SECTION 26 1300 - MEDIUM VOLTAGE LOAD INTERRUPTER SWITCHES

Maintain Section format, including the UH master spec designation and version date in the center columns of the header and footer. Complete the header and footer with Project information.

Revise this Section by deleting and inserting text to meet Project-specific requirements.

This Section uses the terms “Architect” and "Engineer." Change this term to match that used to identify the design professional as defined in the General and Supplementary Conditions.

Verify that Section titles referenced in this Section are correct for this Project's Specifications; Section titles may have changed.

Delete hidden text after this Section has been edited for the Project.

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. The Contractor's attention is specifically directed, but not limited, to the following documents for additional requirements:

1. The current version of the *Uniform General Conditions for Construction Contracts*, State of Texas, available on the web site of the Texas Facilities Commission.
2. The University of Houston’s *Supplemental General Conditions and Special Conditions for Construction.*

1.2 DESCRIPTION OF WORK

A. The switch shall consist of load interrupting, SF6 insulated, 630A linear puffer switches and manually operated, electronically controlled fault interrupters.

1.3 STANDARDS

A. The switch shall comply with requirements of the latest revision of applicable industry standards, including:

1. IEEE C37.71, IEEE C37.72, IEEE C37.60, ANSI/IEEE 386, IEEE 592
2. ANISI/ IEEE C37.60.2 or equivalent, C37.60.1 or equivalent, IEC 60255-22, IEC 60255-21-1 or equivalent, IEC 60255-21-2 or equivalent

B. The switch manufacturers shall be ISO 9001:2008 and ISO 14001:2004 certified.

1.4 QUALITY ASSURANCE

A. G&W LPFI style with ATC-451 Automatic Transfer Control Package is the basis of design; however, equivalent substitute products from the following may be considered, if approved by Owner:
1. Powell Esco
2. S&C

B. NEMA Compliance: Comply with applicable National Electrical Manufacturers' Association (NEMA) Standards.

1.5 SUBMITTALS

A. Shop drawing submittals shall include, but not be limited to, the following:

1. Manufacturer's product data sheets.
2. Dimensioned drawings of load interrupter switches showing accurately scaled basic units and rough-in information.
3. Furnish, upon request, manufacturer's certification of rating of the basic switch and fusing components and the integrated metal-enclosed interrupter switch assembly.
4. Additional information as required in Section 26 0001 “Electrical General Provisions.”

1.6 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Deliver switches in factory-fabricated water resistant wrapping.

B. Maintain factory-wrapping or provide an additional heavy canvas or plastic cover.

C. Store switches in a clean and dry space and protected from weather.

D. Handle switches carefully to avoid damage to material components, enclosure, and finish.

PART 2 - PRODUCTS

2.1 SWITCH CONFIGURATION

A. Each switch shall be equipped with two 3-phase load break switch ways and 3-phase fault interrupter ways, quantities as indicated on the Drawings.

B. Switches shall be designed for front access to cables and operators.

2.2 SWITCH CONSTRUCTION

A. General

1. Switch contacts and cable entrance terminations shall be contained in a single, welded mild steel tank with entrances internally connected by copper conductors. Construction shall be a dead front design. Switches shall be shipped factory filled with SF6 gas conforming to ASTM D-2472. Switch tanks shall be painted ASA70 light gray using a corrosion-resistant epoxy paint.

B. Load Break Source Switch

1. Each switching way is to be equipped with an internally mounted operating mechanism capable of providing quick-make, quick-break operation in either switching direction. The mechanism must be capable of delivering sufficient torque and shall be provided with latches for each position to assure load interrupting, fault closing and momentary ratings. All switch positions are to be clearly identified,

padlockable and adaptable to keylock schemes. The operating mechanism shall be actuated from outside the switch tank with a motor operator. The operating shaft shall be made of stainless steel for maximum corrosion resistance. A double "O" ring type operating shaft seal shall be used for a leak resistant, long life seal. Switch contacts shall be a tulip-bayonet design and made of plated, high-conductivity copper alloy with arcing tips of copper/tungsten alloy to assure permanent low resistance and to avoid sticking during operations. The contacts shall be designed such that arcing does not occur in the area of main current interchange and contact pressure will increase with increased current flow. The stationary contacts shall be supported independent of the cable entrance bushings, eliminating possible misalignment. The contact nozzle shall have a converging/diverging geometry which improves the flow of SF6 into the Arc zone. Contact travel shall be a minimum of 3 inches and have sufficient open contact separation to assure efficient Arc extinction and to withstand field DC testing levels and maintain BIL levels. Switch contacts shall be clearly visible in the open position through viewing windows. Auxiliary blades used for load interruption are not acceptable.

C. Fault Interrupters

1. The fault interrupter shall consist of vacuum bottles and a spring-assisted operating mechanism. The mechanism used shall be designated "Model FI" for three phase operation. The mechanism shall consist of three vacuum bottles mechanically linked to a single spring-assisted operating mechanism. The vacuum interrupter operating mechanism shall consist of the support assembly, linkage, spring latch mechanism, and solenoid utilized for electronic tripping. Maximum interrupting time shall be three cycles (50 msec). The movable contact shaft shall be flagged to indicate the contact position, open or closed. This contact position indicator shall be fully visible through viewing windows supplied in the switch tank. Each tap phase is to be equipped with an individual 630A vacuum interrupter fully enclosed in an SF6 insulated switch tank. Electrical opening shall be by a solenoid that is activated from sources external to the switch tank. Manual reset or closing of the fault interrupter shall be actuated from outside the switch tank via a motor operator with a SEL 751A motor controller. The SEL 751A shall also provide overcurrent protection functions and signal to trip solenoid. The mechanical linkage assembly shall provide for a "trip-free" operation which allows the fault interrupter to interrupt independent of the operating handle. 600:5 Multiratio external CT's shall be included with the switch along with mounting brackets for CT installation by Contractor. The CT outputs will be wired into the SEL 751A relay for overcurrent protection. The CTs shall be wired to a shorting block.

2.3 DESIGN RATINGS

A. Switch Ratings

The switch shall be rated **(choose appropriate column):**

SELECTION OF RATINGS	IEEE
Maximum Design Voltage, kV	15.5
Impulse Level (BIL) Voltage, kV	110
Continuous Current, Amperes	630
Load break Current, Amperes	630
One Minute Withstand (dry), AC kV	35
Production Test Rating	34
15 Minute Withstand, DC kV	53
Momentary Current, kA, ASYM	40
Fault-Close Current, kA, ASYM	40
One Second Current, kA, SYM	25
Fault Interrupting Rating, kA, SYM	12.5
Mechanical Endurance, Operations	2000
Load Break Switch Operations at 600 Amperes	500

B. Interrupters shall be tested to IEEE C37.60 Fault Interrupter Duty per the table below.

Percent of Maximum: Interrupting Rating	Approx. Interrupting: Current Amps	No. of Fault: Interruptions
15-20%	2000	44
45-55%	6000	56
90-100%	12000	16
Total Number of Fault Interruptions: 116		

2.4 CABLE ENTRANCES

A. Cable entrances shall be tested to IEEE 386 and be as indicated on the switch drawing:

1. 600A G&W voltage sensing bushings

B. Fault Interrupters

1. Cable entrances shall be tested to IEEE 386 and be as indicated on the switch drawing:

a. 200 amp Deepwell bushing on load connections.

2.5 AUTOMATIC TRANSFER CONTROL (ATC-451)

A. Product Construction

1. Enclosure shall be NEMA 4 (mild steel) enclosure
2. Power supply

    a. Provide solid dielectric control power transformer with 12.47kV primary and 120VAC secondary with secondary fuses for control power to unit. Include elbow fuses to protect the primary bus of the switch from a CPT Failure.
    b. Power supply shall include battery test (control sends a battery test command either via included programmable timer or specific customer request). AC power and battery status are displayed on the front panel (for 120VAC or 208VAC power supply only).

3. Display: The transfer control shall have a display and LEDs that are used to show whether the control is in manual or automatic mode, the position of the two source switches (open or close) as well as several messages. The messages shall be used to inform the user of the current system status if the ATS control is timing for an operation.
4. Communication Ports - the transfer control shall have two communications ports for dedicated relay-to-relay communications.

    a. One serial port pre-programmed for use with DNP3.0 Level 2.
    b. The transfer control shall include three independent EIA-232 serial ports for external communications

5. Environment. The transfer control shall be suitable for continuous operation over a temperature range of –40°C to +80°C.

B. Product Features

1. The microprocessor-based transfer control shall provide control, automation, monitoring, fault locating, and protection. The number of switched ways shall be indicated on the single line diagram. The control shall include self-checking functions shall be included. Specific requirements are as follows:

    a. Programming: The transfer control shall be programmed using SEL AcSELerator software. A copy of this software shall be included with the control. Programmable templates shall also be included to allow modification of the basic transfer and protective settings listed in section 2.4 OPERATION.
    b. Overcurrent Fault Protection: The transfer control shall incorporate selectable operating quantity time-overcurrent elements for load ways.
    c. Password Protection: The transfer control shall have multilevel passwords to safeguard ATS control, protection, and automation settings.

d. Communication: Device communication capability shall include Distributed Network Protocol (DNP). The transfer control shall incorporate certified DNP3 Level 2 Slave protocol.
e. Event Reporting and Sequential Events Recorder: The transfer control shall have the ability to automatically record disturbance events of up to 2 seconds at 8 kHz sampling rate and 5 seconds at 1 kHz sampling rate. Events shall be stored in nonvolatile memory. The relay shall also include a Sequential Events Recorder (SER) that stores the latest 1000 entries. The transfer control shall time-tag event reports to an absolute accuracy of 10 µs.

2. The control shall include the following front panel interface features:

a. Open/Close pushbuttons for each switched way
b. Trip pushbuttons for each fault interrupting way
c. Local, Automatic, and/or Test mode enable/disable pushbuttons
d. LED indication of Source switch status. Open to be shown as Green, and Closed to be shown as Red.
e. LED indication of health of the Source
f. LED indication for cause of overcurrent trip of fault interrupting way(s)
g. LED indication of a malfunction and/or blocked condition

C. Operation of the Transfer Control Package

1. Programming of the following Control and Timing functions shall be included as part of the Auto Transfer package and be settable through the provided programming templates.

a. Source 1 Initial Transfer Time: Time between loss of Source 1 voltage and initiation of transfer to Source 2.
b. Source 1 Return Transfer Time: Time after Source 1 returns to stable voltage before setting it as the preferred source.
c. Source 2 Initial Transfer Time: Time between loss of Source 2 voltage and initiation of transfer to Source 1.
d. Source 2 Return Transfer Time: Time after Source 2 returns to stable voltage before setting it as the preferred source.
e. Return Transfer Interruption Delay: Time between operations on a return to preferred source transfer.
f. Preferred Source Operation: One of the sources can be selected as preferred. The transfer control will always try to return to the preferred source when voltage is stabilized.
g. Source paralleling (yes or no)
h. Initial Transfer Sequence (open before close, close before open)
i. Return Transfer Sequence (open before close, close before open)
j. Ability to Open source ways of the switch(es) if both sources are lost with a user selectable time delay to ensure both sources are lost.
k. Ability to automatically reset a faulted condition alarm on the Source ways.

2. Programming the following overcurrent functions shall be included as part of the SEL 751A relay and be settable for each load way through the provided programming templates:

    a. Optional activation of single phase protection or option to activate 3-phase protection for a tap and single phase protection on another tap
    b. Option to block the trip signal output contact on overcurrent trips for the load ways
    c. Current Transformer Secondary value for 50P Instantaneous trip
    d. Current Transformer Secondary value for 51P Phase Time overcurrent trip
    e. Time current curve selection for 51P protection
    f. Time dial for customization of 51P time current curve
    g. Current Transformer Secondary value for 50G Instantaneous Overcurrent trip on Phase Imbalance
    h. Current Transformer Secondary value to begin timing for 51G Phase Time Overcurrent trips due to phase imbalance
    i. Time current curve selection for 51G protection
    j. Time dial for customization of 51G time current curve
    k. Optional Maintenance Settings that allow for tighter settings to be applied by the user during specific time periods. These settings are in addition to the primary overcurrent functions.

3. The following Operating Modes shall be part of the standard transfer control package:

    a. Local Operation Mode shall override any other mode. In Local Mode the operator shall have sole control over the switch(es). The pushbuttons on the front display panel shall be capable of operating both switch 1 and switch 2. Settings changes shall be made only while the control is in the Local Operation Mode. The control shall not respond to the automatic transfer logic or SCADA commands while in Local Operation Mode. The control shall not be able to initiate a transfer on voltage loss while the transfer control is in Local Operation Mode.
    b. Automatic (Auto) Operation Mode shall cause the automatic transfer logic and the settings to be enabled. In Automatic Operation Mode the ATS shall act on its own to initiate a transfer if source voltages are lost. An LED next to the "AUTO MODE" push button on the front control panel shall illuminate when the ATS is set to Automatic Operation Mode for clear visual indication to operators. The preferred/alternate scheme the normal state of the control is to have the Preferred Source closed and the Alternate Source open. If power is lost to the Preferred Source for a period of time greater than that selected Initial Transfer Time delay, the control shall initiate a transfer to the Alternate Source if the Alternate Source is live. When the Preferred Source returns for a period of time greater than that selected for the Return Time delay, the control shall initiate a return transfer to the Preferred Source. If the Return Transfer Interruption Timer is activated it shall delay the Preferred Source's operation. If the Alternate Source is lost before the Preferred Source returns,

the control shall initiate emergency return logic which shall set the return delay timer to zero (0) and proceeds with the return transfer (including the Return Transfer Interruption delay). In the Non-Preferred scheme, the normal state of the control is to have a live source feeding the load. A transfer shall be initiated only if the source feeding the load is lost for a period of time greater than that selected for its transfer time delay, and the alternate source is live.

c. Remote Mode shall allow the SCADA system to issue operational commands (open/close) to both switch 1 and 2. The control shall not be able to initiate a transfer on voltage loss while the transfer control is in Remote Mode.

d. Test Mode shall mean that the transfer control is in a state where the user can verify logic settings, use simulated position inputs, and have the option to operate actuators. Test Mode shall be available by first putting the transfer control into Local Mode and then pressing a button on the front panel titled "TEST MODE." From Test Mode the operator can verify the operation of the actuators and the timing of the transfer scheme.

e. Optional Blocked Condition shall mean the user can prevent the ATS from operating in manual or automatic mode until the conditions causing the block are removed or reset. The following conditions shall cause the transfer control to enter a blocked state:

1.) Source 1 or 2 status is invalid: shows both open and closed indication or no indication at all
2.) Low Dielectric Condition: can only be removed if condition is removed (SF6 switches only)
3.) Fault Block: An overcurrent fault has occurred and has not been cleared

D. Transfer Control Options **(specifier to choose which options are required)**

1. The following enclosure options shall be supplied:

a. Document holder inside of enclosure door
b. 120 VAC outlet for programming laptop power
c. Ethernet connection using 10/100Base-T or 100Base-FX
d. Ethernet DNP3 LAN/WAN communications capability
e. Ethernet Switch Hub to connect 751A and 451 Relay for communications

2.6 PAD MOUNT ENCLOSURE

A. The enclosure shall be fabricated of 12 gauge galvanized steel and manufactured to ANSI C37.72 and C57.12.28 standards. The enclosure shall be tamper-resistant incorporating hinged access doors with pentahead locking bolts and provisions for padlocking. The enclosure shall be provided with lifting provisions and painted with a Munsell 7.0GY3.29/1.5 green finish.

2.7 STANDARD COMPONENTS

A. The following shall be included as standard:

1. Welded stainless steel mechanism housing, painted light gray with stainless steel and brass fasteners.
2. Lifting provisions
3. ½ inch-13 nuts to provide sufficient grounding provisions for interrupter and all cable entrances
4. Stainless steel three line diagram and corrosion-resistant nameplates
5. Switch operating handle with padlock provision
6. Removable parking stands
7. Mounting bracket
8. Operating handles for the vacuum interrupter and for the visible break switch, secured with cotter pins, and suitable for operation via hot stick

2.8 SWITCH OPTIONS

A. The following options shall be supplied:

1. Mounting frame to bolt switch to the floor **[specify galvanized or stainless steel construction. Specify height of lowest bushing.]**

2.9 LABELING

A. Hazard Alerting Signs

1. The exterior of the pad mount enclosure (if furnished) shall be provided with "Warning--Keep Out--Hazardous Voltage Inside--Can Shock, Burn, or Cause Death" signs. Each unit of switchgear shall be provided with a "Danger--Hazardous Voltage--Failure to Follow These Instructions Will Likely Cause Shock, Burn, or Death" sign. The text shall further indicate that operating personnel must know and obey the employer's work rules, know the hazards involved, and use proper protective equipment and tools to work on this equipment. Each unit of switchgear shall be provided with a "Danger--Keep Away--Hazardous Voltage--Will Shock, Burn, or Cause Death" sign.

B. Nameplates, Ratings Labels, and Connection Diagrams

1. Each unit of switchgear shall be provided with a nameplate indicating the manufacturer's name, catalog number, model number, date of manufacture, and serial number. Each unit of switchgear shall be provided with a ratings label indicating the following: voltage rating; main bus continuous rating; short-circuit rating; fault interrupter ratings including interrupting and duty-cycle fault-closing; and load break switch ratings including duty-cycle fault-closing and short-time.

PART 3 - EXECUTION

3.1 DELIVERY, STORAGE, AND HANDLING

A. The switch shall be shipped preassembled at the factory. No field assembly shall be required.

B. The Contractor, if applicable, shall handle, transfer and move the switches in accordance with manufacturer's recommendations.

C. Deliver material in manufacturer's original unopened protective packaging unless it is built into new distribution equipment.

D. Securely store materials in original packaging in a manner to prevent soiling, physical damage, incursion of moisture or corrosion prior to installation.

E. Handle in a manner to prevent damage to finished surfaces.

F. Maintain protective coverings until installation is complete and remove such covers as part of final clean-up.

G. Temperature Ranges

1. Storage and Operational Without Batteries: -40°C to 70°C
2. Operational (with Batteries): -20°C to 70°C

3.2 INSTALLATION OF LOAD INTERRUPTER SWITCHES

A. General: Install switches where shown, in accordance with the manufacturer's written instructions and recognized industry practices, to ensure that the switchgear complies with the requirements and serves the intended purposes.

B. Standards: Comply with the requirements of NEMA and NEC standards and applicable portions of NECA's "Standard of Installation", for installation of switches.

C. Tightness: Torque bus connections and tighten mechanical fasteners.

D. Manufacturer shall program overcurrent protective relay settings into SEL 751A relays with settings as determined by Section 26 0573 "Power Systems Studies."

E. Adjustment: Adjust operating mechanisms for free mechanical movement.

3.3 FACTORY PRODUCTION TESTS

A. Each interrupter shall undergo the following production testing. Test reports must be available upon request.

1. A mechanical operation check
2. AC hi-pot tested one minute phase-to-phase, phase-to-ground and across the open contacts

3. Circuit resistance
4. Leak test to insure the integrity of all seals and gaskets
5. Primary current injection test to test CTs, trip mechanism, and electronic control

3.4 TESTING

A. Pre-energization Checks: Prior to energization, check switches for continuity of circuits and for short circuits.

B. Thermographic Testing: Refer to Section 26 0125 "Electrical Testing" for thermographic testing.

C. Prior to energization of switches, Megger-test phase-to-phase and phase-to-ground insulation resistance.

3.5 IDENTIFICATION

A. General: Refer to Section 26 0553 “Identification for Electrical Systems” for nameplates, identification and warning signs.

END OF SECTION 26 1300