LOAD BANKS DIRECT

Instruction Manual

LS Series
Stationary Outdoor
Resistive Load Banks
50 Hertz Models

IMPORTANT: These instructions should be read thoroughly before installation. All warnings and precautions should be observed for personal safety, proper equipment performance and longevity. Failure to follow these instructions could result in equipment failure, serious injury to personnel, and/or property damage. Load Banks contain lethal voltages when connected to the power source. It is very important to remove all sources of power to the load circuits, resistors, blower motor circuits, and control circuits before installing, operating, or servicing this unit. Always allow adequate time after removing power before touching any system components.

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Safety Precautions

The following instructions are general safety precautions that are not necessarily related to any specific part or procedure, and do not necessarily appear elsewhere in this publication. These precautions must be thoroughly understood and applied to all phases of operation and maintenance.

This manual contains various **Warning** and **Caution** statements. Personal injury or death may occur to an operator and/or technician if a warning statement is ignored. Equipment damage or hazardous conditions for personnel could result if caution or warning statements are ignored.

Carefully read and review this instruction manual, supplemental manuals, and all electrical schematic/interconnection drawings provided with the Load Bank prior to installation and operation.

Keep Away From Live Circuits

Operating and Maintenance personnel must at all times observe normal safety regulations. Do not replace components or make adjustments to equipment with power turned on. To avoid casualties, always remove power to the entire system. Turn off and disconnect the main-power source under test. Disconnect all sources of power to the Load Bank (Main input load bus, blower motor circuit, and 120 VAC control circuits).

Shock Hazard

Load Banks contain lethal voltages when connected to the power source. Power to the load resistors (main input load bus), power to fan motor circuits, and power to 120 VAC control circuits must be removed before servicing. Allow adequate time after removing power before servicing or touching any components. .

Do Not Service or Adjust Alone

Under no circumstances should any person reach into an enclosure for the purpose of service or adjustment of equipment except in the presence of someone who is capable of rendering aid.

Safety Earth Ground

An uninterruptible and approved earth ground must be supplied from the main power source. Serious injury or death can occur if this grounding is not properly supplied. Grounding of this equipment should be done by qualified personnel only and must be installed in accordance with all applicable national and local electrical codes and regulations.

Chemical Hazard

No chemicals are included in the manufacturing or operation of this unit. There are no chemical hazards to consider.

Emergency Aid

Personnel working with or near high voltages should be familiar with modern methods of resuscitation.

Potentially Hazardous Operator Conditions

- Read this manual prior to operation.
- Always run an approved ground conductor from the load bank frame to the power source under test which in turn must be properly earth grounded.
- Do not operate the unit unattended. Access to an approved electrical fire extinguisher should be on hand at all times.
- *Do not operate the Load Bank with access panels removed or doors open. Doing so would expose personnel to potential injury from electrical shock or from a moving fan blade.*
- Careful consideration needs to be taken during installation and equipment location during operation. Hot exhaust air can cause damage to other installed equipment. Do not direct hot exhaust air in the direction of other installed equipment.
- Do not allow hot-air exhaust to recirculate through the cold-air intake.
- Do not allow objects to enter or block the cold-air intake or hot-air exhaust.
- Do not install any external cold-air intake or hot-air exhaust duct work to the Load Bank for ventilation. The Load Bank must be installed and operated in a cool, well-ventilated area with adequate clearance for both intake and exhaust air. Do not allow hot air exhaust to recirculate into the cold-air intake.
- The unit should always be operated outdoors in a clean, cool, well-ventilated area free of dust and debris.

- Operating personnel should avoid and never come in contact with the hot-air exhaust and/or surrounding covers during operation and for some-time after operation as these surfaces become hot and may result in a serious burn injury.
- Never bypass any blown fuse.
- Replace any indicator lamps on the operator control panel as required. Each indicator is important to the protection of the unit and safety of the operator, and is an indication of proper system operation or failure.
- Do not bypass any safety circuit including but not limited to; air-safety switch, fan motor overload, exhaust over-temperature switch.
- Always short/shunt current transformer secondary circuits when troubleshooting metering and instrumentation circuits.
- Operating personnel should not come in contact with hot air exhaust opening, outside panels, system components, and load resistors for some time after operation.

A recommended 5 minute cool down period of the blower motor circuit, with no load applied is recommended as best practice and will protect operating personnel from possible burn injuries. A 5 minute cool down should adequately remove any residual heat from the Load Bank and system components.

Emergency Shut-Down: The Emergency STOP pushbutton will immediately turn off control power to the load step application circuits, blower motor circuits and control/instrumentation circuits. In a controlled emergency stop condition, turn the "Master Load" switch to the "OFF" position first (allowing fan motor to run while all load steps are disconnected). Turning the "Power On" switch to the "OFF" position will then turn off all control and blower circuits. Turn off and disconnect the main-power source under test. Disconnect all sources of power to the Load Bank (Main input load bus, blower motor circuit, and 120 VAC control circuits).

Maintenance should always be done only by qualified personnel and with all sources of power disconnected from the unit (main input load bus power, power to all blower fan and control circuits).

Always follow The National Electric Code (NEC), local electrical safety codes, and the Occupational Safety and Health Act (OSHA) when handling, installing, and operating equipment to reduce hazards, personal injury and property damage.

Safety Symbols

WARNING
Warning notes call attention to a procedure, which if not correctly performed could result in personal injury.

CAUTION
Caution notes call attention to a procedure, which if not correctly performed could result in damage to the unit.

This symbol indicates that a shock hazard exists if the precautions in the instruction manual are not followed.

The caution symbol appears on the equipment indicating there is important information in the instruction manual regarding that particular area.

This symbol indicates that the unit radiates heat and should not be touched while hot.

NOTE: Calls attention to supplemental information.

Warning Statements

The following safety warnings appear in the text where there is danger to operating personnel. They are noted and repeated here for emphasis.

WARNING

Disconnect unit from all power sources before any disassembly or service. Main input Load Bus, Blower Motor circuits, 120 VAC control circuits.

WARNING

Do not insert a screwdriver or any thin metal objects through the perforated cooling air grilles while the load bank is in operation. The fan blade and power within the unit could cause serious injury to personnel and damage to the unit.

WARNING

Do not remove the enclosure covers while unit is in operation or operate with covers removed. Unit will not properly cool without all covers in place and pose a shock hazard to personnel.

WARNING

Do not touch the enclosure surfaces while the unit is in operation. Enclosure surfaces are hot and exhaust temperatures can reach in excess of 500ºF when unit is under load and in operation.

WARNING

Do not look into enclosure while in operation. Exhaust temperatures can reach temperatures in excess of 500ºF when unit is under load and in operation. Dust and or debris may also be present.

WARNING

Do not position the exhaust to blow on other equipment or material susceptible to excessive heat. Never direct exhaust air towards flammable materials.

Caution Statements

The following equipment cautions appear in the text whenever the equipment is in danger of damage. They are noted and repeated here for emphasis.

CAUTION

Air enters through the bottom/side cold-air intake of the enclosure and exhausts at the top hot-air exhaust end of the enclosure. Blocking these openings will cause overheating and unit failure.

CAUTION

Do not apply more than the rated Voltage or exceed the power rating of the Load Bank. Excessive power will damage the internal resistor banks.

CAUTION

Confirm all control voltages before operation. Improper Voltage or Over-Voltage will damage load resistors, fan motors, and control components.

CAUTION

Confirm that all load, control, and blower connections are securely attached, turned, and tightened, and that the unit is properly grounded prior to operation. Failure to do so may result in equipment damage and harm to personnel.

CAUTION

Not using all four (4) mounting holes when anchoring the enclosure will lessen wind load and mechanical integrity of the unit and may result in equipment damage, property damage, and/or harm to personnel.

Lingual General Safety Statements

USAGE: ANY USE OF THIS INSTRUMENT IN A MANNER NOT SPECIFIED BY THE MANUFACTURER MAY IMPAIR THE INSTRUMENTS SAFETY PROTECTION.

USO

EL USO DE ESTE INSTRUMENTO DE MANERA NO ESPECIFICADA POR EL FABRICANTE, PUEDE ANULAR LA PROTECCIÓN DE SEGURIDAD DEL INSTRUMENTO.

BENUTZUNG

WIRD DAS GERÄT AUF ANDERE WEISE VERWENDET ALS VOM HERSTELLER BESCHRIEBEN, KANN DIES GERÄTESICHERHEIT BEEINTRÄCHTIGT WERDEN.

UTILISATION

TOUTE UTILISATION DE CET INSTRUMENT QUI N`EST PAS EXPLICITEMENT PRÉVUE PAR LE FABRICANT PEUT ENDOMMAGER LE DISPOSITIF DE PROTECTION DE LINSTRUMENT.

IMPIEGO

QUALORA QUESTO STRUMENTO VENISSE UTILIZZATO IN MODO DIVERSO DA COME SPECIFICATO DAL PRODUTTORE LA PROZIONE DI SICUREZZA POTREBBE VENIRNE COMPROMESSA.

SERVICE: SERVICING INSTRUCTIONS ARE FOR USE BY SERVICE - TRAINED PERSONNEL ONLY. TO AVOID DANGEROUS ELECTRIC SHOCK, DO NOT PERFORM ANY SERVICING UNLESS QUALIFIED TO DO SO.

SERVICIO

LAS INSTRUCCIONES DE SERVICIO SON PARA USO EXCLUSIVO DEL PERSONAL DE SERVICIO CAPACITADO. PARA EVITAR EL PELIGRO DE DESCARGAS ELÉCTRICAS, NO REALICE NINGÚN SERVICIO A MENOS QUE ESTÉ CAPACITADO PARA HACERIO.

WARTUNG

ANWEISUNGEN FÜR DIE WARTUNG DES GERÄTES GELTEN NUR FÜR GESCHULTES FACHPERSONAL. ZUR VERMEIDUNG GEFÄHRLICHE, ELEKTRISCHE SCHOCKS, SIND WARTUNGSARBEITEN AUSSCHLIEßLICH VON QUALIFIZIERTEM SERVICEPERSONAL DURCHZUFÜHREN.

ENTRENTIEN

LE'EMPLOI DES INSTRUCTIONS D'ENTRETIEN DOIT ETRE RÉSERVÉ AU PERSONNEL FORMÉ AUX OPÉRATIONS D'ENTRETIEN. POUR PREVENIR UN CHOC ELECTRIQUE DANGEREUX NE PAS EFFECTUER D'ENTRENTIEN SI L'ON N'A ÉTÉ QUALIFIÉ POUR CE FAIRE.

ASSISTENZA TECNICA

LE ISTRUZIONI RELATIVE ALL'ASSISTENZA SONO PREVISTE ESCLUSIVAMENTE PER IL PERSONALE OPPORTUNAMENTE ADDESTRATO. PER EVITARE PERICOLOSE SCOSSE ELETTRICHE NON EFFETTUARRE ALCUNA RIPARAZIONE A MENO CHE QUALIFICATI A FARLA.

Inspection and Unpacking

As part of your safety program, an initial inspection of all equipment should occur after receiving the unit. Periodic preventative maintenance and inspections should be performed to ensure system reliability.

Upon receipt of your Load Bank, be sure to carefully unpack the unit and inspect the unit carefully for any shipping damage. Check for loose, broken or otherwise damaged parts due to shipping. If damage is noticed, do not unpack the unit. Immediately notify Load Banks Direct LLC and report any shipping damage to the freight carrier.

Be sure to verify that the part number and ratings listed on the nameplate match the order specification. ***The ratings listed on the nameplate are critical – installing, operating, and energizing the incorrect part number could damage the unit and load resistors.***

If the unit is not damaged, unpack the equipment and remove protective stretch wrap. Remove all covers and inspect all of the components for visual signs of damage. Immediately notify the freight carrier and Load Banks Direct LLC of equipment damage or missing parts.

Reinstall packing materials for storage with exception of stretch wrap. **Do not store the unit with the protective plastic in place.**

☞ NOTE: Do not reinstall or reapply protective stretch wrap. This material is meant for shipping protection only. Prolonged storage in stretch wrap may cause condensation damage to powder coat, painted, or mill galvanized finishes.

Product Overview

Load Banks Direct (LBD) LS Series of Stationary Outdoor Resistive Load Banks are designed for installation and operations outdoors – typically mounted and secured on a roof or to a concrete pad. The Load Bank is an industrial power test unit specifically designed for outdoor operation, and will absorb a balanced resistive load at unity power factor.

The Load Bank is a self-contained unit that includes a Remote Operator Control Panel which allows the user to control and monitor individual-discrete load steps, blower motor circuits, control circuits, and safety circuits. Electrical energy from the power source under test is absorbed by the load bank resistors and converted into heat. The blower motor provides the necessary cooling airflow to cool the resistor load elements.

The Load Bank Unit contains all of the necessary principle system components for control and operation.

- **Load Circuits**: Including load power resistors, load step switching and main input load bus.
- **Cooling System**: Including integrally powered blower motor and controls.
- **Control Circuits**: Including 120 VAC controls, load application circuits, blower circuits, and indicators.
- **Automatic Load Dump Circuit**: Provides user interface provisions to disconnect and disable all load steps from a remote device.
- **Remote Indication and Alarm**: Provides user interface to building management system for indication and alarm of load bank safety circuits.
- **Safety Circuits**: Including branch circuit fuse protection for load power resistor circuits, fuse protection for blower and control circuits, motor overload protection, exhaust over temperature protection, cooling air-loss protection, wrong voltage protection, load dump indication, and E-Stop.

CAUTION

The Load Bank should never be used without the Fan Blower Motor operating. Inadequate cooling airflow will result in resistor load elements overheating, fire hazard, and danger to personnel.

CAUTION

Never exceed the rated voltage of the unit as this will cause the Load Bank to overheat.

An AIRFLOW switch is provided to monitor the flow of cooling air through the load power resistor section of the enclosure. If there is inadequate cooling airflow, or an obstruction sensed at the air-intake or air-exhaust, all load is removed.

An Over Temperature switch is provided to monitor the temperature of the enclosure hot-air exhaust. If an over temperature condition is sensed, all load is removed.

Lower Voltages and variation in Frequency may be applied to the Resistor Load Bank load circuit (main input load bus). Frequency change causes no de-rating of the load. Application of lower voltages causes a de-rating of power (KW) from designed nameplate rating. The applied KW with a lower voltage is de-rated from its rated KW value. The actual applied KW when operated at a lower voltage is computed using the following formula:

$$kW_{Applied} = kW_{Rated} \times \frac{(\text{Voltage Applied})^2}{(\text{Voltage Rated})^2}$$

The Operator Control Panel provides the user control of the Load Bank. Main Power ON switch and indicator tell the operator control power circuits are energized and ready for operation. Blower Motor START/STOP push buttons activate and energize the Load Bank cooling system. The Blower Power On lamp indicates blower motor is energized and in operation. Load step application circuits include individual load step switching (one switch provided for each load step). Switched load steps (KW) are additive such that the desired amount of load can be achieved. The Master Load step switch allows a pre-selectable amount of load to be applied when the Master Load step switch is turned on. Dual Voltage Units feature a Load Voltage Selector Switch which selects “System” operational Voltage with wrong voltage protection circuit. [Optional Blower Voltage Selector switch for selection of blower voltage, and Fan-Phase reversal switch for selection of fan phasing ABC – ACB].

Definitions and Formulas

KW = Kilowatts (Watts x 1000)

KVA = Kilo Volt Amperes

KVAR = Kilo Volt Amperes Reactive

PF = Power Factor

HP = Horse Power

BTU = British Thermal Unit

KW = KVA x PF

PF = KW / KVA

KVA = KW / PF

KVA = $\sqrt{KW^2 + KVAR^2}$

1 KW = 3412.14 BTU/Hour

$\sqrt{3}$ = 1.7321

1 HP = .746 KW

1 KW = 1.34 HP

Volts (L-L) is expressed as 3-phase System Voltage (Line to Line).

Amps is expressed as phase Amperes.

PF is expressed as Power Factor and is unity (1.0) in a Resistive Load Bank.

	3 Phase	**Single Phase**	**DC**
KW	$\frac{\text{Volts (L-L) x Amps x } \sqrt{3} \text{ x PF}}{1000}$	$\frac{\text{Volts x Amps x PF}}{1000}$	$\frac{\text{Volts x Amps}}{1000}$
KVA	$\frac{\text{Volts (L-L) x Amps x } \sqrt{3}}{1000}$	$\frac{\text{Volts x Amps}}{1000}$	
Amps	$\frac{\text{KW x 1000}}{\text{Volts (L-L) x } \sqrt{3} \text{ x PF}}$	$\frac{\text{KW x 1000}}{\text{Volts x PF}}$	$\frac{\text{KW x 1000}}{\text{Volts}}$
Amps	$\frac{\text{KVA x 1000}}{\text{Volts (L-L) x } \sqrt{3}}$	$\frac{\text{KVA x 1000}}{\text{Volts}}$	
HP	$\frac{\text{Volts (L-L) x Amps x } \sqrt{3} \text{ x PF}}{746}$	$\frac{\text{Volts x Amps x PF}}{746}$	

Theory of Operation

General

Load Banks are precision test and measurement instruments which are designed to provide discrete, selectable, resistive electrical loads for testing mission critical power sources. They can be effectively utilized for production testing and/or periodic maintenance testing of back up (standby) generators and Uninterruptible Power Supply (UPS) systems.

Equipment Cooling

The power resistors used within the Load Bank are LBD-*PowerDyne*™ resistor load elements situated within the "Resistor Assembly" (RA) frame. The resistor load elements are forced air cooled and designed for continuous operation at rated voltage. When the unit is in operation, the blower motor (located at the cold-air intake end of the unit) draws cooling air into the air intake openings and forces air flow across the entire resistor bank network. Hot-air exits the unit through the hot-air exhaust opening located at the opposite end of the unit.

WARNING

Do not look into enclosure exhaust while in operation. Exhaust temperatures can reach temperatures in excess of 500ºF when unit is under load and in operation. Dust and or debris may also be present.

Load Banks Direct LS Series of Stationary Outdoor Resistive Load Banks are forced air-cooled, high powered, weatherproof units designed to be installed and operated outdoors (typically secured to a roof or concrete pad). The highly efficient design and fan motor assembly provides a relatively low noise solution featuring differential air pressure and thermal monitoring over-temperature shut-down protection. Simple to operate, these units should provide years of operation yet are field repairable in the event of failure of a load resistor or other components.

Environmental Parameters

Wind Loading:	75 MPH
Seismic Zone Rating:	Zone 4
Ambient Temperature:	-20°F to +120°F
Altitude:	3,000 feet above sea level

- The equipment is intended for outdoor installation and operation. The surrounding air must be free of contaminants or particles that could be drawn into the air intakes.
- The Resistor Load Bank Unit and resistors are fan forced-air cooled, and have no intermediate dielectric fluids, and require no cooling water hookups.
- Careful consideration to surrounding equipment is required as hot-air exhaust temperatures can be in excess of 500ºF when the unit is operated under full load.
- The unit should be placed in an open air environment where adequate space is available for air circulation. Do not enclose the unit in a small confined area with obstructions, or with nearby equipment in close proximity to the cold-air intake or hot-air exhaust. A minimum of 3-4 feet of clearance should be provided for cold-air intake and 10-12 feet of clearance at hot-air exhaust. A minimum of 36 inches of clearance should be provided for equipment maintenance on each side of the enclosure. Never vent cold-air intake or hot-air exhaust. (Refer to Safety section of this manual).

WARNING

Do not touch the enclosure surfaces while the unit is in operation. Enclosure surfaces are hot and exhaust temperatures can reach in excess of 500ºF when unit is under load and in operation.

Equipment Placement and Location

- Diligent care is required for proper installation of the Load Bank. The National Electric Code, all local installation codes, all electrical and safety codes, Occupational Safety and Health Act codes (OSHA) are required to be followed when installing this equipment to reduce any hazards to persons, personal property, and injury to any installation and operating personnel.
- Failure to follow installation guidelines will void the warranty.
- Installation, hook-up and operation should only be done by certified, qualified, licensed contractor technicians, which are trained and familiar with installation practice, operation of Load Banks and industrial electrical equipment.
- Prior to equipment placement and installation, inspect the Load Bank for any enclosure damage, broken wires, cracked or broken ceramic insulators, or any other component damage that may have occurred during shipment. Immediately report any damage claims to the freight carrier and contact the factory.
- Do not install the Load Bank where standing water can accumulate. Installation should be above grade.
- The unit is equipped with fork-lift channels located in the base and should be utilized for equipment placement.
- The Load Bank must be operated in a cool well ventilated open area where hot-air exhaust cannot be recirculated to the cold-air intake. Hot-air exhaust can exceed 500°F when operated under full load conditions.
- The enclosure should be mounted on a level and solid surface with a minimum clearance of 36 inches on each side of the enclosure for service and maintenance. A minimum of 3-4 feet of clearance should be provided for cold-air intake and 10-12 feet of clearance at hot-air exhaust.
- The hot-air exhaust should blow to open air with no restrictions, redirection, or threat to personnel or other equipment.
- Never vent the cold-air intake or hot-air exhaust.

☞ NOTE: This Resistor Load Bank is designed for outdoor use. Due to heat produced and generated during operation, it should never be mounted indoors. Careful consideration should always be taken when operated in close proximity to any other industrial equipment. Hot-air exhaust can damage temperature sensitive equipment up to 15 feet from hot-air exhaust.

☞ NOTE: All clearances are recommended factory minimums. Clearances less than specified should be discussed with the factory prior to installation.

CAUTION

Air enters through the cold-air intake sides of the enclosure and exhausts at the hot-air exhaust at the opposite end of the enclosure. Blocking these openings will cause overheating and unit failure.

☞ NOTE: The enclosure is designed to be lifted from the base. Fork-Lift channels are provided in the base for ease of lifting and positioning. Ensure fork lift truck tines are pushed completely through the enclosure for safety and to prevent damage to the enclosure.

☞ NOTE: To avoid damage to the enclosure and internal components, do not lift the enclosure in any manner with covers removed.

Equipment Mounting

There are four (4) mounting holes located on the bottom base of the enclosure for anchoring to the mounting surface. The (5/8" DIA.) holes are located at the base of the unit and should be used to solidly anchor the unit to the mounting surface. Torque all mounting bolts to a minimum of 50 ft/lb. After the enclosure is securely mounted, remove covers and ensure all packing materials and any other debris are cleared. Reinstall covers and toque bolts to 30 ft/lb.

CAUTION

Not using all four (4) mounting holes when anchoring the enclosure will lessen wind load and mechanical integrity and may result in equipment damage or harm to personnel.

Installation of Exhaust Hood

LS250 through LS2000 Load Banks are shipped with separate exhaust louver that must be installed on the top hot air exhaust of the unit during installation of the Load Bank. Reference the Load Bank outline drawing for proper position and location of the exhaust hood. Carefully hoist/lift the hood using heavy duty through rods for lifting. Set the exhaust hood over the perimeter flange on top of the Load Bank and secure in place using all mounting holes with stainless steel fasteners.

Power Connection Considerations

Reference the Electrical Schematic and Electrical-Mechanical Ratings section of this manual for the Total Power Ratings of; Main Input Load Bus (KW, Voltage, Phase, Frequency), Blower Motor Circuit Ratings, and Control Circuit Ratings.

Load cable conductors from the power source to the load bank should be adequately sized and protected to handle the maximum rated load, and in accordance to the National Electric Code and any local codes.

In order to adequately protect the conductors to the Load Bank, an approved, lockable, and properly sized main circuit breaker and/or disconnect switch should be mounted as close to the power source as possible. Always refer and adhere to National Electric Code and any local codes.

Power Connection Access

A removable gland plate is provided on the bottom of the terminal compartment for customer installed knockouts and cable bushings. Remove the front cover of the terminal compartment for access to main input load bus bars, blower motor circuits, and 120 VAC control circuits.

Main Input Load Bus Power Connections

Reference the Electrical Schematic/Interconnection drawing, and Electrical- Mechanical Ratings section of this manual for the Total Power Ratings of; Main Input Load Bus, Blower Motor Circuit, and 120 VAC Control Circuit

The Load Bank has three main input load bus bars (marked A, B, C). Load cable connections are made directly to the respective bus bars which have provisions provided for suitable mounting using ½" hardware. A standard NEMA 2-hole pattern is provided on each respective bus bar for phase-A, phase-B, and phase- C.

Load cable conductors from the power source to the load bank should be adequately sized and protected to handle the maximum rated load, and in accordance to the National Electric Code and any local codes.

In order to adequately protect the conductors to the Load Bank, an approved, lockable, and properly sized main circuit breaker and/or disconnect switch should be mounted as close to the power source as possible. Always refer and adhere to National Electric Code and any local codes.

Verify that load cables, lugs, and mounting hardware connections have sufficient clearance to the surrounding sheet metal enclosure, control components, phase- phase clearance, and phase to enclosure chassis clearance and cover, prior to securing the cover panel in place and sealing the enclosure.

☞ NOTE: After all load power cable is connected to the respective main input load bus bars (A, B, C), use torque wrench to ensure all termination hardware is properly tightened.

Grounding

An uninterruptible and approved earth ground must be supplied from the main power source which in turn must be connected to a solid earth ground. Serious injury or death can occur if this grounding is not properly supplied. Grounding of this equipment should be done by qualified personnel only and must be installed in accordance with all applicable National Electric Code, local electrical codes, and regulations.

Permanent ground conductors must be sized and connected to the Load Bank enclosure per the National Electric Code and any local codes. Two (2) ground studs are located within the enclosure below the main input load bus bar terminals (left and right side) and are provided for this connection. The ground studs must be solidly connected to both the power source frame and in turn, connected to solid earth ground.

Blower Motor Power

The Blower Motor circuit consists of a motor starting relay for energizing the blower motor. Short circuit protection for the motor circuit is provided by fast- acting current limiting fuses and thermal protection by overload relay.

Blower motor power connections are made to terminal block TB2 terminals 1-3.

- Reference detailed Electrical Schematic and Interconnection drawing for blower motor power terminal block connection points, and for motor power rating requirements.
- Reference Blower Motor Circuit Ratings in the Electrical and Mechanical Ratings section of this manual for motor power rating requirements.

The Blower Motor circuit can be wired to an external power source OR, can be internally wired to the main input load bus.

External Blower Motor Power: When wired to an external power source, safe practice dictates that the blower power is wired through an approved lockable safety disconnect switch. Blower Motor power requirements are noted on the Electrical Schematic and Interconnection drawing supplied with this manual and also noted in the Electrical and Mechanical Ratings section of this manual. Blower Motor power conductors, supply voltage, and load service amperage should be adequately sized and protected to handle the maximum rated load according to the National Electric Code and any local codes.

Internal Blower Motor Power: The power for the blower motor circuit can be internally derived from the source under test by wiring the blower motor circuit to the main input load bus. When operating the blower motor from the source under test, an additional load is added to the power source (equal to the power rating of the blower motor circuit). Careful consideration and verification is required such that the Voltage – Phase – Frequency of the power source match the requirements of the blower motor circuit and main input load bus.

Phase Rotation and Verification: Verify correct phase rotation wiring of blower motor circuit. Improper phase rotation will cause the blower to run in reverse/opposite direction blowing cooling air out of the cold-air intake side. Cooling airflow is vital to cooling the load resistors and should always enter the cold-air intake, force cooling air across the load resistors, and exit at the hot- air exhaust.

☞ Note: Ensure, verify, and check for proper phasing of blower motor and direction of airflow from cold-air intake and out of the hot-air exhaust. If airflow is exhausted from cold-air intake, shut down the unit, disconnect all sources of load power, blower power, and control power, and reverse any 2-phase connections to the blower motor.

Control Power Circuit, Control Transformer, and Heater Circuit

External Control Power connections are made to terminal block TB1 at either Load Bank or Operator Control Panel. Three (3) connections are noted and required (High – Low – Ground).

- Reference detailed Electrical Schematic and Interconnection drawing for external control power terminal block connection points, and power rating requirements.
- Reference Control Power Circuit Ratings in the Electrical and Mechanical Ratings section of this manual for control power rating requirements.

Control Power Circuit: When wired to an external power source, safe practice dictates that the 120 Volt AC, 1-phase 50/60 Hertz supply power to the control power circuit is wired through an approved lockable safety disconnect switch. Control Power requirements are noted on the Electrical Schematic and Interconnection drawing supplied with this manual and also noted in the Electrical and Mechanical Ratings section of this manual. Control Power circuit conductors, supply voltage, and load service amperage should be adequately sized and protected to handle the maximum rated load according to the National Electric Code and any local codes.

Control Power Transformer: If the Load Bank is supplied with a 120 VAC Control Power Transformer, no additional wiring for control circuit operation is required. The 120 VAC 1-phase Control Power Transformer will come factory sized and wired to adequately provide the necessary power requirements to run the Load Bank control circuits. Control Power Transformer is both primary and secondary fuse protected, and is factory wired to derive power from 2-phases of the blower power circuit.

Heater Circuit: A thermostatically controlled anti-condensation heater circuit is provided within the Load Bank relay/control compartment to limit the effects of potentially hazardous moisture and condensation (during operation and during times of non-use). It is recommended that the heater circuit be hooked up, run, and energized during times of outdoor storage, and outdoor installation. Heater circuit wiring and hook-up is made to terminal block TB1-1 located within Load Bank relay/control compartment. Reference Electrical Schematic/Interconnection drawing for heater circuit hook-up and terminal block wiring connection points.

CAUTION

Confirm all bus bar connections to main input load bus and ground connections are properly tightened to required torque values. Confirm all external blower power and control power connections, and all customer interconnection wiring between Load Bank and Operator Control Unit are properly crimped and tightened to required torque values. Loose connections will result in equipment damage and danger to personnel.

WARNING

Loose terminal connections may promote arcing to the enclosure posing a shock hazard. Never connect powered control leads to a terminal block as it may result in component damage or pose a shock hazard to personnel.

Operator Controls

The Load Bank is supplied with an Operator Control Panel which is used for remote control and monitor of the Load Bank control circuits, load application circuits, blower circuits, and safety circuits. The Operator Control unit is supplied as a separate enclosure designed for indoor use and mounting.

Interconnection of Operator Controls to Load Bank is by *point-point* wiring between Operator Control unit and Load Bank (from terminal block TB1 on Operator Control Unit to terminal block TB1 on the Load Bank).

- Reference detailed Electrical Schematic and Interconnection drawing for point-point interconnection and terminal block connection points between Operator Control Panel TB1, and Load Bank TB1.
- Adequately size the interconnection conductors in accordance with the control power circuit power ratings and taking into consideration any potential voltage drops in the installed distance between Operator Control unit and Load Bank unit.
- To minimize Voltage drop, it is recommended that interconnection control wiring be minimum 14 AWG for interconnection wire run lengths under 50 feet. Select control interconnection wire size and type in accordance to the National Electric Code and local codes.
- Always check the mechanical integrity of all interconnection wiring and that lugs are properly crimped and terminations properly torqued.
- Always use Electrical Schematic and Interconnection drawing to verify, check, and ohm out all customer supplied interconnection and control wiring.

Automatic Load Dump Circuit: Provides user interface provisions to the generator controls, automatic transfer switch, or building management system, to disconnect and disable all load steps from a normally closed (NC) set of auxiliary contacts from the automatic transfer switch (ATS) or other remote device. In the event of utility loss during a regularly scheduled load test on the standby emergency power source, all load bank load is removed from the source under test.

- Reference Electrical Schematic and Interconnection drawing for terminal block wiring location of optional Automatic Remote Load Dump Contacts.

Remote Indication and Alarm: Provides user interface contact closure [form-c-type normally open and normally closed] to building management systems for indication, detection, and alarm of “Air-Flow-Failure”, “Over-Temperature” and “Load Dump”.

- Reference Electrical Schematic and Interconnection drawing for terminal block wiring location of optional remote indication and alarm circuits.

Multi-Power Meter

If the Load Bank Operator Control unit is supplied with a multi-function Multi-Power Meter Display, all meter input wiring for Voltage and Current is factory complete within the Load Bank. With the Load Bank in operation and under load, the Multi-Power Meter allows the operator to monitor, measure, display, and record electrical load parameters such as 3-Phase System Volts, Phase Amperage, Frequency, and Power Functions.

- Voltage inputs are sensed from the main input load bus and are fuse protected, wired direct to the meter by interconnection of Load Bank and Operator Control Panel [TB3].
- Current Transformers are located within the Load Bank enclosure and sense primary phase current. Secondary connections are made direct to the meter by interconnection of Load Bank and Operator Control Panel [TB3].
- Point-Point Interconnection of Voltage and Current Transformer connections are made between Operator Control Unit and Load Bank Terminal Block TB3.
- Reference Electrical Schematic and Interconnection drawing for exact terminal block locations numbers of all point-point interconnection wiring of metering/instrumentation circuit.

☞ Note: The Load Bank is shipped with jumper wires installed across the current transformer secondary for protection. These jumper wires must not be removed until after interconnection of Load Bank and Operator Control Unit is complete. Always short/shunt current transformer secondary circuits when servicing or troubleshooting metering and instrumentation circuits. Primary current flowing through an un-shunted open secondary of a current transformer will destroy the current transformer with possible danger and harm to personnel.

☞ ***Note: Complete details, functions, and operation of the Multi-Power Meter are described in the supplemental Multi-Power Meter Quick Start Guide supplied as part of the Appendix of this Load Bank Manual.***

CAUTION

Confirm all external blower and control voltages before operation. Over or under voltage will damage blower and control components.

CAUTION

Confirm all main input load bus and ground connections are properly connected, turned, and tightened. Confirm external blower power and control power connections. Loose connections will result in damage and danger to personnel.

Automatic Load-Level Option

If the Load Bank is provided with an Automatic Load Level Control option, the unit is shipped with a separately supplied current transformer CT100 that must be installed and wired accordingly as shown on the Electrical Schematic and Interconnection diagram.

Theory of Operation

The Automatic Load Controller senses the downstream connected building load and upon "Transfer of Control" contact closure, will add/subtract Load Bank load steps in response to downstream building load changes as to provide a minimum load on the power source. With the Load Bank in operation in the Automatic mode, the controller will continue to add/subtract load in response to the dynamic power fluctuations of the connected building load. The controller utilizes the load bank as a "supplemental load" for maintaining a minimum load on the power source.

When the Operator Control panel Manual/Auto switch is in the "Auto" position, the customer supplied "Transfer of Control" contact closure will initiate the Load Bank controls, start the blower motor, initiate the load application circuit, and begin sensing the downstream connected building load. The separately supplied current transformer CT100 provides the necessary feedback signal for sensing the downstream connected building load. After an initial Time Delay, the controller begins adding/removing load steps accordingly as to keep a minimum load on the power source.

Customer supplied "Transfer of Control" contacts and separately supplied current transformer CT connections are to be wired to the respective load bank terminal block location terminals as noted on the Electrical Schematic/Interconnection Diagram.

☞ Note: The Load Bank is shipped with a separately supplied current transformer that must be mounted in a location as to sense the downstream building load connected to the power source.

☞ Note: Always short/shunt current transformer secondary circuits when servicing or troubleshooting current transformer sensing and/or instrumentation circuits. Primary current flowing through an un-shunted open secondary of a current transformer will destroy the current transformer with possible danger and harm to personnel.

Operating Instructions

General

- All installation should be reviewed and checked by a qualified technician with all local and National Electric codes observed.
- Ensure all connections are properly tightened and all covers are installed.
- Never operate the unit un-attended.
- All wiring from external power sources to Load Bank Unit (including; main input load bus, blower motor circuits, and 120 VAC control circuits) should be verified and checked by a qualified technician with all local and National Electric codes observed.
- All interconnection wiring of Operator Control Unit and Load Bank should be verified and checked by a qualified technician with all local and National Electric Codes observed.
- The following Cautions and Warnings should be strictly enforced:

CAUTION

Operation of the unit with any covers removed will disrupt air flow and allow debris to pass through resistors possibly damaging equipment.

WARNING

Operation of the unit with any covers removed will pose a shock hazard and danger to personnel.

WARNING

Do not look into the exhaust of the enclosure while in operation. Exhaust temperatures can reach temperatures in excess of 500ºF when unit is under load and in operation. Dust and or debris may also be present.

WARNING

Do not touch the enclosure surfaces while the unit is in operation. Enclosure surfaces are hot and exhaust temperatures can reach in excess of 500ºF when unit is under load and in operation.

WARNING

Do not insert a screwdriver or any thin metal objects through the perforated cooling air grilles while the load is in operation. The power within the unit could arc over and will cause serious injury to personnel and damage to the unit.

WARNING

Do not operate under load without fan blower in motion. Immediate equipment damage may result.

Operation

- Connect the power source under test to main input load bus as described in the Installation section of this manual.
- Verify – Check Emergency Stop Button is in the "Closed" operating position
- Verify – Check the Load Voltage Selector Switch is in the proper position and matches the System Voltage applied to the Load Bank main input load bus terminals (dual voltage units).
- With Operator control panel switches in the OFF position, place Control Power switch to the ON position (control power on indicator will illuminate).
- Press Blower Start push button. Blower Power indicator will illuminate. When blower fan motor reaches proper speed, the air-flow failure indicator will de-energize.
- **Note**: Ensure and check for proper phasing of blower motor and direction of airflow form cold-air intake to hot-air exhaust. If airflow is exhausted from cold-air intake, shut down the unit, disconnect all sources of load power, blower power, and control power, and reverse any 2-phase connections to the blower motor.

CAUTION

DO NOT operate the Load Bank over rated nameplate Voltage as this will cause catastrophic failure.

The operation of the blower motor circuit is critical for safe operation. If the air-flow failure and/or over-temp lamp is illuminated, all load steps are disabled and load cannot be applied.

DO NOT attempt to bypass the air switch or over-temperature switch as this will cause catastrophic damage to the unit.

- With Master Load and KW load step switches in the OFF position, pre-select a KW load using one or any additive combination of load step increments by turning the switches to the ON position.
- Turning the Master Load step switch to the ON position, the pre-selected amount of load KW will be applied to the power source under test.

- Any available combination of incremental KW load values can be turned ON/OFF during operation to achieve the desired load on the power source under test.
- Shut-Down: Turn the "Master Load" switch, and all load step switches to the "OFF" position first (allowing fan motor to run while all load steps are disconnected). Press the Blower STOP push button. Turning the "Power On" switch to the "OFF" position will then turn off all control and blower circuits. Turn off and disconnect the main-power source under test. Disconnect all sources of power to the Load Bank (Main input load bus, blower motor circuit, and 120 VAC control circuits).
- A recommended 5 minute cool down period of the blower motor circuit, with no load applied, should adequately remove any residual heat from the Load Bank and system components.

WARNING

DO NOT touch the exhaust louver during operation. Hot-Air exhaust will cause serious burns
DO NOT allow objects to enter or block air intake or exhaust louvers.
DO NOT operate the Load Bank over rated nameplate Voltage as this will cause catastrophic failure and danger to personnel.
DO NOT apply DC voltages to main input load bus. Refer to Safety section of this manual

Safety and Shut-Down Indicators

- "Emergency Stop" Pushbutton disables 120 VAC control power to all control circuits (blower circuit, load application circuit, instrumentation, control and safety circuits)
- "Air-Failure" lamp indicates a loss of cooling airflow (all load is removed).
- "Over-Temperature" indicates an exhaust over-temp condition (all load is removed).
- "Wrong Voltage" indicates Load Voltage Selector Switch does not match System Voltage applied to main input load bus terminals (load steps disabled).
- "Load Dump" indicates removal of all loads due to one or all of the above conditions
- "Motor Overload" lamp indicates motor thermal overload and motor shut-down.

Maintenance

Maintenance personnel must always exercise caution when access panels are removed. Personal injury from electrical shock or from moving fan blades could result unless all sources of power are completely disconnected before servicing. Maintenance must always be done by qualified technician.

Maintenance procedures must be followed to provide longevity of equipment life, and to reduce the probability of electric shock hazard, fire, personal injury, or property damage.

Before servicing this equipment, completely review the "**Safety Points**" and "**Potentially Hazardous Operator Conditions**" sections of this manual. Maintenance must always be done by a qualified and certified technician. Proper protective arch-flash clothing, eye protection, ear protection, gloves, and hard-hat should be worn when servicing or maintaining the unit.

WARNING

Disconnect from all sources of power to the unit (Main input Load Bus, external Blower Power, External Control Power) prior to any inspection, service, or cleaning. Electric Shock Hazard exists while connected.

For optimum performance and service life, preventative maintenance is a key factor. It is recommended that during scheduled inactiveness, reactivation from storage, or unit relocation the following maintenance steps are performed:

Daily Maintenance Prior to Operation

1. Inspect and remove any restrictions and/or obstructions to cold-air intake and hot-air exhaust of the Load Bank unit.
2. Check screens to make sure objects have not blocked/entered openings.
3. Verify the direction of the airflow is in the proper direction from cold-air intake to hot-air exhaust.
4. Verify that there is no possibility of re-circulation of hot-air exhaust to cold-air intake.

Quarterly Maintenance (every three months)

1. Remove all exterior access panels to Load Bank enclosure (including air intake and exhaust covers).
2. Inspect the intake and exhaust covers. Blow or brush away any noticeable dirt or debris from air intake and exhaust openings. Ensure covers are functional and free of debris. Replace any respective panel that is compromised or damaged.
3. Clean any and all dirt and/or debris from the interior of the entire Load Bank. Do not exceed 40 PSI when using clean, dry, compressed air for blowing and removing dust and debris.
4. Inspect blower motor and fan blade, clearing any debris or removing any obstruction. Check fan blade for balance and all respective fan blade and motor mounting hardware for tightness. Torque to proper values of tightness as required.
5. Inspect all resistor elements ensuring all hardware is tightened and elements are clear and free of debris.
6. Inspect all resistors for mechanical and structural integrity and location. Replace any excessive sagging resistor elements, ceramics and support rods. Replace any and all broken or cracked termination ceramics, and ceramics on resistor support rods as required.
7. Inspect all termination ceramic insulators at resistor case ends (both sides) for breaks or cracks and replace as necessary.
8. Inspect all support rod ceramic insulators for breaks or cracks and replace as necessary.
9. Inspect the entire inside of the enclosure for loose hardware or loose connections and tighten to proper torque values as required.
10. Inspect all load and control wiring for signs of insulation failure or breakdown.
11. Inspect for any signs of heat stress on connections and terminals. This could be a sign of loose hardware or corroded/oxidized connections. Repair and replace connection hardware as required.
12. Inspect all electrical connections to terminal blocks, main input load bus bars, fuses mounted to bus bars, Cam-Lok power receptacle connections, all resistor connections for corrosion and oxidation. Clean connections and replace hardware as required. Tighten as necessary.
13. Inspect all load step contactors. Inspect magnetic contactor coils for oxidation and rust. Inspect contacts that carry load if pitted, rusted or corroded. Contacts must all move freely and properly seal when closed. Replace as necessary.
14. When replacing current transformers, mark all leads before removing to ensure proper phasing of new current transformer. Never leave the secondary of a current transformer un-shunted.
15. Reinstall all covers ensuring all materials are well in place and all hardware is properly tightened.

16. Verify Airflow protection circuit. This can be done when unit is powered up for operation with all access panels closed and in place, and blocking off the cold-air intake and/or hot-air exhaust.
17. Check all indicator lamps on Operator Control unit (replace as necessary).
18. Blower motor should be lubricated per manufacturer's requirements as noted on motor nameplate.

CAUTION

Do not pressure wash the inside component terminal compartment (relay panel) as damage may occur to electro-mechanical load step relays, motor and control circuits, safety circuits, and terminal strip wiring. If splashed, ensure entire compartment is dry before covering.

WARNING

Pressure washing terminal compartment (relay panel) may lead to condensation and promote internal arching.

Additional Preventative Maintenance Measures (as required)

1. The outside surface of the unit should be wiped or blown free of dust and dirt. Careful consideration to controls, metering and relay compartment must be taken into account when pressure washing the exterior of the enclosure. Ensure air intake and exhaust areas are clean and debris free. Blast or sand any noticeable corrosion areas and cover with a suitable paint or coating.
2. Remove both side access panels and ensure all resistor terminal connections including wire, bus jumper, and bushings are tightened to 50 ft/lb. Inspect all ceramic bushings and insulators for cracks. Replace all broken or cracked ceramic insulators. Ensure all fan and safety component connections are tight. If required, it is safe to blow any dust from this compartment using 40 PSI or less of clean, dry, compressed air. Replace any broken or failed components. Reinstall access panel cover before proceeding with any enclosure maintenance.
3. If resistor elements are extremely dirty, elements can be pressure washed. Pressures up to 400 PSI at a distance of two feet or greater may be used when cleaning the resistor elements. Pressure should be reduced for the connection points and the distance from the nozzle to any insulator should not be closer than four feet to prevent damage.

Troubleshooting Guide

WARNING

Disconnect all sources of power to the unit (Main input Load Bus, external Blower Power, External Control Power) prior to any inspection, service, or cleaning. Electric Shock Hazard exists while connected.

For corrections requiring repair or replacement of components, contact the factory immediately for further instruction. Only those functions within the scope of normal maintenance are listed. This manual cannot list all malfunctions that may occur, or corrective actions. If a malfunction is not listed or is not corrected by listed corrective actions, notify the factory.

☞ Note: When checking fuses for continuity, remove all fuses from fuse blocks, bus bars, fuse holders, and disconnect switch. Test each fuse individually and out of circuit. A blown fuse left in the circuit may check out OK with false reading of continuity due to feedback and return paths within the circuit.

1) No Main Power to 120 VAC Control Circuits

- Emergency Stop / "E-STOP" push button is in the open position.
- Terminals damaged during shipment.
- External Control Power Main Switch or circuit breaker is not closed.
- Control Power Transformer failure (primary or secondary control power fuse is blown (check and replace as required).
- Control Circuit Fuse is blown (check and replace as required).
- Dirty or loose connections or faulty Main Power Switch.

2) Blower Motor Not Operating

- No External Power to Motor Circuits.
- Main Power switch is in the off position.
- Emergency Stop / “E-STOP” push button is in the open position.
- External Blower/Control Power Main Switch or circuit breaker is not closed or power source is disconnected.
- Blower Motor is internally wired to main input load bus with no main input load bus voltage applied.
- External power source is inadequate
- Loose or broken connection at terminal block, motor starter, motor starting coil or on operator control unit (main power, blower start/stop pushbuttons)
- Blower Motor fuse is blown (check and replace as required).
- Motor Over-Load relay is tripped.
- Motor starting relay failed.
- Fan blade obstruction, motor winding failure, or shaft does not turn to improper lubrication

3) Blower Motor Circuit energized but Fan Blade is not turning

- Fan blade motion is obstructed or broken.
- Fan blade is loose at hub or is not keyed properly.

4) Air Failure Lamp Illuminated

- Obstruction or restriction of air flow at Load Bank cold-air intake or hot-air exhaust.
- Blower motor phasing is incorrect causing rotation of fan blade and wrong direction of cooling air flow. Check motor power connections for proper phase sequence.
- Exhaust over-temperature switch is activated. Sign of resistor over-temperature. Verify and ensure air intake and exhaust openings are clear of any debris, blockage or obstruction. Check for proper blower operation and proper direction of airflow.
- Air switch or Air failure auxiliary relay is malfunctioning or not operating correctly.
- Air switch high pressure intake tubing obstruction. Remove, clean and replace tubing as necessary.

5) Over-Temp Lamp Illuminated

- Obstruction or restriction of air flow at Load Bank cold-air intake or hot-air exhaust.
- Blower motor phasing is incorrect causing rotation of fan blade and wrong direction of cooling air flow. Check motor power connections for proper phase sequence.
- Airflow switch is activated indicating a loss of cooling airflow. Sign of resistor over-temperature. Verify and ensure air intake and exhaust openings are clear of any debris, blockage or obstruction. Check for proper blower operation and proper direction of airflow.
- Over-Temp switch or Over-Temp auxiliary relay is malfunctioning or not operating correctly.
- Air switch high pressure intake tubing obstruction. Remove, clean and replace tubing as necessary.

6) Wrong Voltage Lamp Illuminated (dual voltage units)

- Load Voltage Selector Switch is in the wrong position
- Load Voltage Selection does not match the applied System Voltage sensed at main input load bus terminals.
- Wrong Voltage Relay (K-VCR) failure or R100 dropping resistor failure/open.

7) Load Dump Lamp Illuminated

- Indication that all load steps are removed due to Air-Failure, Over-Temp, Wrong Voltage, Motor Overload condition, or motor shut down condition.

8) Motor Overload Lamp Illuminated

- Motor Thermal Overload Relay tripped. Check ambient air intake temperature and for re-circulation of hot air. Motor windings running hot. Blower motor winding failure (replace if necessary). Reset Overload relay.

9) Resistor Open or Phase Imbalance

- Blown load step fuse in branch load circuit (check and replace as necessary).
- Loose bus bar or loose connection at resistor terminal or fuse (tighten all bus bar and connection points as required).
- Resistor element failure and burned open (replace as necessary).

10) Load Step or Load step application circuit cannot be energized

- Blower Failure, Air failure, Over-Temp, Wrong Voltage, Motor Overload, Load Dump, (see item 2 thru 8 above).
- Master Load Step switch is in the OFF position or not functioning.
- Load Step toggle switch is inoperative.
- One or more of the branch circuit load step fuses for the load step in question is blown (check and replace as necessary).
- One or more of the load step resistor for the load step in question has failed or burned open (check and replace as necessary).
- Load step contactor has failed or is inoperative due to loose connection or failed-open coil.

11) Load Step energized without rated load, or un-balanced load

- Applied main input bus voltage from power source under test is de-rated, low, imbalanced or inadequate.
- Contactor failure or not closing properly. Loose connection.
- One or more of the branch circuit load step fuses for the load step in question is blown (check and replace as necessary).
- One or more of the load step resistor for the load step in question has failed or burned open (check and replace as necessary).

12) Load Step contactor or relay chattering

- Contacts are pitted or oxidized.
- Magnetic core and coil are dirty or corroded.
- Coil connections to the contactor are loose.
- 120 VAC control circuit line voltage is low and/or inadequate.

13) Switchgear Circuit Breaker trips or Main Disconnect fuses are blown

- Fuses and/or circuit breaker trip settings are undersized.
- A short circuit exists at the Load Bank Resistor (main input load bus or blower circuit).
- A short exists in the power conductors feeding the Load Bank Resistor.

☞ Note: When checking fuses for continuity, remove all fuses from fuse blocks, bus bars, fuse holders, and disconnect switch. Test each fuse individually and out of circuit. A blown fuse left in the circuit may check out OK with false reading of continuity due to feedback and return paths within the circuit.

Storage

- It is recommended that the unit be stored indoors in a dry enclosed area. There is no special preparation required.
- If the unit is to be unused or stored for any length of time indoors, cover the unit to prevent any accumulation or buildup of dust or dirt. If stored outdoors, do not cover with plastic that may create condensation and enclosure corrosion or staining (keep exhaust hood in place).
- Storage temperatures should remain -22°F to +122°F [- 30°C to +50°C]

Shipping

- Attach the enclosure to a skid constructed with minimum board thickness of two inches (2") to properly support the unit's weight. Use (4) or more lag bolts in the mounting base holes provided at the entrance to the integrated fork lift tine receptacles, and properly secure the load bank to the mounting skid.
- Secure all loose parts in the bottom of the enclosure and reinstall cover.
- Pack, seal securely in a sturdy wooden crate or equivalent, with sufficient padding to avoid shock damage.
- Ship Operator Control Unit and Exhaust Hood separately.
- If returning to the factory, a factory Return Merchandise Authorization (RMA) Number will be required prior to shipment or may be refused at the dock.

Customer Service

Any maintenance or service procedure beyond scope of those provided in this manual should be referred to a factory engineer. All units returned for service must be shipped prepaid and to the attention of the factory engineer in which return and service were discussed with RMA number noted.

Contact Information

Load Banks Direct LLC
125 West 34th Street
Covington, KY 41015
U.S.A.

Toll Free: 855-LBD-CALL (855-523-2255)
Fax: 859-554-2530

Email: **cs@LoadBanksDirect.com**

Website: www.LoadBanksDirect.com

Warranty

LOAD BANKS DIRECT LOAD BANKS PRODUCTS: The Company warrants title to the product(s) and, except as noted below with respect to items not bearing the Load Banks Direct load banks brand, also warrants the product(s) on date of shipment to Purchaser, to be of the kind and quality described, merchantable, and free of defects in workmanship and material. THIS WARRANTY IS EXPRESSLY IN LIEU OF ALL OTHER WARRANTIES FROM THE COMPANY OR THE MANUFACTURER, INCLUDING BUT NOT LIMITED TO IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS, AND CONSTITUTES THE ONLY WARRANTY WITH RESPECT TO THE PRODUCT(S) AND NO OTHER WARRANTY IS GIVEN WHICH EXTENDS BEYOND THE DESCRIPTION ON THE FACE OF THE COMPANY'S QUOTATION OR ACCEPTANCE FORM. This warranty shall remain in effect for a period of one (1) year from date of initial operation or eighteen (18) months from date of shipment, whichever is earlier. This warranty shall be null and void if Purchaser makes any alterations, additions, modifications or improvements to the product(s).

DISCLAIMER OF WARRANTY, OTHER PRODUCTS: ANY SEPARATELY LISTED ITEM OF THE PRODUCT(S) WHICH IS NOT A LOAD BANKS DIRECT LOAD BANKS BRANDED PRODUCT IS NOT WARRANTED BY THE COMPANY, and shall be covered only by the express warranty, if any, of the manufacturer thereof. As between Purchaser and the Company, such products are sold AS IS, and Company makes no warranties, express or implied, as to any matter whatsoever, including, without limitation, THE CONDITION OF THE EQUIPMENT, ITS MERCHANTABILITY, ITS DESIGN, ITS CAPACITY, ITS PERFORMANCE, ITS MATERIAL, ITS WORKMANSHIP, AND ITS FITNESS FOR ANY PARTICULAR PURPOSE. COMPANY DISCLAIMS ANY LIABILITY WHATSOEVER FOR LOSS, DAMAGE, OR INJURY TO PURCHASER OR THIRD PARTIES AS A RESULT OF ANY DEFECTS, LATENT OR OTHERWISE, IN A PRODUCT NOT MANUFACTURED BY COMPANY, AND COMPANY SHALL NOT BE LIABLE IN ANY EVENT FOR ANY
LOSS, DELAY, OR DAMAGE OF ANY KIND OR CHARACTER RESULTING FROM DEFECTS IN, OR INEFFICIENCY OF, PRODUCTS NOT MANUFACTURED BY LOAD BANKS DIRECT. NO OTHER WARRANTY IS GIVEN EXTENDING BEYOND THE DESCRIPTION ON THE FACE OF THE COMPANY'S QUOTATION OR ACCEPTANCE FORM. The Company will in respect of such goods use reasonable efforts to pass on to the Purchaser the benefit of any guarantee provided by the manufacturer or supplier of such goods but not so as to impose on the Company any liability in respect thereof.

Electrical and Mechanical Ratings

Always refer to the Load Bank Nameplate and Electrical Schematic included with this manual for specific rating information. The most common part numbers are listed below. Model and part number is listed on the Load Bank Nameplate.

LBD Part Number	Power Rating (KW)	Voltage (VAC)	Amps per phase	Load Step Res	Motor HP	Airflow CFM	SPL dB(A)
LS50-400-10T	50	400	72	10	1.5	5500	84
LS75-400-10T	75	400	108	10	1.5	5500	84
LS100-400-10T	100	400	144	10	1.5	5500	84
LS125-400-10T	125	400	180	10	1.5	5500	84
LS150-400-25T	150	400	216	25	1.5	5500	84
LS150-400-10T	150	400	216	10	1.5	5500	84
LS200-400-25T	200	400	287	25	1.5	5500	84
LS200-400-10T	200	400	287	10	1.5	5500	84
LS250-400-25T	250	400	361	25	5	12000	85
LS250-400-10T	250	400	361	10	5	12000	85
LS300-400-25T	300	400	433	25	5	12000	85
LS300-400-10T	300	400	433	10	5	12000	85
LS400-400-25T	400	400	577	25	5	12000	85
LS400-400-10T	400	400	577	10	5	12000	85
LS500-400-25T	500	400	722	25	7.5	15000	85
LS500-400-10T	500	400	722	10	7.5	15000	85

LBD Part Number	Power Rating (KW)	Voltage (VAC)	Amps per phase	Load Step Res	Motor HP	Airflow CFM	SPL dB(A)
LS600-400-25T	600	400	866	25	7.5	15000	85
LS600-400-10T	600	400	866	10	7.5	15000	85
LS700-400-25T	700	400	1010	25	10	18000	86
LS700-400-10T	700	400	1010	10	10	18000	86
LS750-400-25T	750	400	1083	25	10	18000	86
LS750-400-10T	750	400	1083	10	10	18000	86
LS800-400-25T	800	400	1155	25	10	18000	86
LS800-400-10T	800	400	1155	10	10	18000	86
LS900-400-25T	900	400	1299	25	15	20000	88
LS900-400-10T	900	400	1299	10	15	20000	88
LS1000-400-25T	1000	400	1443	25	15	20000	88
LS1000-400-10T	1000	400	1443	10	15	20000	88
LS1500-400-25T	1500	400	2165	25	2 x 10	34000	90
LS2000-400-25T	2000	400	2887	25	2 x 15	38000	92

Sound Pressure [SPL db(A)]: Sound Pressure Level is all octave band frequencies at a distance of 10 feet, using a propagation of 1/8 spherical. Sound data is calculated and should be used as a guideline only.

[M] Denotes unit comes equipped with Digital Power Meter

Single Phase Operation: Power Rating (KW), will de-rate by 50% when operated phase-phase at rated single phase voltages, and will provide up to 66% of rated load when single phase voltages are applied across all three phases.

Blower Motor Circuit Ratings: Blower Motors are 3-phase motors that can operate internally off the main input load bus or from an external power source.

Control Power Circuit Ratings: 110-120 Volts AC, 1-phase, 50/60 Hertz, 10 Amps

Operating Temperature: -20ºF to +120ºF [-29ºC to +49ºC]

Enclosure Finish: Power Coat Paint Finish

Approximate Enclosure Dimensions and Weights:

LS50-LS200: 27”W x 31”D x 52”H [685 x 790 x 1320 mm]
500 pounds [230 kg]

LS250-LS750: 40.25”W x 52.5”D x 69”H [1020 x 1335 x 1755 mm]
1400 pounds [635 kg]

LS750-LS1000: 40.25”W x 52.5”D x 92”H [1020 x 1335 x 2340 mm]
2000 pounds [910 kg]

LS1500: 40.25”W x 88”D x 92”H [1020 x 2235 x 2340 mm]
3000 pounds [1360 kg]

LS2000: 40.25”W x 88”D x 92”H [1020 x 2235 x 2340 mm]
4000 pounds [1820 kg]

NOTE: Separate supplied exhaust hood provided for LS250-LS2000
Adds 29” [740 mm] to installed height.

Specifications

Type: Stationary Outdoor Resistive Load Bank, Unity (1.0) Power Factor.

Duty Cycle: Forced Air-Cooled, rated for continuous operation.

Cooling System: Integrally mounted blower motor with high-performance, direct-driven fan blade delivers the required airflow volume (CFM) for cooling resistor load elements. Motors are 3-phase and can be operated from an external power source, or internally from the main input load bus.

Control Power: External 110-120 Volt AC, 1-phase, 50/60 Hertz, 10 Amp source

Remote Operator Control Panel: Emergency Stop (E-Stop) push button, Main Power On/Off switch, Blower Start/Stop push buttons, Master Load On/Off switch and individual Load Step Switches (KW On/Off) provided for each load step. Illuminated indicators provided for Power On, Blower On, Motor Overload, Air-Flow Failure, Over-Temperature, and Load Dump.

Automatic Load Dump circuit provides user interface provisions to the generator controls, automatic transfer switch, or building management system, to disconnect and disable all load steps from a normally closed (NC) set of auxiliary contacts. In the event of an actual power failure, all load bank load is removed from the source under test.

Remote Indication and Alarm contact closure [form-c-type normally open and normally closed] provides user interface to building management system for indication, detection, and alarm of “Air-Flow Failure”, “Over-Temperature”, and “Load Dump”.

Operator Protection and Safety Features:

- A Control Power Emergency-Stop (E-STOP) push button is provided to disable control power voltage to all operator control power circuits, including blower circuit and load application circuits.

- Operator control panel provides detection and display of Main Power On, Blower Motor On, Motor Overload, Air-Flow Failure, Over-Temperature, and Load Dump.

- Branch circuit fuse protection provides short-circuit fault protection of all load steps. Fuses are fast-acting, current-limiting type with an interrupting rating of 200K A.I.C.

- Blower Motor is short-circuit protected by current-limiting fuses and thermally protected by overload relay.
- A differential air pressure switch provides protection from loss of cooling air or insufficient airflow. The switch automatically removes all load if an airflow problem is detected. Load cannot be reapplied until sufficient airflow is present.
- An over-temperature switch is provided to monitor load bank exhaust temperature. The switch automatically removes all load if an over-temperature condition is detected. Load cannot be reapplied until the over-temperature condition is corrected.
- Operator warning and caution statements are located on appropriate access panels.

LBD-PowerDyne™ Resistor load elements provide the necessary KW load rating for each load step. PowerDyne™ Resistors are fully supported across their entire length within the air stream by stainless steel support rods which are insulated with heavy-duty, high-temperature ceramic insulators. Change in resistance is minimized by maintaining conservative resistor designs.

Load Bank Construction and Power Connections:

- The load bank enclosure is constructed of galvanized steel with powder coat paint finish with exterior stainless steel fasteners. Bolt on access panels provide a dead-front enclosure, safely enclosing all electrical and mechanical connections.

  The load bank is designed for installation and operation in an outdoor environment with sufficient fresh intake air available, while secured to a flat surface such as a roof, finished floor, or concrete pad. Cooling airflow is drawn in from the screened air-intake sides, with hot air vertically exhausted from the top of the unit away from personnel. A separate supplied screened, louvered exhaust hood provides a superior all-weather protected enclosure.

- Fork-lift channels are provided in the base for ease of lifting and handling during installation.

- All power connections including main-input load bus, external blower power, external control power, operator remote control, instrumentation, and customer interface connections are made within the enclosed relay/connection compartment. Bottom access with a removable gland plate provides “safe and sealed” ease of installation of all conduit entry cable.

- Load connections are made directly to the main input load bus bars or power distribution block. A standard Nema 4-hole pattern is provided for customer load cable connections to bus bars. All copper bus bar load connections are

plated for superior oxidation resistance.

- Relay/connection compartment is heated and thermostatically controlled to limit any harmful effects of condensation.

[Letter] Denotes Accessory

[Add letter designator to end of the load bank part number]

[A] - The Automatic Load Level Controller will add/subtract load bank load in response to dynamic power fluctuations of the connected building load. It utilizes the load bank as a "supplemental load" for maintaining a minimum load on the power source. Customer "transfer of control" contact closure initiates the load bank and time delay load application circuit. A separately supplied current transformer provides the necessary feedback signal for sensing building load.

[G] - Gravity Louver: Stainless steel exhaust air-gravity louver provided in place of fixed exhaust hood.

[L] - Local Operator Control Panel: The Remote Operator Control Panel is provided as a Local Control Panel which is mounted and wired to the Load Bank Enclosure.

[M] - Digital Power Meter: Fully equipped, 3-phase Digital Metering System that measures a standard range of 16 load parameters. Includes RS485 (Modbus protocol) for remote reading - compatible with PC, PLC, and data loggers.
See additional details at: http://www.multitek-ltd.com/HTMs/M800/M850.htm

[T] - Control Power Transformer delivers the necessary 120 Volt AC, 1-phase, 50/60 Hertz power required for control circuit operation. Control power transformer is wired to blower motor circuit and is primary and secondary fuse protected.

Parts List

The parts list in this section contains the description and part number of the typical parts used in each of the principle load bank circuits. It is intended to be used as a guide along with the electrical schematic to simplify troubleshooting and the repair process. Cross reference the electrical schematic designator with the actual parts and part numbers used within the load bank to ensure accuracy as specifications are subject to change without notice. Always refer to the Load Bank Nameplate and Electrical Schematic included with this manual for specific rating information. Contact factory for direct assistance. See Load Bank Nameplate for specific model number, part number, and serial number.

BLOWER CIRCUIT	DESCRIPTION	PART NUMBER
B1	BLOWER MOTOR, 1 HP, 400 VAC, 3-PHASE, 50 Hertz	
	BLOWER MOTOR, 1.5 HP, 400 VAC, 3-PHASE, 50 Hertz	M3550T-58
	BLOWER MOTOR, 3 HP, 400 VAC, 3-PHASE, 50 Hertz	M3611T-58
	BLOWER MOTOR, 5 HP, 400 VAC, 3-PHASE, 50 Hertz	M3616T-58
	BLOWER MOTOR, 7.5 HP, 400 VAC, 3-PHASE, 50 Hertz	M3710T-58
	BLOWER MOTOR, 10 HP, 400 VAC, 3-PHASE, 50 Hertz	M3714T-58
	BLOWER MOTOR, 15 HP, 400 VAC, 3-PHASE, 50 Hertz	M2333T-58
O/L1	RELAY, THERMAL OVERLOAD	XTOB001BC1
	RELAY, THERMAL OVERLOAD	XTOB2P4BC1
	RELAY, THERMAL OVERLOAD	XTOB004BC1
	RELAY, THERMAL OVERLOAD	XTOB006BC1
	RELAY, THERMAL OVERLOAD	XTOB010BC1
	RELAY, THERMAL OVERLOAD	XTOB012BC1
	RELAY, THERMAL OVERLOAD	XTOB016BC1
O/L 1	RELAY, OVERLOAD	XTOE045CCSS
O/L 1	RELAY, OVERLOAD	XTOE020CCSS
O/L 1	RELAY, OVERLOAD	XTOE005CCSS
F110, 111, 112	FUSE, CLASS J, 600V, 2 AMP	AJT2
	FUSE, CLASS J, 600V, 5 AMP	AJT5
	FUSE, CLASS J, 600V, 8 AMP	AJT8
	FUSE, CLASS J, 600V, 10 AMP	AJT10
	FUSE, CLASS J, 600V, 15 AMP	AJT15
	FUSE, CLASS J, 600V, 20 AMP	AJT20

	FUSE, CLASS J, 600V, 30 AMP	AJT30
	FUSE, CLASS J, 600V, 35 AMP	AJT35
	FUSE, CLASS J, 600V, 40 AMP	AJT40
K110, K111, K113-K115	CONTACTOR, MOTOR STARTER, 3-POLE,	XTCE015B10A
	CONTACTOR, MOTOR STARTER, 3-POLE,	XTCE040DS1A
K112	RELAY, DPDT, 120 VAC COIL	W92S11A22D-120
XF110-F112	FUSE, FUSE BLOCK, 3 POLE	60308SJ
	FUSE BLOCK, 3 POLE	60608J
SAFETY CIRCUITS	**DESCRIPTION**	**PART NUMBER**
S61 (O/T) OVERTEMP	THERMAL SWITCH	3L03-190
S51 (AS) AIR SWITCH	DIFFIRENTIAL AIR PRESSURE SWITCH	AFS-262-379-B
	FITTING, BULKHEAD, 1/4" FEMALE ADAPTER	B-400-71-4
	FITTING, ADAPTER STRAIGHT THERMO	SS-400-1-4
K99, K100, K101, K102	RELAY, DPDT, 120 VAC COIL	W92S11A22D-120
K-VCR	RELAY, VOLTAGE CONTROL	DUR-110A
R100	RESISTOR, 100 K OHM, 1 W	OA104K
F107-F108	FUSE, CLASS CC, 600V, 1A	ATQR1
CONTROL CIRCUITS	**DESCRIPTION**	**PART NUMBER**
F103	FUSE, CLASS CC, 600V, 5 AMP	ATDR5
	FUSE, CLASS CC, 600V, 6 AMP	ATDR6
	FUSE, CLASS CC, 600V, 7 AMP	ATDR7
	FUSE, CLASS CC, 600V, 8 AMP	ATDR8
	FUSE, CLASS CC, 600V, 10 AMP	ATDR10
	FUSE, CLASS CC, 600V, 12 AMP	ATDR12
	FUSE, CLASS CC, 600V, 15 AMP	ATDR15
XF103	FUSE HOLDER	GPM-SRR
S2, E-STOP	PILOT DEVICE, SWITCH, PUSHBUTTON "E-STOP"	M22-DRP-R-GB99
S1, MAIN POWER SWITCH	PILOT DEVICE, SWITCH, ILLUM, GREEN	M22-WLKV-G
S1, MAIN POWER ON	PILOT DEVICE, LIGHT, GREEN, 90-260VAC	M22-LED230-G
S3, BLOWER START/STOP	PILOT DEVICE, SWITCH, PUSHBUTTON, DOUBLE	M22-DDL-GR-GB1-GBO
S3, BLOWER ON	PILOT DEVICE, LIGHT, WHITE, 90-260VAC	M22-LED230-W
S1,S3 MAIN POWER/BLOWER	PILOT DEVICE, SWITCH, CONTACT, NO	M22-K10
S2,S3, E-STOP/BLOWER	PILOT DEVICE, CONTACT, NC	M22-K01

S4-BLOWER VOLT SELECT	PILOT DEVICE, SWITCH, SELECTOR	M22-WRK3
S4-BLOWER VOLT SELECT	PILOT DEVICE, SWITCH, CONTACT, NO	M22-K10
VOLT SELECT, FAN REVERSE	SWITCH, TOGGLE, DPDT (ON-OFF-ON)	7992K10
LOAD STEP SWITCH'S	SWITCH, TOGGLE, 250V, 16A (SPDT)	92B3802
M/O,O/T,A/F,LD,WV	PILOT DEVICE, INDICATOR, RED, 90-260VAC	M22-L-R-230R
LOAD STEP CONTACTORS	**DESCRIPTION**	**PART NUMBER**
	CONTACTOR, 3-POLE, 15/20 AMP, 600 VAC	XTCE015B10A
	CONTACTOR, 3-POLE, 15/20 AMP, 600 VAC	C25DND315A
	CONTACTOR, 3-POLE, 25/35 AMP, 600 VAC	C25DND325A
	CONTACTOR, 3-POLE, 30/40 AMP, 600 VAC	C25DND330A
	CONTACTOR, 3-POLE, 40/50 AMP, 600 VAC	C25DNF340A
	CONTACTOR, 3-POLE, 50/65 AMP, 600 VAC	C25DNJ350A
	CONTACTOR, 3-POLE, 60/75 AMP, 600 VAC	C25FNF360A
	CONTACTOR, 3-POLE, 75/90 AMP, 600 VAC	C25FNF375A
	CONTACTOR, 3-POLE, 90/120 AMP, 600 VAC	C25GNF390A
	CONTACTOR, 3-POLE, 120/140 AMP, 600 VAC	C25HNE3120A
	CONTACTOR, 3-POLE, 200/200 AMP, 600 VAC	C25KNE3200A
	CONTACTOR, 3-POLE, 160 AMP, 600 VAC	XTCE115G00A
LOAD STEP FUSES	**DESCRIPTION**	**PART NUMBER**
	FUSE, FAST-ACTING, 15 AMP, 600 VAC	ATM15
	FUSE, FAST-ACTING, 20 AMP, 600 VAC	ATM20
	FUSE, FAST-ACTING, 25 AMP, 600 VAC	ATM25
	FUSE, FAST-ACTING, 30 AMP, 600 VAC	ATM30
	FUSE, CLASS CC, 20 AMP, 600 VAC	ATQR20
	FUSE, CLASS CC, 25 AMP, 600 VAC	ATQR25
	FUSE, CLASS J, 35 AMP, 600 VAC	AJT35
	FUSE, CLASS T, 70 AMP, 600 VAC	A6T70
	FUSE, CLASS T, 80AMP, 600 VAC	A6T80
	FUSE, CLASS T, 100 AMP, 600 VAC	A6T100
	FUSE, CLASS T, 125 AMP, 600 VAC	A6T125
	FUSE, CLASS T, 150 AMP, 600 VAC	A6T150
	FUSE, CLASS T, 175 AMP, 600 VAC	A6T175
	FUSE, CLASS T, 200 AMP, 600 VAC	A6T200
MISCELANEOUS	**DESCRIPTION**	**PART NUMBER**
TS1	THERMAL SWITCH, NV, 15C	317-1492ND
HR1	HEATER STRIP, 100W, 120V	3619K32

F104	FUSE, 2 AMP	TRM2
XF104	FUSE HOLDER	30321
XF107-F108	FUSE, FUSE BLOCK, 2 POLE	30312R
XF107-F109	FUSE, FUSE BLOCK, 3 POLE	30313R
XF110-F112	FUSE, FUSE BLOCK, 3 POLE	60308SJ
	FUSE BLOCK, 3POLE	60608J
TB2	TERMINAL BOARD, 3P, 30A	6ZEJO
TB1	TERMINAL BLOCK, END BLOCKS	11511607
XTB1	TERMINAL BLOCK, END BLOCKS	20635116
XTB1	TERMINAL BLOCK, END BLOCKS	11836816
XTB1	GROUND BLOCK	16511417
POWER METERING	**DESCRIPTION**	**PART NUMBER**
M1	PILOT DEVICE, METER, MULTIPOWER	M850-JB69
F107-F109	FUSE, CLASS CC, 600V, 1A	ATQR1
CT1, CT2	CURRENT TRANSFORMER	SEE SCHEMATIC
CONTROL TRANSFORMER	**DESCRIPTION**	**PART NUMBER**
T1	TRANSFORMER, 250 VA, 400:115 VAC	
	TRANSFORMER, 500 VA, 400:115 VAC	E500TC
	TRANSFORMER, 1000 VA, 400:115 VAC	CE1000TH
F100, F101, F102	FUSE, CLASS CC, 600 VAC, 3 AMP	ATQR3
	FUSE, CLASS CC, 600 VAC, 4 AMP	ATQR4
	FUSE, CLASS CC, 600 VAC, 5 AMP	ATQR5
	FUSE, CLASS CC, 600 VAC, 8 AMP	ATQR8
	FUSE, CLASS CC, 600 VAC, 10 AMP	ATQR10
XF100-F101	FUSE, FUSE BLOCK, 2 POLE	30312R
XF100-F102	FUSE BLOCK, 3-POLE	30313R
AUTO LOAD CONTROLLER	**DESCRIPTION**	**PART NUMBER**
CT100	CURRENT TRANSFORMER	SEE SCHEMATIC
AUTO/MANUAL SWITCH	TOGGLE SWITCH DOUBLE THROW	7992K10
AUTO INDICATOR	PILOT DEVICE, INDICATOR, GREEN, 90-230VAC	M22-L-G-230G
K-CCR	CURRENT CONTROL RELAY	DIRT-110A
TD	TIME DELAY RELAY	822TD10H-UNI
K200	CONTROL RELAY	XTCE015B01A
XK200	CONTACT BLOCK	XTCEXFAC22
K201-K202, K203-K204	RELAY, DPDT, 120 VAC COIL	W92S11A22D-120

Appendix – Drawings and Multi-Power Meter Quick Start Guide

PROPRIETARY

The Dimensional Outline Drawings, Electrical Schematics and Interconnection Drawings included with this manual are the property of Load Banks Direct LLC, and shall remain so while in user's possession. The information is provided for the instruction, operation, maintenance and service of this equipment and not to be used for manufacturing or procurement of equipment from any source other than Load Banks Direct LLC. The technology shown here is strictly proprietary and is not to be disclosed to any 3rd party without prior consent and the express written permission of Load Banks Direct LLC.

- **Multi-Power Meter Quick Start Guide**
- **Load Bank Dimensional Outline Drawing**
- **Load Bank Electrical Schematic and Interconnection Drawing**

Note: If Load Bank Part Number is not listed in the Electrical and Mechanical Ratings table of this manual, it is a custom engineered to order product. The part number specific electrical schematic and top level bill of material included with this manual should always be used for specific rating information and as the reference parts list.

Always refer to the Load Bank Nameplate and Electrical Schematic included with this manual for specific rating information. Load Bank Model, Part Number, and Serial Number are listed on the Load Bank Nameplate.