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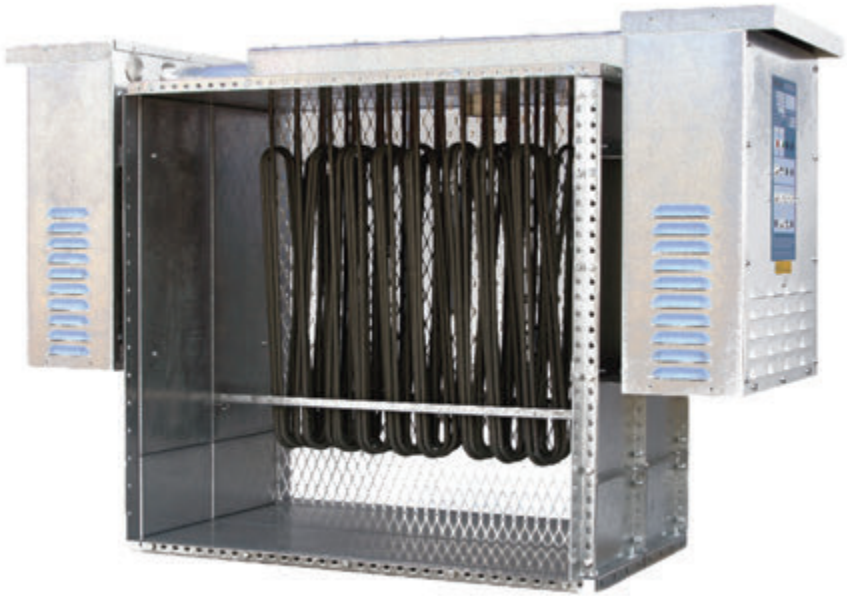

LBD

DUCT-MOUNTED LOAD BANK

Last Revision Date: June 8, 2021

For the most up-to-date information for this product and others, please contact Simplex, Inc. at (800) 637-8603 or visit us on the web at http://www.simplexdirect.com.

Many of the illustrations and instructions in this manual refer to the standard configuration for this product. If you have requested customizations, the drawings provided with your order take precedence; please refer to them for details specific to your order.

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1 WARNINGS AND CAUTIONS

Safety information symbols

The following images indicate important safety information:

This **General** warning symbol points out important information that, if not followed, could endanger personal safety and/or property.

This **Explosion** warning symbol points out potential explosion hazards.

This **Fire** warning symbol points out potential fire hazards.

This **Electrical** warning symbol points out potential electrical shock hazards.

Cautions

This load bank is high-powered, technical, industrial equipment operating at dangerous voltages and temperatures. It is capable of damaging itself, property or personnel if improperly used. It is not a consumer product.

It must be installed, connected and operated by personnel properly trained and experienced in its use. An operator's manual is supplied with each load bank and available online at www.simplexdirect.com. The operator must be familiar with its contents and have access to it during operation.

- **High Voltage:** Turn off and disconnect power source before opening this equipment
- **High Temperature:** Allow hardware to cool before servicing or opening this equipment.
- **Rotating Equipment:** Ensure that the fans have stopped before opening this unit.
- **For Operator Safety:** Make sure this equipment is properly grounded when in use.

All compression-type connections on fuse blocks, load blocks, and contactors should be checked for tightness frequently. This check should be established as part of routine maintenance.

The following cautions should be observed before and during operation:

- Check intake and exhaust screens as well as fan and load elements for foreign objects.
- Position and install the load bank with consideration given

to large cubic airflow requirements, exhaust temperature, and velocity. Do not point exhaust at any nearby surface or object that may be adversely affected by high temperature. This includes but is not limited to painted surfaces, tar paper and asphalt roofs, water sprinkler heads, fire alarms, and volatile material.

- Do not use in confined spaces. The load bank may have to compete with cooling air requirements of a nearby running engine generator set where cooling air intake to a confined space may not be adequate for both engine and load bank. Be especially careful not to bounce hot exhaust air off nearby obstructions for re-circulation through the load bank.
- Verify that all control switch positions are set correctly for your intended usage before connecting the load bank to the source to be tested.
- The load cables carry high amperage. Be constantly aware of possibility of inductively heating adjacent ferrous objects to temperatures sufficient to damage cable insulation.
- Always connect the safety ground cable to a proper ground. Do not rely on a possible grounded neutral somewhere else in the system.
- Routinely inspect all components and electrical connections for tightness and integrity.
- Repair any damaged or degraded components and wiring without delay.
- If technical assistance, service, or parts are needed, please call 800-637-8603 (24 Hours).
- All hardware covered by this manual have dangerous electrical voltages and can cause fatal electrical shock. Avoid contact with bare wires, terminals, connections, etc. Ensure all appropriate covers, guards, grounds, and barriers are in place before operating the equipment. If work must be done around an operating unit, stand on an insulated dry surface to reduce the risk of electrocution.

- Do not handle any kind of electrical device while standing in water, while barefoot, or while your hands or feet are wet.
- If people must stand on metal or concrete while installing, servicing, adjusting, or repairing this equipment, place insulative mats over a dry wooden platform. Work on the equipment only while standing on such insulative mats.
- The National Electrical Code (NEC), Article 250 requires the frame to be connected to an approved earth ground and/or grounding rods. This grounding will help prevent dangerous electrical shock that might be caused by a ground fault condition or by static electricity. Never disconnect the ground wire

while the load bank is in use.

- Wire gauge sizes of electrical wiring, cables, and cord sets must be adequate to handle the maximum electrical current (ampacity) to which they will be subjected.
- Before installing or servicing this (and related) equipment, ensure that all power voltage supplies are completely turned off at their source. Failure to do so can result in hazardous and possibly fatal electrical shock.
- In case of accident caused by electric shock, immediately shut down the source of electrical power. If this is not possible, attempt to free the victim from the live conductor. AVOID DIRECT CONTACT WITH THE VICTIM. Use a nonconducting implement, such as a dry rope or board, to free the victim from the live conductor. If the victim is unconscious, apply first aid and seek immediate medical attention.
- Never wear jewelry when working on this equipment. Jewelry can conduct electricity resulting in electric shock or may get caught in moving components causing injury.
- Keep a fire extinguisher near the hardware at all times. Do NOT use any carbon tetra-chloride type extinguisher. Its fumes are toxic, and the liquid can deteriorate wiring insulation. Keep the extinguisher properly charged and be familiar with its use. If there are any questions pertaining to fire extinguishers, please consult the local fire department.

- The illustrations in this manual are examples only and may differ from your load bank.

- Load Bank warranty is void if incorrectly cooled.

2 DESCRIPTION AND SPECIFICATION

Because each LBD unit is custom-designed, it is impossible to provide specifications here. Please consult your electrical drawings package for capacities, etc.

Simplex LBD Series load banks are a special form of stationary, resistive, forced air-cooled load banks that use the air outflow of an engine radiator to cool the load elements. They are used to apply discrete, selectable electrical load to a power source while measuring the response of the generator. They also provide a means for routine maintenance exercise to assure long-term reliability and readiness of the standby generator.

Exercise load banks eliminate the detrimental effects of unloaded operation of diesel engine generators. Simplex LBD Series load banks are intended for use with water-cooled engine generator sets equipped with unit-mounted radiators. These load banks are built per customer specifications and can be installed in numerous ways, including directly bolted to the radiator, installed within an air duct, or mounted over the air outflow opening.

Safety

The control panel can contain the following controls and indicator lamps:

1. Over Temperature, Load Dump, and Normal Operation lamps
2. Control Power switch and/or pushbutton
3. Manual Load and individual load step switches

This load bank is protected against cooling failures (high exhaust air temperature which could damage the load bank or present a safety hazard to the operator). The "Normal Operation" lamp illuminates when control power is available and the cooling system is operating properly. When a cooling failure occurs, the automatic safety features in the control system immediately remove the load from the test source and illuminates the "Over Temperature" lamp. The malfunction must be corrected and the load bank must be reset by turning the load bank "Off" then "On" before the load can be re-applied.

These load banks utilize either Simplex Powr Rod or Simplex Powr-Web load elements. See Parts Legend Drawing for specific elements used.

Powr Rod load elements

Simplex Powr Rod load elements are totally enclosed, sealed, and weatherproof. UL-recognized Powr Rod elements consist of nickel-chromium resistance wire electrically insulated and sealed within a metallic sheath. The hazard of electric shock to personnel and the danger of short circuit by foreign object penetration are reduced because the current does not reach the outside of the elements. Powr Rod load elements will not fatigue from engine or air-blast vibrations and will not sag or stretch if overheated. The sheath material is "incolloy", a rustproof nickel alloy with a very high temperature rating (1600°F). These elements do not require a cooldown period.

Figure 1 Powr Rod load elements

Powr-Web load elements

Simplex Powr-Web load elements are UL recognized. These elements conservatively operate at approximately half the maximum temperature rating of the alloy (1080°F vs. 1920°F).

These elements are rigidly supported by high-temperature, ceramic-clad, stainless-steel supports. Element-to-element short circuits are virtually eliminated.

Figure 2 Powr-Web load elements

3 UNPACKING

Included components and parts

The following items are included with your load bank. If any of the following are not included, please contact Simplex Direct, Inc., at 800-637-8603.

1. Load bank
2. Manual
3. Electrical drawings package

Primary inspection

Preventative visual inspection of the shipping crate and the load bank is advised. Physical or electrical problems due to handling and vibration may occur. Never apply power to a load bank before performing this procedure. The following five-point inspection is recommended before installation and as part of a 6-month maintenance schedule or as a load bank is relocated:

If any problems are observed during Primary Inspection, call Simplex 24 hours a day at 800-637-8603

1. If the crate shows any signs of damage, examine the load bank in the corresponding areas for signs of initial problems.
2. Check the entire outside of the cabinet for any visual damage, which could cause internal electrical or mechanical problems due to reduced clearance.
3. Inspect all relays and control modules. Make sure all components are secure in their bases and safety bails are in place. Spot check electrical connections for tightness. If any loose connections are found, inspect and tighten all remaining connections.
4. Examine all accessible internal electrical components such as fuses, contactors, and relays. Check lugged wires at these components.
5. Visually inspect the element chamber for foreign objects, broken ceramic insulators, and mechanical damage.

1. Using the flanges provided, attach the load bank with bolts per specifications. Bottom support for the load element enclosure is recommended.
2. Ensure the test source is properly grounded.
3. Ground the load bank to an independent ground.
4. Ensure all load switches are in the "Off" position.
5. Per load connection drawings, cable the load source to the load bank. Consult NEC for proper wire size. When cabling the load bank to the test source, pull Load Bank access holes and install conduit connectors and conduits as needed.
6. Connect customer-supplied contacts to load dump terminals shown on electrical drawing or jumper if not used.
7. Per drawings, connect customer-supplied alarm contacts.

INSTALLING CURRENT TRANSFORMERS

If your load bank is equipped with Metering or Automatic Mode, you will have to install current transformers on your power cable. The current transformers must be placed and oriented correctly to ensure they accurately detect the current.

Figure 3
CT orientation

- For metering mode, install the current transformers on the load bank leg of your power system (see **Figure 4 on page 10**.)
- For Automatic Mode, install the current transformers on the power source leg of your power system (see **Figure 5 on page 10**.)

Orient the current transformers so that the XI or HI on the ring is facing the power source (**Figure 3**.) If multiple current transformers are installed, ensure that they face the same way.

When the current transformers are installed, connect them to the load bank as specified in the electrical drawings package.

Figure 4 Current transformer placement for metering

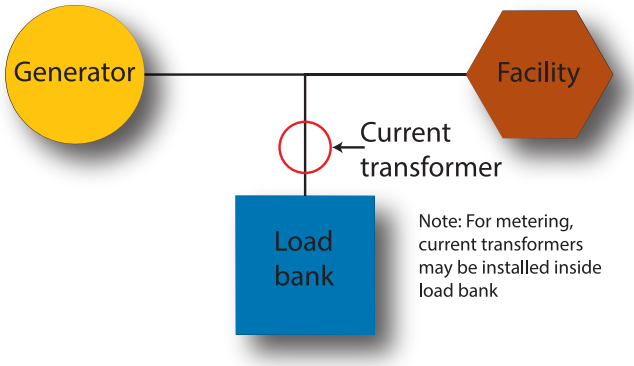
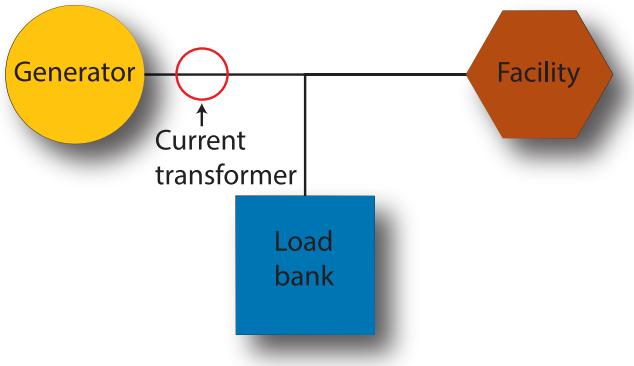


Figure 5 Current transformer placement for Automatic Mode



5 SETUP-DIGITAL

If your LBD has a digital interface, or HMI, you will need to set up certain aspects of the unit before using it. You can access the Setup screen from the Main Screen by pressing the F5 button. If prompted for a password, enter 62711.

On the first Setup screen, you can change eight values:

1. **Cooldown Delay:** Not used.
2. **Current Transformer:** Set the Current Transformer Ratio. Consult a Simplex engineer if you are unsure how to do so.
3. **Resolution:** Sets the load step resolution of the unit, measured in kilowatts. Generally is equal to the size of the smallest load step.
4. **# of Steps:** Set to the number of load steps in the unit.
5. **Total KW:** Set to the total capacity of the unit.
6. **Auto Startup Delay:** Determines how long the unit will wait before entering Auto Regulate mode.
7. **Min KW:** Sets the lowest load the unit will keep on the power source.
8. **Max KW:** Sets the highest load the unit will keep on the power source.

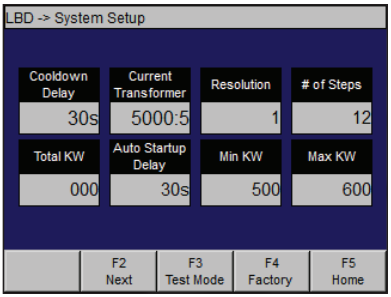


Figure 6 Setup screen 1

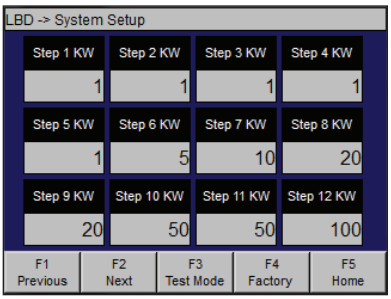


Figure 7 Setup screen 2

Pressing F2 or "Next" brings up the second setup screen (Figure 7). Here you can set the load capacity in kilowatts for each step, if necessary.

If you have purchased the automatic mode, pressing F2 or "Next" again will bring up the third and final setup screen, which has the settings necessary for reverse power protection mode.

How reverse power protection works

To configure a load bank for reverse power protection, you must install current transformers near the motor being monitored. These will detect when the motor generates electricity. For more information, see **"Installing current transformers" on page 9**.

To protect against reverse power generation, the load bank watches for the power to drop below four checkpoints, called Banks 1-4. Banks 1 and 2 can be any value up to the generator's maximum. Bank 3 should always be 0KW. Bank 4 should be a negative number (see **Figure 8**).

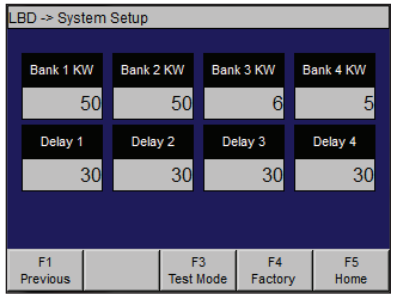


Figure 8 Setup screen 3

Regenerative Mode works as follows:

1. The load bank monitors the load near the motor through current transformers.
2. When the load, measured in kilowatts, drops below Bank 1, the load bank waits for the duration of Delay 1, then generates 25% of its capacity.
3. If the load continues to drop past the Bank 2 checkpoint, the load bank waits for the duration of Delay 2, then generates 50% of its capacity.
4. If the load drops below 0KW, meaning the motor is generating power, the load bank immediately begins generating 75% of its capacity.
5. If the load continues to drop and crosses the Bank 4 threshold, which is a negative number, the load bank begins generating 100% of its capacity.
6. If the load then begins to increase and crosses the Bank 4 checkpoint, the load bank waits for the duration of Delay 4 and drops to 75% of its capacity.
7. Similarly, if the load rises past the Bank 3 threshold, the load bank waits for the duration of Delay 3 and drops to 50% of its capacity.
8. As the load continues to increase and passes Banks 2, the load bank will drop to 25% of its capacity immediately.
9. When the load passes Bank 1, the load bank will immediately drop to 0%, no longer generating load.

6 OPERATING INSTRUCTIONS-ANALOG

1. Before operating the load bank, ensure that the unit is wired properly based on the instructions from **"Installation" on page 9**.
2. Start up generator or otherwise bring test source on line.
3. Adjust power source voltage and frequency.
4. Place the "Control Power" switch in the "On" position or press the "On" pushbutton (see **Figure 9**).
5. Make sure the "Normal Operation" lamp comes on before proceeding.

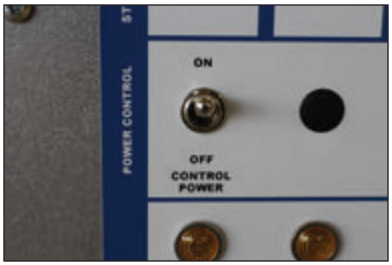


Figure 9 Control power switch

MANUAL OPERATION

1. Select the desired load steps by placing them in the "On" position. LBD load banks equipped with only manual control have two-position load step switches: "On" and "Off". LBD load banks equipped with Manual and Automatic Control have three-position load step switches: "Auto", "Off" and "Manual" – or – a Mode Selector switch with the following positions: "Auto", "Off", and "Manual" and load step switches with "On" and "Off" positions (see **Figure 10**).
2. Place the "Manual Load" switch, if equipped, in the "On" position. This simultaneously applies all of the load steps which are in the "On" position. Trim is achieved by flipping the load steps "On" and "Off" while the "Manual Load" is in the "On" position.
3. Adjust source voltage and load.

Figure 10 Three-way switch

Automatic operation (if equipped)

To put the load bank in automatic mode, set the load step switches in the "Auto" position or the Mode Selector Switch in the "Auto" position. In Automatic Mode, the unit automatically applies load as needed to prevent the generator from "wet stacking" or being damaged by reverse power generation.

Load dump

Most load banks contain a load dump feature, which de-energizes all applied load when customer-supplied contacts open.

If desired, the customer may install automatic transfer switch contacts, a manual push-button or circuit breaker for this use. If you do not want to enable the load bump feature, install a jumper between the contacts specified in your electrical drawings package.

Changing the step up/step down delay

On load banks without an HMI, you can change the Step Up/Step Down delay using the load step switches. Simplex ships LBD load banks without HMIs preset to a 5-second delay.

The load step numbering may not correspond to the load it will apply. Check your control panel nameplate for step numbering.

1. Ensure the load bank is inactive by taking it out of both manual and automatic modes.
2. Turn the load bank's control power and master manual load switch on.
3. To ensure accuracy, while the load bank is off and either the generator is running or an external control power source is available, turn the highest-numbered load step on and off again to reset the delay to 1 second.
4. Turn the Step 1 load step on and off again to increase the Step Up/Step Down delay by one second to a maximum of 10 seconds, after which it returns to 1 second. Repeat until you have reached your desired delay.
5. If you need to reset the Step Up/Step Down delay, turning the highest-numbered load step on and off again will reset the delay to 1 second. Repeat step three until you have reached your desired delay.

7 OPERATING INSTRUCTIONS-DIGITAL

Operating the load bank

Before operating the load bank, ensure that the unit is wired properly based on the instructions from "Installation" on page 9.

When turning on the load bank, you will start on the main screen (See Figure 11.)

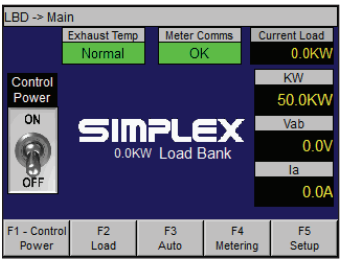


Figure 11 Main screen

Applying a load

To conduct an operation, turn on the control power by pressing the "Control Power" switch on the screen, the F1 - Control Power button, or the F1 function key. This will turn on the load bank and its fan.

The load bank applies loads based on its step resolution. If you enter a value the unit cannot apply, it will apply the closest load it can without exceeding the value you entered. For example, if you enter 64.9KW on a load bank with a step resolution of 5KW, the load bank will apply 60KW.

Press the F2 Load button or the F2 function key to go to the Manual Load Entry screen (see Figure 12.) Here you can enter a load value and apply it.

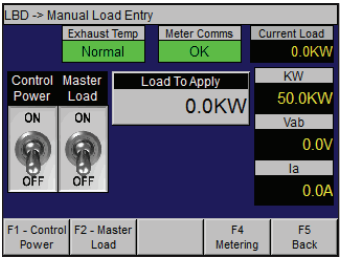


Figure 12 Manual load entry screen

To begin applying a load, press the Master Load switch on the screen, the F2 - Master Load button, or the F2 function key. Then press the Load To Apply field on the HMI screen. A numeric keyboard will come on the screen (see "Figure 13 Numeric keypad" on page 15.) Type in the load you wish to apply, measured in kilowatts, and press ENT. If you make a mistake entering the load, you can press BS to backspace over a value, CLR to clear the field and type a new number, or ESC to return to the previous screen without changing the applied load.

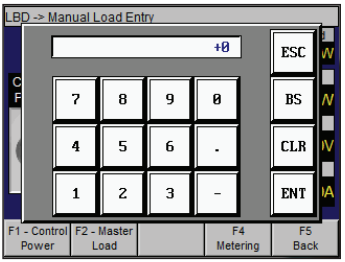


Figure 13 Numeric keypad

To change the load being applied, press the Load to Apply field again and enter a new value.

Block loading

To conduct a block load test, simply enter the load as described above before activating the Master Load switch.

Ending an operation

When your operation is concluded, press the Master Load switch on the screen, the F2 - Master Load button on the screen, or the F2 function key to remove the load from the source. To turn off the load bank, press the Control Power switch on the screen, the F1-Control Power button on the screen, or the F1 function key.

Metering (if equipped)

If your load bank has the Metering option installed, you can monitor the aspects of the power generated by the source as measured by the load bank by pressing "F4 Metering" on the screen or the F4 function key. On the Metering screen, you can see the voltage and amperage of the power source in the first two rows, as well as the kilowatts being generated, the power factor, and the frequency of the power (see **Figure 14**.) Pressing "F4 Back" or the F4 function key will return you to the main screen.

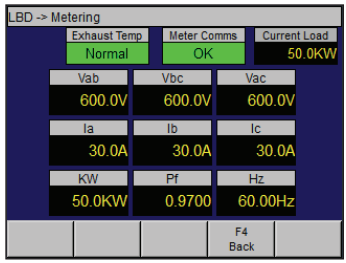


Figure 14
Metering screen

Auto mode (if equipped)

If your load bank is equipped with Automatic Mode, you can access auto mode by pressing F3 on the main screen.

From this screen, you can activate Auto Mode by pressing F2 or flipping the switch on the screen. The interface will tell you when the load bank is Stepping Up and Stepping Down.

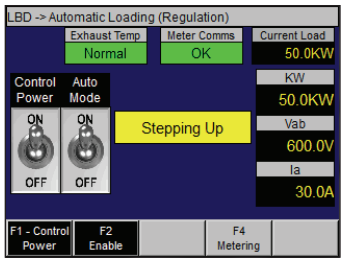


Figure 15 Auto mode screen

Once set, the unit can remain in Auto Mode indefinitely.

8 ALARMS AND WARNINGS

COOLING FAILURE SUBSYSTEM

If the load bank exhaust exceeds a safe temperature, the unit will trigger an Over Temperature alarm, dump the load, and lock out all load steps. The load bank can not be used until the problem is fixed and the unit is turned off and back on.

Unresolved cooling issues may result in damage to the load bank.

The most likely causes of an Over Temperature failure include debris on the intake louvre and an excessively high ambient temperature. Consult **"Table 1 Troubleshooting" on page 20** for directions on how to clear the error.

9 MAINTENANCE/TROUBLESHOOTING

General Maintenance

Simplex load banks are designed to require minimum maintenance. All components have been chosen for a long, reliable life. Most problems can be avoided by simply keeping the control panel enclosure clear of any debris or foreign objects and ensuring all electrical connections are tight.

Remove all power before servicing the load bank.

Tighten the electrical connections:

1. After the first use
2. After the fifth use
3. Every 6 months thereafter

Every 6 Months

- Check the air intake screens and louvers, fan and cooling chamber, and exhaust openings for any obstructions or foreign objects.
- Check the exhaust vent for obstructions
- Check the load branches for blown fuses or opened load resistors.

To check the fuses or load resistors, operate the load bank from a balanced 3-phase source and check the three line currents. The three current readings should be essentially the same. If a sizable difference is noted, one or more load fuses or load resistors may have malfunctioned.

Visually inspect the wiring and contactors in the control panel area and wiring in the load element trays for signs of loose connections. Indications of loose connections include:

1. Discolored wires
2. Black or white discoloration on contactors
3. Signs of electrical arcing.

For a comprehensive inspection, operate the load bank for five minutes, then shut it off and conduct a thermal scan of the control panel area. Loose connections will show up as bright areas on the thermal scan.

Trouble Shooting

This section is designed to aid the electrical technician in basic troubleshooting. All of the problems listed can be verified with a basic test meter and/or continuity tester. For safety reasons, when troubleshooting Load Bank systems always remove all test source power, control power, anti-condensation heater power, etc.

Table 1 Troubleshooting

Problem	Solution
Cooling failure indicated	Clear intake and exhaust vents of any debris Make sure ambient temperature isn't too high to allow for cool air flow Ensure load bank was not installed too close to generator or any other source of exhaust
Some load steps inoperative	Check for broken fuses Check for loose connections Ensure all relays and contactors are operative

Contact Simplex
for all your Load Bank and Fuel Supply needs.

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800-637-8603
www.simplexdirect.com