

SECTION 26 36 23
AUTOMATIC TRANSFER SWITCHES

12-01-12

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section specifies the furnishing, installation, connection, and testing of open-transition automatic transfer switches with bypass isolation, indicated as automatic transfer switches or ATS in this section.

1.2 RELATED WORK

- A. Section 03 30 00, CAST-IN-PLACE CONCRETE: Requirements for concrete equipment pads.
- B. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS: Requirements that apply to all sections of Division 26.
- C. Section 26 05 19, LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES: Low-voltage conductors.
- D. Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS: Requirements for personal safety and to provide a low impedance path for possible ground fault currents.
- E. Section 26 05 33, RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS: Conduits.
- F. Section 26 05 73, OVERCURRENT PROTECTIVE DEVICE COORDINATION STUDY: Short circuit and coordination study, and requirements for a coordinated electrical system.
- G. Section 27 05 11, REQUIREMENTS FOR COMMUNICATIONS INSTALLATIONS: General communications requirements that are common to more than one section in Division 27.
- H. Section 27 05 33, RACEWAYS AND BOXES FOR COMMUNICATION SYSTEMS: Raceways for communications cabling.
- I. SECTION 27 15 00, COMMUNICATIONS HORIZONTAL CABLING: Communications media for interconnecting automatic transfer switches and remote control and annunciation components.

1.3 QUALITY ASSURANCE

A. QUALITY ASSURANCE

Refer to Paragraph, QUALIFICATIONS (PRODUCTS AND SERVICES), in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

- B. A factory-authorized representative shall be capable of providing emergency maintenance and repairs at the project site within 4 hours maximum of notification.
- C. Automatic transfer switch, bypass/isolation switch, and annunciation control panels shall be products of the same manufacturer.

1.4 FACTORY TESTS

A. Automatic transfer switches shall be thoroughly tested at the factory to ensure that there are no electrical or mechanical defects. Tests shall be conducted per UL standards. Factory tests shall be certified, and shall include the following tests:

- 1. Visual inspection to verify that each ATS is as specified.
- 2. Mechanical test to verify that ATS sections are free of mechanical hindrances.
- 3. Insulation resistance test to ensure electrical integrity and continuity of entire system.
- 4. Main switch contact resistance test.
- 5. Electrical tests to verify complete system electrical operation.

B. Furnish four (4) copies of certified manufacturer's factory test reports to the COR prior to shipment of the ATS to ensure that the ATS has been successfully tested as specified.

1.5 SUBMITTALS

A. Submit six copies of the following in accordance with Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

1. Shop Drawings:

- a. Submit sufficient information to demonstrate compliance with drawings and specifications.
- b. Include voltage rating, continuous current rating, number of phases, withstand and closing rating, dimensions, weights, mounting details, conduit entry provisions, front view, side view, equipment and device arrangement, elementary and interconnection wiring diagrams, factory relay settings, and accessories.
- c. For automatic transfer switches that are networked together to a common means of annunciation and/or control, submit

interconnection diagrams as well as site and building plans, showing connections for normal and emergency sources of power, load, control and annunciation components, and interconnecting communications paths. Equipment locations on the diagrams and plans shall match the site, building, and room designations on the drawings.

- d. Complete nameplate data, including manufacturer's name and catalog number.
 - e. A copy of the markings that are to appear on the automatic transfer switches when installed.
2. Manuals:
- a. Submit, simultaneously with the shop drawings, companion copies of complete maintenance and operating manuals, including technical data sheets, wiring diagrams, and information for ordering replacement parts.
 - 1) Schematic signal and control diagrams, with all terminals identified, matching terminal identification in the automatic transfer switches.
 - 2) Include information for testing, repair, troubleshooting, assembly, disassembly, and factory recommended/required periodic maintenance procedures and frequency.
 - 3) Provide a replacement and spare parts list. Include a list of tools and instruments for testing and maintenance purposes.
 - b. If changes have been made to the maintenance and operating manuals originally submitted, submit updated maintenance and operating manuals two weeks prior to the final inspection.
 - 1) Include complete "As Installed" diagrams that indicate all pieces of equipment and their interconnecting wiring.
 - 2) Include complete diagrams of the internal wiring for each piece of equipment, including "As Installed" revisions of the diagrams.
 - 3) The wiring diagrams shall identify the terminals to facilitate installation, maintenance, operation, and testing.
3. Certifications:
- a. When submitting the shop drawings, submit a certified test report from a recognized independent testing laboratory that a representative sample has passed UL 1008 prototype testing.
 - b. Two weeks prior to final inspection, submit the following.

- 1) Certification by the manufacturer that the ATS conform to the requirements of the drawings and specifications.
- 2) Certification by the Contractor that transfer switches have been properly installed, adjusted, and tested.

1.6 APPLICABLE PUBLICATIONS

- A. Publications listed below (including amendments, addenda, revisions, supplements, and errata) form a part of this specification to the extent referenced. Publications are referenced in the text by designation only.
- B. Institute of Electrical and Electronic Engineers (IEEE):
- 446-95.....Emergency and Standby Power Systems for Industrial and Commercial Applications C37.90.1-02 Surge Withstand Capability (SWC) Tests for Relays and Relay Systems Associated with Electric Power Apparatus
 - C62.41.1-02.....Guide on the Surges Environment in Low-Voltage (1000 V and Less) AC Power Circuits
 - C62.41.2-02.....Recommended Practice on Characterization of Surges in Low-Voltage (1000 V and Less) AC Power Circuits
- C. International Code Council (ICC):
- IBC-12.....International Building Code
- D. National Electrical Manufacturers Association (NEMA):
- 250-08.....Enclosures for Electrical Equipment (1000 Volts Maximum)
 - ICS 6-06.....Enclosures
 - ICS 4-10.....Application Guideline for Terminal Blocks
 - MG 1-11.....Motors and Generators
- E. National Fire Protection Association (NFPA):
- 70-11.....National Electrical Code (NEC)
 - 99-12.....Health Care Facilities
 - 110-10.....Emergency and Standby Power Systems
- F. Underwriters Laboratories, Inc. (UL):
- 50-95.....Enclosures for Electrical Equipment
 - 508-99.....Industrial Control Equipment
 - 891-07.....Switchboards
 - 1008-07.....Transfer Switch Equipment

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS

- A. Automatic transfer switches shall comply with UL, NEMA, NEC, ANSI, IEEE, and NFPA, and have the following features:
1. Automatic transfer switches shall be open transition switches, 4-pole, draw-out construction, electrically operated, mechanically held open contact type, without integral overcurrent protection. Automatic transfer switches utilizing automatic or non-automatic molded case circuit breakers, insulated case circuit breakers, or power circuit breakers as switching mechanisms are not acceptable.
 2. Automatic transfer switches shall be completely factory-assembled and wired such that only external circuit connections are required in the field. All customer connections shall be wired to a common terminal block to simplify field-wiring connections.
 3. Each automatic transfer switch shall be equipped with an integral bypass/isolation switch.
 4. Ratings:
 - a. Phases, voltage, continuous current, poles, and withstand and closing ratings shall be as shown on the drawings.
 - b. Transfer switches are to be rated for continuous duty at specified continuous current rating on 60Hz systems.
 - c. Maximum automatic transfer switch rating for this project: 1000
 5. Markings:
 - a. Markings shall be in accordance with UL 1008.
 6. Tests:
 - a. Automatic transfer switches shall be tested in accordance with UL 1008. The contacts of the transfer switch shall not weld during the performance of withstand and closing tests when used with the upstream overcurrent device and available fault current specified.
 7. Surge Withstand Test:
 - a. Automatic transfer switches utilizing solid-state devices in sensing, relaying, operating, or communication equipment or circuits shall comply with IEEE C37.90.1.

8. Housing:
 - a. Enclose automatic transfer switches in wall- or floor-mounted steel cabinets, with metal gauge not less than No. 14, in accordance with UL 508, or in a switchboard assembly in accordance with UL 891, as shown on the drawings.
 - b. Enclosure shall be constructed so that personnel are protected from energized bypass-isolation components during automatic transfer switch maintenance.
 - c. Automatic transfer switch components shall be removable without disconnecting external source or load power conductors.
 - d. Finish: Cabinets shall be given a phosphate treatment, painted with rust-inhibiting primer, and finish-painted with the manufacturer's standard enamel or lacquer finish.
 - e. Viewing Ports: Provide viewing ports so that contacts may be inspected without disassembly.
9. Operating Mechanism:
 - a. Actuated by an electrical operator.
 - b. Electrically and mechanically interlocked so that the main contact cannot be closed simultaneously in both normal and emergency position.
 - c. Normal and emergency main contacts shall be mechanically locked in position by the operating linkage upon completion of transfer. Release of the locking mechanism shall be possible only by normal operating action.
 - d. Contact transfer time shall not exceed six cycles.
 - e. Operating mechanism components and mechanical interlocks shall be insulated or grounded.
10. Contacts:
 - a. Main contacts: Silver alloy.
 - b. Neutral contacts: Silver alloy, with same current rating as phase contacts.
 - c. Current carrying capacity of arcing contacts shall not be used in the determination of the automatic transfer switch rating, and shall be separate from the main contacts.
 - d. Main and arcing contacts shall be visible for inspection with cabinet door open and barrier covers removed.

11. Manual Operator:
 - a. Capable of operation by one person in either direction under no load.
12. Replaceable Parts:
 - a. Include the main and arcing contacts individually or as units, as well as relays, and control devices.
 - b. Automatic transfer switch contacts and accessories shall be replaceable from the front without removing the switch from the cabinet and without removing main conductors.
13. Sensing and Control Features:
 - a. Microprocessor: The controller's sensing and logic shall be provided by a single built-in microprocessor for maximum reliability, minimum maintenance, and the ability to communicate serially through an optional serial communication module.
 - b. Voltage/Frequency sensing: A single controller shall provide twelve selectable nominal voltages for maximum application flexibility and minimal spare part requirements. Voltage sensing shall be true RMS type and shall be accurate to $\pm 1\%$ of nominal voltage. Frequency sensing shall be accurate to $\pm 0.2\%$.
 - c. Accuracy: Repetitive accuracy of all settings shall be within $\pm 0.5\%$ over an operating temperature range of -20°C to 60°C .
 - c. Environmental conditions: The controller shall be capable of operating over a temperature range of -20 to $+60$ degrees C and storage from -55 to $+85$ degrees C.
 - d. Controller wiring: The controller shall be connected to the transfer switch by an interconnecting wiring harness. The harness shall include a keyed disconnect plug to enable the controller to be disconnected from the transfer switch for routine maintenance. Sensing and control logic shall be provided on multi-layer printed circuit boards. Interfacing relays shall be industrial grade plug-in type with dust covers. The panel shall be enclosed with a protective cover and be mounted separately from the transfer switch unit for safety and ease of maintenance. The protective cover shall include a built-in pocket for storage of the operator's manuals.

- e. The controller shall meet or exceed the requirements for Electromagnetic Compatibility (EMC) as follows:
 - 1. IEEE 472 (ANSI C37.90A) Ring Wave Test.
 - 2. EN55011 1991 Class A Conducted and Radiated Emission.
 - 3. EN61000-4-2 Electrostatic Discharge Immunity, Direct Contact & Air Discharge.
 - 4. EN61000-4-3 Radiated Electromagnetic Field Immunity.
 - 5. EN61000-4-4 Electrical Fast Transient Immunity.
 - 6. EN61000-4-5 Surge Immunity.
 - 7. ENV50141 HF Conducted Disturbances Immunity.
- f. Voltage and frequency on both the normal and emergency sources (as noted below) shall be continuously monitored, with the following pickup, dropout, and trip setting capabilities (values shown as % of nominal unless otherwise specified):

<u>Parameter</u>	<u>Sources</u>	<u>Dropout / Trip</u>	<u>Pickup / Reset</u>
Undervoltage	N&E, 3 ϕ	70 to 98%	85 to 100%
Overvoltage	N&E, 3 ϕ	102 to 115%	2% below trip
Underfrequency	N&E	85 to 98%	90 to 100%
Overfrequency	N&E	102 to 110%	2% below trip
Voltage unbalance	N&E	5 to 20%	1% below dropout

- g. Voltage and frequency settings shall be field adjustable in 1% increments either locally with the display and keypad or remotely via serial communications port access.
- h. Undervoltage Sensing for Each Phase of Normal Source: Factory set for pickup at 90% and dropout at 85%.
- i. Time Delays:
 - 1. Momentary Normal source outage: For override of normal-source voltage sensing to delay transfer and all engine start signals. Adjustable from zero to six seconds, and factory set for one second. Capability shall be provided to extend this time delay to 60 minutes by providing an external 24 VDC power supply.
 - 2. For Retransfer to Normal Source after Emergency fail: Adjustable from 0 to 30 minutes, and factory set for 10 minutes to automatically defeat delay on loss of voltage or sustained undervoltage of emergency source, provided normal supply has been restored.

3. Transfer to Emergency: A time delay shall be provided on transfer to emergency, adjustable from 0 to 60 minutes, for controlled timing of transfer of loads to emergency.
4. Momentary Emergency source outage: An adjustable time delay of 0 to 6 seconds to override momentary emergency source outage to delay all retransfer signals during initial loading of engine generator set.
5. Re-transfer to Normal: Two time delay modes (which are independently adjustable) shall be provided on re-transfer to normal. One time delay shall be for actual normal power failures and the other for the test mode function. The time delays shall be adjustable from 0 to 60 minutes. Time delay shall be automatically bypassed if the emergency source fails and the normal source is acceptable.
5. Adjustability: All time delays shall be adjustable in 1 second increments, unless noted otherwise.
6. Adjustment access: All time delays shall be adjustable by using the LCD display and keypad or with a remote device connected to the serial communications port.
- j. Voltage/Frequency Lockout Relay: Prevent premature transfer to the engine-generator. Pickup voltage shall be factory set at 90%. Pickup frequency shall be factory set at 95%.
- k. Test Switch: Simulate normal-source failure.
- l. Phase rotation sensing: The controller shall be capable (when activated by the keypad or through the serial port) of sensing the phase rotation of both the normal and emergency sources. The source shall be considered unacceptable if the phase rotation is not the preferred rotation selected (ABC or CBA).
- m. LED Indication:
 1. Switch-Position Indication: Indicate source to which load is connected.
 2. Source-Available Indication: Supervise sources via transfer switch normal- and emergency-source sensing circuits.
 3. Normal Power Indication: Indicate "Normal Source Available."
 4. Emergency Power Indication: Indicate "Emergency Source Available."
- n. Controller Display and Keypad: A four line, 20 character LCD display and keypad shall be an integral part of the controller

for viewing all available data and setting desired operational parameters. Operational parameters shall also be available for viewing and limited control through the serial communications input port. The following parameters shall only be adjustable via DIP switches on the controller:

1. Nominal line voltage and frequency.
 2. Single or three phase sensing.
 3. Operating parameter protection.
 4. Transfer operating mode configuration (open transition or delayed transition).
- o. Source status screens: Screens shall be provided for both normal & emergency to provide digital readout of voltage on all 3 phases, frequency, and phase rotation.
- p. System Status: The controller LCD display shall include a "System Status" screen which shall be readily accessible from any point in the menu by depressing the "ESC" key a maximum of two times. This screen shall display a clear description of the active operating sequence and switch position.
- q. Transfer Override Control: Overrides automatic retransfer control so that automatic transfer switch shall remain connected to emergency power source regardless of condition of normal source. Control panel shall indicate override status.
- r. The controller shall be capable of accepting a normally open contact that will allow the transfer switch to function in a non-automatic mode using an external control device.
- s. Engine Starting Contacts: One isolated and normally closed and one isolated and normally open; rated 5 A at 30 V DC minimum.
- t. Engine Shutdown Contacts: Time delay adjustable from zero to 60 minutes, and factory set for 5 minutes. Contacts shall initiate shutdown at remote engine-generator controls after retransfer of load to normal source.
- u. Engine-Generator Exerciser (ATS shall be provided with the following capability, however, existing engine-generator exercise control programming in existing paralleling switchgear shall remain in effect): Programmable exerciser starts engine-generator(s) and transfers load to them from normal source for a preset time, then retransfers and shuts down engine-generator(s) after a preset cool-down period. Initiates exercise cycle at

preset intervals adjustable from 7 to 30 days. Running periods are adjustable from 10 to 30 minutes. Factory settings shall be for 7-day exercise cycle, 20-minute running period, and 5-minute cool-down period.

- v. Self Diagnostics: The controller shall contain a diagnostic screen for the purpose of detecting system errors. This screen shall provide information on the status input signals to the controller which may be preventing load transfer commands from being completed.
 - w. In-Phase Monitor: An In-phase monitor (passive) shall be provided in the controller. The monitor shall control transfer (by monitoring the difference in source phases) so that motor load inrush currents do not exceed normal starting currents, and shall not require external control of power sources. The in-phase monitor shall be specifically designed for and be the product of the ATS manufacturer.
 - x. Time clock battery: A 10-year life battery that supplies power to the real time clock in the event of a power loss will maintain all time and date information.
 - y. Transfer inhibit: Terminals shall be provided for a remote contact which opens to signal the ATS to transfer to emergency and for remote contacts which open to inhibit transfer to emergency and/or retransfer to normal. Both of these inhibit signals can be activated through the keypad or serial port.
 - z. "Commit/No commit": Provide the ability to select "commit/no commit to transfer" to determine whether the load should be transferred to the emergency generator if the normal source restores before the generator is ready to accept the load.
14. Controls:
- a. Controls shall provide indication of switch status and be equipped with alarm diagnostics.
 - b. Controls shall control operation of the automatic transfer switches.
15. Factory Wiring: Train and bundle factory wiring and label either by color-code or by numbered/lettered wire markers. Labels shall match those on the shop drawings.
16. Annunciation, Control, and Programming Interface Components:
Devices for communicating with remote programming devices,

- annunciators, or control panels and paralleling switchgear shall have open-protocol communication capability matched with remote device. ATS shall have communication capability as required to communicate with existing paralleling switchgear.
17. Communications interface: The controller shall be capable of interfacing, through an optional serial communication module, with a network of transfer switches, locally (up to 4000 ft.) or remotely through modem serial communications. Standard software specific for transfer switch applications shall be available by the transfer switch manufacturer. This software shall allow for the monitoring, control, and setup of parameters.
 18. Communications Module: A full duplex RS485 interface shall be installed in the ATS controller to enable serial communications. The serial communications shall be capable of direct connect or multi-drop configured network. This module shall allow for the seamless integration of existing or new communication transfer devices.
 19. Motor Disconnect and Timing Relay: Controls designate starters so they disconnect motors before transfer and reconnect them selectively at an adjustable time interval after transfer. Control connection to motor starters is through wiring external to the automatic transfer switch. Time delay for reconnecting individual motor loads is adjustable between 1 and 300 seconds, and settings are as indicated. Relay contacts handling motor-control circuit in-rush and seal currents are rated for actual currents to be encountered. Modes of use shall include:
 - a. Prior to transfer only.
 - b. Prior to and after transfer.
 - c. Normal to emergency only.
 - d. Emergency to normal only.
 - e. Normal to emergency and emergency to normal.
 - f. All transfer conditions or only when both sources are available.
 20. Provide new power monitoring modules in each new ATS unit as noted; mount devices in enclosure door. Metering modules shall be installed by ATS manufacturer, yet be 100% compatible with existing VA facility power monitoring system (Sq D Power Logic). See drawings for additional power monitoring requirements.
 21. Auxiliary contacts: Two Form C, 10 amp, 250 VAC, auxiliary contacts on both normal and emergency positions, operated by the transfer

switch. Contacts shall be factory-wired to terminal blocks inside the transfer switch enclosure to allow for field wiring connections.

22. Data Logging: The controller shall have the ability to log data and to maintain the last 99 events, even in the event of total power loss. The events shall be time and date stamped and maintained in a non-volatile memory.

2.2 SEQUENCE OF OPERATION

- A. The specified voltage decrease in one or more phases of the normal power source shall initiate the transfer sequence. The automatic transfer switch shall initiate engine-generator(s) start sequence via existing paralleling switchgear after a specified time delay to permit override of momentary dips in the normal power source.
- B. The automatic transfer switch shall transfer the load from normal to emergency source when the frequency and voltage of the engine-generator(s) have attained the specified percent of rated value - after the paralleling switchgear has enabled transfer switch according to existing ATS priority list.
- C. Engine Start: A voltage decrease, at any automatic transfer switch, in one or more phases of the normal power source to less than the specified value of normal shall start the engine-generator(s) after a specified time delay.
- D. Transfer to Emergency System Loads: Automatic transfer switches for Emergency System loads shall transfer their loads from normal to emergency source when frequency and voltage of the engine-generator(s) have attained the specified percent of rated value and after the paralleling switchgear has enabled the switch. Only those switches with deficient normal source voltage shall transfer.
- E. Transfer to Equipment Branch Loads: Automatic transfer switches for Equipment Branch loads shall transfer their loads to the engine-generator on a time-delayed, staggered basis, after the Emergency System switches have transferred and after the paralleling switchgear has enabled the switch. Only those switches with deficient normal source voltage shall transfer.
- F. Retransfer to Normal (All Loads): Automatic transfer switches shall retransfer the load from emergency to normal source upon restoration of normal supply in all phases to the specified percent or more of normal voltage, after a specified time delay, and after the passive in-phase monitor has sensed acceptable source synchronization. Should the

emergency source fail during this time, the automatic transfer switches shall immediately transfer to the normal source whenever it becomes available. After restoring to normal source, the engine-generator(s) shall continue to run unloaded for a specified interval before shut-down.

- G. The sequence of operation shall match the existing sequence for similar ATS units connected to the paralleling switchgear. Coordinate with existing paralleling switchgear to accommodate the existing priority load block scheme.

2.3 BYPASS-ISOLATION SWITCH

- A. Provide each automatic transfer switch with two-way bypass-isolation manual type switch. The bypass-isolation switch shall permit load bypass to either normal or emergency power source and complete isolation of the automatic transfer switch, independent of transfer switch position. Bypass and isolation shall be possible under all conditions including when the automatic transfer switch is removed from service.
- B. Operation: The bypass-isolation switch shall have provisions for operation by one person through the movement of a maximum of two handles at a common dead front panel in no more than 15 seconds. Provide a lock, which must energize to unlock the bypass switch, to prevent bypassing to a dead source. Provide means to prevent simultaneous connection between normal and emergency sources.
 - 1. Bypass to normal (or emergency): Operation of bypass handle shall allow direct connection of the load to the normal (or emergency) source, without load interruption or by using a break-before-make design, or provide separate load interrupter contacts to momentarily interrupt the load.
 - a. Ensure continuity of auxiliary circuits necessary for proper operation of the system.
 - b. A red indicating lamp shall light when the automatic transfer switch is bypassed.
 - c. Bypassing source to source: If the power source is lost while in the bypass position, bypass to the alternate source shall be achievable without re-energization of the automatic transfer switch service and load connections.
 - 2. Isolation: Operation of the isolating handle shall isolate all live power conductors to the automatic transfer switch without interruption of the load.

- a. Interlocking: Provide interlocking as part of the bypass-isolation switch to eliminate personnel-controlled sequence of operation, and to prevent operation to the isolation position until the bypass function has been completed.
 - b. Padlocking: Include provisions to padlock the isolating handle in the isolated position.
 - c. Visual verification: The isolation blades shall be visible in the isolated position.
3. Testing: It shall be possible to test (normal electrical operation) the automatic transfer switch and engine-generator(s) with the isolation contacts closed and the load bypassed without interruption of power to the load.
- C. Ratings: The electrical capabilities and ratings of the bypass-isolation switch shall be compatible with those of the associated automatic transfer switch, including any required additional withstand tests.
- 2.4 REMOTE ANNUNCIATOR SYSTEM (At New Graphics Control via HMI screen)**
- A. Provide remote annunciation for indicated new automatic transfer switches and existing ATS switches. Annunciation shall include the following:
 1. Sources available, as defined by actual pickup and dropout settings of automatic transfer switch controls.
 2. Switch position.
 3. Switch in test mode.
 4. Failure of communication link.
 - B. Remote annunciation shall be via HMI screen; provide with audible signal, and silencing switch.
 1. Panel shall indicate each automatic transfer switch monitored, the location of automatic transfer switch, and the identity of load it serves.
 2. Mounting: Steel cabinet, flush or surface mounted, as shown on the drawings.
 - C. HMI screen shall be provided in boiler plant. HMI screen shall display all existing units as included in existing Graphics Control HMI, plus the two additional ATS units.
 - D. Existing HMI screen at existing Graphics control shall be modified to include the two additional ATS units.

2.5 REMOTE ANNUNCIATOR AND CONTROL SYSTEM (At C094-1 and C093-1)

- A. Add the following functions for the new automatic transfer switches:
 - 1. Indication of sources available, as defined by actual pickup and dropout settings of automatic transfer switch controls.
 - 2. Indication of automatic transfer switch position.
 - 3. Indication of automatic transfer switch in test mode.
 - 4. Indication of failure of communication link.
 - 5. Key-switch or user-code access to control functions of panel.
 - 6. Control of automatic transfer switch test initiation.
 - 7. Control of automatic transfer switch operation in either direction.
 - 8. Control of time-delay bypass for transfer to normal source.
- B. Malfunction of remote annunciator and control system or communication link shall not affect functions of automatic transfer switches. Automatic transfer switch sensing, controlling, or operating functions shall not depend on remote annunciator and control system for proper operation.
- C. Remote annunciation and control system shall include the following features (modify the existing HMI and controls to accept the two additional ATS units):
 - 1. Touchscreen type operator interface (existing).
 - 2. Control and indication means grouped together for each automatic transfer switch.
 - 3. Label each indication and control group. Indicate the automatic transfer switch it controls, the location of the automatic transfer switch, and the identity of the load that it serves.
 - 4. Digital Communication Capability: Matched to that of automatic transfer switches supervised.
 - 5. Mounting: Existing components are mounted in paralleling switchgear control cubicle and in cabinet outside of switchgear room.
- D. Remote Control Capability:
 - 1. The existing Electrical Power Monitoring and Control System (PMCS) shall be modified to provide a signal to initiate either a test with a user-programmed timer to return to normal mode or remotely switch to the emergency source until the signal is manually switched to return to normal mode.
 - 2. A contact closure from the PMCS shall initiate a signal to start the generator and select the emergency as the preferred source.

2.6 ATS MONITOR

- A. Description: The ATS Monitor shall consist of an electronic power meter and Input/Output Module.
1. Electronic Power Meter: True rms electronic power meter to be mounted on the load side of the ATS. Meter shall be designed for use on a 3-phase, 4-wire, 480Y/277 volt system with 4 current transformers where 4 pole transfer switches are indicated. Where 3 pole transfer switches are indicated, the meter shall be designed for use on a 3-phase, 3-wire 480V delta system with 3 current transformers.
 2. Input/Output Module shall report the ATS status to the Electric Power Monitoring and Control System.
 3. ATS monitor shall be 100% compatible with existing facility power monitoring system.
- B. The features of the electronic power meter shall include the following:
1. Current, per-phase
 2. Current, neutral (where 4 pole is indicated)
 3. Volts, phase-to-phase
 4. Volts, phase-neutral (where 4 pole is indicated)
 5. Real Power (kW), per phase & three-phase total
 6. Reactive Power (kVAR), per phase & three phase total
 7. Apparent Power (kVA), per phase & three phase total
 8. Power Factor (true), per-phase & three phase total
 9. Frequency
 10. Compliance monitoring
 11. Sag/Swell Monitoring
 12. Harmonics measurement
 13. Waveform capture
 14. Waveshape alarm
 15. Trend / billing
 16. Minimum and Maximum
 17. Events / Maintenance
 18. Timestamp resolution (seconds)
 19. GPS Clock Synchronizing
 20. Ethernet communications card
 21. RS485/RS232 ports
 22. Modbus RTU communication protocol compatible
 23. The ANSI energy accuracy class shall be 0.5% of reading.

24. Timestamp resolution shall be 1 second.
25. The meter shall be UL Listed per UL 508, CSA recognized under C22.2, and tested for EMC in accordance with the IEC 1000-2, 1000-4, 1000-5 series of electrical tests (level 4), FCC compliant per FCC Part 15, Class A, and vibration and temperature tested. The meter module shall be rated for an operating temperature range of 0°C to 60°C.
26. The power meter metering inputs shall utilize current transformers for the current inputs. It shall be rated 5A nominal and 10A full scale. In addition, it shall be industrially and utility hardened to have an overload withstand rating of 15A continuous and 500A for 1 second.
27. The device shall not require potential transformers or control power transformers when applied at 600V or less. The power meter shall accept control power over a range of 90-600Vac, 50 or 60 HZ, or 100-350Vdc.
28. The electronic power meter shall have built-in Ethernet data communications to allow multipoint communication to multiple computer workstations, programmable controllers, and other host devices.
29. The meter shall be connected via a network to the PC server to provide logging, trending, and alarming information.
30. All setup information and reset commands shall be password protected.
31. All information shall be reported to the Electrical Power Monitoring and Control System using Modbus RTU protocol.
32. A KYZ pulse initiator for communication of kWh, kVARh, or kVAh information to third-party energy management systems shall be provided.
33. The electronic power meter shall be compatible as part of a power monitoring and control system.
34. The electronic power meter shall be powered from the existing 125 VDC station batteries in C094-1. Provide 125 VDC wiring from the electronic power meter to a terminal strip mounted in the ATS for field connection to the station batteries.
35. The Input/Output Module shall provide status monitoring for the following:
 - a. Switch in Normal Position
 - b. Switch in Emergency Position

- c. Normal Source Available
- d. Emergency Source Available
- e. Bypass to Normal
- f. Bypass to Emergency
- g. Switch in Automatic Position
- h. Switch in Isolate Position
- i. Switch in Test Position
- j. Control Switch "Not in Auto"
- k. Control Switch in "Test" mode

2.7 METERING COMPONENTS

- A. Meter fusing: Provide a fuse block mounted in the ATS containing one fuse per phase to protect the voltage input to the electronic power meter. Size fuses as recommended by the meter manufacturer.
- B. Current transformers: ANSI/IEEE C57.13. Provide butyl-molded window type current transformers with 600-volt insulation, 10 kV BIL, and mount on the load side of the ATS. Provide three current transformers with 5 ampere secondaries for three pole transfer switches and four current transformers with 5 ampere secondaries for four pole transfer switches.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install automatic transfer switches in accordance with the NEC, as shown on the drawings, and as recommended by the manufacturer.
- B. Anchor automatic transfer switches with rustproof bolts, nuts, and washers not less than 12 mm (1/2 inch) diameter, in accordance with manufacturer's instructions, and as shown on drawings.
- C. Mount automatic transfer switches on concrete slab. Unless otherwise indicated, the slab shall be at least 100 mm (4 inches) thick. The top of the concrete slab shall be approximately 100 mm (4 inches) above finished floor. Edges above floor shall have 12.5 mm (1/2 inch) chamfer. The slab shall be of adequate size to project at least 100 mm (8 inches) beyond the equipment. Provide conduit turnups and cable entrance space required by the equipment to be mounted. Seal voids around conduit openings in slab with water- and oil-resistant caulking or sealant. Cut off and bush conduits 75 mm (3 inches) above slab surface. Concrete work shall be as specified in Section 03 30 00, CAST-IN-PLACE CONCRETE.
- D. Anchor remote control and/or annunciator panel to wall.

3.2 ACCEPTANCE CHECKS AND TESTS

- A. An authorized representative of the automatic transfer switch manufacturer shall technically supervise and participate during all of the field adjustments and tests. Major adjustments and field tests shall be witnessed by the COR. The manufacturer's representative shall certify in writing that the equipment has been installed, adjusted and tested in accordance with the manufacturer's recommendations.
- B. Perform manufacturer's required field tests in accordance with the manufacturer's recommendations. In addition, include the following:
 1. Visual Inspection and Tests:
 - a. Compare equipment nameplate data with specifications and approved shop drawings.
 - b. Inspect physical, electrical, and mechanical condition.
 - c. Confirm correct application of manufacturer's recommended lubricants.
 - d. Verify appropriate anchorage, required area clearances, and correct alignment.
 - e. Verify tightness of accessible bolted electrical connections by calibrated torque-wrench method, or performing thermographic survey after energization.
 - f. Verify grounding connections.
 - g. Verify ratings of sensors.
 - h. Vacuum-clean enclosure interior. Clean enclosure exterior.
 - i. Exercise all active components.
 - j. Verify that manual transfer warning signs are properly placed.
 - k. Verify the correct operation of all sensing devices, alarms, and indicating devices.
 2. Electrical tests:
 - a. Perform insulation-resistance tests.
 - b. After energizing circuits, demonstrate the interlocking sequence and operational function for each automatic transfer switch at least three times.
 - 1) Test bypass-isolation unit functional modes and related automatic transfer switch operations.
 - 2) Power failure of normal source shall be simulated by opening upstream protective device. This test shall be performed a minimum of five times.

- 3) Power failure of emergency source with normal source available shall be simulated by opening upstream protective device for emergency source. This test shall be performed a minimum of five times.
 - 4) Low phase-to-ground voltage shall be simulated for each phase of normal source.
 - 5) Operation and settings shall be verified for specified automatic transfer switch operational feature, such as override time delay, transfer time delay, return time delay, engine shutdown time delay, exerciser, auxiliary contacts, and supplemental features.
 - 6) Verify pickup and dropout voltages by data readout or inspection of control settings.
 - 7) Verify that bypass and isolation functions perform correctly, including the physical removal of the automatic transfer switch while in bypass mode.
- d. When any defects are detected, correct the defects and repeat the tests as requested by the COR at no additional cost to the Government.

3.3 FIELD SETTINGS VERIFICATION

- A. The automatic transfer switch settings shall be verified in the field by an authorized representative of the manufacturer.

3.4 FOLLOW-UP VERIFICATION

- A. Upon completion of acceptance checks and tests, the Contractor shall show by demonstration in service that the automatic transfer switches are in good operating condition and properly performing the intended function.

3.5 INSTRUCTION

- A. Furnish the services of a factory-trained technician for one 4-hour training period for instructing personnel in the maintenance and operation of the automatic transfer switches, on the dates requested by the COR.

---END---

*Replace Boilers - FCA D, Energy
Malcom Randall VA Medical Center, Gainesville, FL*

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