

# SPECIFICATION FOR VERTICAL AIRFLOW OUTDOOR RESISTIVE LOAD BANK

## **PART 1.0 GENERAL**

### **1.1 SCOPE**

- A. This specification contains the minimum requirements for the design, manufacture and testing of a UL listed, air-cooled, outdoor weatherproof resistive load bank.
- B. The load bank is required for periodic exercising and testing of the (standby) emergency power source. The load bank shall be permanently mounted in a weatherproof enclosure, forced air cooled with remotely mounted control panel.
- C. This specification shall apply if the load bank is supplied to the purchaser, or as a part of other equipment.
- D. Should the vendor take exception to any part of this specification, it shall be stated in the bid, and referenced to the specification line number.

### **1.2 SUBMITTALS**

- A. The manufacturer shall submit for review technical data including features, performance, electrical characteristics, physical characteristics, ratings, accessories, and finishes.
- B. Shop drawings shall include dimensional plans, front and side elevations and mounting details sufficient to properly install the load bank. Load bus configuration and load connections termination area shall be clearly identified.
- C. Electrical schematic drawings shall be provided to detail the operation of the load bank and the provided safety circuits. Over-current protection and control devices shall be identified and their ratings marked. A system interconnection drawing shall be included for control wiring related to the load bank.

### **1.3 STANDARDS**

- A. The equipment covered by this specification shall be designed with the latest applicable NPFA-70 NEMA, NEC, IEEE, and ANSI standards.
- B. The load bank certified to a NRTL such as UL or CSA.

## **PART 2.0 PRODUCTS**

### **2.1 RATINGS**

- A. The total capacity of the load bank shall be rated (\_\_\_\_\_) kW at (\_\_\_\_\_) Volts, 3-Phase, 3-Wire, 60 Hertz, at unity Power Factor and (\_\_\_) kW minimum load step resolution.
- B. The load bank shall be designed for continuous duty cycle operation with no limitations. The load bank shall operate in an ambient temperature of -28°C to 49°C (-20°F to 120°F).

### **2.2 MATERIAL AND CONSTRUCTION**

- A. The load bank shall be outdoor weatherproof construction, suitable for installation on a concrete pad or structural base. All exterior fasteners shall be stainless steel. The load bank shall include forklift channels in the base for lifting.

- B. The load bank shall be constructed of heavy gauge of aluminized steel per ASTM A463. Aluminized steel provides superior corrosion protection and extended service life, with a better tolerance to high heat exposure compared to the more common galvanized steel.
- C. The main input load bus, load step relays, fuses and blower/control relays shall be located within the load bank enclosure. A thermostatically controlled heater shall be located within the control section to provide protection to the control devices from the effects of moisture and condensation.
- D. Airflow throughout the load bank shall be vertical. Ambient intake cooling air shall be drawn in at the base of the unit and heated air exhausted out the top. Intake openings shall be designed to prevent objects greater than 0.50" diameter from entering the unit.
- E. The load bank exhaust hood(s) shall be angled and include interior baffle plates to direct falling rain from the interior of the load bank. The exhaust hood(s) shall be constructed of non-corrosive aluminized steel or aluminum.
- F. The load bank enclosure shall have a baked polyester powder coated finish with a film thickness of 2.8 +/- 0.4 mils per coat.
- G. Load elements shall be contained in an integral resistor case. Resistors can be individually removed for inspection or service.
- H. The load bank shall be of riveted construction. Riveted provides a stronger framework.
- I. Remote-controlled contactors switch groups of load elements. Contactor coils are rated 120 V. Contactors shall be located in a separate NEMA 250, Type 3R enclosure within load-bank enclosure, accessible from exterior through bolt on panels with stainless steel hardware.

### 2.3 RESISTIVE LOAD ELEMENTS

- A. Load elements shall be ASCO Helidyne, helically wound chromium alloy rated to operate at approximately ½ of maximum continuous rating of wire. Elements must be fully supported across the entire length within the air stream by segmented ceramic insulators on stainless steel rods. Element supports shall be designed to prevent a short circuit to adjacent elements or to ground.
- B. The change in resistance due to temperature shall be minimized by maintaining conservative watt densities.
- C. The overall tolerance of the load bank shall be -0% to +5% kW at rated voltage. A -5%, +5% rating allows the load bank to deliver less than rated kW and shall not be used. The load bank must deliver full rated kW at rated voltage.
- D. The resistors shall not require a cool down period. Failure shutdown of the cooling fan during operation of the resistors shall not shorten their life expectancy.

### 2.4 COOLING

- A. The load bank shall be cooled by integral TEFC or TEAO motor(s) which is direct coupled to the cooling fan blade. The fan motor must be electrically protected against overload using a motor overload device and short circuit protected using three (3) current limiting fuses with an interrupting rating of 200K A.I.C.
- B. The fan blade is to be an airfoil design constructed from aluminum or non-corroding material.

## 2.5 PROTECTIVE DEVICES

- A. A differential pressure switch shall be provided to detect air loss. The switch shall be electrically interlocked with the load application controls to prevent load from being applied if cooling air is not present.
- B. An over-temperature switch shall be provided to sense the load bank exhaust in the resistor case assembly. The switch shall be electrically interlocked with the load application controls to remove load from being applied in the event of an over temperature condition.
- C. To provide for major fault protection, branch fuses shall be provided on all three phases of switched load steps above 50 kW. Branch fuses shall be current limiting type with an interrupting rating of 200K A.I.C.
- D. The exterior of the load bank shall have appropriate warning/caution statements on access panels.
- E. The fan motor shall separately protected by motor overload and short-circuit devices.

## 2.6 CONTROL SYSTEMS – DIGITAL CONTROLS

- A. A robust purpose designed microprocessor based module with industrial connectors and LED status display shall be installed in the load bank. The module shall connect with Voltage and Current Transformers to obtain real time monitoring of the load bank at a sampling rate of at least 28.8kHz. The module shall have large flash memory, which allows remote upgrading and space for configuration data and calibration maps. Non-volatile RAM provides 500 event history log time stamped by on-board real time clock.
- B. Usage counters shall provide information on individual contactor operation, element run times, overall power-on time, load-on time and kWh. Load monitoring checks each phase for faulty contactors, blown fuses or faulty elements. Faults are logged with visual indication via blinking stop lamp and warning code. Automatic detection senses the supply-on-test voltage, frequency, phase and phase rotation.
- C. The module shall have a load correction facility, which shall compensate for any voltage drop on supply.
- D. The module shall balance the usage of each load element to increase the life of the load bank.
- E. An HMI Hand Held controller shall also be provided with a 10 meter cable for operator interface with all functionality faults and features. When carrying out full-load testing, one page will show the three-phase measurements of voltage (V), frequency (Hz), current (A), power (both kW and kVA) and power factor (Cos  $\phi$ ).
- F. Building Management Interface: Load bank control module shall have provisions to interface with existing building management system. Modbus communications protocol which shall allow integration of load bank with building supervisory & monitoring systems through a PLC, HMI or SCADA systems. Interface shall be directly from an Ethernet port within the load bank.

- G. Switchgear Interface: Load bank shall have provisions to interface with the switchgear critical power management system. This shall be done through Modbus Ethernet.

## 2.7 CONTROL SYSTEMS – MANUAL CONTROLS

- A. The control panel shall be a (remote) or (local) 19" rack mounted panel housed in a NEMA 4 type enclosure. The control panel shall contain the following manual controls:
  - 1. Power ON/OFF switch
  - 2. Blower START/STOP pushbuttons.
  - 3. Master load ON/OFF switch.
  - 4. Load step switches for ON/OFF application of individual load steps.

Control panel visual indicators shall be as follows:

- 1. Power ON indication light.
  - 2. Blower ON light.
  - 3. Blower/Air FAILURE light.
  - 4. OVERTEMPERATURE light.
- B. A digital meter shall be installed in the control panel to show 3 line digital display of voltage, current, frequency, and power measurement. The software interface to the meter shall allow for real-time data acquisition and data logging from a laptop PC.
- C. A standard remote load dump circuit shall be provided as part of the load bank control circuit. Provisions shall be provided to remove the load bank off-line from the operation of a remote normally closed set of auxiliary contacts from a transfer switch or other device. In the event of the remote contact opening, all load is removed.
- D. An integral control power transformer shall be provided to supply 120V, 1 phase, 60 Hz to the load banks control and motor starter circuitry. Transformer primary and secondary control circuits shall be fuse protected.
- E. An Automatic Load Controller shall be provided for maintaining a minimum load steps on the generator set. The controller shall monitor the connected downstream loads and shall automatically add or subtract load steps in response to building load changes as to maintain a minimum load level on the generator set. The controller includes an initial time-delay circuit, and automatic time delayed load step application circuit. A remote contact closure is required for activation and transfer of control. A separate current transformer shall be supplied loose for mounting and sensing of downstream loads.

## 2.8 DOCUMENTATION

- A. Installation and operation manuals shall be provided with the equipment and shall include complete details for the installation, commissioning, operation, troubleshooting, and maintenance of the load bank.
- B. The manuals shall include the electrical schematic and interconnect drawings for the power and control wiring for the load bank and all control devices.
- C. A complete parts list with part numbers, device identification, and rating shall be included in the manuals. The original manufacturers name and part number shall be included in the parts listing.
- D. The manuals shall be provided electronically on a USB drive.

## **PART 3.0 QUALITY ASSURANCE**

### **3.1 QUALITY CONTROL**

- A. The load bank shall be fully tested using a test specification written by the supplier. Tests shall include electrical functional testing, verifying conformance to assembly drawings and specifications. Each load step shall be cold resistance checked to verify proper calibration of resistive load steps and proper ohmic value.
- B. The manufacturer shall maintain this data on file for inspection purposes by the purchaser. Tests using high potential equipment shall be performed to ensure isolation of the load circuits from the control circuits and to determine isolation of the load circuits from the load bank frame. Tests of all safety circuits shall be performed to verify conformance to the specification
- C. All electrical circuits shall have a high potential insulation resistance test performed at twice rated voltage plus 1000 VAC to assure insulation integrity.
- D. All quality control test equipment shall be regularly maintained and calibrated to traceable national standards.
- E. The Company's Quality System shall be at least ISO9001:2015 Certified.

### **3.2 QUALIFICATIONS OF MANUFACTURER**

- A. The load bank shall be manufactured by a firm regularly engaged in the manufacture of load banks and who can demonstrate at least twenty five (25) years of experience with at least twenty five (25) installations of load banks similar or equal to the ones specified herein.
- B. The manufacturer shall have a written Quality Control procedure available for review by the purchaser, which shall document all phases of operations, engineering, and manufacturing.
- C. Manufacturer must have a field service organization with service personnel having a minimum of an Associate Degree in Electrical Engineering.
- D. The manufacturer shall have a service organization capable of providing service within a 4 hour time frame.
- E. A 2 Year warranty shall be provided for both the resistors and the load bank. A longer warranty period shall be able to be purchased.
- F. The load bank shall be manufactured by:

ASCO Power Technologies, Avtron Load Bank Products  
6255 Halle Drive, Cleveland, Ohio 44125

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