

SPECIFICATIONS - DETAILED PROVISIONS
Section 16251 - Manual Transfer Switch

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**SECTION 16251
MANUAL TRANSFER SWITCH**

PART 1 - GENERAL

1.01 SCOPE

- A. This Section specifies the requirements for the design, fabrication, assembly, wiring, testing, delivery, and installation of low voltage (600 volt) non-automatic transfer switches. Each non-automatic transfer switch unit shall consist of a mechanically held power transfer switch and a microprocessor controller.
- B. Contractor shall furnish and install non-automatic, manual transfer switch (MTS) units with the number of poles, amperage, voltage, and withstand current ratings as specified herein and shown on the Drawings.

1.02 RELATED SECTIONS

- A. The Contract Documents are a single integrated document, and as such all Specification Sections apply. It is the responsibility of the Contractor and its subcontractors to review all sections and ensure a complete and coordinated project.
- B. Related Specification Sections include, but are not limited to, the following:
 - 1. Sections of the Specifications specifying equipment and/or systems producing electrical power.
 - 2. Division 16 – Electrical
 - 3. Division 17 – Instrumentation and Controls

1.03 STANDARDS AND CODES

MTS units and accessories, including installation of same, shall meet or exceed the applicable requirements of the following standards and codes (latest edition):

- A. UL 1008 - Standard for Automatic Transfer Switches
- B. NFPA 70 - National Electrical Code, including use in emergency and standby systems in accordance with Articles 517, 700, 701, and 702
- C. NFPA 110 – Standard for Emergency and Standby Power Systems

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- D. ANSI/IEEE Standard 446 - Recommended Practice for Emergency and Standby Power Systems for Commercial and Industrial Applications
- E. NEMA ICS10 (formerly ICS2-447) - AC Automatic Transfer Switch Equipment

1.04 SUBMITTALS

A. Shop Drawings

Contractor shall prepare and submit complete and organized shop drawings and product data as specified herein and in accordance with the requirements of the District's General Conditions. Shop drawings and product data shall include, but not be limited to, the following:

1. Manufacturer's product literature, specifications, performance capabilities, features and accessories, materials of construction, illustrations, and data in sufficient detail to demonstrate compliance with Specification requirements. Manufacturer's literature and data shall be marked to clearly delineate all applicable information and crossing out all inapplicable information.
2. Plan, elevation, side, and front view arrangement drawings, including component identification, overall dimensions, weights, clearances, conduit entrance locations, and mounting or anchoring requirements.
3. Electrical wiring diagram showing MTS normal, emergency and load connections. Electrical wiring diagram showing all controller terminal block connections. In addition, provide a summary listing of all terminal block connections, including terminal block number, function, and a brief description of each connection.
4. Manufacturer's certificate of compliance or published data reflecting a UL 1008 listing for the MTS unit(s) to be supplied.

B. Operation and Maintenance Manual

Contractor shall submit a detailed Operation and Maintenance Manual for the equipment specified herein and incorporated into the Work. The Operation and Maintenance Manual shall be provided in accordance with the requirements of the District's General Conditions, and Section 01430.

Operation and maintenance manuals shall include, but not be limited to, the following:

1. Equipment Performance Data and Drawings
 - a. Manufacturer's product literature, specifications, performance capabilities, features and accessories, materials of construction, and illustrations.
 - b. As-built general arrangement drawings.
 - c. As-built schematic diagrams and electrical wiring diagrams showing MTS normal, emergency and load connections, and controller input/output connections.
2. Equipment Installation Requirements
 - a. Complete, detailed installation instructions for all equipment and components.
3. Equipment Operation Data
 - a. Complete and detailed sequence of operation and operating instructions, including operator interface menus, programming, and setup parameters.
 - b. Printed list of all final setup parameters for each MTS unit, including factory settings and any field modifications to factory settings.
4. Equipment Service and Maintenance Data
 - a. Maintenance data shall include all information and instructions required by District's personnel to keep equipment properly cleaned and adjusted so that it functions correctly throughout its full design life.
 - b. Unloading, handling, and long term storage requirements.
 - c. Explanation with illustrations as necessary for each maintenance task.
 - d. Recommended schedule of maintenance tasks.
 - e. Troubleshooting instructions.
 - f. List of maintenance tools and equipment.

- g. Recommended spare parts list.
 - h. Name, address and phone number of manufacturer and manufacturer's local service representative.
5. Manufacturer's Warranty
6. Provide a signed written certification report with the Final Operation and Maintenance Manuals, certifying that each MTS unit has been properly installed, calibrated and adjusted, and is suitable for satisfactory continuous operation under varying operating conditions, and meets all requirements specified in the Contract Documents.

1.05 QUALITY ASSURANCE

Each MTS unit shall be designed, fabricated, tested, furnished, and warranted by a manufacturer that has been regularly engaged in the production of UL Standard 1008 listed MTSs for a minimum of 10 years, and the MTS unit to be supplied has been available on the open market for a minimum of 5 years. All MTS units shall be the product of the same manufacturer. MTS units shall be as manufactured by ASCO, Russelectric, Zenith, or equal.

The listing of specific manufacturers herein does not imply acceptance of their products that do not meet the specified ratings, features and functions. Manufacturers listed herein are not relieved from meeting these specifications in their entirety; and, if necessary, they shall provide non-standard, custom equipment and/or products. Contractor shall be responsible for confirming that the proposed equipment and/or products will meet these specifications.

1.06 MANUFACTURER'S WARRANTY

Manufacturer shall guarantee all equipment against defects in material and workmanship for a period of two years from date of project acceptance. During the warranty period, manufacturer shall provide all labor and material required to repair or replace defective equipment at no cost to the District.

PART 2 – PRODUCTS

2.01 GENERAL

- A. The MTS unit shall transfer load in delayed transition (break-before-make) mode. Transfer shall be accomplished with a user-defined interruption period in both directions, as specified herein. The load disconnect time delay shall be configured to be active for all transfers or to be bypassed in the event that the voltage of all three phases of the source the load is connected to drop below 70% of nominal.

- B. Minimum MTS size (amperage rating) shall be as shown on the Drawings. The MTS unit shall be rated for continuous duty based on all load classes (inductive motors, resistive loads, electric discharge lamps, and tungsten lamps).
- C. Each MTS unit shall be suitable for installation in an MCC section or in its own enclosure as shown on the Drawings.
- D. Unless specified otherwise, MTS units shall be 3-pole and suitable for application to 3-phase, 3-wire, 60 Hz, 480 V systems.
- E. MTS units shall be rated to close-on and withstand the available RMS symmetrical short circuit current at the MTS terminals with the type of overcurrent protection shown on the Drawings and selective coordination (short time/instantaneous ratings) determined by Contractor's Short Circuit/Coordination Study per Specification Section 16040.

As a minimum, MTS units shall be 3-cycle rated in accordance with UL Standard 1008. Minimum UL 3-cycle close-on and withstand ratings at 480 VAC with any molded case circuit breaker (MCCB) matching the MTS size, specific coordinated MCCBs, or current limiting fuses shall be as follows:

MTS Size (Amps)	Any MCCB	Specific Coordinated MCCB	Current Limiting Fuses
150 – 200	30,000 A	42,000 A	200,000 A
260 – 400	35,000 A	42,000 A	200,000 A
600	42,000 A	50,000 A	200,000 A
800 – 1200	50,000 A	65,000 A	200,000 A
1600 – 2000	85,000 A	85,000 A	200,000 A
2600 - 3000	100,000 A	100,000 A	200,000 A

2.02 CONSTRUCTION

- A. The MTS unit shall be electrically operated and mechanically held. The electrical operators shall be dual-solenoid or dual-motor mechanisms, momentarily energized. The normal and emergency contacts shall be positively interlocked mechanically and electrically to prevent simultaneous closing.
- B. The MTS unit shall be positively locked and unaffected by momentary outages so that contact pressure is maintained at a constant value and temperature rise at the contacts is minimized for maximum reliability and operating life.
- C. All main contacts shall be silver alloy composition designed to resist burning or pitting. Separate arcing contacts designed for rapid and reliable arc quenching and equipped with magnetic blowouts shall be provided.

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- D. Inspection of all contacts shall be possible from the front of the MTS without disassembly of operating linkages and without disconnection of power conductors. A manual operating handle shall be provided for maintenance purposes. The handle shall permit the operator to manually stop the contacts at any point throughout their entire travel to inspect and service the contacts when required.
- E. Designs utilizing components which are not intended for continuous duty, repetitive switching or transfer between two active power sources are not acceptable. Insulated case and molded-case circuit breaker type switches are not acceptable.
- F. Where specified for use on 3-phase, 4-wire systems, utilizing ground fault protection, a true 4-pole switch shall be provided with all 4-poles mounted on a common shaft. The continuous current rating and the closing and withstand rating of the fourth pole shall be identical to the rating of the main poles.
- G. Power connection lugs shall be screw type or compression type, suitable for 75°C (minimum) rated copper conductors. Where neutral conductors are to be solidly connected, a fully-rated neutral terminal plate or bar with AL-CU neutral lugs shall be provided.
- H. Control components and wiring shall be front accessible without disassembly of operating linkages and with disconnection of power conductors. All control wiring shall be identified with tubular sleeve-type markers.
- I. Each MTS unit shall be mounted and wired at the factory, including mounting and wiring of all door-mounted accessories.

2.03 CONTROLLER

- A. 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. Controller components and wiring shall be front accessible.
- B. The controller shall direct the operation of the transfer switch. The controller's sensing and logic shall be controlled by a built-in microprocessor for maximum reliability and minimum maintenance.

- C. A graphical LCD or VGA 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 a front accessible communications port. All instructions and controller settings shall be easily accessible, readable and accomplished without the use of codes, calculations, or instruction manuals.
- D. Voltage sensing shall be true RMS type and shall be accurate to $\pm 1\%$ of nominal voltage. Frequency sensing shall be accurate to $\pm 0.1\text{Hz}$. Time delay settings shall be accurate to $\pm 0.5\%$ of the full scale value of the time delay.
- E. As a minimum, the MTS unit including controller shall be capable of operating over a temperature range of 0 to 40°C.
- F. The controller shall be enclosed with a protective cover and be mounted separate from the transfer switch unit for safety and ease of maintenance. Sensing and control logic shall be provided on printed circuit boards.
- G. The controller shall be configured for manually actuated electrical operation with provisions for remote operation. The controller shall also be re-configurable for future full automatic operation without physical modification to the controller or transfer switch.
- H. Manual operation of the MTS unit shall be selectable via the controller keypad, without requiring the use of an external manual operator or opening of the enclosure door.
- I. The controller shall meet or exceed the requirements for Electromagnetic Compatibility (EMC) as follows:
 - 1. IEC 60947-6-1 Multiple Function Equipment Transfer Switching Equipment, 61000-4 Testing and Measurement Techniques – Overview
 - a. IEC 61000-4-2: Electrostatic Discharge Immunity Test (Level 4)
 - b. IEC 61000-4-3: Radiated RF, Electromagnetic Field Immunity Test
 - c. IEC 61000-4-4: Electrical Fast Transient/Burst Immunity Test
 - d. IEC 61000-4-5: Surge Immunity Test
 - e. IEC 61000-4-6: Conducted RF Immunity Test
 - 2. EN55022 (CISPR11): Conducted and Radiated Emissions, Class B

2.04 OPERATION

A. Voltage and Frequency Sensing

1. Voltage and frequency on both the normal and emergency sources (as noted below) shall be continuously monitored, with the following pickup, dropout, and trip settings capabilities (values shown as % of nominal unless otherwise specified).

<u>Parameter</u>	<u>Source</u>	<u>Dropout/Trip</u>	<u>Pickup/Reset</u>
Undervoltage	N & E	70 to 98%	85 to 100%
Overvoltage	N & E	102 to 115%	2% below trip
Underfrequency	N & E	85 to 98%	90 to 100%
Overfrequency	N & E	102 to 110%	2% below trip

2. Repetitive accuracy of all settings shall be within 1% at +25°C.
3. 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.
4. Source status screens shall be provided for both normal and emergency to provide digital readout of voltage and frequency.

B. Time Delays

1. A time delay shall be provided to override momentary normal source outages and delay all transfer and engine starting signals, adjustable 0 to 6 seconds (minimum). It shall be possible to bypass the time delay from the controller user interface.
2. A time delay shall be provided on transfer to emergency, adjustable from 0 to 60 minutes (minimum) for controlled timing of transfer of loads to emergency. It shall be possible to bypass the time delay from the controller user interface.
3. A time delay shall be provided on retransfer to normal, adjustable 0 to 240 minutes (minimum). Time delay shall be automatically bypassed if emergency source fails and normal source is acceptable.
4. The controller shall include a timer for the delayed transition transfer operation to control the transition time from neutral to the emergency source, adjustable 0 to 6 minutes (minimum).

5. The controller shall include a timer for the delayed transition transfer operation to control the transition time from neutral to the normal source, adjustable 0 to 6 minutes (minimum).
6. A cool down time delay shall be provided on shutdown of engine generator, adjustable 0 to 60 minutes (minimum).
7. A time delay activated output signal shall also be provided to drive an external relay(s) for selective load disconnect control. The controller shall have the ability to activate an adjustable 0 to 6 minutes (minimum) time delay in any of the following modes:
 - 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.
8. All adjustable time delays shall be field adjustable without the use of special tools.

2.05 ADDITIONAL FEATURES

- A. The user interface shall be provided with keys to transfer between the normal and emergency sources, and to simulate a normal source failure.
- B. The user interface shall be provided with a reset key to bypass the time delay on transfer to emergency.
- C. Auxiliary contacts, rated 10 A, 250 VAC, shall be provided consisting of:
 1. One (1) normally closed dry contact, which shall open when the normal power source fails for "power failure" signal to RTU or controls as shown on the Drawings.
 2. One (1) normally open dry contact, which shall close when the MTS is connected to the emergency source for "emergency power" signal to RTU or controls as shown on the Drawings.

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- D. LED indicating lights shall be provided; one to indicate when the MTS is connected to the normal source (green) and one to indicate when the MTS is connected to the emergency source (red).
- E. LED indicating lights shall be provided and energized by controller outputs. The lights shall provide true source availability of the normal (green) and emergency (red) source, as determined by the voltage sensing trip and reset settings for each source.
- F. LED indicating light shall be provided to indicate switch not in automatic mode (manual); and blinking (amber) to indicate transfer inhibit.
- G. LED indicating light shall be provided to indicate any alarm condition or active time delay (red).
- H. An engine generator exercising timer shall be provided to configure weekly and bi-weekly automatic testing of an engine generator set with or without load. It shall be capable of being configured to indicate a day of the week, and time weekly testing should occur.
- I. 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.
- J. Unless specified otherwise, MTS units installed outdoors shall be provided with strip heaters to prevent condensation and freezing of condensation. Unless indicated otherwise on the Drawings, strip heaters shall be provided with thermostMTS and shall be connected to the load terminals of the MTS for power.

PART 3 - EXECUTION

3.01 FACTORY TESTING

- A. The complete MTS unit shall be factory tested to ensure proper operation of the individual components and correct overall sequence of operation and to ensure that the operating transfer time, voltage, frequency, and time delay settings are in compliance with the specification requirements and the manufacturer's recommendations.
- B. The manufacturer shall provide three (3) certified copies of factory test reports to District for approval prior to shipment.

3.02 INSTALLATION

- A. Contractor shall install all equipment in accordance with the manufacturer's written instructions, NEC standards, requirements and standards specified herein, and as shown on the Drawings.
- B. Where an MTS unit is provided in an MCC or switchboard, Contractor shall anchor MCCs and switchboards in accordance with specified requirements for same. Where an MTS unit is provided in a separate free standing enclosure, Contractor shall anchor the enclosure to a reinforced concrete pad and floor slab in accordance with the calculations and details prepared by the manufacturer's engineer. Anchor bolt embedment depth shall be based on the thickness of the structure slab only, and shall not include any portion of the raised concrete housekeeping pad beneath the equipment. Where an MTS unit is provided in a separate wall mounted enclosure, Contractor shall anchor the enclosure to a concrete or masonry wall in accordance with the calculations and details prepared by the manufacturer's engineer.
- C. Verify the compatibility of conductor size, type, and stranding versus the power lugs furnished. Utilize correct lugs in all applications. Crimp compression lugs with manufacturer recommended tools.
- D. Tighten all lugs, connectors, terminals, etc. in accordance with the equipment manufacturer's published torque tightening values for same.
- E. Install arc flash hazard labels in accordance with the requirements of Specification Section 16040.
- F. Perform all pre-energizing checks as recommended by the manufacturer.

3.03 FIELD QUALITY CONTROL

- A. Contractor shall provide the services of a qualified factory-trained manufacturer's representative to assist the Contractor in installation and start-up of the equipment specified under this Section. The manufacturer's representative shall provide technical direction and assistance to the Contractor in equipment connections and adjustments, and testing of the assembly and components contained therein.
- B. The following minimum work shall be performed by the Contractor under the technical direction of the manufacturer's service representative.
 - 1. Perform insulation tests on each power phase (and neutral where provided) and verify low resistance ground connection on ground bus.

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2. Connect all power wiring and control wiring and verify basic operation of external control and status signals.
3. Torque all bolted connections made in the field and verify all factory bolted connections.
4. Perform pre-startup of the MTS controller. Calibrate any solid-state metering or control relays for their intended purpose and make written notations of adjustments on record drawings.

3.04 FIELD ADJUSTMENTS AND TESTING

- A. Follow the manufacturer's instructions and the Contract Documents concerning operating transfer times, voltage and frequency settings, time delay settings, and startup of components.
- B. Follow the minimum requirements as stipulated in the NETA testing procedure for MTS assemblies.
- C. Prepare a field report on tests performed, test values recorded, adjustments, etc., and provide same to District for review and approval.

3.05 MANUFACTURER'S CERTIFICATION

- A. A qualified factory-trained manufacturer's representative shall certify in writing that the equipment has been installed, adjusted, and tested in accordance with the manufacturer's recommendations. Equipment shall be inspected prior to the generation of any reports.
- B. Manufacturer's written certification shall be provided in accordance with Detailed Provision Section 16010.

3.06 CLEANUP

- A. All parts of the electrical equipment and materials shall be left in a clean condition. Exposed parts shall be clean of dust, dirt, cement, plaster and other materials, and all oil and grease spots shall be removed with a non-flammable cleaning solvent. Such surfaces shall be carefully wiped and cleaned. Paint touch-up shall be applied to all scratches on panels and cabinets. Electrical cabinets or enclosures shall be free of spider webs.
- B. Paint touch-up matching factory color and finish shall be applied to all scratches on panels and cabinets.

3.07 INSTRUCTION

After the equipment has been installed, tested, and adjusted, and placed in satisfactory operating condition, the equipment manufacturer shall provide classroom instruction to District's personnel in the use and maintenance of the equipment. Two (2) hours of instruction shall be provided, unless otherwise specified. Contractor shall give the District formal written notice of the proposed instruction period at least two weeks prior to commencement of the instruction period. Scheduled training shall be at a time acceptable to the District and the manufacturer. During this instruction period, the manufacturer shall answer any questions from District personnel. The manufacturer's obligation shall be considered ended when he and the District agree that no further instruction is needed.

END OF SECTION 16251

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