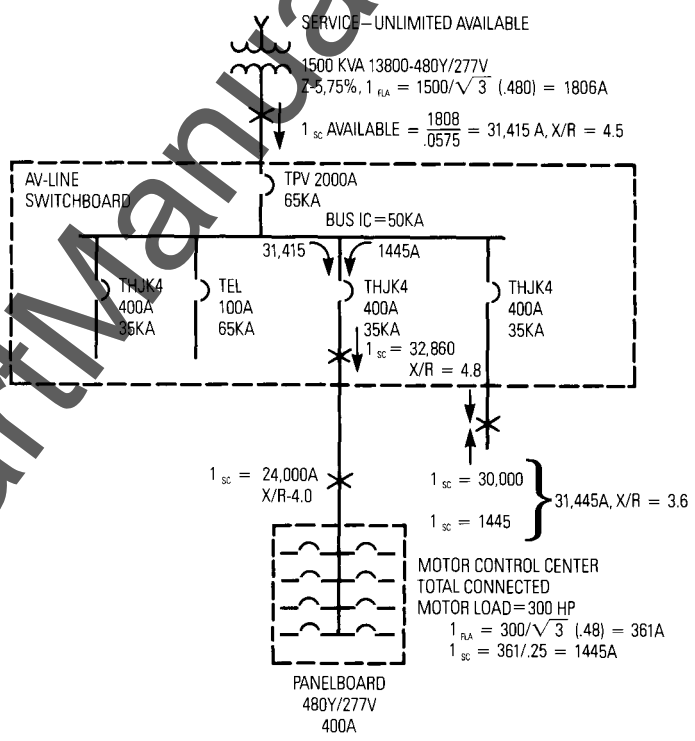


Fig. 17.2

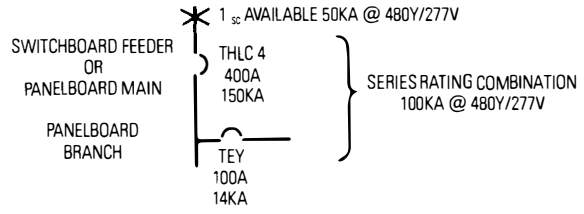
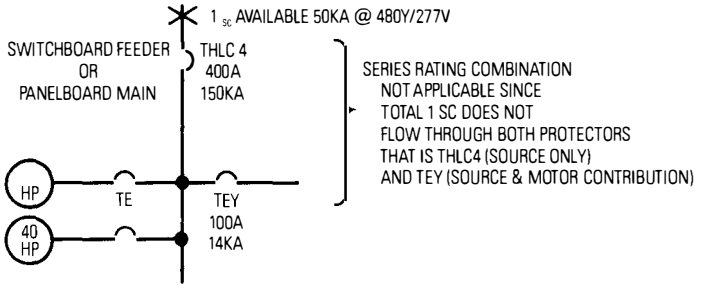


Fig. 17.3



UL LISTED SERIES – CONNECTED RATINGS

Table 18.1 240 Volts, 22,000 Amps IC

Main		Branch		
Type	**Max Amp**	**Type**	**Poles**	**Amp Range**
THQD	225	TQD	2,3	100-225
TFJ	225	TQD	2,3	100-225
		TED	2,3	110-150
TJD	400	TQD	2,3	100-225
TJJ/TJ4V	600	TQD	2,3	100-225
		TJD	2,3	250-400
		TED	3	110-150
TKM/TK4V	1200	TQD	2,3	100-225
		TJD	2,3	250-400

Table 18.2 240 Volts, 35,000 Amps IC

Main		Branch		
Type	**Max Amp**	**Type**	**Poles**	**Amp Range**
TKM/TK4V	1200	TED	3	110-150
		TFJ	2,3	70-225

Table 18.3 240 Volts, 42,000 Amps IC

Main		Branch		
Type	**Max Amp**	**Type**	**Poles**	**Amp Range**
THED	150	TEB	2,3	15-100
		TED	2,3	15-150
		TQD	2,3	100-150
THFK	225	TQD	2,3	125-225
TJJ/TJ4V	600	TED	2,3	15-150
		TFJ	2,3	70-225
		TFK	2,3	70-225
J, T FUSES	600	TJD	2,3	250-400
L FUSE①	2000	TJD	2,3	250-400

①Max Class L fuse size in Spectra Series Panelboards is 1200A.

Table 19.1 240 Volts, 65,000 Amps IC

Main		Branch		
Type	**Max Amp**	**Type**	**Poles**	**Amp Range**
THFK	225	TED	1	15-50
		TED	2, 3	110-150
THJK	600	TED	3	110-150
		TFJ	2, 3	70-225
		TJJ	2, 3	125-400
		TJ4V	3	150-600
		TJK4	2, 3	125-400
		TJK6	2, 3	250-600
		TJD	2, 3	250-400
J, R, T	600	TFJ	2, 3	70-225
FUSES		TJJ	2, 3	125-400
		TJ4V	3	150-600
		TJK4	2, 3	125-400
		TJK6	2, 3	250-600
J FUSE	600	TKM	2, 3	300-1200
		TK4V	3	400-1200
THKM	1200	TED	3	110-150
		TFJ	2, 3	70-225
		TJJ	2, 3	125-400
		TJK4	2, 3	125-400
		TJD	2, 3	250-400
		TJK6	2, 3	250-600
		TJ4V	3	150-600
		TKM	2, 3	300-1200
		TK4V	3	400-1200

240 Volts, 65,000 Amps IC (Continued)

Main		Branch		
Type	**Max Amp**	**Type**	**Poles**	**Amp Range**
L FUSE①	3000	TFJ	2, 3	70-225
		TJ4V	3	150-600
		TJK4	2, 3	125-400
		TJK6	2, 3	250-600
		TK4V	3	400-1200
		TKM	2, 3	300-1200
TPV/THPV①	3000	TFJ	2, 3	70-225
		TJJ	2, 3	125-400
		TJ4V	3	150-600
		TJK4	2, 3	125-400
		TJK6	2, 3	250-600
		TKM	2, 3	300-1200
		TK4V	3	800-1200

①These devices are not available in Spectra Series Panelboards and have been included here for series rating evaluation purposes.

UL LISTED SERIES–CONNECTED RATINGS

Table 20.1 240 Volts, 85,000 Amps IC

Main		Branch		
Type	**Max Amp**	**Type**	**Poles**	**Amp Range**
TLB4	400	TQD	2,3	125-225
		TEB	1	15-100
		TEB	2,3	15-150
		TED	2,3	15-150
		TFJ	2,3	70-225
		TJD	2,3	250-400
		TEY	1,2,3	15-100
TB4①②	250	TQD	2	100
TJL	600	TQD	2,3	125-225
		THQD	2,3	125-225
		TED6	2,3	15-150
		THED6	2,3	15-150
		TFJ	2,3	70-225
		TJD	2,3	250-400
		TJJ	2,3	125-400
		TJK	2,3	125-600
		THJK	2,3	125-600
		TJV	3	150-600
		THJV	3	150-600

①When equipped with TB3F05 limiter only.
②These devices are not available in Spectra Series Panelboards and have been included here for series rating evaluation purposes.

Table 20.2 240 Volts, 100,000 Amps IC

Main		Branch		
Type	**Max Amp**	**Type**	**Poles**	**Amp Range**
TB1②	100	TEB	2,3	15-100
TEL	150	TEB	1,2,3	15-100
		TED	2,3	15-100
		TED	3	150
		TEY	1,2,3	15-100
		THQL②	2,3	15-100
		THQL②	2,3	15-100
TFL	225	TQD	2,3	125-225
		TEB	1,2,3	15-100
		TED	2,3	15-100
		TED	3	150
		TFJ	2,3	70-225
		TJJ	2,3	125-225
TB4①②	250	TEB	2,3	15-100
		TQD	2,3	125-225
		TJD	2,3	250-400
THLC1/2/4	400	TQD	2,3	125-225
		THQD	2,3	125-225

240 Volts, 100,000 Amps IC (Continued)

Main		Branch		
Type	Max Amp	Type	Poles	Amp Range
J, T FUSE	400	TQD	2, 3	125-225
TB6	600	TJD	2, 3	250-400
J, T FUSES	600	THHQB①	3	40-100
		TFJ	2, 3	70-225
		TQD	2	100-225
		TQD	3	125-225
TB8①	800	TJJ	3	125-400
		TJD	2, 3	250-400
		THJ9V	3	150-600
		TJK6	3	250-600
J, T FUSES	800	TJD	2, 3	250-400
L FUSES	1200	TFJ	2, 3	70-225
		TJJ	2, 3	150-400
L FUSES①	2000	TJD	2, 3	250-400
		TKM	2, 3	300-1200
L FUSES①	2500	TJK	2, 3	250-600
		THJK	2, 3	250-600
TPV①	3000	TJJ	2, 3	400
		TJK	2, 3	400
		TJK6	2, 3	250-600
		TJ4V	3	150-600
		TK4V	3	400-1200
		TKM	2, 3	800-1200

①These devices are not available in Spectra Series Panelboards and have been included here for series rating evaluation purposes. Maximum available Class L fuse size is 1200A.

Table 21.1 240 Volts, 200,000 Amps IC

Main		Branch		
Type	Max Amp	Type	Poles	Amp Range
R FUSE	200	TEB	1, 2, 3	15-100
		TED	2, 3	15-100
		TFJ	2, 3	70-200
J, T FUSE	400	TEB	1, 2, 3	15-100
		TED	2, 3	15-100
		TFJ	2, 3	70-225
		TJD	2, 3	250-400

UL LISTED SERIES–CONNECTED RATINGS

Table 22.1 240 Volts, 200,000 Amps IC

Main		Branch		
Type	**Max Amp**	**Type**	**Poles**	**Amp Range**
THLC1/2	225	TEB	1	15-100
		TED	1	15-50
		THED	1	15-30
		TED	2,3	60-100
		TED	3	150
		TJJ	2,3	125-400
THLC1/2/4	400	TEB	1,2,3	15-100
		TED	2,3	15-100
		TFJ	2,3	70-225
		TJD	2,3	250-400

Table 22.2 277 Volts, 50,000 Amps IC

Main		Branch		
Type	**Max Amp**	**Type**	**Poles**	**Amp Range**
TLB4②	400	THED	1	15-50
		TED	1	15-50
		TEY	1	15-100

Table 22.3 277 Volts, 65,000 Amps IC

Main		Branch		
Type	**Max Amp**	**Type**	**Poles**	**Amp Range**
TEL	150	TEY	1	15-100
TFL	225	TED	1	15-50
		THED	1	15-30
		TEY	1	15-100
TLB4②	400	TED	1	15-50
		THED	1	15-30
		TEY	1	15-100

Table 22.4 277 Volts, 100,000 Amps IC

Main		Branch		
Type	**Max Amp**	**Type**	**Poles**	**Amp Range**
R FUSE	100	TED	1	15-50
		THED	1	15-30
J, T FUSES	400	TED	1	15-50
THLC4		THED	1	15-30
TB4①③	250	TED	1	15-50
		THED	1	15-30
THLC1/2/4	400	TED (Mod 2)	1	15-50
		TEY	1	15-100
J, T FUSES	600	TEY	1	15-100
R FUSES	200	TEY	1	15-100

Table 22.5 277 Volts, 150,000 Amps IC

Main		Branch		
Type	**Max Amp**	**Type**	**Poles**	**Amp Range**
THLC1/2	225	TED	1	15-50
		THED	1	15-30

①When equipped with TB3F05 limiter only.
②Dependent on nameplate interrupting rating (50,000 or 65,000 AIC)
③This device is not available in Spectra Series Panelboards and has been included here for series rating evaluation purposes.

Table 23.1 480 Volts, 25,000 Amps IC

Main		Branch		
Type	**Max Amp**	**Type**	**Poles**	**Amp Range**
THED (3P)	110-150	TED	2, 3	50-150
THFK	225	TED	3	110-150
		TFJ	2, 3	70-225
TJJ/TJ4V	600	TED	3	110-150
TKM/TK4V	1200	TFJ	2, 3	70-225

Table 23.2 480 Volts, 30,000 Amps IC

Main		Branch		
Type	**Max Amp**	**Type**	**Poles**	**Amp Range**
TJJ/TJ4V	600	TFJ	2, 3	70-225

Table 23.3 480 Volts, 35,000 Amps IC

Main		Branch		
Type	**Max Amp**	**Type**	**Poles**	**Amp Range**
THJK6	600	TJJ	2, 3	125-400
		TFJ	2, 3	125-225
		TJK	2, 3	250-600
		TJ4V	3	150-600
THKM/	1200	TJJ	2, 3	400
TKH		TJK6	2, 3	250-600
TKL		TJ4V	3	150-600
		TKM	2, 3	300-1200
		TK4V	3	400-1200
LFUSE	1200	TK4V	3	400-1200
TPV②	3000	TJK	2, 3	250-600

Table 23.4 480 Volts, 42,000 Amps IC

Main		Branch		
Type	**Max Amp**	**Type**	**Poles**	**Amp Range**
TPV②	2500	TKM	2, 3	300-1200

Table 23.5 480 Volts, 50,000 Amps IC

Main		Branch		
Type	**Max Amp**	**Type**	**Poles**	**Amp Range**
TLB4①	400	TED	2, 3	15-150
		TEY	2, 3	15-100
		TFJ	2, 3	70-225
		TJJ	2, 3	125-400
TJL	600	TED	2, 3	15-30
		TFJ	2, 3	70-225
		TJJ	2, 3	125-400
		TJK	2, 3	125-600
		TJ4V	3	150-600
TPV②	3000	TJ4V	3	150-600

①Dependent on nameplate interrupting rating (50,000 or 65,000 AIC)
②These devices are not available in Spectra Series Panelboards and have been included here for series rating evaluation purposes.

UL LISTED SERIES – CONNECTED RATINGS

Table 24.1 480 Volts, 65,000 Amps IC

Main		Branch		
Type	**Max Amp**	**Type**	**Poles**	**Amp Range**
TEL	150	TED	2, 3	15-100
		TED	3	150
		TEY	2, 3	15-100
TFL	225	TED	2, 3	15-100
		TED	2, 3	150
		TEY	2, 3	15-100
		TFJ	2, 3	70-225
		TJJ	2, 3	125-225
TLB4②	400	TED	2, 3	15-150
		TEY	2, 3	15-100
		TFJ	2, 3	70-225
		TJJ	2, 3	125-400

Table 24.2 480 Volts, 100,000 Amps IC

Main		Branch		
Type	**Max Amp**	**Type**	**Poles**	**Amp Range**
R FUSE	100	TED	2, 3	15-100
		THED6	2, 3	15-100
TB1	100	TED6	2, 3	20-150
		THED	2, 3	20-150
R FUSE	200	TEY	2, 3	15-100
THLC1/2/4	400	TED	2, 3	15-100
		TEY	2, 3	15-100
TB4①③	250	TED6	2, 3	20-150
		THED	2, 3	20-150
	400	TFJ	2, 3	70-225
		TJJ	2, 3	125-400
		TJK4	2, 3	150-400
		TJK6	2, 3	250-400
		THJK4	2, 3	150-400
		THJK6	2, 3	250-400
J, T FUSES	400	TED	2, 3	15-100
		THED6	2, 3	15-100
		TFJ	2, 3	70-225
		TJJ	2, 3	125-400
J, T FUSES	600	TEY	2, 3	15-100

①When equipped with TB3F05 limiter only.
②Dependent on nameplate interrupting rating (50,000 or 65,000 AIC).
③This device is not available in Spectra Series Panelboards and has been included here for series rating evaluation purposes.

480 Volts, 100,000 Amps IC (Continued)

Main		Branch		
Type	Max Amp	Type	Poles	Amp Range
TB6①	600	TFJ	2,3	70-225
TB8①	800	TJJ	2,3	125-400
		THJK6	3	250-600
J, T FUSES	800	TKM	2,3	300-1200
L FUSE	1200	TJJ	2,3	125-400
		TJK	2,3	125-600
		THJK	2,3	125-600
L FUSE①	2000	TKM	2,3	300-1200
THPV①	3000	TPV	3	200-2000

Table 25.1 480 Volts, 150,000 Amps IC

Main		Branch		
Type	Max Amp	Type	Poles	Amp Range
THLC 1/2	225	TED	2,3	15-100
		TED	2,3	150
THLC 1/2/4	400	TFJ	2,3	70-225
		TJJ	2,3	125-400

①These devices are not available in Spectra Panelboards and have been included here for series rating evaluation purposes. Maximum available Class L fuse size is 1200A.

Table 25.2 480 Volts, 200,000 Amps IC

Main		Branch		
Type	Max Amp	Type	Poles	Amp Range
L FUSE①	2000	TPV	3	200-800
		THPV	3	200-800
	2500	TPV	3	800-2500
		THPV	3	800-2500

Table 25.3 600 Volts, 200,000 Amps IC

Main		Branch		
Type	Max Amp	Type	Poles	Amp Range
L FUSE①	2000	TPV/THPV	3	200-800
	2500	TPV/THPV	3	800-2500

The following circuit breakers may be substituted for the circuit breakers shown:

Circuit Breaker	Substitute
TED	THED
TQD	THQD
TFJ	TFK, THFK
TJJ	TJK, THJK, TJ4V, THJ4V, TJH
TJ4V	THJ4V, TJH
THJK	THJ4V, TJH, TJL
TKM	THKM, TK4V, TKH, TKL
THKM	TKH, TKL
TK4V	TKH
TPV	TP, TC
THPV	THP, THC

Lower amperes J, T, or L fuses may be substituted for listed fuses. R fuses refer to factory.

Tri-Break® Circuit Breakers except TB4 are listed only with standard limiters.

Lower ampere TPV (Power Break®) circuit breakers may be substituted for listed TPV breaker provided substitute TPV has short circuit rating equal to or greater than series connected rating.

Molded case circuit breakers with MicroVersaTrip® (4 and 9 functioning) with line or load side fuses are not to be used where the available short-circuit current exceeds 85,000A. RMS symmetrical.

INTERIOR

Spectra Series™ Universal Interior is the basic building block designed for use with either fusible switches or molded case circuit breakers, or both. In addition, any main device (lugs only, fusible switch, or circuit breaker) can be installed in the factory or at the construction site.

The interior is available in copper (1000 amps per square inch) and aluminum (750 amps per square inch).

Table 26.1

Amp Rating	Enclosure Width Inches	Panelboard Interior X-Heights Available						
		18	23	28	38	43	48	53
250	27	✓	–	✓	✓	–	–	–
	36/44	✓	–	✓	✓	–	–	✓
400	27	✓	–	✓	✓	–	–	–
	36/44	✓	–	✓	✓	–	✓	–
600	27	–	✓	–	✓	–	–	–
	36/44	–	✓	–	✓	–	✓	–
800	36/44	–	✓	–	✓	✓	–	–
1200	36/44	–	✓	–	✓	✓	–	–

COMPONENT MODULES

Main Modules. Spectra Series™ Main Modules consist of lugs only, fusible switch, and molded case circuit breaker. They are either factory-installed or can be assembled in the field (provided that the selected enclosure has adequate wire-bending room).

Table 26.2 Main Lug Modules (See Page 32 for Lug Sizes)

Maximum Amp Rating	Width Dimension-Inches				
	Main Lug	Enclosure	Dual Main	Enclosure	X-Height
250 400 600	19	27/36/44	19	27/36/44	4①
250	21	36/44	21	36/44	6
400	21	36/44	21	36/44	6
600	21	36/44	21	36/44	6
800	21/27②	36/44	27	36/44	6
1200	21/27②	36/44	27	36/44	6

①Mechanical lugs only.
②21" Standard, 27" Optional.

Table 27.1 Main Switch Modules (See Page 33 for Lug Sizes)

Main Rating Amps	Poles	Voltage	Available Fuse Class						X-Height	Minimum Enclosure Width
			H	J	K	L	R	T		
200	2/3	240	✓	–	✓	–	✓	–	7	36″
	2/3	600	✓	✓	✓	–	✓	–	7	36″
400	2/3	240	✓	–	✓	–	✓	✓	10	36″ wide with J&T fuses. All others are 44″ wide
	2/3	600	✓	✓	✓	–	✓	✓	10	
600	2/3	240	✓	–	✓	–	✓	✓	10	
	2/3	600	✓	✓	✓	–	✓	✓	10	
800	2/3	600	–	–	–	✓	–	–	19	44″
1200	2/3	600	–	–	–	✓	–	–	19	44″

Table 27.2 Main Breaker Modules (See Page 34 for Lug Sizes)

Maximum Ampere Rating	Main Breaker Type	Poles	X-Height	Minimum Enclosure Width
225A	TFJ	2/3	3X	27″
225A	TFK/THFK	2/3	3X	27″
400A	TJD	2/3	6X	27″
400A	TJJ	2/3	6X	27″
600A	TJK/THJK	2/3	6X	27″
600A	TJ4V/THJ4V	3	6X	27″
600A	TJL4V	3	6X	27″
1200A	TKM/THKM	3	6X	44″
1200A	TK4V/TKL4V	3	6X	44″
225A	TFL	3	3X	27″
400A	TLB4	3	5X	27″
250A	THLC2	3	5X	27″
400A	THLC4	3	5X	27″

COMPONENT MODULES

Branch Modules. Spectra Series™ Branch Modules include both fusible switch units and molded case circuit breakers. Branch modules are either double-branch (with a pair of switches or breakers mounted side by side) or single-branch. Most double-branch modules have a "blank" option where a single switch or breaker is mounted on one side of the module, and the other side is left empty with a blank cover. Fusible switch expansion kits are available for installation in empty (blank) halves of double-branch switch modules. Circuit breakers can be added to blank halves, provided the mounting means match.

Table 28.1 Fusible Switch Expansion Kits[1]

Amps	Poles	Voltage	H	J	K	R	T	X-Height
30	2/3	240	✓	–	✓	✓	–	4
	2/3	600	✓	✓	✓	✓	–	4
60	2/3	240	✓	–	✓	✓	–	4
	2/3	600	✓	✓	✓	✓	–	5
100	2/3	240	✓	–	✓	✓	–	5
	2/3	600	✓	✓	✓	✓	–	5
	2/3	240/600	–	–	–	–	✓	7
200	2/3	240/600	–	✓	–	–	✓	7

[1] Voltage and X-Height must match switch in the double-branch module. If switch in module is two poles, expansion kit must be two poles.

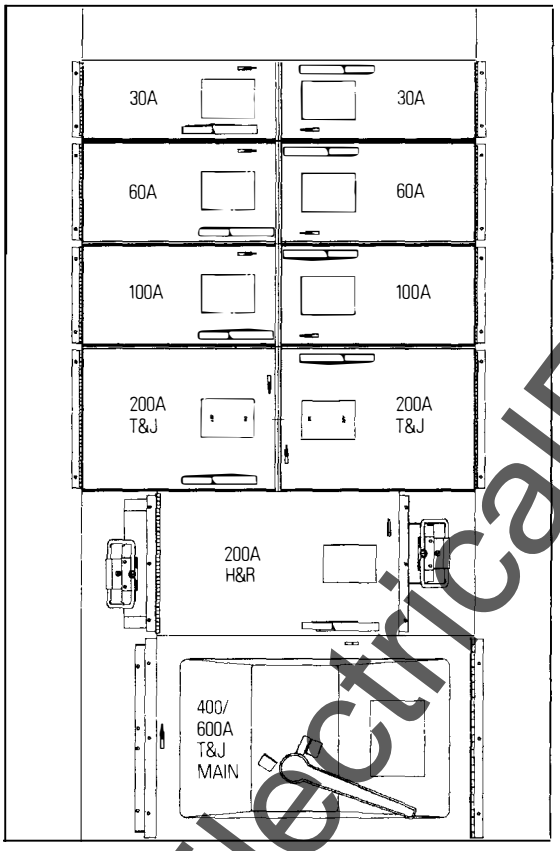
Table 28.2 Branch Fusible Switch Units

Amps	Poles	Voltage	H	J	K	L	R	T	Mounting[1] Module Config.	Blank Option	X-Height	Minimum Enclosure Width
30	2/3	240	✓	–	✓	–	✓	–	Double	Yes	4	36″
	2/3	600	✓	✓	✓	–	✓	–	Double	Yes	4	36″
60	2/3	240	✓	–	✓	–	✓	–	Double	Yes	4	36″
	2/3	600	✓	✓	✓	–	✓	–	Double	Yes	5	36″
100	2/3	240	✓	–	✓	–	✓	–	Double	Yes	5	36″
	2/3	600	✓	✓	✓	–	✓	–	Double	Yes	5	36″
	2/3	240/600	–	–	–	–	–	✓	Double	Yes	7	36″
200	2/3	240/600	✓	–	✓	–	✓	–	Double	No	7	44″
	2/3	240/600	✓	–	✓	–	✓	–	Single	No	7	36″
	2/3	240	–	–	–	–	–	✓	Double	Yes	7	36″
	2/3	600	–	✓	–	–	–	✓	Double	Yes	7	36″
400/600	2/3	240/600	✓	–	✓	–	✓	–	Single	No	10	44″
	2/3	240	–	–	–	–	–	✓	Single	No	10	36″
	2/3	600	–	✓	–	–	–	✓	Single	No	10	36″
800/1200	2/3	600	–	–	–	✓	–	–	Single	No	19	44″

[1] See Figures 29.1 and 29.2 for device mounting arrangements.

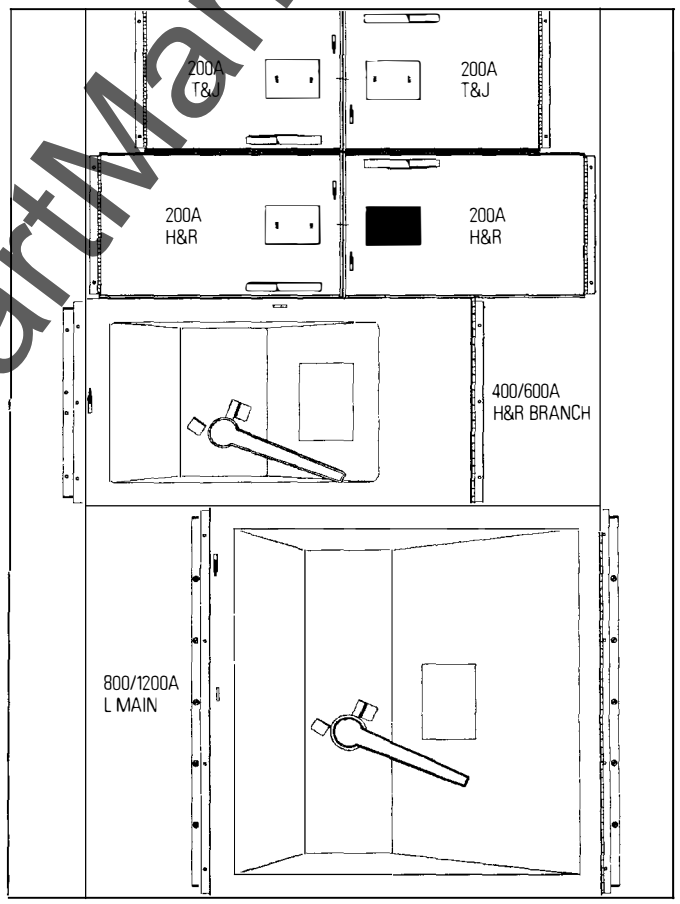
Figures 29.1 and 29.2 are examples of fusible switch mounting arrangements.

Fig. 29.1



36″ wide enclosure

Fig. 29.2



44″ wide enclosure

Table 30.1 Branch MCCB Modules

		Double Branch			Single Branch		
	Poles	Maximum Poles	Minimum Enclosure Width	Maximum # Poles Blank Option	Maximum Poles	Minimum Enclosure Width	Module X-Height
TEL	3	6		3			3X
THQB	1/2/3	6		5	–		3X
TEY	1/2/3	6		5			3X
TEB/TED/THED	1/2	4	27″	2	–	–	2X
TEB/TED/THED	1/2/3	6		3	–		3X
TQD/THQD	2	4		2	–		2X
TQD/THQD	3	6		3	–		3X
TFJ	2/3	6		3	3		3X
TFK/THFK	2/3	6	36″	3	3	27″	3X
①TFL/THLC1	3	6		3	3		3X
THLC2	3	6		3	3		5X
TJD	2/3	6		3	3		6X
TJJ/TJK/THJK	2/3	6		3	3		6X
TJ4V/THJ4V/TJL4V	3	6	44″	3	3	27″	6X
TLB4	3	6		3	3		5X
THLC4	3	6		3	3		5X
TKM/THKM	2/3	–	–	–	3	44″	6X
TK4V/TKL4V	3	–		–	3		6X

①When TFL is intermixed with fusible devices – X-Height is 4X.

Figures 30.1, 30.2, and 31.1 are examples of molded case circuit breaker mounting arrangements.

Fig. 30.1

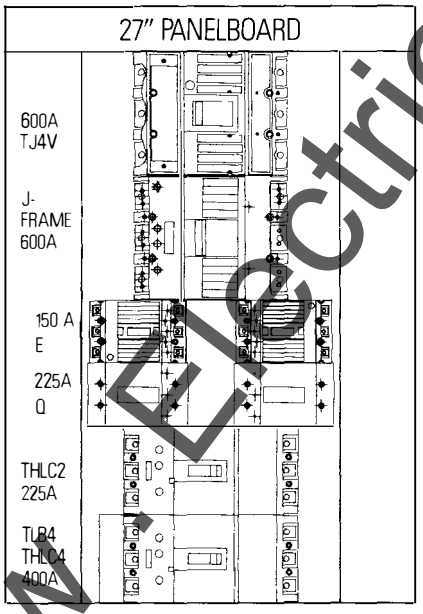
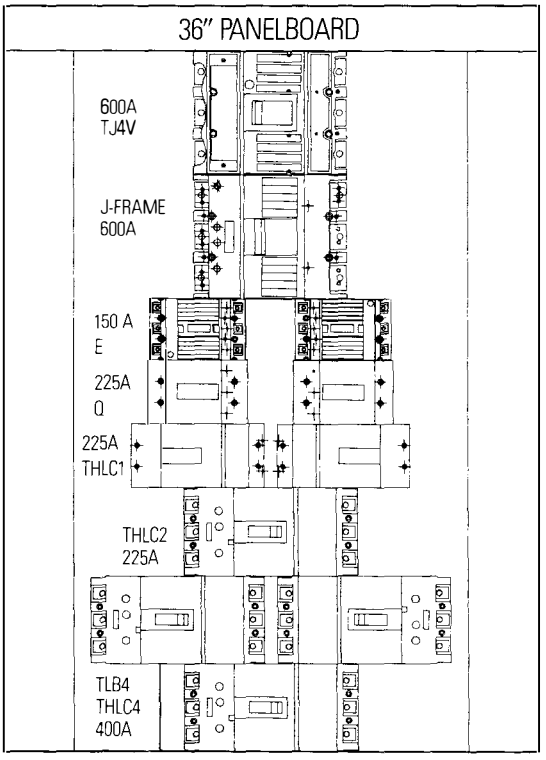


Fig. 30.2



Circuit breakers and fusible switches can be included in the same panel assembly as shown in figure 31.2.

Fig. 31.1

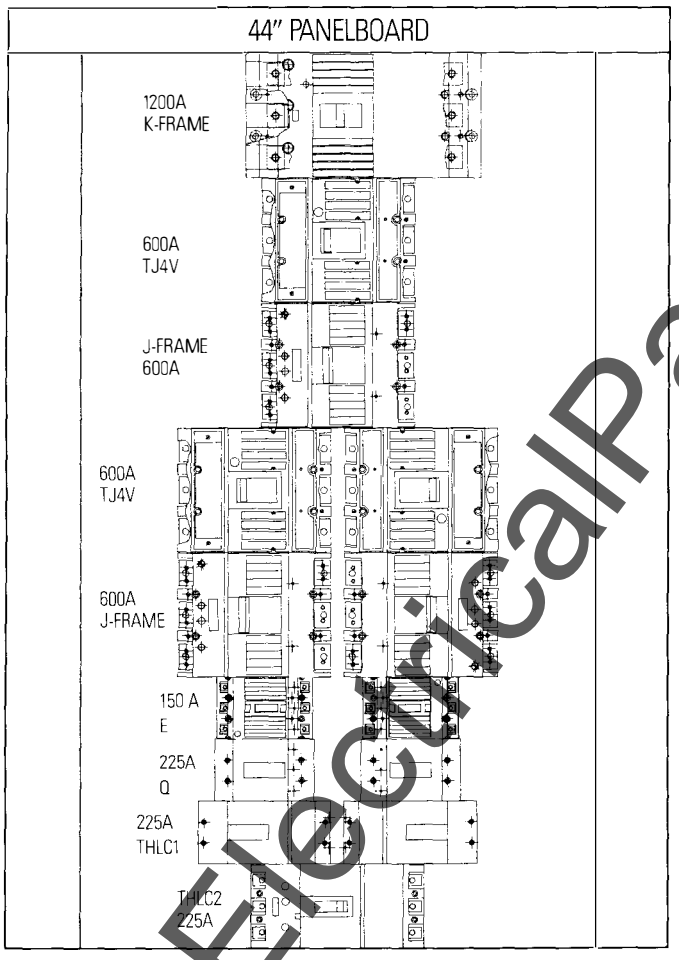


Fig. 31.2

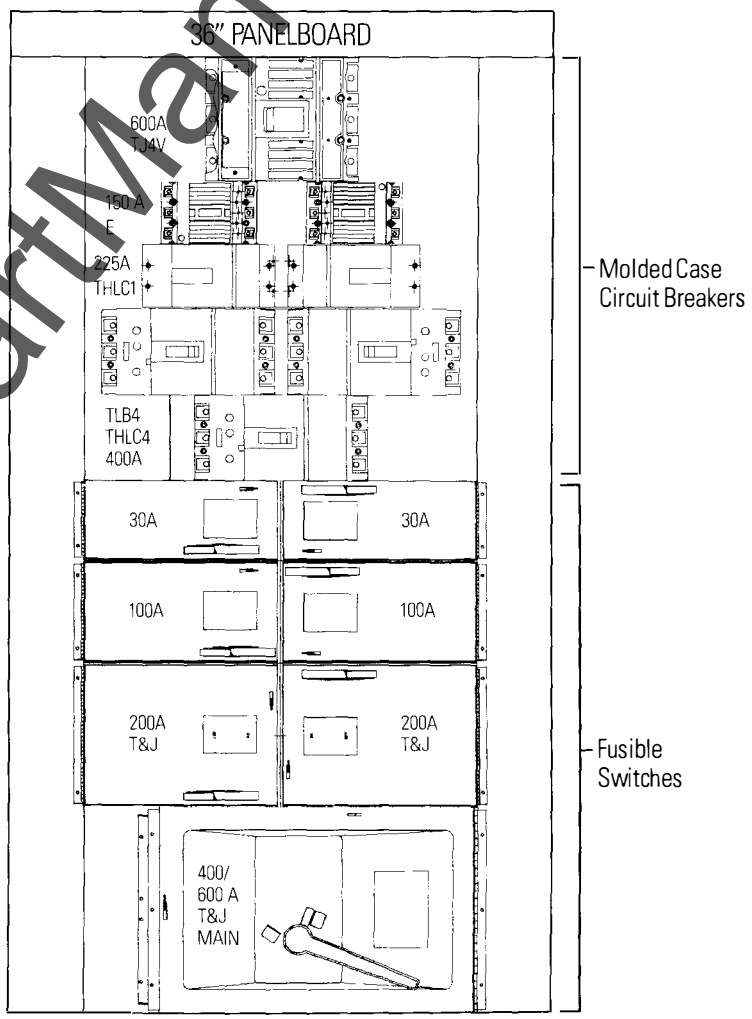


Table 32.1 Standard Main Lug Module Terminations (CU/AL Mechanical)

Amp Rating	Wire Size (CU/AL)	# Wires Per Lug	# Lugs Per Phase-Single	# Lugs Per Phase-Dual
250	#6-350 MCM	1	1	2
400	#2-500 MCM	2	1	2
600	#2-500 MCM	2	1	2
800	#2-500 MCM	2	2	4
1200	#2-500 MCM	2	2	4

Table 32.2 Optional Main Lug Module Terminations (see Table above for Standard)

	# Wires Per Lug	Max. # Lugs Per Phase		
		250-600A	800A 1200A 21″	800A 1200A 27″
CU/AL MECHANICAL				
#6-350 MCM	1	2	2	4
#2-500 MCM	2	2	2	4
#2-600 MCM	2	2	2	4
3/0 750 MCM	2	2	2	4
CU/AL COMPRESSION①				
1/0	1	4	4	8
2/0	1	4	4	8
3/0	1	4	4	8
4/0	1	4	4	8
250 MCM	1	4	4	8
300 MCM	1	4	4	8
350 MCM	1	4	4	8
400 MCM	1	4	4	8
500 MCM	1	4	4	8
600 MCM	1	4	4	8
750 MCM	1	4	4	8

①Not available on 19″ main lug module.

Table 32.3 Standard Neutral Lug Terminations (CU/AL mechanical)

Amp Rating	Lug Quantity	Wire Size (CU/AL)
250	1	①# 6-350 MCM
	8	# 14-#4
	16	# 14-2/0
	5	# 4-300MCM
400	2	①# 4-500 MCM
	8	# 14-#8
	6	# 14-#4
	16	# 14-2/0
	5	# 4-300 MCM
	2	# 2-500 MCM
600	2	①# 4-500 MCM
	8	# 14-2/0
	10	# 4-300 MCM
	4	# 2-500 MCM
800	4	①# 4-500 MCM
	8	# 14-2/0
	10	# 4-300MCM
	6	# 2-500 MCM
1200	4	①# 4-500 MCM
	8	# 14-2/0
	10	# 4-300 MCM
	6	# 2-500 MCM

①The #6-350 MCM and the #4-500 MCM lug can be field-replaced with a #2-600 MCM or #3/0-750 MCM lug, which is available in kit form.

TABLE 33.1 Standard Fusible Switch Module Terminations (CU/AL Mechanical)

Amp Rating	Voltage	Wire Size (CU/AL)	#Wires Per Lug	#Lugs Per Phase
30	240/600	#2-#14	1	1
60	240	#2-#14	1	1
60	600	#14-1/0	1	1
100	240/600	#14-1/0	1	1
200	240/600	#6-250 MCM	1	1
400	240/600	1/0-250 MCM or #2-600 MCM	2 or 1	1
600	240/600	1/0-250 MCM or #2-600 MCM	2 or 1	2
800	600	1/0-250 MCM or #2-600 MCM	2 or 1	3
1200	600	1/0-250 MCM or #2-600 MCM	2 or 1	4

Table 33.2 Optional Fusible Switch Module Terminations

	# Wires Per Lug	Max # Lugs Per Phase								
		30A	60A 240V	60A 600V	100A	200A	400A	600A	800A	1200A
CU/AL MECHANICAL										
#6-350 MCM	1					1				
3/0-800 MCM CU 250-800 MCM AL	1						2	2	4	4
CU MECHANICAL										
#4-#14	1	1	1							
#6-#14	1			1						
#6-1/0	1			1	1					
#6-250 MCM	1					1				
1/0-600 MCM	1						2	2	4	4
1/0-4/0	2						2	2	4	4
CU/AL COMPRESSION										
#8-1/0	1	1	1	1	1					
#4-300 MCM	1					1				
2/0-500 MCM	1						2	2	4	4
400-500 MCM CU	1						2	2	4	4
400-600 MCM AL	1						2	2	4	4
750 MCM CU	1						2	2	4	4
500-750 MCM AL	1						2	2	4	4
CU COMPRESSION										
#6-1/0	1	1	1	1	1					
2/0-300 MCM	1					1				
250-500 MCM	1						2	2	4	4
400-750 MCM	1						2	2	4	4

Physical Data

Table 34.1 Molded Case Circuit Breakers

Circuit Breaker Frame					Terminal Lugs (CU-AL)			
							Wire – CU-AL (Unless otherwise noted)	
Standard	Hi-Break®	Current Limiting	High Interrupting	Poles	No. Per Pole	Catalog Number	Per Lug	Range
THQB	THHQB	–	–	1,2,3	1	Fixed to Breaker Terminal	1	(15-30A) #14-4 CU or #12-4 AL (35-100A) #14-1/0 CU or #12-1/0 AL
TEY	–	–	–	1,2,3	1		1	(15-20A) #14-#12 CU or #12-#1 AL (30-60A) #10-#6 CU or #8-#4 AL (70-100A) #4-#1 CU or #2-1/0 AL
TEB	–	–	–	1,2,3	1	TCAL14 TCAL12 TCAL12A TCAL15	1	(15-30A, TCAL 14) #14-8 (30-60A, TCAL 12) #14-3 CU #12-1 AL (70-110A, TCAL 12A) #6-2/0 CU #4-2/0 AL (110-150A, TCAL 15) #2-3/0
TED	THED①	–	–	1				
TED4	–	–	–	2-3				
TED6	THED	–	–	2-3				
TQD	THQD	–	–	2-3	1	TCAL25	1	#1-300MCM
TFJ, TFK	THFK	–	TFL	2-3	1	TCAL24, 26	1	#4-300MCM
TJJ, TJK4	THJK4	–	–	2-3	1	TCAL43	1	#6-600MCM or 2-(2/0-250MCM)
TJD	–	–	–	2-3	1	TCAL43	1	#6-600MCM or 2-(2/0-250MCM)
TJK6 TJ4V	THJK6 THJ4V	–	TJL4V	2-3	1	TCAL43	1	#6-600MCM or 2-(2/0-250MCM)
					1	TCAL63	2	250-350MCM, CU or 350-500MCM, AL
–	–	–	–	3	1	TCAL61	2	2/0-500MCM
TKM8	THKM8	–	TKL4V	2-3	1	TCAL41	1	#4-600MCM or 2-(1/0-250MCM)
					1	TCAL61	2	2/0-500MCM
					1	TCAL81	3	300-500MCM
–	–	–	LOAD END	–	1	TCAL91	3	250-500MCM
–	–	–	–	3	1	TCAL81	3	300-500MCM
TKM12 TK4V	THKM12	–	TKL4V	2-3	1 1	TCAL81 TCAL121	3 4	250-500MCM 250-300MCM CU or 350-500MCM AL
–	–	–	LOAD END		1	TCAL131	4	250-300MCM CU or 350-500MCM AL
–	–	THLC1	TEL	3	1	TCAL12 TCAL12A TCAL15	1	(15-60A, TCAL 12) #14-#3 CU or #12-#1 AL (70-110A, TCAL 12A) #6-2/0 CU or #4-2/0 AL (125-150A, TCAL 15) #1-2/0 CU or 1/0-3/0 AL
–	–	THLC2	–	3	1	TCAL27	1	(125-225A, TCAL 27) #4-300MCM
–	–	THLC4	TLB4	3	1	TCLK43②		3/0-500MCM or 2-(3/0-250MCM)

① One-pole THED frame available only in 15-30 amp trip. ② Three-pole lug assembly suitable for line or load end.

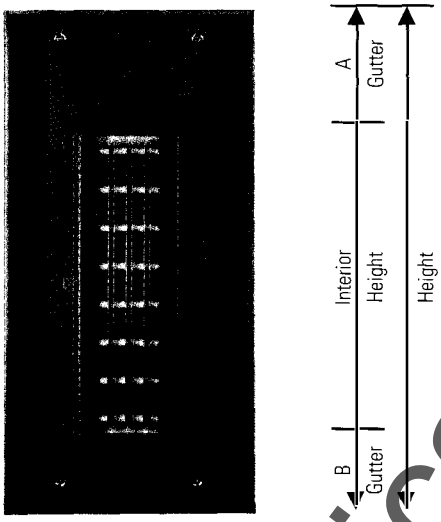
Ground lugs are available in kit form for field installation.
Catalog numbers are included here for references.

Table 35.1 Ground Lug Terminations

Lug Quantity	Wire Size	Catalog Number	Insulated/ Isolated
10	#6-2/0 CU/AL	AEG 10	No
12	#14-#8 CU, #12-#8 AL — Solid or #12-#8 CU, #12-#8 AL — Stranded	AEG 21	No
9	#14-#8 CU, #12-#8 AL — Solid or #10-#4 CU, #10-#4 AL — Stranded	AEG 21	No
12	Identical lug offering as listed above for Cat. #AEG 21	AEG 21S	Yes
9	Identical lug offering as listed above for Cat. #AEG 21	AEG 21S	Yes
12	Identical lug offering as listed for AEG 21	AEG 31S	Yes
9	Identical lug offering as listed for AEG 21	AEG 31S	Yes
10	#6-2/0 CU/AL	AEG 31S	Yes

ENCLOSURES

Spectra Series Panelboard Enclosures come in eleven standard sizes. Enclosure heights are determined by two criteria: interior height and main device rating (to provide adequate wire-bending space). Enclosure widths are determined by the largest main/branch device.



36″ and 44″ wide enclosures are 11½″ deep (NEMA 1) and 14″ deep (NEMA 32/12). 27″ wide enclosures are 14.5″ deep.

When doors are required over devices in 36″ and 44″ wide enclosures, enclosure depth is 16.25″. Door is included as a standard feature for 27″ wide enclosures.

Table 36.1 (36″ and 44″ wide enclosures)

Main Amp Rating	Interior Height		Gutter Inches		Enclosure Dimensions	
	X-Height	Inches	A	B	Height Inches	Width Inches
250	18X	24.75	19.94	19.94	64.63	36/44
	28X	38.50	19.94	6.25	64.63	36/44
	38X	52.25	22.75	14.25	89.25	36/44
	53X	72.88	17.00	6.25	96.13	36/44
400	18X	24.75	19.94	19.94	64.63	36/44
	28X	38.50	22.75	14.25	75.50	36/44
	38X	52.25	22.75	14.25	89.25	36/44
	48X	66.00	19.94	10.25	96.13	36/44
600	23X	31.63	19.94	13.13	64.63	36/44
	38X	52.25	22.75	14.25	89.25	36/44
	48X	66.00	19.94	10.25	96.13	36/44
800	23X	31.63	22.75	21.25	75.50	36/44
	38X	52.25	22.75	14.25	89.25①	36/44
	43X	59.13	22.75	14.25	96.13	36/44
1200	28X	38.50	22.75	14.25	75.50	36/44
	38X	52.25	22.75	14.25	89.25①	36/44
	43X	59.13	22.75	14.25	96.13	36/44

①Height is 96.13″ if dual main or feed through and neutral are provided.

Table 36.2 (Circuit breakers only. 27″ wide enclosures)

Main Amp Rating	Interior Height		Gutter Inches		Enclosure Dimensions	
	X-Height	Inches	A	B	Height Inches	Width Inches
250	18X	24.75	19.94	19.94	64.63	27
	28X	38.50	18.50	7.62	64.63	27
	38X	52.25	18.50	18.50	89.25	27
400	18X	24.75	19.94	19.94	64.63	27
	28X	38.50	18.50	18.50	75.50	27
	38X	52.25	18.50	18.50	89.25	27
600	23X	31.63	18.50	14.50	64.63	27
	38X	52.25	18.50	18.50	89.25	27

Appendices

APPENDIX A: DIMENSIONS AND SIZING EXAMPLE

Spectra Series Power Panelboards can be sized in six easy steps. Factory-assembled panels include all trim, fillers, etc. to make a complete panelboard. Enclosures are shipped separately, ahead of the interior, main, branch, neutral and grounding modules, and trim. Sizing requires calculating the X-Height (to determine interior and enclosure size) and maximum main/branch widths (to determine enclosure width).

Table 37.1 (36" and 44" Wide Enclosures)

Main Amp Rating	Interior Height		Gutter Inches		Enclosure Dimensions	
	X-Height	Inches	A	B	Height Inches	Width Inches
250	18X	24.75	19.94	19.94	64.63	36/44
	28X	38.50	19.94	6.25	64.63	36/44
	38X	52.25	22.75	14.25	89.25	36/44
	53X	72.88	17.00	6.25	96.13	36/44
400	18X	24.75	19.94	19.94	64.63	36/44
	28X	38.50	22.75	14.25	75.50	36/44
	38X	52.25	22.75	14.25	89.25	36/44
	48X	66.00	19.94	10.25	96.13	36/44
600	23X	31.63	19.94	13.13	64.63	36/44
	38X	52.25	22.75	14.25	89.25	36/44
	48X	66.00	19.94	10.25	96.13	36/44
800	23X	31.63	22.75	21.25	75.50	36/44
	38X	52.25	22.75	14.25	89.25①	36/44
	43X	59.13	22.75	14.25	96.13	36/44
1200	28X	38.50	22.75	14.25	75.50	36/44
	38X	52.25	22.75	14.25	89.25①	36/44
	43X	59.13	22.75	14.25	96.13	36/44

①Height is 96.13" if dual main or feed through and neutral are provided.

Table 37.2 (Circuit Breakers Only 27" Wide Enclosure)

Main Amp Rating	Interior Height		Gutter Inches		Enclosure Dimensions	
	X-Height	Inches	A	B	Height Inches	Width Inches
250	18X	24.75	19.94	19.94	64.63	27
	28X	38.50	18.50	7.62	64.63	27
	38X	52.25	18.50	18.50	89.25	27
400	18X	24.75	19.94	19.94	64.63	27
	28X	38.50	18.50	18.50	75.50	27
	38X	52.25	18.50	18.50	89.25	27
600	23X	31.63	18.50	14.50	64.63	27
	38X	52.25	18.50	18.50	89.25	27

Table 37.3 Main Lug Modules (see page 32 for lug sizes)

Maximum Amp Rating	Width Dimension-Inches				
	Main Lug	Enclosure	Dual Main	Enclosure	X-Height
250 400 600	19	27/36/44	19	27/36/44	4①
250	21	36/44	21	36/44	6
400	21	36/44	21	36/44	6
600	21	36/44	21	36/44	6
800	21/27②	36/44	27	36/44	6
1200	21/27②	36/44	27	36/44	6

①Mechanical lugs only.
②21" Standard, 27" Optional.

Table 37.4 Main Switch Modules (See Page 33 for Lug Sizes)

Main Rating Amps	Poles	Voltage	Available Fuse Class						X-Height	Minimum Enclosure Width
			H	J	K	L	R	T		
200	2/3	240	✓	–	✓	–	✓	–	7	36"
	2/3	600	✓	✓	✓	–	✓	–	7	36"
400	2/3	240	✓	–	✓	–	✓	✓	10	36" wide with J&T fuses. All others are 44" wide
	2/3	600	✓	✓	✓	–	✓	✓	10	
600	2/3	240	✓	–	✓	–	✓	✓	10	
	2/3	600	✓	✓	✓	–	✓	✓	10	
800	2/3	600	–	–	–	✓	–	–	19	44"
1200	2/3	600	–	–	–	✓	–	–	19	44"

Table 37.5 Main Breaker Modules (See Page 34 for Lug Sizes)

Maximum Ampere Rating	Main Breaker Type	Poles	X-Height	Minimum Enclosure Width
225A	TFJ	2/3	3X	27"
225A	TFK/THFK	2/3	3X	27"
400A	TJD	2/3	6X	27"
400A	TJJ	2/3	6X	27"
600A	TJK/THJK	2/3	6X	27"
600A	TJ4V/THJ4V	3	6X	27"
600A	TJL4V	3	6X	27"
1200A	TKM/THKM	3	6X	44"
1200A	TK4V/TKL4V	3	6X	44"
225A	TFL	3	3X	27"
400A	TLB4	3	5X	27"
250A	THLC2	3	5X	27"
400A	THLC4	3	5X	27"

Table 38.1 Branch Fusible Switch Units

Amps	Poles	Voltage	H	J	K	L	R	T	Mounting[1]			
									Module Config.	Blank Option	X-Height	Minimum Enclosure Width
30	2/3	240	✓	–	✓	–	✓	–	Double	Yes	4	36″
	2/3	600	✓	✓	✓	–	✓	–	Double	Yes	4	36″
60	2/3	240	✓	–	✓	–	✓	–	Double	Yes	4	36″
	2/3	600	✓	✓	✓	–	✓	–	Double	Yes	5	36″
100	2/3	240	✓	–	✓	–	✓	–	Double	Yes	5	36″
	2/3	600	✓	✓	✓	–	✓	–	Double	Yes	5	36″
	2/3	240/600	–	–	–	–	–	✓	Double	Yes	7	36″
200	2/3	240/600	✓	–	✓	–	✓	–	Double	No	7	44″
	2/3	240/600	✓	–	✓	–	✓	–	Single	No	7	36″
	2/3	240	–	–	–	–	–	✓	Double	Yes	7	36″
	2/3	600	–	✓	–	–	–	✓	Double	Yes	7	36″
400/600	2/3	240/600	✓	–	✓	–	✓	–	Single	No	10	44″
	2/3	240	–	–	–	–	–	✓	Single	No	10	36″
	2/3	600	–	✓	–	–	–	✓	Single	No	10	36″
800/1200	2/3	600	–	–	–	✓	–	–	Single	No	19	44″

[1] See Figures 29.1 and 29.2 for device mounting arrangements.

Table 38.2 Branch MCCB Modules

	Poles	Double Branch			Single Branch		Module X-Height
		Maximum Poles	Minimum Enclosure Width	Maximum # Poles Blank Option	Maximum Poles	Minimum Enclosure Width	
TEL	3	6	27″	3	–	–	3X
THQB	1/2/3	6		5	–		3X
TEY	1/2/3	6		5	–		3X
TEB/TED/THED	1/2	4		2	–		2X
TEB/TED/THED	1/2/3	6		3	–		3X
TQD/THQD	2	4		2	–		2X
TQD/THQD	3	6		3	–		3X
TFJ	2/3	6	36″	3	3	27″	3X
TFK/THFK	2/3	6		3	3		3X
[1]TFL/THLC1	3	6		3	3		3X
THLC2	3	6		3	3		5X
TJD	2/3	6	44″	3	3	27″	6X
TJJ/TJK/THJK	2/3	6		3	3		6X
TJ4V/THJ4V/TJL4V	3	6		3	3		6X
TLB4	3	6		3	3		5X
THLC4	3	6		3	3		5X
TKM/THKM	2/3	–	–	–	3	44″	6X
TK4V/TKL4V	3	–		–	3		6X

[1] When TFL is intermixed with fusible devices – X-Height is 4X.

WORKSHEET/ORDER FORM

STEP 1. Specify Incoming Service Characteristics

___ 3P4W ___ ≤ 240 Vac ___ Top Feed Service Entrance
___ 3P3W ___ ≤ 600 Vac ___ Bottom Feed ___ YES
___ 1P3W ___ ≤ 250 Vdc ___ NO
___ 1P2W

Voltage to be printed on label: ___ / ___ V

STEP 2. Specify Main Device

___ 200A ___ Main Switch ___ Main Lugs Only
___ 250A ___ H Fuse ___ Dual Main Lugs
___ 400A ___ J Fuse ___ Main Breaker
___ 600A ___ K Fuse
___ 800A ___ L Fuse
___ 1200A ___ R Fuse
___ T Fuse

Subtotal: X-Height _____

STEP 3. Specify Branch Devices (Include Futures):

Left Side (or Center)				Right Side		
Amps	**Poles**	**Fuse Type**	**X-Height**	**Amps**	**Poles**	**Fuse Type**

☐ SPECIFIED LAYOUT
OR
☐ FACTORY TO SELECT LAYOUT (CHECK ONE)

→ Subtotal: X-Height _____

STEP 4. Specify options.

___ Wider Enclosure
___ Compression Lugs
___ Main Device
___ Branch Switches
___ Interior Bus Bars
___ Aluminum – 750 amps/sq. in. – Standard
___ Copper – 1000 amps/sq. in.
___ Equipment Ground: Cat. No._____
___ Painted Enclosure
___ Lamicoid Nameplates
___ Metal Nameplates
___ Touch-Up Paint

OPTIONAL

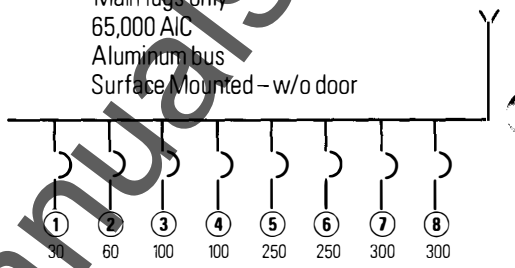
STEP 5. Calculate panel height from table.

STEP 6. Calculate panel width from figure.

Appendices

CIRCUIT BREAKER PANEL EXAMPLE

Main
800 amp – 3P4W, 480Y/277 Vac
Main lugs only
65,000 AIC
Aluminum bus
Surface Mounted – w/o door



STEP 1. Specify Incoming Service Characteristics

X 3P4W	___ ⩽ 240 Vac	X Top Feed	Service Entrance
___ 3P3W	X ⩽ 600 Vac	___ Bottom Feed	___ YES
___ 1P3W	___ ⩽ 250 Vdc		X NO
___ 1P2W			

Voltage to be printed on label: 480Y / 277

STEP 2. Specify Main Device

___ 200A	X Main Lugs Only
___ 250A	___ Dual Main Lugs
___ 400A	___ Main Breaker
___ 600A	
X 800A	
___ 1200A	

Subtotal: X-Height 6

STEP 3. Specify Branch Devices (Include Futures):

☐ SPECIFIED LAYOUT
OR
☒ FACTORY TO SELECT LAYOUT (CHECK ONE)

Left Side (or Center)				Right Side		
Amps	**Poles**	**Breaker Type**	**X-Height**	**Amps**	**Poles**	**Breaker Type**
30	3	TEL	3	60	3	TEL
100	3	TEL	3	100	3	TEL
250	3	TJL4V	6	250	3	TJL4V
300	3	TJL4V	6	300	3	TJL4V

18 →

Subtotal: X-Height 18

STEP 4. Specify options.

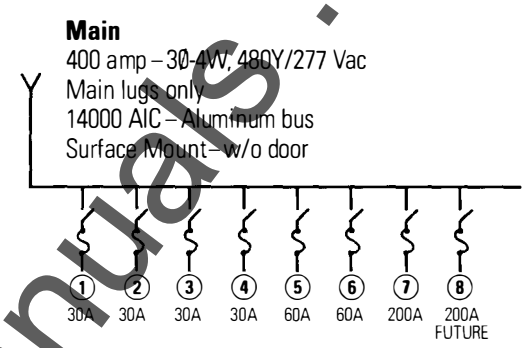
___ Wider Enclosure	___ Painted Enclosure
___ Compression Lugs	___ Lamicoid Nameplates
___ Main Device	___ Metal Nameplates
___ Branch Switches	___ Touch-Up Paint
___ Interior Bus Bars	
X Aluminum – 750 amps/sq. in.	
___ Copper – 1000 amps/sq. in.	
___ Equipment Ground: Cat. No. ____	

OPTIONAL

STEP 5. 24X→89.25″
Calculate panel height from table.

STEP 6. 44″
Calculate panel width from figure.

FUSIBLE PANEL EXAMPLE



STEP 1. Specify Incoming Service Characteristics

X 3P4W	___ ≤ 240 Vac	X Top Feed	Service Entrance
___ 3P3W	X ≤ 600 Vac	___ Bottom Feed	___ YES
___ 1P3W	___ ≤ 250 Vdc		X NO
___ 1P2W			

Voltage to be printed on label: 480Y / 277

STEP 2. Specify Main Device

___ 200A	___ Main Switch	X Main Lugs Only
___ 250A	___ H Fuse	___ Dual Main Lugs
X 400A	___ J Fuse	___ Main Breaker
___ 600A	___ K Fuse	
___ 800A	___ L Fuse	
___ 1200A	___ R Fuse	
	___ T Fuse	

Subtotal: X-Height 6

STEP 3. Specify Branch Devices (Include Futures):

	Left Side (or Center)				Right Side		
	Amps	Poles	Fuse Type	X-Height	Amps	Poles	Fuse Type
	30	3	R	4	30	3	R
	30	3	R	4	30	3	R
	60	3	R	5	60	3	R
☐ SPECIFIED LAYOUT OR ☒ FACTORY TO SELECT LAYOUT (CHECK ONE)	200	3	T	7	200 (FUTURE)	3	T

20X →

Subtotal: X-Height 20

STEP 4. Specify options.

___ Wider Enclosure	___ Painted Enclosure	**OPTIONAL**
___ Compression Lugs	___ Lamicoid Nameplates	
X Main Device	___ Metal Nameplates	STEP 5. 26X→75.50″
___ Branch Switches	___ Touch-Up Paint	Calculate panel height from table.
___ Interior Bus Bars		
X Aluminum – 750 amps/sq. in.		STEP 6. 36″
___ Copper – 1000 amps/sq. in.		Calculate panel width from figure.
___ Equipment Ground: Cat. No.____		

Appendices

APPENDIX B: TERMINOLOGY

Ambient Temperature is the temperature of the surrounding medium that comes in contact with a fuse or circuit breaker.

Ampacity is the amount of current in amps a conductor can carry continuously under the conditions of use without exceeding its temperature rating.

Amp rating is the amount of current a fuse will carry continuously without deterioration, or a circuit breaker without tripping and without exceeding temperature rise limits specified for a particular fuse or circuit breaker by NEC requirements and UL standards.

Amp Setting, Adjustable varies the continuous current-carrying ability of a circuit breaker through a predetermined range.

Arcing Fault is a high-impedance connection, such as an arc through air or across insulation, between two conductors.

Arcing Time, in a fuse, is the amount of time that elapses between the melting of the current-responsive element, such as a link, to the final interruption of the circuit. Arcing time is dependent upon such factors as voltage and impedance of the circuit.

Available Short-Circuit Current is the maximum rms (root-mean-square) symmetrical current at a given point in a power system, operating with maximum generating capacity and connected load, can deliver to any zero impedance short circuit applied at that given point.

Branch Circuit is the circuit conductor between the final overcurrent device protection and the outlets or point of use.

Bus Bar is a solid aluminum or copper alloy bar that carries current to the branch or feeded devices in a power panelboard or switchboard. There is at least one bus bar for each phase of the incoming electrical service.

Compression Lug, also called a crimp lug, is a lug that is crimped to hold cable.

Continuous Load is one in which the maximum current is expected to continue for three hours or more. (NEC Article 100)

Current Density is the amount of current traveling through a member (cable, bus bar, etc.). It is a cross-section measurement of the member in amps per square inch.

Current Sensors monitor and measure line-to-load and return load-to-line current. An imbalance causes a relay to signal the breaker to trip at a present time and current level if ground fault function is present.

Dead Front is a construction technique in which energized parts are not exposed to a person on the operating side of the equipment.

Double-Branch A mounting module that contains two fusible switch units or circuit breakers installed side by side.

Electrical Service or System is the conductors and equipment for delivering energy from the electrical supply system to the wiring system of the premises served. The service or system consists of the number of phases, number of wires, voltages and amps. Type of service determines the number of poles on the main device, the numbers of poles valid for feeder or branch devices, and the minimum voltages for 1-, 2-, or 3-pole breakers and fusible switches.

Enclosure is a constructed case to protect personnel against contact with the enclosed equipment and to protect the enclosed equipment against environmental conditions.

Equipment Grounding is the interconnection and grounding of electrical conducting material that either encloses or is adjacent to electrical power conducting components. (NEC 250-91 (b))

Expansion Kit An assembled kit that can be installed in an empty side of a double-branch fusible switch unit to create a new fusible switch unit. It includes the handle, base plate, cover plate, load base and switch.

Feeder Circuit is all circuit conductors between the service equipment or the source of a separately derived system and the final branch-circuit overcurrent device.

Filler Mounts on side of fusible switch module, circuit breaker module, or between side trims to cover the front of the enclosure. The fillers plus trim comprise the enclosure front around the installed devices.

Frame Size is a specific size of breaker with a specific range of amp ratings. For example, an F-frame breaker is available in ratings of 70 amps to 225 amps in a 225 amp frame.

Front is the part of the panelboard that protects the interior of the panelboard from environmental elements and prevents accidental contact with the panel's interior live conductors.

Fuse Pullers Installed in fusible switch units, to facilitate removal of the fuse.

Fuseholder or Fuse Block is an assembly of fuse clips and insulation for mounting and connecting a fuse into the circuit.

Fusible Switch is a device that can switch off current flow and to which a fuse(s) is added to protect conductors.

Ground Fault, an overcurrent condition, is leakage current of a very low magnitude (measured in milliamps) between the hot and ground conductors and which can shock a person if that person becomes part of the unintentional path to ground.

I^2t is the measure of heat energy developed within a circuit, in which I stands for effective let-through current squared, and t is time in seconds.

Interior The side rails, bus bars and insulation system that mounts in the enclosure. It is energized through the main device (lugs, fusible switch or circuit breaker) and in turn energizes the installed circuit-protective devices (fusible switch or circuit breaker).

Interrupting Rating is the highest rms-rated alternating current a fuse or circuit breaker is intended to interrupt under specified conditions.

Jaw Metal parts that grip the interior bus bar and conduct electricity to the module bus bars. The jaws are spring-reinforced to provide a highly reliable electrical connection.

Line refers to the incoming (live) side of equipment or device.

Load is the outgoing (switched) side of equipment or device.

Lug is a connector from the cable to the bus or from the device to the cable.

Magnetic Trip is synonymous with instantaneous trip and describes a tripping action with no intentional time delay. Current exceeding the magnetic trip level will actuate the trip mechanism and open the breaker contacts immediately.

Main Device is a fusible switch or circuit breaker that can isolate the panelboard from incoming power.

Main Lug is the current connecting means between the incoming service cable and the bus bar.

Mechanical Lug is a terminal with one or more wire binding screws that are driven to hold the conductor or cable.

Overcurrent is any current in excess of the rated current of equipment or the ampacity of a conductor that can result from an overload, a short circuit or a ground fault.

Pole refers to the number of output terminals on a fusible switch or circuit breaker that must be insulated and separated from each other.

Power Panelboard is any panelboard that is not a lighting or appliance panelboard as specified by UL and NEC and is not limited as to the number and rating of branch circuits, except for available spacing and physical size. The dead-front panelboard is accessible from the front only.

Quick-make, Quick-break describes the actions of a mechanism, in which the speed of the contacts in opening and closing a breaker or fusible switch is not controlled by the operator.

Rejection Fuse and Clip is a combination of Class R fuses and clips that will not accept fuses with a lower short-circuit rating. This type of fuse and clip has a mechanism that rejects standard NEMA Class H fuses.

Appendices

Rotor Mechanism in fusible switch unit that mechanically ensures all switch blades open/close simultaneously.

Selective Tripping is the application of circuit breakers or fuses in series, so that, of the breakers or fuses carrying fault current, only the one nearest the fault opens and isolates the faulted circuit from the system.

Series-Connected Rated Panel means the UL Listed short-circuit rating of the panel is equal to the IC rating of the main protective device when properly applied with its branch circuit protective devices.

Service Disconnect is a device or group of devices that all ungrounded conductors of a circuit can be disconnected from the service conductors.

Service Entrance Equipment, such as power panelboard, consists of a fusible switch or circuit breaker located near the point of entrance of supply conductors to a building and serves as the main control and disconnect of electrical power. Service entrance equipment must include a connector for bonding and grounding the neutral conductor at the entrance point of the supply conductors and bear a UL service entrance label.

Shunt Trip opens a breaker by remote control.

Single-Branch A mounting module that is sized to accept one fusible switch unit or circuit breaker. A single-branch fusible switch module may have one fusible switch unit factory-installed on one side, and the other side specified empty (blank) to facilitate installing future expansion kits.

Thermal Trip protects against sustained overloads. A bimetallic element reacts time-wise in inverse proportion to the current. If a circuit is overloaded, heat from excessive current flow causes the bimetal to bend, actuating the trip mechanism to open the breaker.

Time Delay is a term used by NEMA, ANSI and UL to denote a minimum opening time of 10 seconds on an overload current five times the amp rating of a circuit breaker or Class H, K, J and R fuses. Time delay is useful to let through momentary current inrushes, such as in motor startups, without interrupting the circuit.

Trim The four pieces of painted steel (top, bottom and each side) that cover the front of the enclosure. The trim plus fillers comprise the enclosure front around the installed devices.

Trip Function is that portion of the breaker that senses fault conditions, controls the associated logic functions and initiates and powers the breaker trip device.

Trip Mechanisms are independent of manual control handles. The breaker will trip when a fault occurs, even if the handle is held in the "ON" position.

Undervoltage Release instantaneously trips the breaker when voltage (control or line) drops to 30%-70% of nominal rating.

Voltage is electrical pressure that moves electrons through a conductor and is measured in volts.

Voltage Rating is the rms alternating current voltage at which a fuse or circuit breaker is designed to operate.

X Value is a vertical measurement of the usable mounting space on a panelboard for a fusible switch or circuit breaker. X is equal to 1⅜ inches (1.375"). X value is the main factor in determining the required height of a panelboard. Height of the interior is the sum of the horizontally mounted, panel-mounted components.

APPENDIX C:
INSTALLATION PUBLICATIONS

Installation instructions for Spectra Series Power Panelboards

Description	Publication Number
30 amp/60 amp Switch Expansion Kit	GEH 5547
30 amp through 200 amp Fusible Switch Installation	GEH 5548
400 amp/1200 amp Fusible Switch Installation	GEH 5550
400 amp/1200 amp Fusible Switch Handle Replacement	GEH 5553
400 amp/600 amp Fusible Switch Load Block Replacement	GEH 5576
400 amp/600 amp Fusible Switch Rejection Kit	GEH 5577
60 amp/100 amp Fusible Switch Expansion Kit	GEH 5581
200 amp Fusible Switch Expansion Kit	GEH 5582
APP Filler Plate Installation	GEH 5583
ANK Neutral Assembly Kit Installation	GEH 5585
Equipment Grounding Kit	GEH 5586
APF Surface Front Trim Kit	GEH 5587
Main Lug Kit Installation	GEH 5588
Installing Interior Into Box	GEH 5589
AFP Filler Plate Installation	GEH 5590
Compression Lug Kit Installation	GEH 5595
Mechanical Lug Kit Installation	GEH 5596
800 amp/1200 amp Fusible Switch Installation	GEH 5597
Permanent Circuit Numbers	GEH 5598
Flush Mounting Installation	GEH 5621
Door In Door Installation	GEH 5622
K Frame Module Installation	GEH 5623
J Frame Module Installation	GEH 5624
E Frame Module Installation	GEH 5625
F Frame Module Installation	GEH 5626
THLCI Frame Module Installation	GEH 5627
TQD Frame Module Installation	GEH 5628
Feed Through Lug Kit Installation	GEH 5630
Box Extensions	GEH 5631
30 amp/60 amp Rejection Kit	GEH 3047
Alternate Lugs: 30-1200 amp Fusible Switches	GEJ 3050
NEMA Panelboard Installation Instructions	GEJ 3043

APPENDIX D: TECHNICAL INFORMATION

Service Conditions Equipment is rated for operation under the following usual service conditions, unless limited by the devices contained in the equipment. Unusual service conditions should be referred to the factory. These include requirements such as seismic, corrosive or explosive atmospheres, vibration, shock and unusual operating duties, and temperature.

Altitudes Equipment is rated for use up to a certain altitude. Above these altitude values, which vary dependent on the type of equipment being considered, the continuous current and voltage rating may require modification to account for increased temperature and lower dielectric strength. Standard ratings may be applied up to the following altitudes:

Table 46.1 Altitude Derating

Equipment	Rating Correction Required Above
	(Feet)
Low Voltage Panelboards	6600
Low Voltage Switchboards	6600
Low Voltage Switchgear	6600
Low Voltage Motor Control Centers	3300
Medium Voltage Motor Control	3300
Medium Voltage Switchgear	3300

For derating correction factors to be applied when the altitude exceeds the above, refer to the equipment application bulletins or factory.

Ambient Temperature Equipment is rated for use in a given ambient, and if exceeded, the continuous current rating requires derating. Rating correction is required if applied in an ambient exceeding the following:

Table 46.2 Ambient Derating

Equipment	Ambient
Low Voltage Panelboards	40°C
Low Voltage Switchboards	25°C
Low Voltage Switchgear	40°C
Low Voltage Motor Control Centers	40°C
Medium Voltage Motor Control	40°C
Medium Voltage Switchgear	40°C

For derating correction factors to be applied when the ambient exceeds the above, refer to the equipment application bulletin or factory.

Current The continuous current carried by a protective device should not exceed 80% of the device rating unless the equipment or assembly, including the protective device, is listed for continuous operation at 100% of its rating. A continuous load current is one that continues for three hours or more. A noncontinuous load current may be 100% of the device rating.

Low-voltage fusible switches are standard-rated 80% except high-pressure contact and bolted pressure switches, which are 100% rated. Molded case circuit breakers equipped with thermal magnetic trips are standard-rated (80%). When equipped with electronic trips, they can be standard (80%) or 100% rated.

When mounted in equipment, MCCB and fusible switches in group-mounted configuration are all standard (80%) rated. In individual mounted configuration, MCCB with electronic trip can be standard (80%) or 100% rated. Insulated case circuit breakers are standard (80%) or 100% rated. Low-voltage power circuit breakers, type AKR, medium-voltage fuses, and medium-voltage breaker PowerVac are all 100% rated. Low-voltage protective devices are fast operating and their short-circuit rating is based on the maximum current during the first half cycle of fault current flow. The total fault current at initiation of fault consists of two components: the ac and dc components. The ac component is defined as the symmetrical rms current, and ac plus dc, the asymmetrical rms current. The magnitude and rate of decay of the dc component is a function of the reactance to resistance (X/R) ratio. Low-voltage protective devices are rated on the basis of symmetrical rms amps, but tested at known X/R ratios to assure capability of interrupting the total fault current asymmetrical fault. The X/R ratios at which they are tested are as follows:

Table 47.1

Low Voltage Protective Device		X/R
Power Circuit Breaker (AKR)		6.6
Insulated Case Circuit Breaker (IOCB)		4 9
Molded Case Circuit Breaker		
Interrupting Rating	20KA	4 9
	10 20KA	3.2
	10KA	1.7
Current Limiting Fuses		4 9

Thus, the low-voltage protective device interrupting rating symmetrical rms must be equal to, or greater than, the circuit symmetrical rms fault current and test X/R equal to, or greater than, circuit X/R at point of application. If the circuit asymmetrical current should be greater than the protective device will withstand, then the protective devices interrupting rating must be derated. Derating factors are identified in the applicable application bulletins and standards.

Medium- and high-voltage fuses are rated in terms of symmetrical current, but can withstand the total asymmetrical current provided the X/R ratio does not exceed 15. If the circuit where applied exceeds an X/R of 15, then it is necessary to derate the symmetrical current rating in accordance with the applicable standard. Proper application of medium- and high-voltage breakers requires that the circuit- short-circuit duties during the first cycle (momentary), and at contact parting time (interrupting), be compared with the circuit breaker's short-circuit capability to close and latch during the first cycle, and to interrupt at some time later. Refer to GET 3550 to determine methods of calculating short-circuit currents for proper application.

NEC REFERENCES

Conductors for General Wiring

Table 48.1 Ampacities of Insulated Conductors Rated 0-2000 Volts, 60°C to 90°C. Not More Than Three Conductors in Raceway or Cable or Earth (Directly Buried), Based on Ambient Temperature of 30°C (86°F)

Size	Temperature Rating of Conductor.								Size
	60°C (140°F)	75°C (167°F)	85°C (185°F)	90°C (194°F)	60°C (140°F)	75°C (167°F)	85°C (185°F)	90°C (194°F)	
AWG MCM	TYPES †TW †UF	TYPES †FEPW †RH †RHW †THW, THHW †THWN †XHHW †USE †ZW	TYPE V	TYPES TA, TBS SA SIS †FEP †FEPB †RHH †THHN, THHW †XHHW	TYPES †TW †UF	TYPES †RH †RHW †THW, THHW †THWN †XHHW †USE	TYPE V	TYPES TA TBS SA SIS †RHH †THHN †THHW †XHHW	AWG MCM
	COPPER				ALUMINUM OR COPPER-CLAD ALUMINUM				
18				14					
16			18	18					
14	20†	20†	25	25†					
12	25†	25†	30	30†	20†	20†	25	25†	12
10	30	35†	40	40†	25	30†	30	35†	10
8	40	50	55	55	30	40	40	45	8
6	55	65	70	75	40	50	55	60	6
4	70	85	95	95	55	65	75	75	4
3	85	100	110	110	65	75	85	85	3
2	95	115	125	130	75	90	100	100	2
1	110	130	145	150	85	100	110	115	1
1/0	125	150	165	170	100	120	130	135	1/0
2/0	145	175	190	195	115	135	145	150	2/0
3/0	165	200	215	225	130	155	170	175	3/0
4/0	195	230	250	260	150	180	195	205	4/0
250	215	255	275	290	170	205	220	230	250
300	240	285	310	320	190	230	250	255	300
350	260	310	340	350	210	250	270	280	350
400	280	335	365	380	225	270	295	305	400
500	320	380	415	430	260	310	335	350	500
600	355	420	460	475	285	340	370	385	600
700	385	460	500	520	310	375	405	420	700
750	400	475	515	535	320	385	420	435	750
800	410	490	535	555	330	395	430	450	800
900	435	520	565	585	355	425	465	480	900
1000	455	545	590	615	375	445	485	500	1000
1250	495	590	640	665	405	485	525	545	1250
1500	520	625	680	705	435	520	565	585	1500
1750	545	650	705	735	455	545	595	615	1750
2000	560	665	725	750	470	560	610	630	2000

AMPACITY CORRECTION FACTORS

Ambient Temp. °C	For ambient temperatures other than 30°C, multiply the ampacities shown by the appropriate factor shown below.								Ambient Temp. °F
31-35	.91	.94	.95	.96	.91	.94	.95	.96	88-95
36-40	.82	.88	.90	.91	.82	.88	.90	.91	97-104
41-45	.71	.82	.85	.87	.71	.82	.85	.87	106-113
46-50	.58	.75	.80	.82	.58	.75	.80	.82	115-122
51-55	.41	.67	.74	.76	.41	.67	.74	.76	124-131
56-60		.58	.67	.71		.58	.67	.71	133-140
61-70		.33	.52	.58		.33	.52	.58	142-158
71-80			.30	.41			.30	.41	160-176

†The overcurrent protection for conductor types marked with an obelisk (†) shall not exceed 15 amps for 14 AWG, 20 amps for 12 AWG, and 30 amps for 10 AWG copper, or 15 amps for 12 AWG and 25 amps for 10 AWG aluminum and copper-clad aluminum after any correction. Factors for ambient temperature and number of conductors have been applied.

Table 49.1 Ampacities of Insulated Conductors Rated 0-2000 Volts, 60°C to 90°C. Single conductors in free air, based on ambient temperature of 30°C (86°F)

Size	Temperature Rating of Conductor.								Size
	60°C (40°F)	75°C (167°F)	85°C (185°F)	90°C (194°F)	60°C (140°F)	75°C (167°F)	85°C (185°F)	90°C (194°F)	
AWG MCM	TYPE †TW †UF	TYPES †FEPW †RH †RHW †THW, THHW †THWN †XHHW †ZW	TYPE V	TYPES TA, TBS, SA, †TW, SIS, †FEP †FEPB †RHH †THHN †XHHW MI	TYPE †TW †UF	TYPES †RH †RHW †THW, THHW †THWN †XHHW	TYPE V	TYPES TA TBS SA SIS †RHH †THHN †THHW †XHHW MI	AWG MCM
	COPPER				ALUMINUM OR COPPER-CLAD ALUMINUM				
18				18					
16			23	24					
14	25†	30†	30	35†					
12	30†	35†	40	40†	25†	30†	30	35†	12
10	40†	50†	55	55†	35†	40†	40	40†	10
8	60	70	75	80	45	55	60	60	8
6	80	95	100	105	60	75	80	80	6
4	105	125	135	140	80	100	105	110	4
3	120	145	160	165	95	115	125	130	3
2	140	170	185	190	110	135	145	150	2
1	165	195	215	220	130	155	165	175	1
1/0	195	230	250	260	150	180	195	205	1/0
2/0	225	265	290	300	175	210	225	235	2/0
3/0	260	310	335	350	200	240	265	275	3/0
4/0	300	360	390	405	235	280	305	315	4/0
250	340	405	440	455	265	315	345	355	250
300	375	445	485	505	290	350	380	395	300
350	420	505	550	570	330	395	430	445	350
400	455	545	595	615	355	425	465	480	400
500	515	620	675	700	405	485	525	545	500
600	575	690	750	780	455	540	595	615	600
700	630	755	825	855	500	595	650	675	700
750	655	785	855	885	515	620	675	700	750
800	680	815	885	920	535	645	700	725	800
900	730	870	950	985	580	700	760	785	900
1000	780	935	1020	1055	625	750	815	845	1000
1250	890	1065	1160	1200	710	855	930	960	1250
1500	980	1175	1275	1325	795	950	1035	1075	1500
1750	1070	1280	1395	1445	875	1050	1145	1185	1750
2000	1155	1385	1505	1560	960	1150	1250	1335	2000

AMPACITY CORRECTION FACTORS

Ambient Temp. °C	For ambient temperatures other than 30°C, multiply the ampacities shown by the appropriate factor shown below.								Ambient Temp. °F
31-35	.91	.94	.95	96	.91	.94	.95	.96	88-95
36-40	.82	.88	.90	.91	.82	.88	.90	.91	97-104
41-45	.71	.82	85	.87	.71	.82	.85	.87	106-113
46-50	.58	.75	.80	.82	.58	.75	.80	.82	115-122
51-55	.41	.67	.74	.76	.41	.67	.74	.76	124-131
56-60		.58	.67	.71		.58	.67	.71	133-140
61-70		.33	.52	.58		.33	.52	.58	142-158
71-80			.30	.41			.30	.41	160-176

†The overcurrent protection for conductor types marked with an obelisk (†) shall not exceed 20 amps for 14 AWG, 25 amps for 12 AWG, and 40 amps for 10 AWG copper, or 20 amps for 12 AWG and 30 amps for 10 AWG aluminum and copper-clad aluminum after any correction. Factor for ambient has been applied.
*For dry locations only. See 75°C column for wet locations.

APPROXIMATE MOTOR FULL-LOAD CURRENT RATINGS

Table 50.1 Full-Load Current of Normal Efficiency Motors Average Expected Values. For three-phase, 60-Hertz, GE Type K (NEMA design B) Tri-Clad 700-Line, normal efficiency, drip-proof, normal starting torque, continuous, 40°C ambient (1.15 service factor) horizontal induction motors.

Motor HP	Synchronous Speed RPM	Average Expected Values of Full-Load Currents			
		200V	230V	460V	575V
1/4	1800	1.6	1.4	0.70	0.56
	1200	1.7	1.5	0.75	0.60
1/3	3600	2.0	1.7	0.85	0.68
	1800	1.7	1.5	0.75	0.60
	1200	2.0	1.7	0.85	0.68
1/2	3600	2.0	1.8	0.86	0.70
	1800	2.3	2.0	1.0	0.80
	1200	2.3	2.0	1.0	0.80
	900	3.2	2.8	1.4	1.4
3/4	3600	2.8	2.4	1.2	0.96
	1800	3.2	2.8	1.4	1.1
	1200	3.7	3.2	1.6	1.3
	900	4.4	3.8	1.9	1.5
1	3600	3.7	3.2	1.6	1.3
	1800	4.1	3.6	1.8	1.4
	1200	4.4	3.8	1.9	1.5
	900	5.5	4.8	2.4	1.9
1 1/2	3600	5.3	4.6	2.3	1.8
	1800	6.0	5.2	2.6	2.1
	1200	6.0	5.2	2.6	2.1
	900	7.1	6.2	3.1	2.5
2	3600	6.9	6.0	3.0	2.4
	1800	7.1	6.2	3.1	2.5
	1200	7.6	6.6	3.3	2.6
	900	10.6	9.2	4.6	3.7
3	3600	9.4	8.2	4.1	3.3
	1800	9.9	8.6	4.3	3.4
	1200	12.0	10.4	5.2	4.2
	900	15.4	13.4	6.7	5.4
5	3600	15.4	13.4	6.7	5.4
	1800	16.3	14.2	7.1	5.7
	1200	19.3	16.8	8.4	6.7
	900	19.8	17.2	8.6	6.9
7 1/2	3600	21.6	18.8	9.4	7.5
	1800	23.7	20.6	10.3	8.2
	1200	26.0	23.6	11.3	9.0
	900	28.5	24.8	12.4	9.9
10	3600	27.4	23.8	11.9	9.5
	1800	31.3	27.2	13.6	10.9
	1200	32.7	28.4	14.2	11.4
	900	33.1	28.8	14.4	11.5
15	3600	42.6	37.0	18.5	14.8
	1800	46.7	40.6	20.3	16.2
	1200	45.1	38.2	19.6	15.7
	900	47.6	41.4	20.7	16.6
20	3600	62.3	54.2	27.1	21.7
	1800	59.3	51.6	25.8	20.6
	1200	56.6	48.2	24.6	19.7
	900	63.9	55.6	27.8	22.2

Motor HP	Synchronous Speed RPM	Average Expected Values of Full-Load Currents			
		200V	230V	460V	575V
25	3600	72	62.6	31.3	25.0
	1800	71.3	62.0	31.0	24.8
	1200	73.8	64.2	32.1	25.7
	900	82.6	71.8	35.9	28.7
30	3600	85.6	74.4	37.2	29.8
	1800	86	74.8	37.4	29.9
	1200	88.6	77	38.5	30.8
	900	92.2	80.2	40.1	32.1
40	3600	110	95.6	47.8	39.2
	1800	116	100.9	50.4	40.3
	1200	114	99.6	49.8	39.8
	900	122	105.8	52.9	42.3
50	3600	140	122.2	61.1	48.9
	1800	142	123.6	61.8	49.4
	1200	144	125.2	62.6	50.1
	900	159	138.2	69.1	55.3
60	3600	163	141.4	70.7	56.6
	1800	172	149.8	74.9	59.9
	1200	172	149.2	74.6	59.7
	900	176	153.4	76.7	61.4
75	3600	206	178.8	89.4	71.5
	1800	207	180.0	90	72.0
	1200	206	179.2	89.6	71.7
	900	221	191.8	95.9	76.7
100	3600	262	228	114	91.2
	1800	281	244	122	97.7
	1200	283	246	123	98.4
	900	296	258	129	103
125	1800	340	290	145	116
	1200	352	296	148	118
	900	370	306	153	122
			322	161	129
150	3600	398	346	173	138
	1800	412	348	179	143
	1200	419	364	182	146
	900	435	378	189	151
200	3600	–	446	223	178
	1800	–	468	234	187
	1200	–	482	241	193
250	3600	–	574	287	230
	1800	–	590	295	236
	1200	–	594	297	238
300	3600	–	676	338	270
	1800	–	686	343	274
350	3600	–	774	387	310
	1800	–	792	396	317
400	3600	–	890	445	356

(1) Open, Type K, general purpose, NEMA SF, solid base, rolled-steel shell, GE induction motors. Note: The listed data is based on approximate full-load current ratings of standard, open, 1.15 service factor, continuous-rated General Electric motors. Full-load current ratings if similar motors of other manufacturers may vary considerably. Therefore, whenever possible, use actual full-load current rating given on motor nameplate. Contact motor manufacturer for full-load currents or single-phase and dc motors.

TRANSFORMERS

Table 51.1 Distribution and Pad-Mounted Transformers Available Short-Circuit Currents – By Service Ratings

Service Rating in Amps	Maximum Short Circuit kVA Available from Primary Source	Short Circuit Current Total RMS Amps Symmetrical (Average 3-Phase Amps)			
		Ultimate Transformer Size kVA and Impedance	208 Volts Transformer Alone	Ultimate Transformer Size kVA and Impedance	480 Volts Transformer Alone
600	100,000 250,000 500,000 750,000 UNLIMITED	225 2%	28,070 29,980 30,540 30,770 31,230	500 2%	24,060 27,340 28,640 29,100 30,070
800	100,000 250,000 500,000 750,000 UNLIMITED	300 2%	36,200 39,280 40,420 40,820 41,640	750 3.5%	21,230 23,740 24,720 25,780 25,780
1000	100,000 250,000 500,000 750,000 UNLIMITED	300 2%	36,200 39,280 40,420 40,820 41,640	750 3.5%	21,230 23,740 24,720 25,060 25,780
1200	100,000 250,000 500,000 750,000 UNLIMITED	500 2%	55,550 63,000 66,000 67,200 69,300	1000 3.5%	26,730 30,840 32,510 33,100 34,370
1600- 2000	100,000 250,000 500,000 750,000 UNLIMITED	750 3.5%	48,980 54,780 57,040 57,830 59,480	1500 3.5%	36,080 44,000 47,480 48,760 51,550
2500	100,000 250,000 500,000 750,000 UNLIMITED	1000 3.5%	61,680 71,700 75,020 76,400 79,300	2000 5.75%	32,500 37,100 38,900 39,700 41,200
3000	100,000 250,000 500,000 750,000 UNLIMITED	1000 3.5%	61,680 71,700 75,020 76,400 79,300	2500 5.75%	36,400 44,500 48,100 49,500 52,300
4000	100,000 250,000 500,000 750,000 UNLIMITED	1500 3.5%	83,270 101,550 109,570 112,530 118,960	(2) 1500 3.5%	72,160 88,000 94,960 97,520 103,100

Table 51.2 Typical Short-Circuit Contribution for Motors

Voltage	Short Circuit Contribution	Equivalent Motor Contribution
208	2X Transformer Normal Load Continuous Current Amps (or service amp rating)	50%
480	Commercial Buildings: 2X Transformer Normal Load Continuous Current Amps (or service amp rating)	50%
	Industrial Buildings: 4X Transformer Normal Load Continuous Current Amps (or service amp rating)	100%

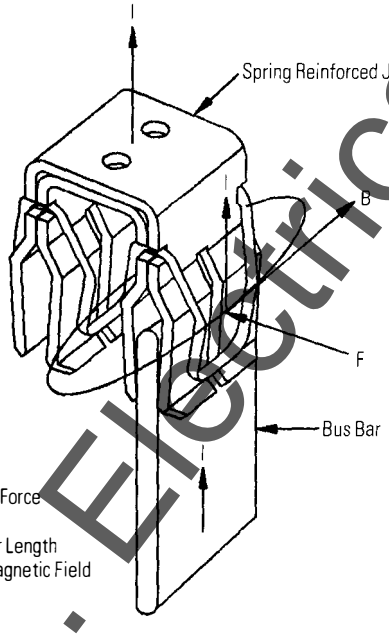
APPENDIX E:
CONNECTING MECHANISM INFORMATION

The concept of holding spring-reinforced jaws onto a bus structure through positive bolted and locking means has been successfully used in busway, and drawout switchboards and switchgear.

The spring-reinforced jaw clamps onto the panelboard interior bus. During normal circuit conditions, it maintains the electrical connection.

At short circuit, a strong electro-magnetic field develops around the jaw. The resulting force increases the jaw pressure on the bus and maintains an excellent connection. The design creates current paths and generates clamping forces as shown in the computer-generated illustration.

Table 52.1 Spring Reinforced Jaw Connection



The spring reinforces the jaw and compensates the weaker electro-magnetic forces between adjacent phases within the double-bus assembly. All jaws are also secured by pressure-lock connectors in order to avoid inadvertent unit removal.

APPENDIX F:
GUIDE FORM SPECIFICATIONS

GENERAL

Furnish and install power panelboards either fused-switch or molded-case circuit breaker type with dead-front safety construction as shown on plans and described herein as General Electric Spectra Series™ panelboards. Panelboards shall be listed and labeled by Underwriters Laboratories, Inc. in accordance with UL Standard 67, and shall conform to the latest requirements of the National Electrical Code and NEMA standard PB.1. The panelboard shall meet service entrance requirements when specified.

ENCLOSURES

Panelboard enclosures shall be corrosion-resistant galvanealed (zinc finished) sheet steel with removable end walls. Fronts shall be cold-rolled steel, coated with a phosphatized rust inhibitor and then finish coated with ANSI 61 light gray enamel.

FRONTS

A four-piece front shall be furnished to provide ease of wiring access. A door, when required, shall be a one-piece bolt-on front with a lockable hinged door over the protective devices. Door-in-door construction, when required, shall consist of a one-piece front with two lockable doors. The smaller door, when open, provides access to all device handles and rating labels. The larger door, when open, provides access to all conductors and wiring terminals. Both doors shall be furnished with locks. All door hinges shall be continuous piano hinges which are welded to the door(s) and bolt-on front. Door locks shall be GE slate red Valox style. (Optional door locks which can be provided are Yale #511, Corbin lift latch style and 3 point latch.) All screw fasteners are zinc coated to retard corrosion.

MAIN AND BRANCH DEVICES

Main and branch-fusible switches shall be of the positive, quick-make, quick-break type with double-break, over-center mechanism. The external handle shall be suitable for padlocking in the "OFF" position and is interlocked with the switch cover to prevent access to the switch interior when the switch is in the "ON" position – an interlock override release is provided. Fusible switch units shall be fully interchangeable without disturbing the adjacent units and shall be capable of withstanding the available let-through short-circuit current as shown on the plans.

Main and branch circuit breakers shall be quick-make, quick-break, and trip-indicating. All two and three pole breakers shall have internal common trips. Interrupting rating of the circuit breaker shall not be less than the maximum short-circuit currents available at the incoming line terminals as shown on the plans.

INTERIORS

Panelboard symmetrical interior shall be so designed and assembled that the circuit-protective modules (either fused switches less than 800A or circuit breaker) are mounted onto the bus bar with positive gripping jaw assemblies and locked pressure connections. The circuit-protective module can be removed or replaced without disturbing adjacent protective devices and without removing the main bus or branch circuit connections. The interiors shall be capable of supporting compatible fusible switches and molded-case circuit breakers in the same panelboard.

BUS BARS

Bus bars shall be current density rated and meet UL67 temperature rise limits thru actual tests. All bus bars are silver plated. Bus bar current density rating shall be 750 amps per square inch for aluminum or 1000 amps per square inch for copper as required by the contract documents. Reduced current density bus ratings of 600 amps per square inch for aluminum or 800A per square inch for copper are also available.

Bus bars shall be sequenced-phased, and rigidly supported by high-impact resistant, insulated bus supporting assemblies to prevent vibration and resulting damage when subjected to stress, vibration or short circuits. All solderless terminations shall be suitable for either copper or aluminum UL Listed wire or cable and shall be tested and listed in conjunction with appropriate UL standards.

(Continued on next page)

APPENDIX F:
GUIDE FORM SPECIFICATIONS
CONTINUED

Panelboards shall be so designed to permit the incoming line conductors to enter either the top or bottom of the enclosure.

The neutral bar shall be fully rated and capable of being relocated to either corner of the enclosure at the line end to facilitate conductor termination.

Ground wire terminations shall be provided as an option in kit form suitable for installation by the panelboard installer without voiding UL label.

SERIES RATINGS

All panelboard series-connected ratings shall be prominently displayed, and all current ratings of protective devices shall be displayed on the device label.

GE Electrical Distribution & Control

General Electric Company
41 Woodford Ave.
Plainville, CT 06062

GET-7006A 0390 MHK