SECTION 26 13 02

MEDIUM-VOLTAGE PAD-MOUNTED SWITCHGEAR (OUTDOOR)

**BASED ON DFD MASTER ELECTRICAL SPEC DATED 03/01/21**

This section has been written to cover most (but not all) situations that you will encounter. Depending on the requirements of your specific project, you may have to add material, delete items, or modify what is currently written. The Division of Facilities Development expects changes and comments from you.

***The designer shall locate the switchgear in an area that provides a minimum working clearance of 10 feet in front of the closed switch doors and 3 feet on each side adjacent to the switch operating hubs.***

***Items shown in square brackets [ ] are options that the Engineer shall include or not include depending on the specific application.***

PART 1 - GENERAL

SCOPE

The work under this section includes furnishing and installing medium voltage pad-mounted outdoor air interrupter switchgear in accordance with the Drawings and these Specifications. Included are the following topics:

PART 1 - GENERAL

Scope

Related Work

References

Submittals

Operation and Maintenance Data

Quality Assurance

Delivery, Storage, and Handling

Extra Materials

PART 2 - PRODUCTS

General

Enclosure

Air Interrupter Switches

Medium Voltage Bus

Medium Voltage Fuse Compartment

Accessories

Factory Finishing

Warning Signs

Nameplates, Ratings Labels and Connection Diagrams

Switchgear Box Pad

Locks

PART 3 - EXECUTION

General

Construction Verification Items

Agency Training

RELATED WORK

Applicable provisions of Division 1 govern work under this Section.

Section 26 05 43 – Underground Ducts and Raceways for Electrical Systems

Section 26 05 13 – Medium-Voltage Cables

Section 26 08 00 - Commissioning of Electrical.

Section 01 91 01 or 01 91 02 – Commissioning Process

REFERENCES

C37.74 - IEEE Standard Requirements for Subsurface, Vault, and Pad-Mounted Load-Interrupter Switchgear and Fused Load-Interrupter Switchgear for Alternating Current Systems up to 38 kV

C57.12.28 – IEEE Standard for Pad-Mounted Equipment Enclosure Integrity.

SUBMITTALS

Furnish third party certified test abstracts for all padmount switchgear models proposed for use on this project. The certified test abstracts shall contain, as a minimum, the manufacturer's current engineering sales brochure showing all equipment proposed with model numbers, and a summary of test procedures (described below) and resultant values actually recorded during the tests. The test procedure and resultant values summary shall contain model numbers (if available) similar to those listed in the current engineering sales brochure.

The padmount switchgear assemblies shall meet the requirements of the applicable sections of ANSI/IEEE C37.74 and C57.12.28. The following tests shall be performed on assemblies similar to those proposed for this project. Assemblies shall be complete with enclosure and all internal components such as switch, fuses (if required), ground pads, ground rods, metal and insulating barriers, etc.

* Voltage and dielectric performance tests including maximum design voltage, BIL impulse, and 60 Hz withstand tests.
* Load current performance tests at maximum design voltage including rated load interrupting, fault closing, and momentary withstand current tests.
* Temperature rise performance tests including continuous load current and thermal runaway tests.
* Mechanical performance tests including open-close endurance tests.
* Enclosure integrity tests including pry, pull, and wire entry tests.

Submit the following shop drawings.

* Outline dimensions, enclosure construction, lifting and supporting points.
* Conduit and cable entrance locations.
* Electrical single line diagram.
* Key interlock flow diagram (if applicable).
* Equipment electrical ratings.
* Certification of ratings of the integrated padmounted switchgear assembly consisting of the basic switch components in combination with the enclosure.
* Product data for components and accessories.
* Manufacturer's installation instructions.
* Time-current curves for fuses (if applicable).

All submittals are to comply with submission and content requirements specified in specification Section 01 91 01, or 01 91 02.

# OPERATION AND MAINTENANCE DATA

All operations and maintenance data shall comply with the submission and content requirements specified under section GENERAL REQUIREMENTS.

In addition to the general content specified under GENERAL REQUIREMENTS supply the following additional documentation:

1. Fuse replacement instructions.
2. Equipment adjustment instructions.
3. Lubrication instructions.

QUALITY ASSURANCE

Enclosure Manufacturer: Company specializing in medium voltage interrupter switch enclosures with five years documented experience.

Switch Manufacturer: Company specializing in medium voltage interrupter switch components with five years documented experience.

Fuse Manufacturer: Company specializing in medium voltage fuses and fuse components with five years documented experience.

The manufacturer/assembler of the overall switchgear assembly shall be completely and solely responsible for the performance of the basic components as well as the complete integrated assembly as rated.

DELIVERY, STORAGE, AND HANDLING

Store and protect products.

Accept switchgear on site and inspect for damage.

EXTRA MATERIALS

Provide one (1) 15 kV rated hotstick designed for removing/installing fuses and grounding jumpers.

Provide four (4) sets of three grounding jumpers with heavy duty hotstick operable connectors at each end to enable one switchgear unit to be completely grounded.

Provide two (2) pentahead socket wrenches for opening compartment doors.

Provide one (1) switch operator handle/wrench for each interrupter switch.

Provide one spare set of three (3) fuses for each fuse compartment.

PART 2 - PRODUCTS

GENERAL

The pad-mounted switchgear shall be an outdoor rated, metal-enclosed compartmentalized design suitable for mounting on a prefabricated polymer concrete box pad.

***Choose the switchgear configuration needed for the application. Add appropriate requirements for configurations not listed below.***

[The medium voltage switchgear units shall be equipped with four (4) 3-pole group operated, 600 amp rated switches. Switchgear to be S&C model PMH-10, or similar. Other manufacturer’s meeting the requirements of this specification will be considered acceptable.]

[The medium voltage switchgear units shall be equipped with three (3) 3-pole group operated, 600 amp rated switches and one (1) three phase 200 amp rated fused tap, with the 200 amp fused tap being fed from one of the 600 amp switches. The fuse compartment door shall be key interlocked with the tap switch door to prevent opening the fuse compartment unless the tap switch is open. Switchgear to be S&C model PMH-19, or similar. Other manufacturer’s meeting the requirements of this specification will be considered acceptable.]

***Add the following requirement if the switchgear is to be used on a looped system with an existing key interlock scheme. Identify the switches to be key interlocked on the Drawings.***

[Switchgear shall be equipped with key interlocks capable of preventing the paralleling of the source interrupter switches as shown on the drawings. The key interlocks shall be used in the operation of the distribution system to require that one switch is open in a typical two source distribution loop. The interlock keying must match and be fully interchangeable with the existing key interlock scheme on the existing distribution loop. Provide a key in each key cylinder.]

ENCLOSURE

The maximum height of the pad-mounted switchgear enclosure shall be 52”.

The pad-mounted switchgear enclosure shall be free-standing, self-supporting construction with provisions for cable entering and exiting through the bottom.

Enclosure material shall be 11-gauge steel sheet. All structural joints shall be welded.

The enclosure shall be tamper resistant construction and shall not utilize any externally accessible hardware.

The inside surface of the enclosure roof shall contain a heavy coating of anti-condensation roof undercoating.

Compartment doors shall utilize a pentahead security bolt and three-point latching mechanism.

Doors shall be tamper resistant and contain provisions for padlocking.

Doors shall have stainless-steel hinges with stainless-steel hinge pins.

AIR INTERRUPTER SWITCHES

Air interrupter switch ratings shall meet or exceed the following:

Nominal Voltage: 14.4 kV, three phase, 60 Hz.

Maximum Design Voltage: 17.0 kV.

Basic Impulse Level: 95 kV.

Load Carrying Ampacity: 600 amperes, continuous.

Load Break Ampacity: 600 amperes.

Short Circuit Rating: 14,000 symmetrical amperes at rated nominal voltage.

Fault Close Rating: 22,400 rms asymmetrical amperes.

Interrupter switches shall be three-pole load-break interrupting devices utilizing a stored energy quick-make, quick-break mechanism. The quick-make, quick-break mechanism shall be integrally mounted on the switch frame, and shall swiftly and positively open and close the interrupter switch independent of the switch-operating hub speed.

Switch contacts shall be clearly visible in the open position to allow the operator to easily verify the switch position.

Interrupter switches shall be operated by means of an externally accessible switch-operating hub. The switch-operating hub shall be located within a recessed pocket mounted on the side of the pad mounted switchgear enclosure and shall accommodate a hex-head socket wrench. Provide one (1) switch operator handle/wrench for each interrupter switch. The switch-operating hub pocket shall include a padlockable access cover that shall incorporate a hood to protect the padlock shackle from tampering. Labels to indicate switch position shall be provided in the switch-operating hub pocket.

Grounding studs shall be provided at all switch terminals.

MEDIUM VOLTAGE BUS

Main bus shall be rated 600 amps continuous.

Bus and interconnections shall consist of copper or aluminum bar with an oxide inhibiting compound at all bus joints.

Bus and interconnections shall withstand the stresses associated with short-circuit currents up through the maximum rating of the pad-mounted switchgear.

***Delete the following paragraphs on medium voltage fuses if only non-fused switchgear is to be used.***

medium voltage fuse COMPARTMENT

The fuse compartment assembly shall have a nominal voltage rating of 14.4 kV with a load carrying and load break rating of 200 amperes.

Fuse Mounting: Disconnect style with hook, hotstick operable, with blown-fuse indicators that shall be readily visible without removing the fuse from the mounting. The fuses shall be vertically mounted permitting easy inspection and replacement.

Fuse Ampere Size: Size as shown on drawings.

Fuse Interrupting Rating: 12,500 amperes RMS.

***The following paragraph is written for standard fusing. If current limiting fuses are needed, delete this paragraph and insert one written specifically for that purpose.***

Fuses: Expulsion type with silver wire fusible element and solid-material extinguishing medium. Fusible elements shall be non-aging and non-damageable. See drawings for exact fuse sizes and speeds. All arcing accompanying fuse operation shall be contained within the fuse, and arc products and gases evolved during fuse operation shall be vented through exhaust-control chambers to eliminate discharge of ionized gases.

Grounding studs shall be provided at all fuse terminals.

Furnish one spare set of three fuses for each fuse compartment. These fuses shall be stored in a metal spare fuse holder on the inside of the door to each fuse compartment.

AccESSORIES

Each switchgear compartment shall include mounting provisions for surge arresters.

The switchgear compartments shall include dual purpose front barriers, interphase barriers and end wall barriers. The barriers shall be constructed of glass reinforced polyester.

One (1) pad per compartment shall be provided for grounding the equipment. Each compartment shall be equipped with cable supports and a ground bar. Each switch and fuse compartment shall include a grounding stud.

FACTORY FINISHING

All surfaces shall be chemically cleaned before applying paint.

An anticorrosion primer shall be applied to all non-stainless steel structural surfaces, supporting surfaces and enclosure surfaces including those surfaces that may become inaccessible.

At the completion of the finish coat, the complete finish shall maintain an average thickness of 2 mils.

The standard finish color shall be dark olive green, Munsell 7GY-3.29/1.5. One (1) pint of paint for touchup shall be provided.

WARNING SIGNS

All external doors shall be provided with "Danger - High Voltage - Keep Out" signs.

The inside of each door shall be provided with a "Danger - High Voltage - Keep Out - Qualified Persons Only" sign.

The inside of each door providing access to a medium voltage switch shall be provided with a sign indicating "Warning - Switch Blades May Be Energized in Any Position."

NAMEPLATES, RATINGS LABELS AND CONNECTION DIAGRAMS

The outside of each door (or set of double doors) shall be provided with a nameplate indicating the manufacturer's name, catalog number and model number. Also provide an engraved identification nameplate for each switch indicating where the circuit comes from and goes to, and the circuit number.

The inside of each door (or set of double doors) shall be provided with a ratings label indicating the following: voltage ratings; main bus continuous ampere ratings; short-circuit ratings (amperes rms symmetrical and MVA three-phase symmetrical at rated nominal voltage); and interrupter switch ratings (including continuous amperes and duty-cycle fault-closing capability).

A three-line connection diagram showing interrupter switches, fuses with integral load interrupter, and bus along with the manufacturer’s model number shall be provided on the inside of the front and rear doors (or set of double doors), and on the inside of each switch-operating hub access cover.

SWITCHGEAR Box Pad

A prefabricated one piece box pad shall be provided for each pad mounted switchgear unit. Each box pad shall be specifically designed to fit each switchgear model. The box pad shall be composed of polymer concrete reinforced with glass fibers. The box pad shall be 36-inches deep and have a rigid, flat top lip sized to permit secure fastening of equipment on all sides. The box pad shall contain an integral bottom flange to support the equipment weight without sinking or tilting. The box pad shall be manufactured by Quazite, Concast, or similar.

LOCKS

Provide padlocks on all pad mounted switchgear installed. All external doors and panels shall be padlocked, rendering all internal equipment inaccessible and inoperable by unauthorized personnel. This includes all access covers to switch operating hubs. Padlocks shall match user agency’s present padlock type and be keyed per user agency requirements. Coordinate and confirm padlock information with the facility maintenance personnel.

Note that the exact lock information should be determined for each project, along with the individual with whom the Contractor shall coordinate the padlock information with.

PART 3 - EXECUTION

GENERAL

Each switchgear unit shall be installed in the location indicated on the Drawings. Contractor shall determine locations of existing utilities in the area before commencing installation. Should unforeseen existing underground obstruction(s) prevent installation in the location specified, the Contractor shall contact the Engineer before commencing installation.

Furnish and install a box pad for each pad mounted switchgear unit unless otherwise noted. Top of box pad shall extend 6” above finished grade. Provide 6” of pea gravel inside bottom of each box pad BEFORE installing the switchgear. Secure the switchgear to the box pad using anchor bolts or hold down brackets in a minimum of four (4) places around the inside perimeter of the switchgear base.

Provide one ¾” x 10’ ground rod within each switchgear base. Drive in to ground 9’0”. Bond the switchgear enclosure to ground rod with #1/0 copper wire.

Install in accordance with the manufacturer's instructions, and in accordance with recognized industry practices.

Cables shall be supported at each termination using the provided cable supports in each compartment. In no case shall the cable be supported by the termination.

Touch-up paint all chips and scratches.

Where indicated on the Drawings, guard posts shall be installed.

**CONSTRUCTION VERIFICATION**

Contractor is responsible for utilizing the construction verification checklists supplied under specification Section 26 08 00 in accordance with the procedures defined for construction verification in Section 01 91 01 or 01 91 02.

**AGENCY TRAINING**

All training provided for agency shall comply with the format, general content requirements and submission guidelines specified under Section 01 91 01 or 01 91 02.

END OF SECTION