

Section 10

Power/Vac[®] Switchgear Guide Form Specification

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INTRODUCTION

Upon completion of the one-line diagram and the layout of the equipment lineup, the specifier may use the following guide to prepare his purchase or proposal specifications for Power/Vac Switchgear. The following Guide Form Specification is in CSI format (Construction Specifications Institute). This document incorporates CSI Manual of Practice principles of cross-references to Division 1 sections for procedural requirements to avoid repetition and duplication. It cross-references other specification sections for Related Work. The specifier should edit cross-references to retain only those sections used for the specific project. The CSI Manual of Practice is copyrighted by the Construction Specifications Institute. This document is designed for the express purpose of pulling copy into larger project specification documents. General Electric gives permission to use any of the contents of this document for this purpose. Unless otherwise indicated in this material, the data should not be changed in any way. This Guide Form Specification is available from the GE web site, www.geindustrial.com, in Microsoft Word format, to facilitate its use in customer's overall specification.

Power/Vac[®] Guide Form Specification

\$\$\$BEGIN SPECIFIER NOTE *This document incorporates CSI Manual of Practice principles of cross-references to Division 1 sections for procedural requirements to avoid repetition and duplication. It cross-references other specification sections for Related Work. Edit cross-references to retain only those sections used for the specific project. Manual of Practice is copyrighted by Construction Specifications Institute.* **ESN\$\$\$**

PART 1 GENERAL

1.01 The requirements of the Contract, Division [1] [01], and Division [16] [26] apply to work in this Section.

1.02 SECTION INCLUDES

- A. Medium Voltage, [5KV] [8.25KV] [15KV], Metal Clad Switchgear.

1.03 RELATED SECTIONS

1.04 REFERENCES

- A. The medium voltage metal clad switchgear and protection devices in this specification are designed and manufactured according to latest revision of the following standards (unless otherwise noted).
- B. ANSI C37.06, Switchgear - AC High-Voltage Circuit Breakers Rated on a Symmetrical Current Basis - Preferred Ratings and Related Required Capabilities
- C. ANSI C39.1, Electrical Analog Indicating Instruments, Requirements for
- D. ANSI/IEEE C37.04, Rating Structure for AC High-Voltage Circuit Breakers Rated on a Symmetrical Current Basis
- E. ANSI/IEEE C37.20.2, Standard For Metal-Clad Switchgear
- F. ANSI/IEEE C57.13, Instrument Transformers, Requirements for
- G. IEEE C37.90, Standard for Relays and Relay Systems Associated with Electric Power Apparatus
- H. NEMA SG 2, High Voltage Fuses
- I. NEMA SG 4, Alternating - Current High Voltage Circuit Breaker
- J. NEMA SG 5, Power Switchgear Assemblies

1.05 DEFINITIONS

1.06 SYSTEM DESCRIPTION

- A. [Indoor] [Outdoor] [Protected Aisle] [Common Aisle] metal clad switchgear intended for use on [2.4] [4.16] [4.8] [6.9] [7.2] [12.47] [13.8] KV, 3-phase, [3] [4] wire [grounded] [ungrounded] 60-Hz system. Switchgear shall be rated as indicated in drawings and have removable element vacuum circuit breakers. Enclosures and circuit breaker(s), [individual,] [as a unit,] shall have a basic impulse rating of [60] [95] KV. Switchgear, including circuit breakers, meters, and relays, shall be factory tested.
- B. Equipment shall be completely factory-built, assembled, wired, and tested. All equipment and components shall be of new construction.

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1.07 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]:
 - 1. Product Data on a specified product;
 - 2. Shop Drawings on a specified product;
 - 3. Certified copies of all Type (Design) and Verification Test Reports on a specified product.

1.08 PROJECT RECORD DOCUMENTS

- A. Maintain an up-to-date set of Contract documents. Note any and all revisions and deviations that are made during the course of the project.

1.09 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].
- B. Submit operation and maintenance data based on factory and field testing, operation and maintenance of specified product.
- C. Provide certified factory test reports
- D. Final factory drawings shall be provided in an electronic format as well as hardcopy format. Provide electronic files in .DXF AutoCAD format.

1.10 QUALITY ASSURANCE (QUALIFICATIONS)

- A. Manufacturer shall have specialized in the manufacture and assembly of medium voltage metal clad switchgear for a minimum of [25] years.
- B. Manufacturer's Certificate of ISO 9002 Compliance.
- C. Switchgear shall be qualified for use in seismic areas as follows:
 - 1. High seismic loading as defined in IEEE Std 693-1997, with 1.4 amplification factor.
 - 2. IBC-2003, Sds = 1.10g, Ss = 165%, Ip = 1.5, for all z/h greater than 0 and Sds = 1.75g, Ss = 262%, Ip = 1.5, for z/h equal to 0 in accordance with ICC-ES-AC156.
 - 3. Seismic compliance shall be qualified only through shake table testing. Compliance by calculation is not acceptable.

1.11 REGULATORY REQUIREMENTS

1.12 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, protect, and handle products in accordance with recommended practices listed in manufacturer's Installation and Maintenance Manuals.
- B. Deliver each medium voltage metal-clad switchgear lineup in shipping splits no larger than four (4) sections wide for ease of handling. Each section shall be mounted on shipping skids and wrapped for protection.
- C. Inspect and report concealed damage to carrier within specified time.
- D. 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. (Heat enclosures to prevent condensation, allowing proper air circulation.)
- E. Handle in accordance with NEMA [____] and manufacturer's written instructions to avoid damaging equipment, installed devices, and finish. Lift only by installed lifting eyes.

1.13 PROJECT CONDITIONS (SITE ENVIRONMENTAL CONDITIONS)

- A. Follow (standards) service conditions before, during and after switchgear installation.
- B. Switchgear shall be located in well-ventilated areas, free from excess humidity, dust and dirt and away from hazardous materials. Ambient temperature of area will be between minus [30] and plus [40] degrees C. Indoor locations shall be protected to prevent moisture from entering enclosure.

1.14 SEQUENCING AND SCHEDULING

1.15 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.

1.16 EXTRA MATERIALS

- A. Provide [parts] [spares] as indicated in drawings.
- B. Provide sizes and ratings of spare fuses as indicated in drawings.
- C. Provide fuse cabinet.

1.17 FIELD MEASUREMENTS

- A. Make all necessary field measurements to verify that equipment shall fit in allocated space in full compliance with minimum required clearances specified in local codes and standards.

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PART 2

2.01 MANUFACTURER

- A. Power/Vac® switchgear and related products have been used as 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 EQUIPMENT

- A. Furnish Power/Vac® Medium Voltage Metal Clad Switchgear [with UL label] [UL/CSA label] as indicated in drawings

2.03 COMPONENTS

- A. 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.
- B. Enclosure
 - 1. Switchgear shall consist of breaker and auxiliary units, as indicated in drawings, bolted together to form a rigid, self-supporting, metal-enclosed structure. Outdoor metal-clad switchgear shall be enclosed in a weatherproof enclosure and shall include suitable weatherproof access doors, [front doors with provision for padlocking] [rear doors with provision for padlocking] [front and rear doors with provision for padlocking]; protected ventilation openings as required; interior lighting, utility outlets with protective devices; and equipment heaters with protective devices. Heaters are to remain energized with no switch or thermostat provided. In each unit, major primary circuit parts (breaker, buses, transformers) shall be completely enclosed by grounded metal barriers, including a front barrier as part of the circuit breaker.
 - 2. Switchgear units shall be arranged as shown on attached drawings.
 - 3. For rigidity during fault conditions all connections to roll-out potential transformer trays and control power transformer trays shall be by rigid bus bars insulated to full voltage rating of switchgear assembly.
 - 4. Circuit breaker compartments shall be designed to house [5.0] [8.25] [15.0] KV removable-element circuit breakers. Stationary primary disconnect contacts shall be silver-plated copper. Grounded metal safety shutters shall isolate all primary connections in compartment when breaker is withdrawn from connected position.
 - 5. Furnish nameplates for each device as indicated in drawings. Nameplates shall be [black letters on white background] [white letters on black background]. Nameplates shall be fastened by [plastic rivets, standard] [screws, optional]. [There shall be a master nameplate] that indicates equipment ratings, manufacturer's name, shop order number and general information.
 - 6. Energized bare parts mounted on doors shall be guarded where the door must be opened for maintenance of equipment or removal of drawout equipment.
 - 7. [Furnish [bolted covers] [full height hinged covers which can be bolted closed] for each cable compartment. [All rear doors shall be capable of being padlocked.]]

8. [Enclosure shall have provisions for close coupled coordination to [MV motor controller lineup] [Load Interrupter switch line-up] [liquid type secondary unit substation transformer] [VPI dry type secondary unit substation transformer] [cast coil type secondary unit substation transformer]]
 9. <Provide a mimic bus on front of the enclosure. Mimic bus shall be [adhesively backed plastic] [plastic and held in place with rivets] [plastic and held in place with screws] [adhesive backed vinyl] >
 10. [Protected Aisle Outdoor Enclosures]
 - a. Outdoor protected aisle metal-clad switchgear shall be enclosed in a weatherproof enclosure. An aisle space measuring a minimum of 75 inches from the exterior front to the breaker covers shall be provided. Provide 36" wide aisle space extension to the left of the switchgear front and a minimum 12" wide aisle space extension to the right of the switchgear front.
 - b. Include suitable weatherproof aisle access doors with provision for padlocking. Interior of access doors shall be provided with panic style hardware.
 - c. Provide protected ventilation openings as required; interior lighting, utility outlets with protective devices; and equipment heaters with protective devices. Heaters are to remain energized with no switch or thermostat provided. In each unit, major primary circuit parts (breaker, buses, transformers) shall be completely enclosed by grounded metal barriers, including a front barrier as part of the circuit breaker.]
- C. Main Bus
1. The main bus shall be tin plated [silver plated] copper and rated [{1200A}{2000A}{3000A}{3500A}{4000A}], or as indicated in drawings. Bus bars shall have a continuous current rating based on temperature rise and documented by design tests. All joints will be tin [silver] plated with at least 2 bolts per joint. Bus bars will be braced to withstand magnetic stresses developed by currents equal to main power circuit breaker close, carry, and interrupt ratings. Access to bus bars shall be through removable front panels. Bus bars shall have fluidized bed epoxy flame retardant and non-hydroscopic insulation. The bus supports shall be [polyester glass (standard)] [porcelain].
- D. Ground Bus
1. A [{bare}{silver plated}{tin plated}] ground bus (1/4 by 2 inch copper) shall extend throughout assembly with connections to each breaker grounding contact and cable compartment ground terminal. Joints shall be made up as indicated in drawings. Station ground connection points shall be located in each end section.
- E. Circuit Breakers
1. Circuit breakers shall have a [symmetrical interrupting rating of {20kA}{25kA}{31.5kA}{40kA}{50kA}{63kA}] [nominal MVA rating of {250}{350}{450}{500}{750}{1000}{1500}] or be rated as indicated in drawings. Circuit breakers of equal rating shall be interchangeable. Circuit breakers shall be operated by an electrically charged, mechanically and electrically trip-free, stored-energy spring. A [handle] shall be used to manually charge the spring for slow closing of contacts for inspection or adjustment.

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2. Circuit breakers shall be equipped with secondary disconnecting contacts, which shall automatically engage in the connected position.
3. Each breaker compartment shall have a breaker rackout device. Using rackout device, a breaker will be self-aligning and will be held rigidly in the operating position. In the disconnect position, breaker shall be easily removable from compartment. Breaker racking shall be accomplished with door closed and latched. Insert handle through a hole in front door to operate rackout device.
4. An indicating tape shall show breaker position when racking breakers in or out of their connected positions
5. Interlocks shall prevent moving breaker to or from operating position unless main contacts are open. Operating springs shall be discharged automatically when breaker is moved from the connected or disconnected position. Rackout device shall have provisions to padlock in connected or disconnected position. When locked in disconnected position, breaker shall be removable from compartment using portable lifting device. Padlock shall not interfere with breaker operation.
6. Automatic shutters shall cover primary disconnect stabs when breaker is withdrawn to test/disconnect position. Linkages connected to racking mechanism shall positively drive shutters. A stationary barrier shall be located in front of the shutters for additional safety.
7. Breaker control voltage shall be [48 VDC] [125 VDC] [250 VDC] [120VAC] [240 VAC].
8. Circuit breakers shall have a rated interrupting time of [{5}{3}] cycles.
9. [Circuit breaker installed in the lower compartment shall be capable of being removed from the compartment without the use of a breaker dolly once it is moved to the disconnect position (indoor and protected aisle enclosures only).]
10. [Where indicated on drawings, provide circuit breakers suitable for capacitor switching duty.]
11. [[Each circuit breaker shall be provided with an auxiliary switch. Main and tie breakers shall have a [3-stage switch containing three “a” and three “b” contacts] [6-stage switch containing six “a” (normally open) and six “b” (normally closed) contacts] [10-stage switch containing ten “a” (normally open) and ten “b” (normally closed) contacts]. Feeder breakers shall have a [3-stage switch containing three “a” and three “b” contacts] [6-stage switch containing six “a” (normally open) and six “b” (normally closed) contacts]. [All spare contacts shall be wired to terminal boards.]]
12. [[Each circuit breaker shall be provided with a position switch indicating whether the circuit breaker is in the “Connect” or Disconnect” position. Main and tie breakers shall have a [3-stage switch containing three “a” and three “b” contacts] [6-stage switch containing six “a” (normally open) and six “b” (normally closed) contacts]. Feeder breakers shall have a [3-stage switch containing three “a” and three “b” contacts] [6-stage switch containing six “a” (normally open) and six “b” (normally closed) contacts] [All spare contacts shall be wired to terminal boards.]]
13. [Main and tie breaker closing circuits shall be wired to prevent parallel connection of the utility source through the tie breaker.]

F. Instrument Transformers

1. Current transformer ratios are listed in each switchgear unit's specification paragraph, and shall be as indicated on drawings. Current transformer accuracy shall be [ANSI standard] [double ANSI standard]. Transformer mechanical ratings shall equal the momentary rating of the circuit breakers. Bar type current transformers, when mounted in switchgear assemblies, shall be rated for the full voltage of the switchgear.
2. Voltage transformers shall be drawout type, with current-limiting fuses and with BIL rating equal to the switchgear. Transformer ratios as listed on drawings.
3. Secondary control wiring shall be [No. 14 (standard)] [No. 12], extra flexible, stranded, tinned-copper control wire, Type SIS cross-linked polyethylene, rated 600 volts, except for specific circuits requiring larger wire.
4. [Crimp-type, uninsulated spade terminals shall be furnished on all wire ends, except where non-insulated ring terminals are used to connect to fuse blocks, instrument studs, or terminal block points with two or more wire connections.] [Crimp-type, insulated spade terminals shall be furnished on all wire ends] [Crimp-type, uninsulated ring terminals shall be furnished on all wire ends] [Crimp-type, insulated ring terminals shall be furnished on all wire ends]
5. Secondary control wires shall be armored where they pass through primary compartments.
6. [Short circuit style terminal blocks shall be installed in current transformer secondary wiring between the current transformer and all connected devices.]
7. [Provide marking sleeves on all switchgear control wiring, heat stamped with wire origin and / destination information.]

2.04 PROTECTIVE DEVICES

NOTE TO SPECIFIER: Specifier to paste in relaying specification sections for specific relays including power monitoring communications if applicable for use in the switchgear equipment.

- A. Protective Devices - Protective relays shall be GE/MULTILIN relays or other approved relays as indicated below:

NOTE TO SPECIFIER: Specifier to paste in metering specification sections for specific meters including power monitoring communications if applicable for use in the switchgear equipment.

2.05 METERING DEVICES

- A. Metering - Meters/monitors shall be GE / MULTILIN meters or other approved equivalent devices as indicated below:

2.06 [NETWORK COMMUNICATIONS

- A. Provide an Ethernet switches for interfacing the protective relays to the facility PMCS network.
 1. Switch shall be Cisco model 2955, GE Multilin ML2400 or GE Multilin ML1600, or approved equal. Switch shall have capability for connecting Ethernet cables over a combination of Fiber, 10BaseT and 100BaseT ports.
 2. 10BaseF ports shall be provided for interconnection of UR relays applied in automatic control and protection communications to achieve better noise immunity.
 3. The Ethernet switch shall be powered by [the switchgear 125VDC battery power.] [a UPS backed-up source provided by others.]

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2.07 ACCESSORIES

- A. Provide two indicating lights (red and green) for each breaker, and one indicating light (white) for each lockout relay provided. The indicating lights shall be GE type ET-16 and shall be provided with LED lamps.
- B. [Provide a hand-resetable lockout relay (device 86) where indicated on the drawings. The lockout relay shall disable closing of the corresponding circuit breaker until the relay has been reset. The lockout relay shall be a GE type HEA.]
- C. [Provide a two-position auto/manual selector switch in each breaker control circuit. Selecting "auto" will permit automatic operation. Selecting "manual" shall permit operation using the local breaker control switch. Contacts from the selector switch shall be wired to inputs on the appropriate protective relay to allow the PMCS to monitor the switch position. The switch shall be a GE type SB1 or approved equal.]
- D. [Provide [station] [intermediate] class arresters where indicated on drawings. Arresters shall be gapless metal-oxide type with a nominal rating of []kV and an MCOV of []kV. The arrester shall be enclosed in a polymer housing. Arresters shall be designed and manufactured in accordance with the latest revision of ANSI/IEEE C62.11. Arresters shall be GE Tranquell type or approved equal.]
- E. [Provide test switches on protective relays to permit trip blocking, relay isolation and testing. Test switch shall be GE Multilin type 515 or approved equal.]
- F. Lift truck (1 furnished per lineup)
- G. Manual racking handle (1 furnished per lineup)
- H. [Test cabinet] to bench test, inspect and maintain the POWER/VAC[®] breaker (optional)
- I. [A ground and test device shall be provided (optional)]
- J. [A high potential test kit shall be provided (optional)]
- K. [A remote racking device] shall be provided including push-button, motor operator, and 25 feet of cable (optional)]

2.08 TESTING

- A. The switchgear equipment and circuit breakers shall receive factory production test as listed below:
 - 1. Equipment
 - a. Low frequency dielectric test
 - b. Grounding of instrument cases
 - c. Control wiring and device functional test
 - d. Polarity verification
 - e. Sequence test
 - f. Low frequency withstand voltage test on major insulation components
 - g. Low frequency withstand test on secondary control wiring

2. Breakers
 - a. Coil check test
 - b. Clearance and mechanical adjustment
 - c. 300 Electrical and mechanical operation test
 - d. Timing test
 - e. Conductivity of current path test
 - f. Hi-potential testing of breaker
 - g. Vacuum bottle integrity test
- B. [Manufacturer shall provide to the Engineer documents verifying completion of factory production tests.]

2.09 FINISH

- A. All steel structure members shall be cleaned, rinsed, and phosphatized prior to painting.
- B. The switchgear shall be painted with an electrostatically applied polyester powder with final baked on average thickness between 1.5 and 2.0 mils and meet ANSI requirements for [indoor] [outdoor] equipment.
- C. All exterior surfaces of the switchgear assembly shall be ANSI 61 gray as standard.
- D. Finish shall have a minimum pencil hardness of 2H as tested per ASTM D3363 and shall pass the ASTM B117 Salt spray test for a minimum of 1000 hours.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine installation area to assure there is enough clearance to install switchgear.
- B. Check concrete pads for flat and level surface.
- C. Verify that medium voltage metal clad switchgear is ready to install.
- D. Verify field measurements are as [shown on Drawings] [instructed by manufacturer].
- E. Verify that required utilities are available, in proper location and ready for use.
- F. Beginning of installation means installer accepts conditions.

3.02 LOCATION

3.03 INSTALLATION

Additional provisions and editing may be required for this part.

- A. Installer's Certificate of ISO 9000 Compliance.
- B. Installer has specialized in installing medium voltage 5 and 15 KV metal clad switchgear with [minimum _ years documented experience].
- C. Install per manufacturer's instructions.
- D. Install required safety labels.

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3.04 FIELD QUALITY CONTROL

- A. Inspect installed switchgear for anchoring, alignment, grounding and physical damage.
- B. Check tightness of all accessible electrical connections with a calibrated torque wrench. Minimum acceptable values are specified in manufacturer's instructions.
- C. Megger and record phase to phase and phase to ground insulation resistance of each bus section. Megger for [1] minute(s) for each measurement at minimum voltage of [1000] VDC. Measured Insulation resistance shall be at least [1] megohm(s).
- D. Test each key interlock system for proper functioning.

3.05 ADJUSTING

- A. Adjust all [circuit breakers] [,] [switches] [,] [access doors] [,] [operating handles] for free [mechanical] [and / or] [electrical] operation as described in manufacturer's instructions.
- B. Adjust relay trip and time delay settings to values [specified] [determined] by Customer's Engineer] [as recommended in the Coordination Study provided by others].
- C. Return "odd" Kirk keys to Engineer before energizing equipment.

3.06 CLEANING

- A. Clean interiors of [switchgear] [,] [switchboards] [,] [panels] [,] [separate enclosures] to remove construction debris, dirt, shipping materials.
- B. Repaint scratched or marred exterior surfaces to match original finish.

END OF SECTION

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