Part Number LSH50 969209

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AVTRON MODEL LSH
OUTDOOR RESISTIVE LOAD BANK
Part Number LSH50 969209

50 kW @ 480 VAC, 3-Phase, 60 Hz.
5 kW Resolution

Cleveland, Ohio

March 5th, 2013

AVTRON LOADBANK, INC.
Cleveland, Ohio

AVTRON MODEL LSH
OUTDOOR RESISTIVE LOAD BANK
Part Number LSH50 969209

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AVTRON MODEL LSH
OUTDOOR RESISTIVE LOAD BANK
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SECTION I

SAFETY CONSIDERATIONS

Throughout this manual, you will find **WARNING** and **CAUTION** statements. Personal injury or death may occur to an operator using or repairing the equipment if a **WARNING** statement is ignored. Damage to the equipment and potentially hazardous conditions for personnel may occur if a **CAUTION** statement is ignored.

Each Avtron unit is safety checked for opens and shorts, and the insulation is high potential tested to ensure safe operation. All fuses, safety interlocks, and related safety equipment have been tested as part of the testing procedure of each unit.

As part of your safety program, an initial inspection after receiving the unit(s) and periodic preventive maintenance and safety inspections should be conducted to ensure the reliability and safety built into your Avtron equipment.

The Model LSH Load Bank is an industrial test unit designed to be used outdoors safely. However, because the function of the Load Bank is to dissipate electrical energy, there are inherent dangers to the operators and to the equipment. These dangers shall be outlined in this section.

Electrical energy is transformed into heat by the resistors. This heat must be removed from the Load Bank by the cooling blower. If there is any restriction or stoppage of airflow, the Load Bank may overheat and may even start a fire. Follow the recommendations below to help prevent injuries, death, or damage to equipment.

1. The operator should read the manual before using Load Bank.

2. Run an approved ground conductor from the Load Bank ground lug to the generator frame. Run an approved ground conductor from the generator frame to a good earth ground. Size ground wire in accordance with National Electrical Code and any local codes.

3. Do not bypass the AIRFLOW safety switch or overtemperature safety switch to prevent nuisance tripping. The switches drop the load if insufficient air is reaching the load elements.

4. Replace any burned out bulbs on the Control Panel. Each lamp is an indication that a system is active or has failed and is important to the operation of the Load Bank and safety of the operator.
5. Maintenance personnel must always exercise caution when access panels are removed. Personal injury from electrical shock or from the moving blower blade may result if all sources of power are not disconnected before servicing. Maintenance work must be done only by qualified personnel.

6. Do not allow exhaust air to recirculate through the Load Bank. If mounted on a roof, make sure the hot exhaust will not damage the roofing material.

7. Venting the heated air from the exhaust toward overhead cables, toward sprinkler systems, or into a room with insufficient volume or "Make-Up" air is a potential hazard.

8. Do not direct the hot exhaust air to other equipment (Load Banks, air conditioners, etc.). Install the unit where the exhaust will be flowing in the direction of the prevailing winds.

9. After running a load test, residual heat may be removed from the Load Bank by allowing the blower to operate for a few minutes after load is removed. This procedure is not required for maintaining Load Bank integrity, but it may guard operating personnel from possible burn injuries.

10. The operator should avoid coming in contact with the resistor elements or surrounding covers during and for some time after operation. These portions of the Load Bank become quite hot and may result in a serious burn should contact be made with them.

11. Do not allow objects to enter or block the air intake or exhaust of the Load Bank. A blockage will cause Load Bank overheating. If an object enters the screens, it will cause damage to the resistor elements, possibly shorting them and causing shock and fire hazards.

12. Operators must not operate the Load Bank with the access panels or screens removed and doors open. To do so would expose the operator and other persons to possible personal injury from electrical shock or from the moving fan blade. With portable units, do not leave the unit unattended during testing or conduct tests with the unit on an inclined surface.

13. Emergency shutdown procedure:

    A. In an emergency, shut down the MASTER LOAD switch, then the generator. The MASTER LOAD switch will allow disconnection of all load steps and still allow for the motor to run, cooling any heated elements.

    B. The POWER ON/OFF switch will disconnect both load steps and fan motor. The Generator Emergency OFF switch should be located near the load system.

14. An approved electrical fire extinguisher should be on hand at all times.

15. It is the responsibility of the customer to take diligent care in installing the Load Bank. The National Electrical Code (NEC), sound local electrical and safety codes, and the Occupational Safety and Health Act (OSHA) should be followed when installing the equipment to reduce hazards to persons and property.
16. Read and heed all **WARNING** and **CAUTION** statements in this manual.

SECTION II

DESCRIPTION

The Avtron Model LSH Load Bank is an outdoor unit designed to absorb a balanced resistive load of unity power factor, at 480V, 3-phase, 60 Hz. The total load capability is 50 kW. Load steps are 5, 10, 10, and 25 kW. Using the toggle switches on the Control Panel, any combination of the available load steps may be selected to achieve a desired load.

The LSH50 969209 Load Bank contains a 1 H.P. blower motor that operates from the load input source, and provides the necessary cooling air for the load elements. The blower motor is controlled by a motor starter contactor. Overcurrent protection is provided by three fuses and an overload relay. The overload relay assembly must be reset manually. The blower air delivery is 5000 CFM at 3/4 inch of static pressure.

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C A U T I O N

This Load Bank should never be used without the Fan Blower Motor operating. Inadequate cooling airflow will result in resistor elements overheating and a definite fire hazard.

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An AIRFLOW switch is provided to monitor the flow of cooling air. This differential pressure switch is electrically interlocked with the load application controls to prevent load application if the blower is not working properly (AIR FAILURE light comes on).

Overtemperature switches are provided to monitor the exhaust cooling air. These switches are electrically interlocked with the load application controls to prevent load application in the event of an overtemperature condition.

Control power is derived from an integral 480:120 volt control transformer that derives its source voltage from the blower input terminals.

The Control Panel contains a control POWER ON/OFF switch, a CONTROL POWER light, a BLOWER POWER light, an AIR FAILURE light, an AUTO/MANUAL switch, an AUTO ON light, a MASTER LOAD ON-OFF switch, blower power START and STOP pushbutton switches, and individual load step switches. All load step switches are the toggle type with metal levers. The Control Panel also contains a fuse for the control circuit.

The Control Panel is mounted locally on the top of the Load Bank.

The LSH Load Bank is fabricated using heavy-gauge aluminized sheet steel, making a rigid structure. Mounted within the structure are the load element resistors and the cooling blower. The resistive elements are porcupine type, fully supported along their length. Mounted within the enclosure are the necessary load step contactors, motor starter, motor overload relay, fuses, and customer connection terminals. The cooling air is drawn in from the sides on one end, forced across the resistor elements, and exhausted out the opposite end. The control section has a temperature controlled heater that may be used to prevent condensation from hindering operation of the Load Bank.

The unit is equipped with a louver mounted on the exhaust opening and a screened cover mounted on the inlet opening that provide protection for the motor and resistor assembly from the weather. Bolt holes are supplied in the forklift channels to permit permanent mounting to a pad.

****

C A U T I O N

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

Do not apply DC voltages as the contactors do not have arc blowout magnets.

****

Lower voltages and different frequencies may be applied to the load circuit of the Load Bank. Frequency change causes no derating of the load; however, the applied kW with a lower voltage is computed with the following formula:

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

****

C A U T I O N

The blower circuit is factory wired to the load circuit connection. Lower voltages and different frequencies may not be applied to this circuit.

If load testing requires lower voltages or different frequencies, the blower circuit must be disconnected and run from a separate source at rated voltage and frequency.

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SECTION III

INSTALLATION

BEFORE INSTALLATION

Inspect the Load Bank for obvious damage such as broken wires, broken or dented panels, cracked ceramic insulators, or any other component breakage that may have occurred in shipment.

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W A R N I N G

It is vitally important to install the Load Bank properly. Installation errors may result in a catastrophic failure. The AIRFLOW switch, a protective device in the Load Bank, will guard against some of these problems. If protective circuitry prevents application of the load, determine the source of the problem. DO NOT DISABLE the AIRFLOW SWITCH. This will cause a safety hazard and will void our warranty. The following installation instructions are critical to the safe operation of the Load Bank. Refer to the SAFETY CONSIDERATIONS section of this manual.

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LOCATION

The Load Bank must be used in a cool, well-ventilated area. It must be installed where cool air is continually available and where hot exhaust air will not be recirculated through the Load Bank. If the Load Bank is operated in a closed space, ventilation of 6,000 CFM or greater is required.

The unit must not be installed near any equipment, wiring, or plumbing which may be damaged by high air temperatures or which may constitute a fire hazard. Care should also be taken so as not to set off a sprinkler system by exposing it to hot exhaust air.

Do not install the Load Bank in any area where standing water can pool or accumulate. Do not install near: a drainage basin, surface/ground or roof runoff, sewer collection, or any location where water can back up or collect. If flooding can occur, we recommend a different location or a raised platform

sufficiently above high water level. Do not operate if any portion of the Load Bank is submerged. Always install above grade.

The Load Bank should be mounted outdoors in a free field. A prerequisite to approval of site location is to read the next section titled AIRFLOW CONSIDERATIONS. If the installation dictates mounting in close proximity to any external or adjacent device, transformer, generator set, building, structure or protuberance, follow these guidelines:

1. Position the Load Bank with a minimum of 6 feet of clearance on both sides. This is in line with the airflow to allow access for service (Figure 3-1).

2. The inlet requires a free unobstructed hemispherical zone. The radius of this sphere must be at least 6 feet. Refer to Figure 3-1. If a unit is backed into a corner, the 6 feet is no longer sufficient. Consult Avtron Engineering to review prior to installation. The intake must not ingest heated air from another source. The maximum ambient intake air temperature is 120ºF.

3. Provide a minimum of 4 feet from any obstruction for exhaust clearance to prevent air restrictions and to limit air recirculation. For thermal considerations, provide a minimum clearance of 15 feet from any temperature sensitive object. The heated exhaust air stream will damage temperature sensitive items if they are positioned within the 15 foot clearance area. Refer to Figure 3-1.

4. Load Banks mounted into a channel, trough, hollow, well, pit, or exhausting into a full wall or corner require special considerations even if the above conditions are met. In these cases, provide detailed site layout drawings to Avtron for inspection and comments.

5. Locations which have full or partial perimeter fence necessitate a review. The fencing material should have at least 75% open area. The 6 foot minimum side clearances shown in Figure 3-1 still apply. Clearance on intake and exhaust can be adjusted only after approval by an authorized Avtron representative. Painted or plated metal chain link fence is the preferred material. All nonmetallic fencing materials are not recommended.

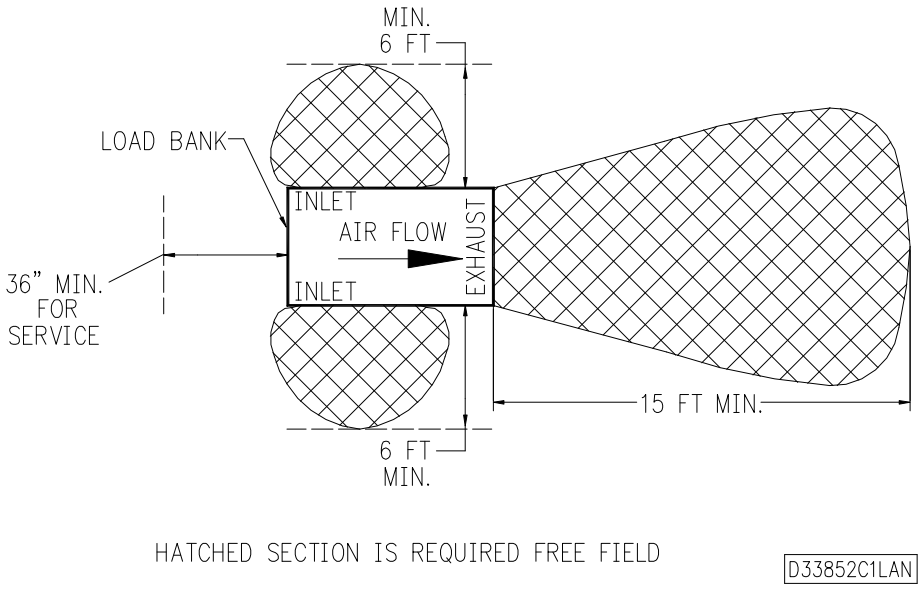

Figure 3-1. Load Bank Installation Airflow Clearance Requirements

ADDITIONAL LOCATION NOTES

1. Do not stack, tier, or layer Load Banks without Avtron approval, as air recirculation will occur.

2. Indoor installations will always require review. Make up air must be by a supplemental air moving device. The Load Bank cooling system cannot be used for any purpose other than cooling the Load Bank.

3. In northern climates with snow depths exceeding 6 inches, a physical inspection of the Load Bank intake and exhaust is required prior to operation. Any significant snow drifts or snow depths must be cleared prior to operation.

4. Standard Load Banks are designed for operation between sea level and 2,000 feet maximum altitudes. Operation at altitudes over 2,000 feet above sea level requires special consideration. Contact Avtron for assistance.

5. In general, these guidelines also apply to portable or trailer mounted Load Banks.

FAILURE TO FOLLOW THESE GUIDELINES WILL VOID THE WARRANTY.

AIRFLOW CONSIDERATIONS

Even with an ample supply of cooling air, the Load Bank may overheat if it is not properly installed. There are two types of airflow problems that should be avoided:

1. Recirculating airflow - If the hot, exhausted air is permitted to recirculate through the Load Bank, it will reach such a high temperature and low density that it will no longer cool the elements. A Load Bank should not be installed so close to any surface as to reflect the exhausted air back to the air intake. When two or more Load Banks are being used, care must be taken in positioning the Load Banks so that the exhausted air of one unit does not feed the air intake of another. If a Load Bank is to be mounted on a raised structure, a shield must be incorporated in the structure to prevent exhaust air from being drawn back under the unit.

2. Restriction of Cooling Air - Any obstruction located within the outlined parameters listed in the previous LOCATION section of the manual will restrict the Load Bank's airflow. Do not modify louvers or screens on intake and exhaust. Ducting or diverting of airflow will increase system airflow resistance and will void the warranty. If ducting is mandatory, obtain written approval from Avtron prior to installation. Airflow is also restricted when two or more Load Banks have air inlets positioned close to each other. This competition for cooling air causes a low pressure area, restricting adequate airflow.

When operating a Load Bank outdoors, the wind can work for or against the Load Bank cooling system. If the Load Bank is positioned with the prevailing wind opposing the airflow from the blower, inadequate cooling may result and damage to the Load Bank can occur. Improper positioning may also result in the air switch being deactivated, thus dropping the load.

CONTROL PANEL

The Control Panel is supplied locally on the Load Bank.

For remote load dump capability in manual mode, connect normally closed contacts between Control Panel TB1(8) and load bank TB11(8) terminals.

Control power is obtained from a 480:120 volt, 60 Hz AC, 500 VA transformer mounted on the Load Bank and wired to the blower motor input circuit. Refer to the schematic for details.

ENCLOSURE HEATERS

Each section in the Load Bank containing control components has a 100 watt strip heater and a temperature switch. This heater may be used to prevent problems caused by condensation. If the heater function is desired, 120V power must be connected to TB11(3-4) as shown on the schematic.

BLOWER MOTOR CONNECTIONS

The blower circuit consists of fuses, overload relays, blower motor, and motor starter contactor. Required power for the blower motor is 480V, 3-phase, 60 Hz at 1.8A per phase.

With any connection, make sure that the correct phase rotation is wired to the blower motor. Improper phase rotation will cause the blower to run in the reverse direction. The cooling air must be pushed from the blower, across the resistor elements, and out the exhaust screen. This phase rotation check is mandatory every time the source or blower connections are changed.

Safe practice dictates that the blower power be wired through a safety disconnect switch that can be locked out.

LOAD CONNECTIONS

The Load Bank has three connections marked A, B, and C, which are located in the customer connection area. The connections are made to the bus bars using the .562 diameter holes and appropriate hardware. Cables to the Load Bank should be of adequate size to handle maximum rated load according to the National Electric Code and any local codes.

GROUNDING

A ground conductor must be connected to the Load Bank enclosure to prevent a potential above ground on the enclosure. There is a ground stud in the Load Bank for this connection. This ground conductor should be run with the load power conductors to provide the lowest impedance fault path. The ground stud must be connected to both the power source frame and to a good earth ground. The ground conductor should be sized per the National Electric Code Section 250.122, if not superseded by local codes.

INSTALLATION CHECKOUT PROCEDURE -- TO BE DONE PRIOR TO OPERATION

This Installation Checkout Procedure is intended to be used upon initial receipt of equipment and following any relocation of a permanent mounted Load Bank. These procedures apply to Load Banks in general and may include steps not relevant to the specific unit being installed. Disregard those procedures which do not apply.

****

W A R N I N G

THE FOLLOWING TESTS ARE TO BE ACCOMPLISHED BY A QUALIFIED ELECTRICIAN OR TECHNICIAN USING EXTREME CAUTION AS POTENTIALLY LETHAL VOLTAGES AND DANGEROUS ROTATING COMPONENTS ARE PRESENT. IF ASSISTANCE IS REQUIRED, AVTRON CAN PROVIDE START UP SERVICE AT A NOMINAL CHARGE. AVTRON ALSO WILL PROVIDE TELEPHONE ASSISTANCE IF REQUIRED BY CALLING (216) 641-8310.

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1. Verify the Load Bank placement meets the installation requirements found in the INSTALLATION section of the instruction manual:

   A. Check the clearance from both intake and exhaust to any obstruction.

   B. If the location has a prevailing wind, make the wind aid in the cooling of the resistor elements.

   C. If the Load Bank is elevated, a plate under the Load Bank will be needed to block hot exhaust from returning to the intake.

2. Check the mechanical integrity of all customer-supplied interconnection wiring:

   A. Check lugs that they are properly crimped.

   B. Check terminations that they are properly torqued..

3. Utilize system schematics to ohm out customer-supplied interconnection control wiring and safety circuits:

   A. If control wiring is all the same color, ohm out each individual wire to confirm proper labeling and placement.

> **C A U T I O N**
>
> Control wiring must be a minimum of 14 AWG for wire runs under 50 feet. Consult Avtron Manufacturing, Inc., for wire sizing when wire run exceeds 50 feet.

   B. Confirm the correct wire gauge has been used for interconnection wiring. Control wiring should be a minimum of 14 AWG for Control Panel to Load Bank lengths of 50 feet or less. For lengths greater than 50 feet, consult Avtron Manufacturing, Inc.

   C. Disconnect the Control Transformer before proceeding.

> **C A U T I O N**
>
> When control power is supplied by a transformer within the Load Bank, it must be disconnected before running this installation checkout procedure. Failure to disconnect the control transformer may damage the Load Bank.

4. Energize the source of control power only:

   A. Check the control voltage and confirm it is within 10% of the required voltage.

****

W A R N I N G

Control power is present on terminal block in steps 4 through 6.

****

B. Operate the safety circuitry with a jumper across the air switch contact at its termination at the terminal block.

5. Turn on the POWER switch and verify the proper relays energize with each individual load switch as follows:

   A. Turn on the MASTER LOAD switch. Turn on each load step individually and observe that each relay (or relays) pulls in without chatter or hesitation.

   B. Turn off the MASTER LOAD switch. Turn on all the load steps. Turn on the MASTER LOAD switch and observe the pull in of all the contactors. If chatter or hesitation is observed, locate the cause of the voltage drop causing the problem.

6. While the load relays are energized, remove the jumper across the air switch. All the load contactors should drop out as soon as the jumper is removed. **Leave the jumper off the air switch.**

7. Apply the rated fan voltage. Start blower and verify that air is exiting the resistor assembly end.

This checkout procedure is intended to be a guide to Load Bank installations in general. Special installation considerations not addressed herein may be necessary due to installation site or environment. Any questions or concerns regarding Load Bank installation should be directed to Avtron Field Service at (216) 573-7600.

SECTION IV

OPERATION

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W A R N I N G

DO NOT touch the top exhaust screen during operation. The screen will become hot from the exhausted heat and may cause a serious burn. Refer to the SAFETY CONSIDERATIONS section of this manual.

DO NOT allow objects to enter or block screens.

****

NOTE

Lower voltages and different frequencies may be applied to the load circuit of the Load Bank. Frequency change causes no derating of the load; however, the applied kW with a lower voltage is computed with the following formula:

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

****

C A U T I O N

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

Do not apply DC voltages as the contactors do not have arc blowout magnets.

****

****

C A U T I O N

The blower circuit is factory wired to the load circuit connection. Lower voltages and different frequencies may not be applied to this circuit.

If load testing requires lower voltages or different frequencies, the blower circuit must be disconnected and run from a separate source at rated voltage and frequency.

****

MANUAL OPERATION

1. Place all switches on the Control Panel to the OFF position.

2. Connect the power source to be tested to the Load Bank as described in the INSTALLATION section.

3. Start the generator under test.

4. Place the control POWER ON/OFF switch to the ON position. The CONTROL POWER light will be energized, indicating control power is present.

****

C A U T I O N

DO NOT operate the Load Bank over the rated voltage as this will cause catastrophic failure in the Load Bank.

****

5. Push the blower START pushbutton. Note that the BLOWER POWER light turns on and the AIR FAILURE indicator flashes ON momentarily. When the blower motor has reached proper speed, the AIR FAILURE lamp will be de-energized. Load voltage will not be connected to Load Bank resistance elements unless the AIRFLOW switch has closed.

6. Check for proper blower motor rotation. If rotation is incorrect, place control POWER ON/OFF switch to the OFF position, and allow blower to coast to a stop. Shut down the generator under test. Proper blower rotation is evidenced by airflow moving across the resistor elements and out through the exhaust louvers of the Load Bank. Disconnect power to the Load Bank and reverse any 2-phase connections to the blower. Repeat startup procedure in steps 1 through 6.

****

C A U T I O N

The operation of the blower is vital to the safe operation of this Load Bank. When the BLOWER switch is turned on, the AIR FAILURE light will come on momentarily until the blower accelerates up to its operating speed, at which time the light will go off. If the load elements are energized when this blower is not operating, the Load Bank will burn up. If the AIR FAILURE indicator light stays on for more than a few seconds, shut down the Load Bank, and do not operate the unit until the problem is corrected. Refer to the SAFETY CONSIDERATIONS section of this manual.

****

7. The resistive loading is selected by toggle switches, using any one or combination of the toggle switches to make up a given load.

8. By placing the MASTER LOAD ON/OFF switch to the ON position, the preselected load will be applied to the power source.

9. Any load switch can be added or removed as required while the MASTER LOAD ON/OFF switch is closed (ON).

10. To remove the load, open the MASTER LOAD ON/OFF switch by placing it in the OFF position.

SHUTDOWN

1. Place the MASTER LOAD switch to the OFF position.

NOTE

After running a load test, residual heat may be removed from the Load Bank by allowing the blower to operate for a few minutes after load is removed. This procedure is not required for maintaining Load Bank integrity, but it may guard operating personnel from possible burn injuries.

2. Place the control POWER ON/OFF switch to the OFF position. Other switches on the Control Panel should be turned OFF.

3. Shut down the power source/sources.

4. Disconnect the Load Bank from the power source(s).

AUTOMATIC OPERATION (OPTIONAL)

Complete the Automatic Controller installation by connecting the current transformer on the main power bus as shown on schematic/interconnection diagram.

1. Place all switches on the Control Panel to the OFF position.

2. Connect the generator or other power source to be tested to the Load Bank as described in the INSTALLATION section.

3. Start the generator under test.

4. Place AUTO/MANUAL switch to AUTO.

5. Place the POWER ON/OFF switch to the ON position. The CONTROL POWER light will be energized, indicating control power is present.

6. When the Auto/Transfer Contact is closed, the Auto Load Shedder will be active. The Auto Load Shedder will automatically start the blower and apply load steps. As the load on the generator lessens, the Load Shed Controller will automatically apply load steps until the overall generator load exceeds the minimum setpoint. The Load Shed Controller automatically removes load steps when the generator load exceeds the maximum setpoint.

When the Auto/Transfer Contact is opened, the Auto Load Shedder will be inactive and the blower will be stopped automatically.

NOTE

Before placing the system into AUTO, place the Load Bank load step switch(es) to the OFF position.

THEORY OF OPERATION

The automatic operation circuitry of the Load Bank allows for a generator to which it is connected, to maintain a minimum percentage of its rated output for efficient generator operation. The control range is generally between 60% and 80% of the output rating of the generator.

SYSTEM SETPOINT CALCULATION

System Ratings

Generator Resistive Rating = 250 kW @ 480 VAC, 3 PH.
Load Bank Shedder Capacity: 50 kW @ 480 VAC, 3 PH.
Load Steps: 5, 10, 10, and 25 kW.
Actual Generator Output = Load Bank Load + Building Load.

Trip	BUILDING LOAD	LOAD BANK LOAD	ACTUAL GENERATOR OUTPUT	% of GENERATOR
Point	0-<150 kW	50 kW	50-200 kW	(20%-80%)
TP.1	>,=150-<175 kW	25 kW	175 kW	(76%-80%)
TP.2	>,=175-<185 kW	15 kW	190 kW	(76%-80%)
TP.3	>,=185-<195 kW	5 kW	190 kW	(78%-80%)
TP.4	>,=195 kW	0 kW	BUILDING LOAD	(>78%)

At 0 KW building load, the Load Bank will provide 50 kW worth of load. Actual generator output will be 50 kW (20%), after a preset time-delayed ramp up period.

As the building load increases and the actual generator output approaches 200 kW (80%), the controller disables one load step; in this example, the last 25 kW load step “sheds”.

This load shed control continues as the building load continues to increase. If the building load decreases, causing the actual generator load to fall below 60%, the controller will add the appropriate load step(s) to maintain the desired range of control.

TRIP POINT ADJUSTMENTS

In the system example detailed above, a current transformer having a ratio of 400:5 will be used to monitor the building load. As the actual generator output reached 200 kW, the controller "shed" a load step. The current flowing to the building load at this point will be called the current trip point. This "trip point" value can be determined using the following formula:

LINE CURRENT(I(line)) = (kW * 577)/VOLTAGE(LINE-to-LINE).

In this example, I(line) = (150 * 577)/480,
= 180.3 amps

Secondary Current Calculation

The controller senses the current (Isense), delivered from the current transformer that is monitoring the building load. This value can be determined using the following formula:

I(sense) = I(line)/ CT Ratio.

In this example, the CT Ratio = 400/5 or 80.

For TP.1 I(sense) = 180.3/80 or 2.25 amps. (150 kW)
For TP.2 I(sense) = 210.4/80 or 2.63amps. (175 kW)
For TP.3 I(sense) = 222.4/80 or 2.78 amps. (185 kW)
For TP.4 I(sense) = 234.4/80 or 2.93 amps. (195 kW)

Adjustments can be made to the PC board controller via the adjustable resistor potentiometers found on the PC board. (Reference resistors labeled R73, R60, R47, R34, and R21.)

NOTE

R73 controls the last load step circuit. (i.e., if the Load Bank has five load steps, R73 controls the fifth load step.)

The potentiometers should be adjusted such that the last load step is the first step to be "shed".

In this example, R60 = TP.1
R47 = TP.2
R34 = TP.3
R21 = TP.4

The "trip point" value = I(sense) can be applied to the controller terminals J1 and J2, using a separate current source.

There are two methods of field adjusting the trip point of the current sensing relays:

- Method 1 - Using a separate (0-5 Amp) current source without the current transformer
- Method 2 - Rough adjustment (Approximation Method)

Method 1 - Using a separate (0-5 Amp) Current Source without Current Transformer

1. Disconnect all sources of power to the Automatic Load Shed Controller. (Control voltage and current sense input)

****

W A R N I N G

When disconnecting the current transformer, the secondary terminals must be shorted. The secondary of an unshorted current transformer can exceed several thousand volts.

****

2. Apply 120 VAC, 60 Hz control power J1(10-12) (see schematic).

****

W A R N I N G

There is lethal high voltage within the control enclosure.

****

3. Using a controlled current source, apply the setpoint current (from secondary current calculation) to Controller terminals J1(1) and J1(2).
4. Turn the relay knob labeled THRESHOLD past the trip point; then decrease until the relay trips on, indicated by LED illuminating.

5. Reconnect all wires previously removed.

Method 2 - Rough Adjustment

NOTE

Adjustable potentiometers on the controller board have a % scale reference that directly relates to the current, (Isense), delivered from the current transformer used to monitor the building load. Refer to **Secondary Current Calculation**, in **Trip Point Section** of this manual. The scale is based upon a 5 amp input.

.5 amp	= 10% Dial Setting
1.25 amp	= 25% Dial Setting
2.5 amp	= 50% Dial Setting
3.75 amp	= 75% Dial Setting
5.0 amp	= 100% Dial Setting

With all power removed from the Load Bank, calculate each desired Trip Point and adjust the potentiometers (R21, R34, R47, R60, R73) in order to achieve a rough adjustment controller setting.

NOTE

The current sense relay settings must be set sequentially. It is extremely important that the sequence be correct because the current sense relays are interlocked by the previous relay. Consult the factory at 216-573-7600 if unsure of proper adjustment.

SECTION V

MAINTENANCE

To provide long equipment life and to reduce the chance of electric shock, fires, and personal injury, good maintenance procedures must be used. Before servicing, review the SAFETY CONSIDERATIONS section of this manual.

The following are examples of scheduled maintenance procedures. These examples are not intended to be all-inclusive but must be accomplished to maintain the equipment in a good, safe condition. All maintenance work must be done by qualified personnel only.

****

W A R N I N G

Personal injury from electrical shock or from the moving fan blade may result if ALL sources of power are not disconnected. Refer to the SAFETY CONSIDERATIONS section of this manual.

Eye protection should be worn when cleaning the unit with compressed air.

****

DAILY

1. Remove any restrictions to the airflow through the Load Bank.
2. Check the screens to make sure that no objects have blocked or entered the openings.
3. Verify that the airflow is in the proper direction.
4. Assure that there is no recirculation of the exhaust air through the Load Bank.

THREE MONTHS

1. Remove the access panels and screens, and inspect the load resistors for mechanical breakdown which is demonstrated by excessive sagging of the elements. Replace worn resistor elements with new resistor elements as required.

2. Inspect for broken ceramic insulators. Replace any broken or cracked insulator with a new ceramic insulator.

3. Inspect for loose hardware or loose connections. Tighten where required.

4. Inspect all connections for oxidation or corrosion. Clean the connection or replace the hardware where required.

5. Inspect all magnetic contactors to make sure that the contacts are not severely pitted or corroded. The contacts must move freely and be properly seated.

6. Clean all dirt and debris out of the Load Bank. This can be accomplished by blowing the inside of the units with clean, dry compressed air (not to exceed 40 PSI). Eye protection should be worn when cleaning the Load Bank with compressed air.

7. Inspect all the wiring for any sign of insulation failure.

8. Replace all access panels and screens. Tighten all the fastening hardware securely.

9. Check the indicator lamps on the Control Panel.

ANNUALLY

The blower motor should be lubricated per the motor manufacturer's requirements and specifications on the motor nameplate.

SECTION VI

REPLACEMENT PARTS LIST

INTRODUCTION

The parts list in this section contains the description, quantity required, and Avtron part numbers for each listed part. The list also includes, where appropriate, the manufacturer's name and part number, as well as schematic reference designators to facilitate parts identification.

NOTE

Every effort has been made to ensure the accuracy of this information. However, changes are sometimes necessary and revisions to the parts list may be made at any time without notice.

REFERENCE DESIGNATORS

Service personnel may use this parts list along with the Avtron system schematics to identify and order replaceable parts. The reference designators were carefully selected and matched to those on the schematic diagrams and equipment to simplify the troubleshooting and repair process.

NOTE

When ordering replacement parts, be certain to state the part's description, Avtron part number, and the schematic reference designator number if one is available. Also include the model and serial number of the equipment.

REPLACEMENT PARTS LIST

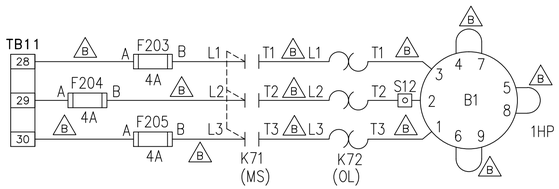
SCHEMATIC REFERENCE	DESCRIPTION	AVTRON P/N	QTY/ UNIT
	AVTRON MODEL LSH LOAD BANK, OUTDOOR	LSH50-969209	
	.SCHEMATIC	970967	REF
	.CONTROL PANEL	D33873-1	1
R100	..RESISTOR, 100K	110048	1
F1	..FUSE, 5 A, 600 V	324475	1
XF1	..FUSEHOLDER	324985	1
DS1,DS3	..LIGHT, INDICATOR (AMBER)	329681	2
DS2	..LIGHT, INDICATOR (RED)	329682	1
K99	..RELAY	350539	1
S4-7,19,20	..SWITCH, TOGGLE	360589	6
S23	..SWITCH, PUSHBUTTON (RED)	361873	1
S22	..SWITCH, PUSHBUTTON (BLACK)	361874	1
K1-K4	.RELAY	B14795	4
S15	.SWITCH, TEMP	363240	1
D	.RESISTANCE ELEMENT	A28608-1	6
E	.RESISTANCE ELEMENT	A28608-2	12
F	.RESISTANCE ELEMENT	A28608-12	6
F203-F205	.FUSE, 4A, 600V	324263	3
F11-16	.FUSE, 40A, 600V	324419	6
XF203-205	.FUSEHOLDER	324997	1
XF11-16	.FUSEHOLDER	324660	2
B1	.MOTOR	341490	1
K72	.RELAY, O/L	350991	1
K98	.RELAY	350539	1
K71	.RELAY	351687	1
HR1	.HEATING ELEMENT	352026	1
S12	.CURRENT SENSOR	362082	1
S11	.SWITCH, TEMP	363099	1
	.IMPELLER, FAN	406084	1
XK72	.SOCKET, RELAY	408369	1
	.TUBE, INSULATOR	AVT-411141	240
	.TUBE, INSULATOR	AVT-411145	24
	.TUBE, INSULATOR	AVT-411181	48
	.TUBE, INSULATOR	AVT-411182	96
	.PIN, SPRING CLIP	461159	48
	.SPRING, COMPRESSION	473042	48
S13,S14	.SWITCH, TEMP	491021	2
	.CONTROL TRANSFORMER	C25672-4	1
T1	..TRANSFORMER	370654	1
F210,211	..FUSE	324453	2
XF210-212	..FUSEBLOCK	324998	1
F212	..FUSE, 5A, 600V	324211	1

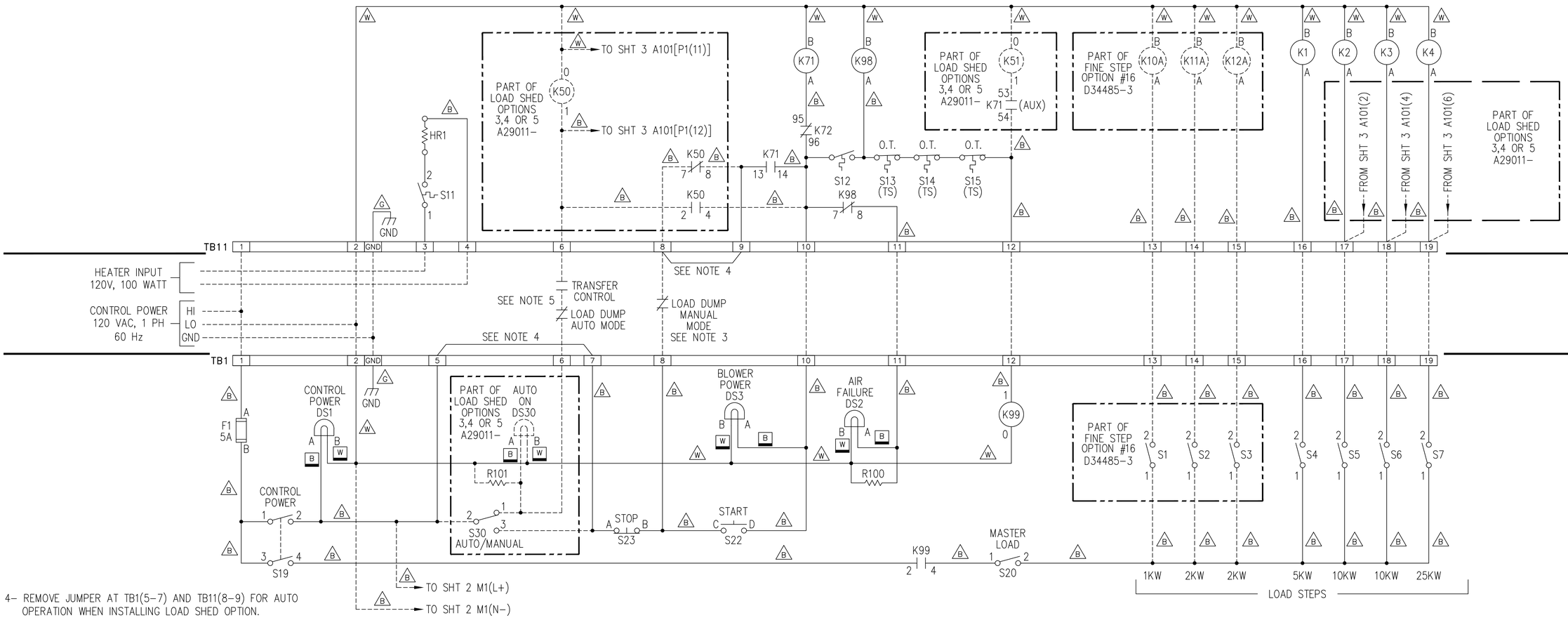
REVISIONS				
ECN NO.	REV	DESCRIPTION	DATE	APPROVED

LOAD BANK LSH 969209

BLOWER INPUT

480 VAC,
3 PHASE, 60 HZ,
1.4 AMP





CONTROL PANEL D33873–1

4– REMOVE JUMPER AT TB1(5–7) AND TB11(8–9) FOR AUTO OPERATION WHEN INSTALLING LOAD SHED OPTION.

3– FOR REMOTE LOAD DUMP INSTALL N/C CONTACT. OTHERWISE INSTALL INTERCONNECTION WIRE.

2– – – – DASH LINES REPRESENT CUSTOMER WIRING.
——— SOLID LINES REPRESENT AVTRON WIRING.

1– WIRE CODE:

- B – DENOTES WIRE TO BE BLACK #16 AWG (PN 390008)
- W – DENOTES WIRE TO BE WHITE #16 AWG (PN 390008)
- G – DENOTES WIRE TO BE GREEN #16 AWG (PN 390008)
- B – DENOTES WIRE TO BE WHITE #22 AWG (PN 390001)
- W – DENOTES WIRE TO BE WHITE #22 AWG (PN 390001)
- 14 – DENOTES WIRE TO BE #14 AWG (PN 390011)
- 10 – DENOTES WIRE TO BE #10 AWG (PN 390016)
- 8 – DENOTES WIRE TO BE #8 AWG (PN 390019)
- 4 – DENOTES WIRE TO BE #4 AWG (PN 390021)

UNLESS OTHERWISE SPECIFIED THE ABOVE NOTES APPLY

FORM 832D-LB, 2/20/2012

7– 2P DENOTES TWO RESISTANCE ELEMENTS IN PARALLEL.

6– FUSE REPLACMENT CHART:

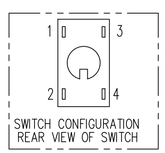
CONTROL

F1,F212 – 600V FAST ACTING, CLASS CC, 200 KAIR
F203–F205 – 600V, DUAL ELEMENT TIME DELAY, CLASS J, 300 KAIR
F100–F102,F210,F211 – 600V, TIME DELAY, CLASS CC, 200 KAIR

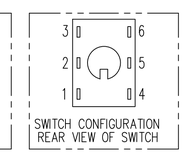
LOAD

ALL LOAD STEP FUSES ON SHEETS 2 & 3 ARE 600V, FAST ACTING, CLASS T, 200 KAIR.

5– FOR REMOTE LOAD DUMP IN AUTO MODE, ADD N/C CONTACT IN SERIES WITH TRANSFER CONTROL CONTACT.



SWITCHES S1–S9,S19 & S20



SWITCH S30

DESIGNATION CODE

ML – DENOTES MASTER LOAD (S20)
MS – DENOTES MOTOR STARTER (K71)
OL – DENOTES OVERLOAD RELAY (K72)
TS – DENOTES OVERTEMP SWITCH (S13,S14,&S15)

LSH 969209	LSH969209
NEXT ASSY	USED ON
APPLICATION	

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES: ANGLES±1° DECIMALS .XX±.03 .XXX±.015
FINISH
PAINT PER PS
PLATE PER
COAT PER PS
ANODIZED PER
OTHER

		DATE
DRAWN	J.FRANK	1/31/13
CHECKED	J.FRANK	1/31/13
ENG APVD	C.KULBAGO	2/1/13
APVD PROD	R.SUTICH	2/1/13
SCALE	1/1	
MODEL	LSH	

AVTRON LOADBANK
6255 HALLE DRIVE
CLEVELAND, OH 44125

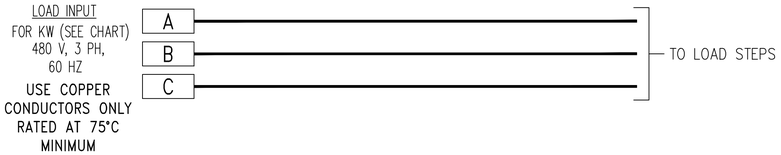
SCHEMATIC/INTCON DIAGRAM

IMF ☒ PSF ☐

CAGE NO.	DWG. NO.	SHEET	REV
6J744	970967	1 OF 3	-

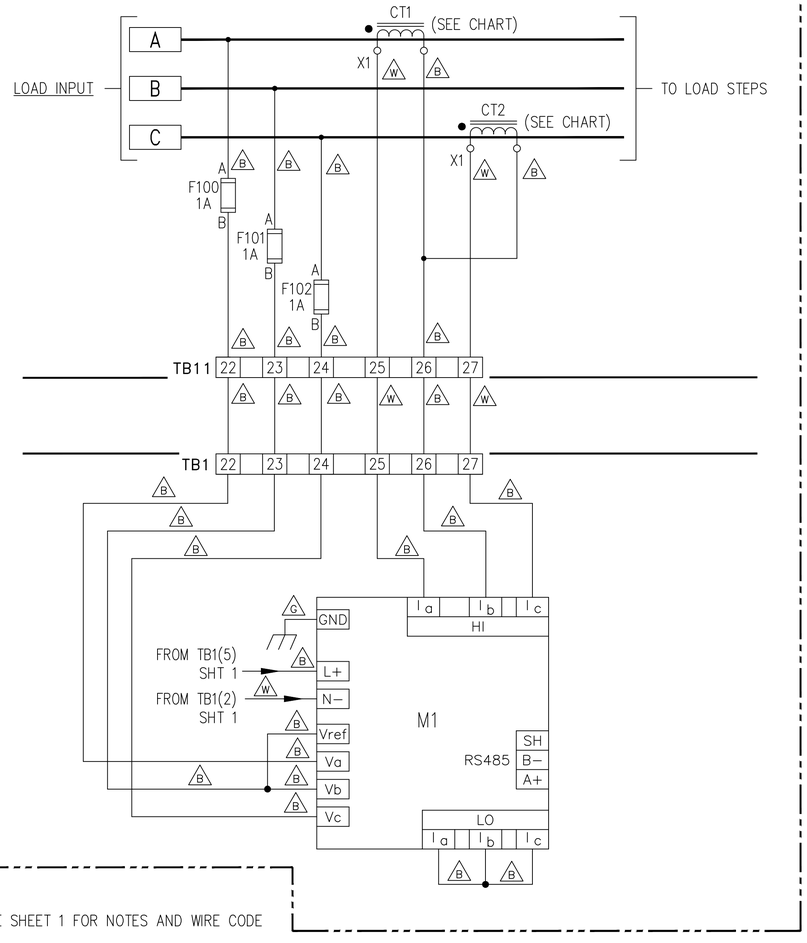
REVISIONS				
ECN NO.	REV	DESCRIPTION	DATE	APPROVED

LOAD BANK LSH 969209

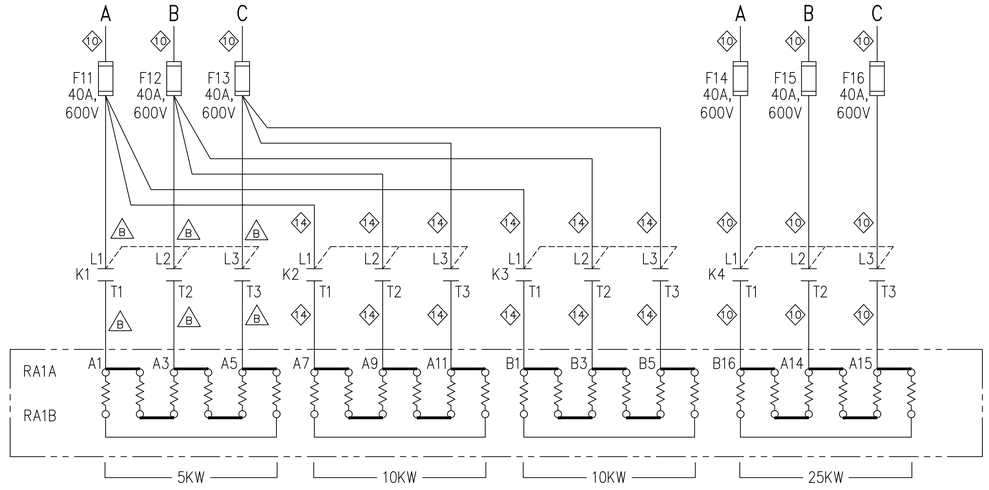


METER OPTION (SEE CHART)

CHART		
OPTION #	METER OPTION	C.T. RATIO
20	D34486-1	100:5
21	D34486-2	200:5
22	D34486-3	300:5
23	D34486-4	500:5



SEE SHEET 1 FOR NOTES AND WIRE CODE



NOTE: WIRES FROM BUS BARS A,B, & C TO FUSES ARE ALL INDIVIDUAL RUNS. BOLD LINES FROM FUSES INDICATE DIRECT CONNECTION TO RESPECTIVE BUS BARS.

UNLESS OTHERWISE SPECIFIED THE ABOVE NOTES APPLY

FORM 832D2-LB, 2/20/2012

AVTRON LOADBANK
6255 HALLE DRIVE
CLEVELAND, OH 44125

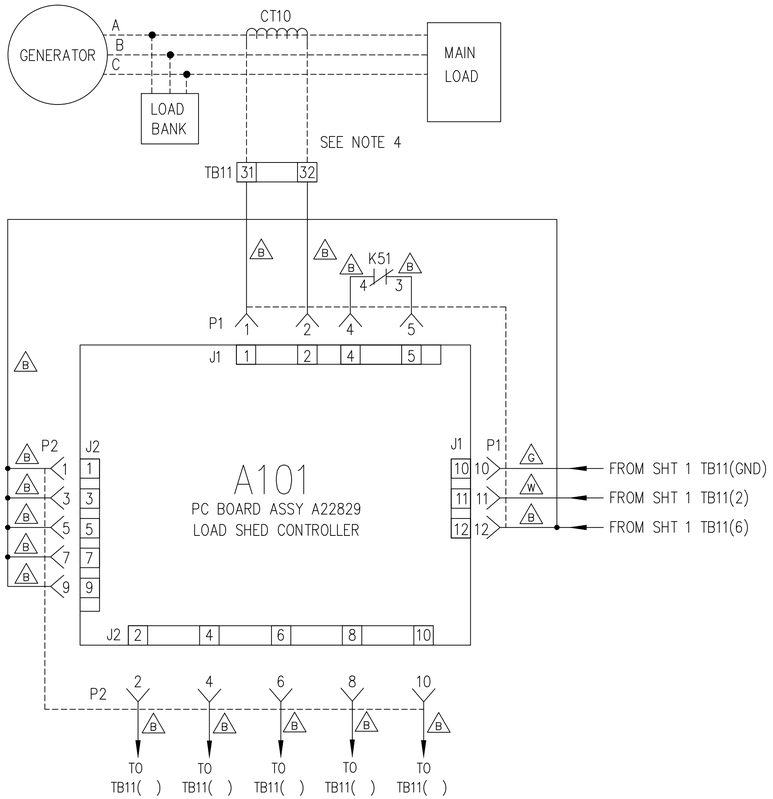
SCHEMATIC/INTCON DAIGRAM

SCALE	CAGE NO.	DWG. NO.	SHEET	REV
1/1	6J744	970967	2	-

MODEL LSH

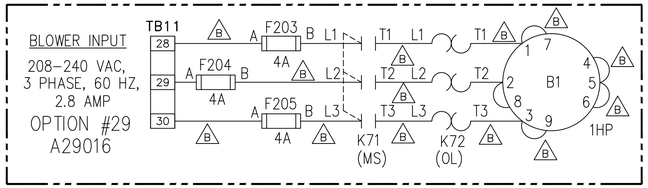
REVISIONS				
ECN NO.	REV	DESCRIPTION	DATE	APPROVED

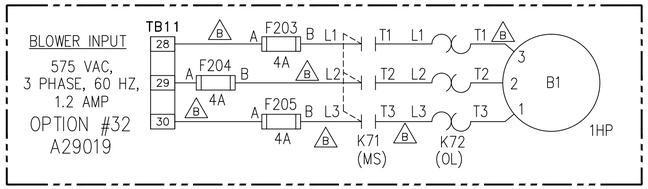
PART OF LOAD SHED OPTIONS 3,4 OR 5 A29011-

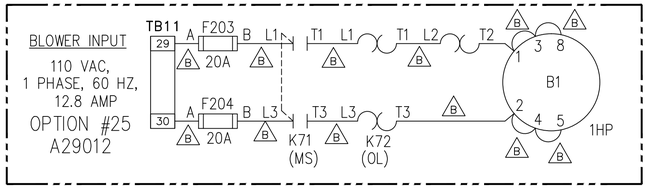


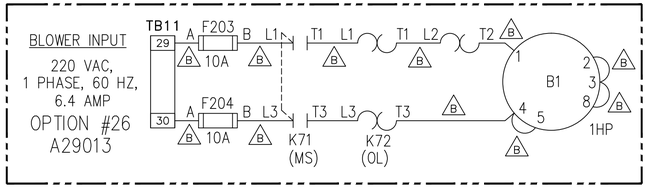
		A101 (P2)					
	PC BD.						
	TERMINAL	2	4	6	8	10	
LOAD SHED OPTION #		WIRE FROM ABOVE POINTS TO LOAD BANK (TB11)					
A29011-1		17	18	19	NC	NC	45KW CONTROL
A29011-2		17	18	19	20	NC	95KW CONTROL
A29011-3		17	18	19	20	21	145KW CONTROL

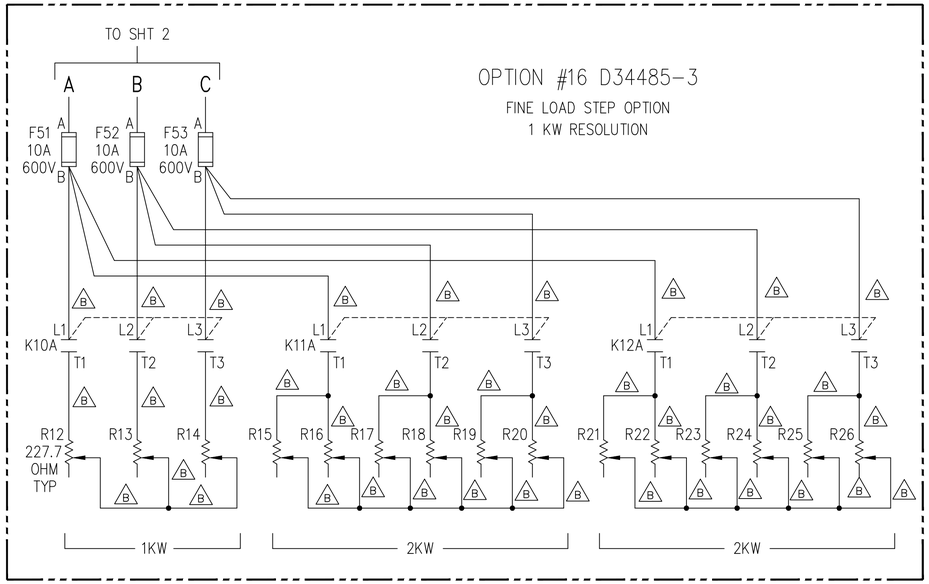
4. DASHED LINES REPRESENT CUSTOMER WIRING.
3. ADJUST VARIABLE RESISTORS ON PC BOARD A101 (R26,R39,R52,R65 & R78) TO 3 SECONDS, ADJUST (R14) TO 5 SECONDS.
2. ADJUST VARIABLE RESISTORS ON PC BOARD A101 (R21,R34,R47,R60 & R73) PER PROJECT NOTES.
1. ALL WIRING TO BE BLACK #16 AWG (PN 390008) UNLESS OTHERWISE NOTED.

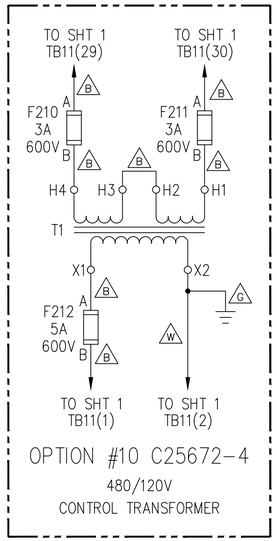


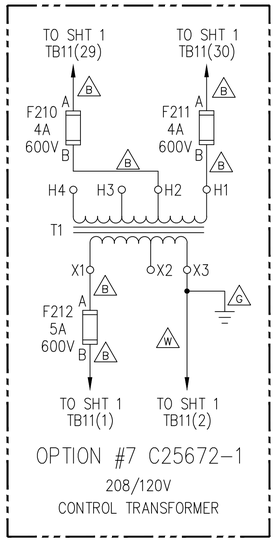


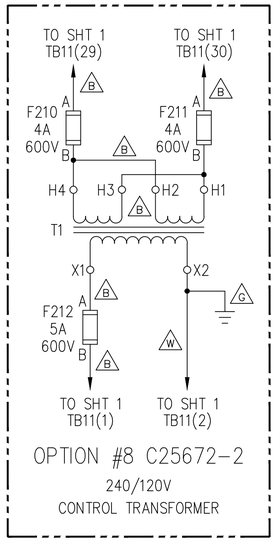


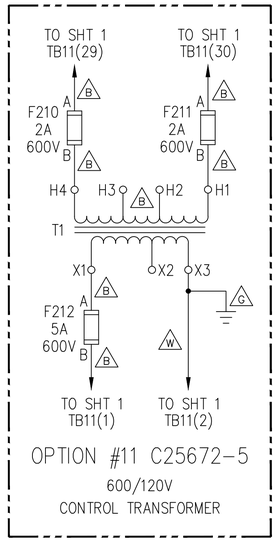












SEE SHEET 1 FOR NOTES AND WIRE CODE

UNLESS OTHERWISE SPECIFIED THE ABOVE NOTES APPLY

FORM 832D2-LB, 2/20/2012

SCALE 1/1

MODEL LSH

AVTRON LOADBANK
6255 HALLE DRIVE
CLEVELAND, OH 44125

SCHEMATIC/INTCON DIAGRAM

CAGE NO.	DWG. NO.	SHEET	REV
6J744	970967	3	-