

## GAS GENERATOR AND AUTOMATIC TRANSFER SWITCH

### 1.1 General

#### 1.1.1 References and Standards

The generator set covered by these specifications shall be designed, tested, rated, assembled and installed in strict accordance with all applicable standards below:

- CSA C22.2 No14
- CSA 282
- CSA 100
- EN61000-6
- EN55011
- FCC Part 15 Subpart B
- ISO8528
- IEC61000
- UL508
- UL2200
- UL142
- Designed to allow for installed compliance to NFPA 70, NFPA99 and NFPA 110

### 1.2 Related Sections

#### 1.2.1 Division 3 - Concrete

#### 1.2.2 Division 15 - Mechanical

### 1.3 Work Included

#### 1.3.1 Installation

The work includes supplying and installing a complete integrated generator system. The system consists of a diesel generator set with related component accessories and automatic transfer switches specified under a separate section.

#### 1.3.2 Fuel System

The CONTRACTOR shall provide a full tank of diesel fuel for the completion of all testing.

#### 1.3.3 System Test

A complete system load test shall be performed after all equipment is installed. Guidelines in the Start-up Section.

#### 1.3.4 Requirements, Codes and Regulations

The equipment supplied and installed shall meet the requirements of the NEC and all applicable local codes and regulations. All equipment shall be of new and current production by a MANUFACTURER who has 25 years of experience building this type of equipment. Manufacturer shall be ISO9001 certified.

### 1.4 Substitution

Proposed deviations from the specifications shall be treated as follows:

#### 1.4.1 Substitution Time Requirement

Requests for substitutions shall be made a minimum of ten (10) days prior to bid date. Manufacturers catalog data shall accompany each request and authorized acceptance shall be addenda only.

#### **1.4.2 Substitution Responsibility**

The power system has been designed to the specified manufacturer's electrical and physical characteristics. The equipment sizing, spacing, amounts, electrical wiring, ventilation equipment, fuel and exhaust components have all been sized and designed around CATERPILLAR supplied equipment. Should any substitutions be made, the CONTRACTOR shall bear responsibility for the installation, coordination and operation of the system as well as any engineering and redesign costs, which may result from such substitutions.

### **1.5 Submittals**

**Engine-generator submittals shall include the following information:**

1. Factory published specification sheet.
2. Manufacturer's catalog cut sheets of all auxiliary components such as battery charger, control panel, enclosure, etc.
3. Dimensional elevation and layout drawings of the generator set, enclosure and transfer switchgear and related accessories.
4. Weights of all equipment.
5. Concrete pad recommendation, layout and stub-up locations of electrical and fuel systems.
6. Interconnect wiring diagram of complete emergency system, including generator, switchgear, day tank, remote pumps, battery charger, control panel, and remote alarm indications.
7. Engine mechanical data, including heat rejection, exhaust gas flows, combustion air and ventilation air flows, fuel consumption, etc.
8. Generator electrical data including temperature and insulation data, cooling requirements, excitation ratings, voltage regulation, voltage regulator, efficiencies, waveform distortion and telephone influence factor.
9. Generator resistances, reactances and time constants.
10. Generator locked rotor motor starting curves.
11. Manufacturer's and dealer's written warranty.

### **1.7 System Responsibility**

#### **1.7.1 Generator Set Distributor**

The completed engine generator set shall be supplied by the **Manufacturer's** authorized distributor only.

#### **1.7.2 Requirements, Codes and Regulations**

The equipment supplied and installed shall meet the requirements of NEC and all-applicable local codes and regulations. All equipment shall be new, of current production. There shall be one source responsibility for warranty; parts and service through a local representative with factory trained service personnel.

#### **1.7.3 Automatic Transfer Switch**

The automatic transfer switch(es) specified in another section shall be supplied by the generator set manufacturer in order to establish and maintain a single source of system responsibility and coordination.

### **1.8 Warranty**

#### **1.8.1 Two Year Standby (ISO 8528-1: ESP) Generator Set Warranty**

The manufacturer's standard warranty shall in no event be for a period of less than two (2) years from date of initial start-up of the system and shall include repair parts, labor, reasonable travel expense necessary for repairs at the job site, and expendables (lubricating oil, filters, antifreeze, and other service items made unusable by the defect) used during the course of repair. Running hours shall be limited to 500 hours annually for the system warranty by both the manufacturer and servicing distributor. Submittals received without written warranties as specified will be rejected in their entirety.

## **1.9 Parts and Service Qualifications**

### **1.9.1 Service Facility**

The engine-generator supplier shall maintain 24-hour parts and service capability within 100 miles of the project site. The distributor shall stock parts as needed to support the generator set package for this specific project. The supplier must carry sufficient inventory to cover no less than 80% parts service within 24hrs and 95% within 48 hours.

### **1.9.2 Service Personnel**

The dealer shall maintain qualified factory trained service personnel.

## **2 Product Specifications**

### **2.1 General Requirements**

#### **2.1.1 Genset Requirements**

The generator set shall be Standby Duty rated at 50.0 ekW, 62.5 kVA, N/A RPM, 0.8 power factor, 480 V, 3-Phase, 60 hertz, including radiator fan and all parasitic loads. Generator set shall be sized to operate at the specified load at a maximum ambient of 85F (29.4C) and altitude of 500.0 feet (152.4 m).

Standby Rating as defined by the following:

Typical Load Factor = 70% or less with variable load

Typical Hours per Year = 200 hours

Maximum Expected Usage = 500 hours/year

Typical Peak Demand = 80% of ESP rated kW with 100% of rating available for the duration of an emergency outage

#### **2.1.2 Material and Parts**

All materials and parts comprising the unit shall be new and unused.

#### **2.1.3 Engine**

The engine shall be diesel fueled, four (4) cycle, water-cooled, operating with nominal speed not exceeding 1800 RPM. The engine will be equipped with in-cylinder combustion technology that allows for engine to meet all US EPA and local Stationary Emission Standards. The engine shall be EPA certified at the kW rating of the package generator set. The in-cylinder engine technology must not permit unfiltered exhaust gas to be introduced into the combustion cylinder. Emissions requirements / certifications of this package: Not Certified

##### **2.1.3.1 Engine Governing**

The engine will be equipped with an isochronous electronic governor to maintain +/- 0.25% steady state frequency variation from steady state no load to steady state full load.

### **2.2 Generator**

#### **2.2.1 Generator Specifications**

The synchronous three phase generator shall be a single bearing, self-ventilated, drip-proof design in accordance with NEMA MG 1 and directly connected to the engine flywheel housing with a flex coupling. The generator shall meet performance class G3 of IEC. The excitation system shall be of brushless construction.

## **2.2.2 Voltage Regulator**

### **2.2.2.1 Automatic Voltage Regulator**

The automatic voltage regulator (AVR) shall maintain generator output voltage within +/- 0.5% for any constant load between no load and full load. The regulator shall be a totally solid state design, which includes electronic voltage buildup, volts per Hertz regulation, over-excitation protection, shall limit voltage overshoot on startup, and shall be environmentally sealed.

## **2.2.3 Motor Starting**

Provide locked rotor motor starting capability of 98.0 skVA at 30% instantaneous voltage dip as defined per NEMA MG 1. Sustained voltage dip data is not acceptable.

## **2.3 Circuit Breaker**

### **2.3.1 Circuit Breaker Specifications**

Provide a generator mounted 80% circuit breaker, molded case, Qty.(1) 100 amp trip, 3 pole, NEMA 1/IP22. Breaker shall utilize a solid state trip unit. The breaker shall be UL/CSA Listed of IEC construction and connected to engine/generator safety shutdowns. Breaker shall be housed in an extension terminal box which is isolated from vibrations induced by the generator set. Mechanical type lugs, sized for the circuit breaker feeders shown on drawing, shall be supplied on the load side of breaker.

## **2.4 Controls – Generator Set Mounted**

Provide a fully solid-state, microprocessor based, generator set control. The control panel shall be designed and built by the engine manufacturer. The control shall provide all operating, monitoring, and control functions for the generator set.

### **2.4.1 Environmental**

The generator set control shall be tested and certified to the following environmental conditions.

1. -40°C to +70°C Operating Range
2. 0-95% humidity non-condensing, 30°C to 60°C
3. IP22 protection
4. 5% salt spray, 48 hours, +38°C, 36.8V system voltage
5. Sinusoidal vibration 4.3G's RMS, 24-1000Hz
6. Electromagnetic Capability (89/336/EEC, 91/368/EEC, 93/44/EEC, 93/68/EEC, BS EN 50081-2, 50082-2)
7. Shock: withstand 15G

### **2.4.2 Functional Requirements**

The following functionality shall be integral to the control panel.

1. The control shall include a 33 x 132 pixel, 24mm x 95mm, positive image, transfective LCD display with text based alarm/event descriptions.

2. Audible horn for alarm and shutdown with horn silence switch
3. Standard ISO labeling
4. Multiple language capability
5. Remote start/stop control
6. Local run/off/auto control integral to system microprocessor
7. Cooldown timer
8. Lamp test
9. Push button emergency stop button

#### **2.4.3 Digital Monitoring Capability**

The controls shall provide the following digital readouts for the engine and generator. All readings shall be indicated in either metric or English units.

##### **Engine**

1. Engine oil pressure
2. Engine coolant temperature
3. Engine RPM
4. Battery volts

##### **Generator**

1. Generator AC volts (Line to Line, Line to Neutral and Average)
2. Generator AC current (Per phase and Average)
3. Generator AC Frequency

#### **2.4.4 Alarms and Shutdowns**

The control shall monitor and provide alarm indication and subsequent shutdown for the following conditions. All alarms and shutdowns are accompanied by an engine hour stamp that are stored by the control panel for first and last occurrence.

##### **Engine Alarm/Shutdown**

1. Low oil pressure alarm/shutdown
2. High coolant temperature alarm/shutdown
3. Loss of coolant shutdown
4. Overspeed shutdown
5. Overcrank shutdown
6. Emergency stop depressed shutdown
7. Low coolant temperature alarm

#### **2.4.5 Inputs and Outputs**

##### **Programmable Digital Inputs**

The control shall include the ability to accept six (6) digital input signals. The signals may be programmed for either high or low activation using programmable Normally Open or Normally Closed contacts.

##### **Digital Outputs**

The control shall include the ability to operate six (6) programmable relay output signals, integral to the controller. The output relays shall be rated for 2A @ 30VDC and consist of six (6) Form A (Normally Open) contacts

#### **2.4.6 Maintenance**

All engine, voltage regulator, control panel and accessory units shall be accessible through a single electronic service tool. The following maintenance functionality shall be integral to the generator set control

1. Engine running hours display
2. 20 events are stored in control panel memory

## **2.5 Cooling System**

The generator set shall be equipped with a rail-mounted, engine-driven radiator with blower fan and all accessories. The cooling system shall be sized to operate at full load conditions and 110 F\* ambient air entering the room or enclosure (If an enclosure is specified). The generator set supplier is responsible for providing a properly sized cooling system based on the enclosure static pressure restriction.

## **2.6 Fuel System**

### **2.6.1 Fuel System**

The fuel system shall be integral with the engine. In addition to the standard fuel filters provided by the engine manufacturer, there shall also be installed a primary fuel filter/water separator in the fuel inlet line to the engine. All fuel piping shall be black iron or flexible fuel hose rated for this service. No galvanized piping will be permitted. Flexible fuel lines shall be minimally rated for 300 degrees F and 100 psi.

## **2.7 Exhaust System (Indoor Installations Only)**

### **2.7.1 Silencer**

A residential grade silencer, companion flanges, and flexible stainless steel exhaust fitting properly sized shall be furnished and installed according to the manufacturer's recommendation. Mounting shall be provided by the contractor as shown on the drawings. The silencer shall be mounted so that its weight is not supported by the engine nor will exhaust system growth due to thermal expansion be imposed on the engine. Exhaust pipe size shall be sufficient to ensure that exhaust backpressure does not exceed the maximum limitations specified by the engine manufacturer.

## **2.8 Starting System**

### **2.8.1 Starting Motor**

A DC electric starting system with positive engagement shall be furnished. The motor voltage shall be as recommended by the engine manufacturer.

### **2.8.2 Jacket Water Heater**

Jacket water heater shall be provided and shall be sized to insure that genset will start within the specified time period and ambient conditions.

### **2.8.3 Batteries**

Batteries - A lead-acid storage battery set of the heavy-duty diesel starting type shall be provided. Battery voltage shall be compatible with the starting system.

### **2.8.4 Battery Charger**

Battery Charger - A current limiting battery charger shall be furnished to automatically recharge batteries. The charger shall be dual charge rate with automatic switching to the boost rate when

required. The battery charger shall be mounted on the genset package or inside the genset enclosure/room.

## **2.9 Enclosure**

### **2.9.1 Standard Weatherproof Enclosure**

The complete diesel engine generator set, including generator control panel, engine starting batteries and fuel oil tank, shall be enclosed in a factory assembled, weather protective enclosure mounted on the fuel tank base.

1. A weather resistant enclosure of steel with electrostatically applied powder coated baked polyester paint. It shall consist of a roof, side walls, and end walls. Fasteners shall be either zinc plated or stainless steel. Handles shall be key lockable, all doors keyed alike, and hinges shall be zinc die cast or stainless steel. Access doors shall be hinged and can be lifted off after opening 90 degrees. Intake openings shall be screened to prevent the entrance of rodents or pests.
2. Lube oil and coolant drains shall be extended to the exterior of the enclosure and terminated with drain valves. Cooling fan and charging alternator shall be fully guarded to prevent injury.

## **3 Execution**

### **3.1 Installation**

Install equipment in accordance with manufacturer's recommendations, the project drawings and specifications, and all applicable codes.

### **3.2 Start-Up and Testing**

Coordinate all start-up and testing activities with the Engineer and Owner. After installation is complete and normal power is available, the manufacturer's local dealer shall perform the following: Perform a 4 hour load bank test at a 1.0 PF at full nameplate rating. Loadbank, cables and other equipment required for this test to be supplied by the genset supplier.

### **3.3 Operation and Maintenance Manuals**

Provide two (2) sets of operation and maintenance manuals covering the generator, switchgear, and auxiliary components. Include final as-built wiring interconnect diagrams and recommended preventative maintenance schedules.

### **3.4 Training**

#### **3.4.1 On-Site Training**

Provide on-site training to instruct the owner's personnel in the proper operation and maintenance of the equipment. Review operation and maintenance manuals, parts manuals, and emergency service procedures.

### **3.5 Remote System Monitoring and Data Management**

#### **3.5.1 Remote Monitoring and Data Management**

There shall be a monitoring and data management system available on a 24/7/365 basis, which interfaces with the asset (generator set, switchgear, etc.) via a serial and/or direct I/O connection.

- A. The system shall monitor the asset continually.
  - a. It will provide automated alarm notification via alphanumeric pager, cellular phone and/or e-mail.
    - i. These alarms will also be displayed by a web-based system which will be updated automatically.
  - b. Asset functions being monitored will be displayed by a web-based system which will be updated automatically.
  - c. Standard reports which can be created by the user from the web-based system shall include:
    - i. Site Run Summary report that shows key items associated with generator set runs including the start/stop time and the run duration all within a user defined timeframe.
    - ii. Alarm History report that shows a table listing alarms/events, their change in status, time-stamped within a user defined timeframe.
- B. The web-based software shall be secure, requiring a registered user name and password structure for access.
- C. The system will allow for the aggregation of multiple assets and/or sites to be viewed on one display and/or report.
- D. General operations assistance shall be available 24/7/365, by trained personnel via a direct toll-free phone call.
- E. All data from site shall be uploaded to a centralized database.
  - a. The centralized database shall be capable of storage and on-line access of data for at least 13 months.
  - b. The centralized database shall have a hot backup to ensure access to data is not lost and that Operations Center functions may continue in the event of a server outage.
- F. The system will offer the user the option of having alarms and/or events handled by trained Operations Center personnel on a 24/7/365 basis.
  - a. The trained Operations Center personnel shall follow a user-defined procedure for handling alarms and/or events.

#### ***Guide Specification***

Model CTG Automatic Transfer Switch

### **PART 1 – GENERAL**

#### **1.1 Scope**

- A. It is the intent of this specification to secure a transfer switch that has been prototype tested, factory built, production tested and site tested. A transfer switch with the number of poles, voltage and current ratings shown on the plans and specified herein shall be provided.

#### **1.2 Codes and Standards**

- A. The automatic transfer switch shall conform to the requirements of:
  - 1. UL 1008: Underwriters Laboratories standard for automatic transfer switches
  - 2. CSA: C22.2 No. 178 certified



3. IEC: 947-6-1 certified at 480 VAC
4. NFPA 70: National Electrical Code including use in emergency and standby systems in accordance with Articles 517, 700, 701, 702
5. NFPA 99: Essential electrical systems for health care facilities
6. NFPA 101: Life safety code
7. NFPA 110: Standard for emergency and standby power systems
8. IEEE 241: I.E.E.E. recommended practice for electrical power systems in commercial buildings
9. IEEE 446: I.E.E.E. recommended practice for emergency and standby power systems
10. NEMA ICS10: AC automatic transfer switch equipment
11. UL 50/508: Enclosures
12. ICS 6: Enclosures
13. ANSI C33.76: Enclosures
14. NEMA 250: Enclosures
15. IEEE 472: (ANSI C37.90A): Ringing wave immunity
16. EN55022 (CISPR11): Conducted and radiated emissions (Exceeds EN55011 & MILSTD 461 Class 3)
17. EN61000-4-2: (Level 4): ESD immunity test Class B:
18. EN61000-4-3: (ENV50140): Radiated RF, electromagnetic field immunity
19. EN61000-4-4: Electrical fast transient/burst immunity test
20. EN61000-4-5: IEEE C62.41: Surge immunity test (1.2 x 50 $\mu$ s, 5 & 8 kV)
21. EN61000-4-6: (ENV50141): Conducted immunity test
22. EN61000-4-11: Voltage dips and interruption immunity

### **1.3 Approved Manufacturers**

- A. The automatic transfer switch shall be Caterpillar Model CTG. Alternate manufactures shall submit a request two weeks prior to bid and include a written list of deviations from this specification to be considered for approval.

## **PART 2 – PRODUCTS**

### **2.1 Performance and Construction**

- A. The automatic transfer switch shall be of double throw construction operated by a reliable solenoid driven mechanism. There shall be a direct mechanical coupling to facilitate transfer in 6 cycles or less.
- B. The normal and emergency contacts shall be mechanically interlocked such that failure of any coil or disarrangement of any part shall not permit a neutral position.
- C. For switches installed in systems having ground fault protective devices, and/or wired so as to be designated a separately derived system by the NEC, a 4th pole shall be provided. This additional pole shall isolate the normal and emergency neutrals. The neutral pole shall have the same withstand and operational ratings as the other poles and shall be arranged to break last and make first to minimize neutral switching transients. Add-on or accessory poles that are not of identical construction and withstand capability will not be considered.
- D. The contact structure shall consist of a main current carrying contact, which is a silver alloy with a minimum of 50% silver content. The current carrying contacts shall be protected by silver tungsten arcing contacts on all sizes above 400 Amps.
- E. The transfer switch manufacturer shall submit test data for each size switch, showing it can withstand fault currents of the magnitude and the duration necessary to maintain the

system integrity. Minimum UL listed withstand and close into fault ratings shall be as follows:

<u>Size (Amps)</u>	<u>Coordinated Breaker</u>	<u>Current Limiting Fuse</u>
40 - 225	30,000	200,000
260	35,000	200,000
400 – 600	50,000	200,000
800	65,000	200,000
1000 - 1200	85,000	200,000
1600 - 3000	100,000	200,000

- F. A dielectric test at the conclusion of the withstand and closing tests shall be performed.
- G. The automatic transfer switch manufacturer shall certify sufficient arc interrupting capabilities for 50 cycles of operation between a normal and emergency source that are 120 degrees out of phase at 480 volts, 600% of rated current at .50 power factor. This certification is to ensure that there will be no current flow between the two isolated sources during switching.
- H. All relays shall be continuous duty industrial type with wiping contacts. Coils, relays, timers and accessories shall be readily front accessible. The control panel and power section shall be interconnected with a harness and keyed disconnect plugs for maintenance.
- I. Main and arcing contacts shall be visible without major disassembly to facilitate inspection and maintenance.
- J. A manual handle shall be provided for maintenance purposes with the switch de-energized. An operator disconnect switch shall be provided to defeat automatic operation during maintenance, inspection or manual operation.
- K. Switches composed of molded case breakers, lighting contactors or components thereof will not be acceptable.
- L. The current rating shall be a continuous rating when the switch is installed in an enclosure, and shall conform to NEMA temperature rise standards.
- M. The unit shall be rated based on all classes of loads, i.e., resistive, tungsten, ballast and inductive loads. Switches rated 400 amperes or less shall be UL listed for 100% tungsten lamp load.
- N. Temperature rise tests in accordance with UL 1008 shall have been conducted after the overload and endurance tests to confirm the ability of the units to carry their rated currents within the allowable temperature limits.
- O. Unless specified otherwise on the drawings, the switch shall be mounted in a NEMA 1 enclosure.

**2.2 Control**

- A. The control panel shall be opto-isolated from electrical noise and provided with the following inherent control functions and capabilities:
  1. Easy-to-view 4 x 20 LCD display with long lasting LED indicators.
  2. Control panel shall display voltage and frequency of both sources.
  3. The user shall be able to view the last 16 recorded events.

4. Capability for external communication and network interface.
  5. Adjustments to all settings shall be made from the front of the panel without opening the door.
- B. The transfer switch shall be equipped with a microprocessor based control panel. The control panel shall perform the operational and display functions of the transfer switch. The display functions of the control panel shall include ATS position, source availability, sequence indication and diagnostics.
  - C. All programmable and control functions shall be pass code protected and accessible through the keypad.
  - D. The control panel shall be provided with a simple user interface for transfer switch monitoring, control and field changeable functions and settings.
  - E. Touch pad test switch with Fast Test/Load/No Load selection capability to simulate a normal source failure.
  - F. The controller shall provide digital timer adjustments with 1-second resolution. Voltage and Frequency shall be adjustable to 1% resolution to facilitate accurate transfer.
  - G. To ensure reliable and consistent user operation the controls must be equipped with nonvolatile memory and allow automatic daylight savings time adjustment.

### **PART 3 – OPERATION**

#### **3.1 Sequence of Operation**

- A. The ATS shall incorporate adjustable three phase under voltage sensing on the normal source.
- B. When the voltage of any phase of the normal source is reduced to 80% (adjustable) of nominal voltage, for a period of 0-10 seconds (programmable) a pilot contact shall close to initiate starting of the engine generator.
- C. The ATS shall incorporate adjustable under voltage and under frequency sensing on the emergency source.
- D. When the emergency source has reached a voltage value of 90% of nominal and achieved frequency within 95% of the rated value, the load shall be transferred to the emergency source after a programmable time delay.
- E. When the normal source has been restored to not less than 90% of rated voltage on all phases, the load shall be retransferred to the normal source after a time delay of 0 to 60 minutes (programmable). The generator shall run unloaded for 5 minutes (programmable) and then automatically shut down. The generator shall be ready for automatic operation upon the next failure of the normal source.
- F. If the engine generator should fail while carrying the load, retransfer to the normal source shall be made instantaneously upon restoration of proper voltage (90%) on the normal source.

#### **3.2 Standard Accessories**

- A. Adjustable time delay to override momentary normal source failure prior to engine start. Field programmable 0-10 seconds factory set at 3 seconds.
- B. Adjustable time delay on retransfer to normal source, programmable 0-60 minutes factory set at 30 minutes. If the emergency source fails during the retransfer time delay, the transfer switch controls shall automatically bypass the time delay and immediately retransfer to the normal position.
- C. A time delay on transfer to emergency, programmable 0-5 minutes, factory set at 1 second.
- D. An in-phase monitor shall be provided. The monitor shall compare the phase angle difference between the normal and emergency sources and be programmed to anticipate the zero crossing point to minimize switching transients.
- E. An exerciser timer with momentary test pushbutton shall be incorporated within the microprocessor and shall be capable of starting the engine generator set and transferring the load (when selected) for exercise purposes on a daily, weekly or monthly basis. The exerciser shall contain a battery for memory retention during an outage.
- F. Provide a momentary pushbutton to bypass the time delays on transfer and retransfer and programmable commit/no commit control logic.
- G. The controller shall accept a remote peak shave or test input to signal the transfer switch to the emergency position.
- H. A set of customer contacts shall be provided to indicate both emergency and normal source position.

The following optional Exerciser Package shall be included (***specifier to select***):

- A. Additional Auxiliary Contact (A3) - Closed when the transfer switch is in Source 2 position.
- B. Additional Auxiliary Contact (A4) - Closed when the transfer switch is in Source 1 position.
- C. Programmable Clock Exerciser (CDP) – This will replace the timer exerciser and allow for a 365 day cycle.
- D. Voltage Imbalance Monitor (VI) - Three Phase sensing shall detect an imbalance and initiate a transfer to the alternate source. Adjustable 5-20% of nominal with a time delay of 10-30 seconds for nuisance conditions.

The following additional accessories shall be included (***specifier to select***):

- A. Heater and Thermostat (HT) – Recommended for NEMA 3R applications.
- B. Elevator pre-signal (T3/W3) – Contact Opens 0-60 seconds prior to transfer in either direction, re-closes after transfer.
- C. Universal Motor Load Disconnect (UMD) - Auxiliary contacts opens 0 – 5 minutes prior to transfer in either direction, re-closes after transfer. Can be configured for pre-transfer, post transfer or both.

- D. Sequential Universal Motor Load Disconnect (A62) – Multiple auxiliary contacts open prior to transfer in either direction, re-closes after transfer. Can be configured for pre-transfer, post transfer or both.
- E. Communications interface card (ZNETM) – RS-485 Modbus
- F. Test Switch (6A) - Maintained
- G. Digital Meter (M80) - Measures and displays true RMS volts, amps and frequency in a three-phase power system.
- H. Digital Meter (M82) - Includes M80 functions plus Watts, KVA, KVAR, PF, etc. w/Modbus RS485 port
- I. Digital Meter (M83) – Includes M82 functions plus THD capability and Modbus RS485 port
- J. Additional Auxiliary Contacts (A3) - Closed when the transfer switch is in Source 2 position.
- K. Additional Auxiliary Contacts (A4) - Closed when the transfer switch is in Source 1 position.
- L. Alarm panel (CTAP) – Alarm on transfer to emergency w/silence button & light
- M. Disconnect Switch (DS) - Inhibits transfer in either direction when in inhibit. (Std on 800A and above)
- N. Extended warranty (ATGEW) - annual parts and labor warranty (1-4 years for a total of 5 years max.)
- O. Protective Cover (OCVR) - Lockable see-through microprocessor and meters cover for NEMA 3R or 12.

## **PART 4 – EXECUTION**

### **4.1 General**

- A. The transfer switch shall be installed as shown on the plans, in accordance with the manufacture’s recommendations and all applicable codes.

### **4.2 Factory Tests**

- A. The transfer switch manufacturer shall perform a complete functional test on the switch, controller and accessories prior to shipping from the factory. A certified test report shall be available upon request.

### **4.3 Service**

- A. The manufacturer shall maintain a national service organization that is factory trained and certified for transfer switch equipment. In addition, the service organization shall be available 24 hours per day, 365 days per year.

### **4.4 Warranty**

- A. The automatic transfer switch shall be warranted against defective workmanship

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for a period of two years, including both parts and labor.