
GUIDEFORM SPECIFICATION

Section 16471: low voltage power panels

Section 26 24 16.02: low voltage power panels

1SQC900001D0201 rev D

PART 1 General

1.01 Section includes

- A. Low voltage [ReliaGear neXT] power panelboards

1.02 Related sections

- A. [16479] [26 43 13], transient voltage surge suppression

1.03 References

The low voltage power panelboards and protection devices in this specification are designed and manufactured according to latest revision of the following standards (unless otherwise noted).

- A. ANSI/NEMA PB 1, Panelboards
- B. ANSI/NFPA 70, National Electrical Code
- C. UL 489, Molded-Case Circuit Breakers and Circuit-Breaker Enclosures
- D. UL 50, Enclosures for Electrical Equipment
- E. UL 67, Panelboards
- F. cUL listing Low Voltage Modular Power Panels
- G. Seismic requirements according to ICC-ES AC156 (2019 CBC).

1.04 Definitions

- A. Overcurrent Protective Device - circuit breaker pole. EXAMPLE: A 2-pole device is considered 2 protective devices.
- B. Short Circuit Rating - The interrupting rating of lowest rated device in the panelboard or applicable UL series rating for proper main and branch device combinations.
- C. Multi-Section Panelboards - Two or more panelboards with sub-feed lugs or thru-feed lugs shall be used in all but 1 section of each panelboard. The lugs shall have same capacity as incoming mains. Cable inter-connections shall be provided, and field installed by the contractor/installer.
- D. Protective Devices - molded case circuit breakers.

- E. Fully Rated System = The short-circuit ratings of all protective devices are equal to or exceed the available short-circuit current of the system.
- F. Series-Connected System = The short-circuit rating of the upstream device is fully rated at its location, but the downstream devices are not fully rated. The downstream device has lower interruption rating than the available fault current at its location.
- G. Series-Connected Rating = UL permits assigning a short-circuit rating to a combination of devices (molded-case circuit breakers and/or fuses) connected in series that is higher than the lowest rated protective device in the combination. **NOTE:**
 - 1. Series ratings are applicable only when the end-use equipment is so marked.
 - 2. The combination rating cannot exceed the rating of the protective device furthest upstream.
 - 3. Upstream device can be a molded-case circuit breaker or fuse.
 - 4. Device combinations are not limited to those in the same equipment. They can be in different equipment, such as the combination of a panelboard feeder and a downstream panelboard main versus a panelboard main and its branches.
 - 5. Any distance between devices in different equipment is permitted.
 - 6. 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.
- H. Line side connector (LSC) = circuit breaker plug-in connection integrated into the circuit protective devices for plugging into bus stack.
- I. Thermal magnetic fixed (TMF) = Circuit breaker with thermal magnetic trip unit with fixed thermal and magnetic threshold
- J. Thermal magnetic adjustable (TMA) = Circuit breaker with thermal magnetic trip unit with adjustable thermal and magnetic threshold

1.05 System description

- A. Equipment shall be indoor deadfront power panelboards for molded-case circuit breakers. Provide NEMA 1, 2, 3R, 4/4X, or 12 where indicated on the plans.
- B. Panelboards are non-service entrance by default. They shall meet service entrance requirements when specified.
- C. Panelboards shall have integrated short circuit rating. Fully rated panel rating is that of lowest rated device in panelboard. Series rating are for the UL tested main-branch combination.

1.06 Submittals

- A. Manufacturer shall provide copies of following documents to owner for review and evaluation in accordance with general requirements of Division [1] [01] and Division [16] [26]:
- B. Product data on specified product;

- C. Shop drawings on specified product;
- D. Trip curves for each specified product;
- 1.07 Installation, operation and maintenance data
 - A. Manufacturer shall provide copies of installation, operation and maintenance procedures to owner in accordance with general requirements of Division [1] [01] and Division [16] [26].
- 1.08 Quality assurance (qualifications)
 - A. Manufacturer shall have specialized in the manufacture and assembly of low voltage power panelboards for [50] years.
 - B. Low voltage power panelboards shall be listed and/or classified by Underwriters Laboratories in accordance with standards listed in Article 1.03 of this specification.
- 1.09 Delivery, storage, and handling
 - A. Contractor shall deliver, store, protect, and handle products in accordance with recommended practices listed in manufacturer's Installation and Maintenance Manuals.
 - B. Ship each low voltage modular power panelboard with the breakers already assembled in the interior. As an alternative, ship each low voltage modular power panelboard section in individual shipping splits for ease of handling. Each modular panelboard section shall be mounted on shipping skids and wrapped for protection.
 - C. Contractor shall inspect and report concealed damage to carrier within specified time.
 - D. Contractor shall store in a clean, dry space. Maintain factory protection or cover with heavy canvas or plastic to keep out dirt, water, construction debris, and traffic.
 - E. Contractor shall handle in accordance with manufacturer's written instructions to avoid damaging equipment, installed devices, and finish.
- 1.10 Project conditions (site environmental conditions)
 - A. Follow (standards) service conditions before, during and after panelboard installation.
 - B. Low voltage ReliaGear neXT power panelboards shall be located in well-ventilated areas, free from excess humidity, dust and dirt and away from hazardous materials. Indoor locations shall be protected to prevent moisture from entering enclosure.
- 1.11 Warranty
 - A. Manufacturer warrants equipment to be free from defects in materials and workmanship for 1 year from date of installation or 18 months from date of purchase, whichever occurs first.
- 1.12 Field measurements
 - A. Contractor shall make all necessary field measurements to verify that equipment shall fit in allocated space in full compliance with minimum required clearances specified in National Electrical Code and required by any applicable local/facility constraints.

PART 2 Products

2.01 Manufacturer

- A. ABB ReliaGear neXT products have been used as the basis for design. Other manufacturers' products of equivalent quality, dimensions and operating features may be acceptable, at the

Engineer's discretion, if they comply with all requirements specified or indicated in these Contract documents.

2.02 Manufactured assemblies

- A. Furnish low voltage modular power panelboards (or equal) as indicated in drawings.

2.03 Components

Refer to drawings for: actual layout and location of equipment and components; current ratings of devices, bus bars, and components; voltage ratings of devices, components and assemblies; and other required details.

A. Enclosures

1. Panel box shall be galvanized and painted enclosure and panels will have hinged gutter covers, [with optional locking doors to cover access to circuit breakers, quarter turn lock provided].
2. Main circuit breakers shall be [horizontally] [vertically] mounted.
3. Different frame circuit breakers shall be able to be mounted across from each other.
4. Enclosures shall be [NEMA 1], [NEMA 2], [NEMA 3R], [NEMA 4], [NEMA 4X], [NEMA 12], [as indicated on the drawings].
5. Fronts shall be provided to cover top and bottom of panel box.
6. A hinged gutter door shall be provided to conceal wiring gutter and wiring access areas. [Hinged gutter doors shall be provided with optional locking doors to prevent access to the breakers except for panels that require a horizontally mounted XT7 breaker.]
7. Gutter covers are secured by single-point rotating latches.
8. [Optional door-in-door will be provided if requested. The circuit breakers door provides access to the breaker operating lever with no risk of contact with live parts. The deadfront door provides access to the entire panelboard interior.]

B. Interiors

1. Panelboard interior shall be designed and assembled such that circuit protective devices shall be solidly connected to the distribution panel bus. The bus bars shall be attached to the feeder device by circuit breaker line side connections integrated into the circuit protective devices.
2. Panelboard interior, when equipped with horizontally mounted mains, shall provide IP20 protection (or finger safe) per IEC 60529 with branch devices connected or disconnected and with front covers removed.
3. Circuit breaker connectors shall be designed so that circuit breakers may be removed without disturbing adjacent devices. Circuit breaker line side connections (LSC) to main bus shall be plug-in and held in place by 1 or 2 fastening screws and shall not require periodic torque inspection. No additional hardware including screws, bolts, nuts, or washers shall be required to connect branch circuit breakers.
4. Interior shall be field reversible from top to bottom feed and vice-versa.
5. Panelboards shall be rated [240V] [480V] [600V] [208Y/120V] [480Y/277V] [600Y/347V] [120/240V] [240/120V Delta] [220Y/127V] [125VDC] [250VDC] as indicated in drawings. Main devices shall have maximum rating of 1200 amperes. The maximum short circuit

rating is equal to 200 kAIC at 240 V, 200 kAIC at 480 V or 100 kAIC at 600 V, or the lowest current interruption rating of any device installed, except as noted in the series rating listed with an integral or remote main breaker or fusible switch installed ahead of the power panel.

6. Bus bars shall be [copper] [aluminum]. [The aluminum bus bars shall be heat rated] to meet UL 67 temperature rise requirements. [Copper bus bars shall be [heat rated] [density rated]] to meet UL 67 temperature rise requirements. Bus bars shall be [silver][tin] plated.
7. Bus shall be phase-sequenced and rigidly supported by tie bolts spaced at regular intervals.
8. All solderless terminations shall be suitable for [copper] [aluminum] UL listed wire or cable and shall be tested and listed in conjunction with appropriate UL standards. Terminations shall be rated for use with conductor ampacity as assigned in the NEC 75 degrees C table; see circuit breaker testing approvals for additional temperature ratings.
9. Ground wire terminations shall be provided as a kit for installation by panelboard installer without voiding UL label.

C. Main Devices

1. Furnish panel with [vertical] [horizontal] mounted main breaker or main lugs as indicated on the project drawings or panel schedules.
2. Refer to Main and Branch Devices - Molded Case Circuit Breakers below for main circuit breaker requirements.
3. The ampere rating of the main lugs shall be as indicated on the project drawings or panel schedules.
4. These terminations shall be UL tested and listed as suitable for UL copper or aluminum wire. For Canadian applications the terminations shall be CSA tested and listed. The lugs shall also be rated for 75 degree C terminations.
5. These main mechanical [compression] lugs shall have a cable range suitable for normal applications of cable at rated amperage.

D. Main and Branch Devices - Molded Case Circuit Breakers

A. General characteristics:

1. Circuit breakers shall be 3-pole ABB SACE Tmax XT molded case circuit breakers, 2-pole Formula A2 molded case circuit breakers, 1-pole or 2-pole Record Plus FB molded case circuit breakers or 1-pole or 2-pole TEY molded case circuit breakers.
2. The MCCB trip amps shall be as shown on drawings.
3. MCCBs shall have double insulation between the live power parts (excluding the terminals) and the front of the apparatus where the operator works during normal operation of the device. The placement of each electrical accessory shall be

completely segregated from the power circuit, preventing risk of contact with live parts.

4. MCCB operating mechanism shall include quick-make, quick-break, non-welding silver alloy contacts, and a common Trip, Open and Close mechanism such that all poles open and close simultaneously.
 5. Arc Extinction shall be confined to arc chutes internal to the MCCB.
 6. The MCCB handle shall indicate the precise position of the moving contacts of the MCCB, thereby providing safe and reliable indication. The MCCB operating mechanism shall be trip-free regardless of the pressure on the lever.
 7. The MCCB handle shall reside in a tripped position between on and off to provide local trip indication. The MCCB escutcheon shall be clearly marked on and off.
 8. The maximum ampere rating and UL, IEC, or other certification standards with applicable voltage systems and their corresponding interrupting ratings shall be clearly marked on the face of the MCCB.
 9. Each MCCB shall be equipped with a test button, located on the face of the MCCB to mechanically operate the MCCB trip mechanism for maintenance and testing purposes.
 10. Every MCCB must have a hologram on the front of the device, obtained using special anti-counterfeit techniques, which guarantees the quality and that the MCCB is an original ABB product.
 11. MCCBs shall be UL listed for reverse fed.
 12. Unless otherwise noted in the project drawings or specifications, MCCBs shall be UL listed for standard duty and are to be applied at 80% of their continuous current rating. Circuit breaker frame sizes 200A or 400A shall be [80% current rated] [100% current rated]. Frame size 600A shall be 80% rated. A circuit breaker with a frame size of 800A shall be [80% rated] [100% rated]. A circuit breaker frame sizes of 1000A and below shall be [80% rated] [100% rated]. The use of 90C cables is needed for 1000A 100% rated breakers.
 13. [Molded Case Switches (MCSs) derived from the MCCB range shall be provided. MCSs up to 1200A will be able to be used in alternating current applications.]
 14. [UL Current Limiting MCCBs up to 600A shall be provided. Current Limiting MCCB will be marked "Current Limiting" on the front and will have a label on the right-hand side specifying peak current and specific let through energy values.]
 15. Circuit breaker frame sizes 200A or 400A shall be [80% current rated] [100% current rated]. Frame size 600A shall be 80% rated. A circuit breaker with a frame size of 800A shall be [80% rated] [100% rated]. A circuit breaker frame sizes of 1200A and below shall be [80% rated] [100% rated]. The use of 90C cables is needed for 1000A 100% rated breakers and 1200A 100% rated breakers.
- B. Trip unit for molded case circuit breakers
- A. General:
 - 1) Trip ratings shall range from 15A to 1200A.

- 2) MCCB shall be available in fixed thermal magnetic (TMF), adjustable thermal magnetic (TMA), and electronic adjustable long time, short time, instantaneous, and ground fault where indicated. Available trip unit types vary by MCCB frame.

B. Thermal Magnetic (800A Frame and Below):

- 1) Basis of Design: ABB with TMF and TMA trip units.

2) General:

- a. Thermomagnetic trip units shall be fitted with bimetal thermal element for overload protection and magnetic element for short circuit protection.
- b. For adjustable trip units, the overload protection shall be continuously adjustable from 70% to 100% of trip rating.
- c. Thermomagnetic trip units shall be available from 15A to 800A trip, fixed rating MCCBs shall be available up to 250A. MCCBs with both adjustable thermal and magnetic elements shall be available from 80A to 800A.

C. Electronic Trip MCCB:

- 1) Basis of Design: ABB Ekip DIP Switches.

- a. Electronic trip unit must be unaffected by electromagnetic interference in compliance with the EMC directive and Annex F of IEC 60947-2
- b. MCCB trip unit shall be electronic adjustable with true RMS sensing and thermal memory.
- c. The standard electronic trip unit shall be fitted with a dip switch interface to ensure accuracy while adjusting protection settings.
- d. The basic electronic trip unit shall have adjustable protection for Long Time, Short Time, Instantaneous, [and Ground Fault]. This protection is commonly referred to as LSI, LIG, or LSIG. All protective elements (LSIG) shall be independent of each other. Trip units with tracking short time are not approved. Short circuit protection may be either Instantaneous type (function I) or, alternatively, with intentional delay (function S). The ability to disable the adjustable instantaneous trip is required. The adjustable instantaneous shall be capable of being disabled; an instantaneous override shall provide protection.
 - i. (L) protection shall be adjustable from 40% to 100% I_n at increments of 4% I_n where I_n is the nominal current rating of the MCCB.
 - ii. (S) protection pickup shall allow fifteen settings from 1 to 10 times I_n .
 - iii. Both (L) and (S) protection shall be available in two different time delay curves.
 - iv. (I) protection pickup shall allow fifteen settings from 1 to 10 times I_n .

- e. Ground fault protection, (G) shall be available where indicated with an external neutral sensor for protection of 4 wire loads.
- f. Accuracy of electronic trip units shall not be affected by ambient temperature.
- g. Electronic trip units shall be suitable for use on AC circuits only and they shall be available from 10A to 1200 A.
- h. Electronic trip unit shall be fitted with a dip switch interface in order to ensure the best accuracy in tuning the protection thresholds.

D. Advanced Electronic Trip Units:

1) Basis of Design: ABB Ekip Touch / Hi-Touch.

2) General:

- a. MCCB trip system shall be an electronic trip unit with true RMS sensing and thermal memory.
- b. [Portable configuration and test unit shall be available for setting and testing each protective function.]
- c. [Trip units shall incorporate Bluetooth unit for wireless communication.]
- d. The advanced electronic trip unit shall be fitted with protection functions against extended time overload (L function), high current overload or short circuit (S function), high short circuit current / instantaneous (I function) and optional Ground Fault (G function) or alarm. Instantaneous short circuit protection (I function) may be disabled allowing instantaneous override to provide UL required protection.
 - i. The minimum pickup threshold for protection against overload will be 40% times I_n .
 - ii. (S) protection pickup shall allow fifteen settings from 1 to 10 times I_n .
 - iii. Both (L) and (S) protection will be available in five different time delay curves.
 - iv. Two different kinds of (S) protection (with inverse or definite time) shall be available.
 - v. (I) protection pickup shall allow fifteen settings from 1 to 10 times I_n .
 - vi. (G) protection pickup shall allow at least seven settings from 20% to 1 times I_n .
 - vii. (G) protection shall be available with four different time delay curves.
- e. The trip thresholds on electronic trip units shall not be affected by ambient temperature.

- f. Trip units shall have the capability to be adjusted locally or remotely. Increments for pickup adjustments shall be 0.1% I_n for (L) and (G) protection, and 10% I_n for (S) and (I) protection.
- g. Electronic trip unit with the [Touch][Hi-Touch] shall have LEDs on the front to indicate the status of MCCB, pickup status, and cause of trip.
- h. Trip units shall be able to provide real time metering. Metering functions shall include, but shall not be limited to, the following:
 - i. Current (phases, neutral, ground).
 - ii. Voltage (phase to phase, phase to neutral, residual).
 - iii. Power (active [kW], reactive [kVAR], apparent [kVA]).
 - iv. Power factor.
 - v. Energy (active [kWh], reactive [kVAR], apparent [kVA]).
 - vi. Frequency.
 - vii. Total harmonic distortion (current, voltage). The harmonic content of voltage and current should be measured to 50th harmonic order.
- i. Metering Selection:
 - i. Trip unit shall have a minimum metering accuracy of 1% current, 1% voltage, and 2% power and energy. These accuracies shall be the accuracy of the entire system including current transformers, potential transformers, etc.
 - ii. The measurements shall be displayed on the MCCB itself, remote display, and/or on a remote system via communication protocol [and/or Bluetooth].
 - iii. Optional features for applications:
 - a. Trip unit shall have a minimum metering accuracy of 1.0% current, 0.5% voltage, and 2% power and energy.
 - b. Trip unit shall have a minimum metering accuracy of 0.5% current, 0.5% voltage, and 1% power and energy.
 - c. Voltage-related protection functions such as overvoltage, undervoltage, voltage unbalance, etc.

SPECIFIER NOTE: ZSI IMPLEMENTATION REQUIRES AT LEAST TWO LEVELS OF CIRCUIT BREAKERS THAT HAVE ZSI CAPABILITY. THE DOWNSTREAM BREAKER THAT SENDS THE SIGNAL AND THE UPSTREAM BREAKER THAT RECEIVES IT AND ADJUSTS ITS PROTECTION TIMING ACCORDINGLY.

- i. [Zone Selective Interlocking for Short Time and Ground Fault and interlocked to supply-side overcurrent devices.] [Zone Selective Interlocking for Short Time, Ground Fault and Instantaneous protection, and interlocked to supply-side overcurrent devices.]

SPECIFIER NOTE: ALSO KNOWN AS ARC FLASH ENERGY REDUCTION MAINTENANCE SWITCH OR ALTERNATE SETTING GROUP CALLED AN RELT (REDUCED ENERGY LET-THROUGH) SETTING IN ABB LITERATURE. ABB

PANELBOARDS FOR CIRCUIT BREAKERS THAT CAN BE RATED 1200 A PER NEC ARTICLE 240.87 MIGHT BE PROVIDED WITH A 3-POSITION SWITCH THAT ALLOWS TESTING OF CONTROL POWER AND INDICATES TRIP PROTECTIVE STATUS.

- i. [Reduced energy let-through (RELT) Instantaneous trip. When specified this feature shall be provided to provide a temporary setting for the instantaneous trip setting of the breaker. Setting shall be adjustable down to 1.5X of the nominal current (In) and shall be enabled through a switch that can be mounted on the equipment or remotely. The switch shall be combined with an indicating light that positively indicates that the RELT is enabled or disabled.]

NOTE TO SPECIFIER: THE FOLLOWING REFLECTS THE CAPABILITIES OF THE RGM40 METER:

E. Power Metering

- i. Single-point meter: The RGM40 power and energy meter shall provide an integrated solution for power monitoring and single-point metering. The meter shall provide:
 - 1. Voltage, amperage, power and energy monitoring
 - 2. Revenue grade, ANSI 12.20 0.2% accuracy
 - 3. Backlit LCD display
 - 4. Data logging option to ensure data is still preserved locally
 - 5. Waveform recording at 512 samples/cycle
 - 6. Harmonic readings to the 40th order.
 - 7. Communication via [Modbus TCP] [Modbus RTU] [BACnet]
 - 8. User-enabled password protection
 - 9. UL 67 approval

2.04 Accessories

- i. [Feed-through lugs] [Sub-feed (dual main) lugs] as indicated in the drawings
- ii. Grounding bars, as indicated on the drawings
- iii. Neutral bus shall have grounding lug for service entrance applications. The neutral bus shall [have the same ampacity as the phase bus.] [be rated 200% of the phase bus.]
- iv. Exterior mounted equipment label
- v. [Provide an SPD as specified in Section [16479] [26 43 13]]
- vi. Standard panelboard boxes shall be galvanized.
- vii. Fronts shall be coated with phosphatized rust inhibitor and finish coated with ANSI 61 light gray baked on powder coat.

PART 3 Execution

3.01 Examination

- i. The following procedure shall be performed by the contractor.
- ii. Verify that low voltage panelboards are ready to install.
- iii. Verify field measurements are as shown on Drawings.
- iv. Verify that required utilities are available, in proper location and ready for use.
- v. Beginning of installation means installer accepts conditions.

3.02 Location

3.03 Installation

- i. Additional provisions and editing may be required for this part.
- ii. Contractor shall install per manufacturer's instructions.
- iii. Contractor shall install required safety labels.

3.04 Field quality control N/A

3.05 Adjusting N/A

3.06 Cleaning N/A

END OF SECTION