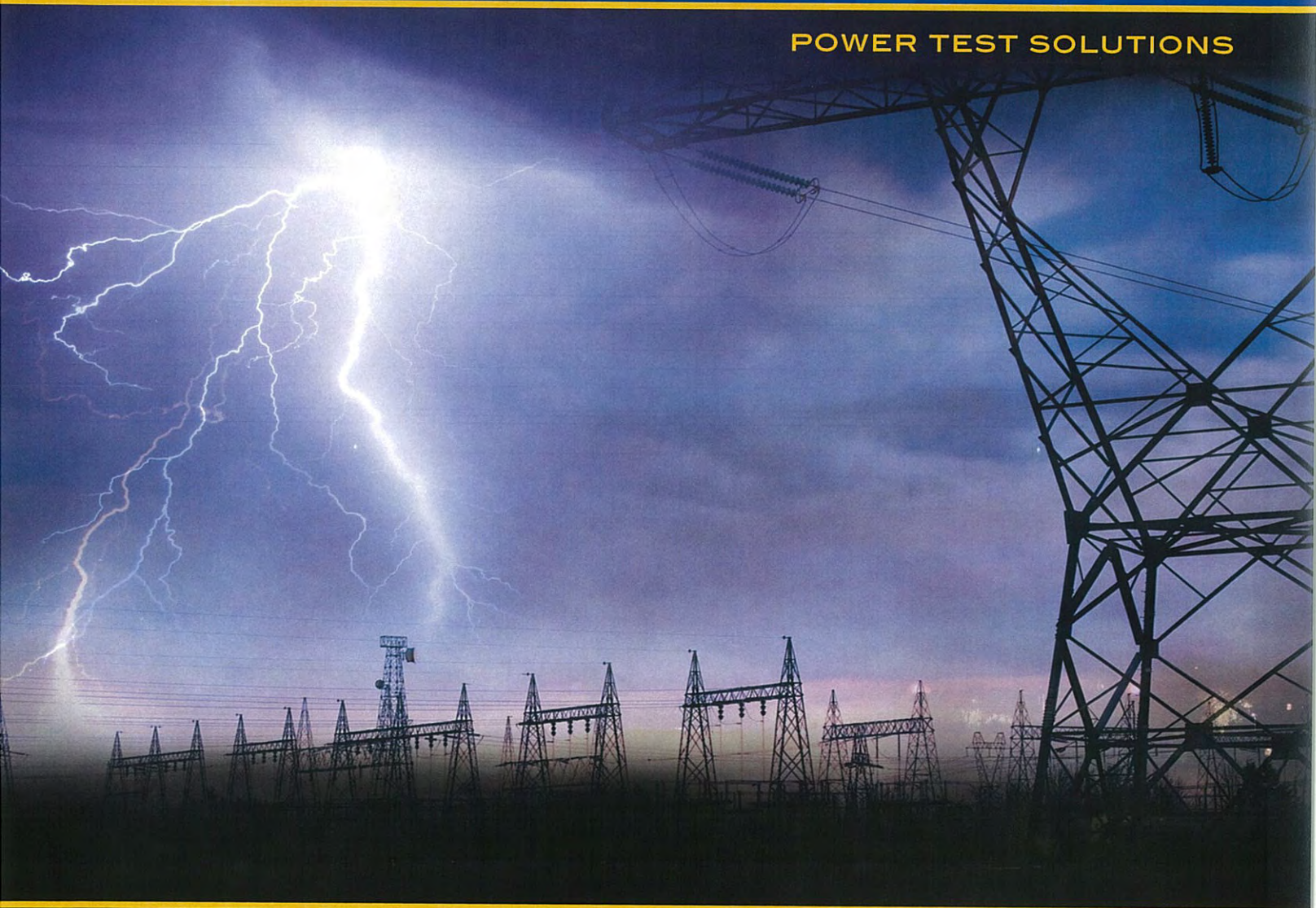
AVTRON
LOADBANK

POWER TEST SOLUTIONS



Instruction Manual

LSH50D34087-1

AVTRON MODEL LSH
OUTDOOR RESISTIVE LOAD BANK
Part Number LSH50D34087-1

50 kW, 480 VAC, 5 kW Resolution

AVTRON MODEL LSH
OUTDOOR RESISTIVE LOAD BANK

Cleveland, Ohio

January 8, 2003
Rev. May 20, 2015

AVTRON LOADBANK
Cleveland, Ohio

AVTRON MODEL LSH
OUTDOOR RESISTIVE LOAD BANK

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LSH35D47317-4	208	35	5, 10, 20	1, 3	1045045	208V
LSH40D47317-3	208	40	5, 5, 10, 20	1, 3	1045044	208V
LSH60D47317-1	208	60	5, 5, 10, 20, 20	1, 3	D47318	208V
LSH75D34084-4	208	75	5, 10, 10, 25, 25	1, 2, 4	D34884	208V
LSH100D34084-2	208	100	5, 10, 10, 25, 50	1, 4	D34089	208V
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LSH50D34085-1	240/480	50	5, 10, 10, 25	1, 4	D34090	460V
LSH75D34877-1	240/480	75	5, 10, 10, 25, 25	1, 3	D34885	460V
LSH100D34085-2	240/480	100	5, 10, 10, 25, 50	1, 4	D34090	460V
LSH150D34085-3	240/480	150	5, 10, 10, 25, 50, 50	1, 4	D34090	460V
LSH50D34087-1	480	50	5, 10, 10, 25	1, 4	D34092	460V
LSH50D34087-4	480	50	5, 10, 10, 25	1, 4	D34040	460V
LSH75D34879-1	480	75	5, 10, 10, 25, 25	1, 3	D34887	460V
LSH100D34087-2	480	100	5, 10, 10, 25, 50	1, 4	D34092	460V
LSH125D34879-2	480	125	5, 10, 10, 25, 25, 50	1, 3	D34887	460V
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LSH75D34880-1	600	75	5, 10, 10, 25, 25	1, 3	D34888	600V
LSH100D34088-2	600	100	5, 10, 10, 25, 50	1, 4	D34093	600V
LSH100D42727-2	600	100	5, 10, 10, 25, 50	1, 4	D42789	600V
LSH150D34088-3	600	150	5, 10, 10, 25, 50, 50	1, 4	D34093	600V
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LSH150D37928-3	240	150	5, 10, 10, 25, 50, 50	1, 4	D37929	240V

*Drawings in these columns are provided at the end of the manual based on specific Load Bank(s) purchased.

AVTRON MODEL LSH
OUTDOOR RESISTIVE LOAD BANK

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 a specified 3-phase voltage. The total load capability and load steps provided in a given LSH are listed in the Table of Contents, page ii. Standard Load Bank load step resolution is 5 kW while 1 kW resolution is available as an option. Using the toggle switches on the control panel, any combination of the available load steps may be selected to achieve a desired load.

The LSH unit contains a blower with a 3-phase Blower Motor (Table of Contents page ii), which 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, except LSH50D34097-4, which is protected with a 3-pole circuit breaker and an overload relay. The overload relay assembly must be reset manually. When required, the unit may be furnished with a blower motor sized to operate at voltages different from standard. The 1 HP blower air delivery is approximately 5000 CFM at a three-quarter inch static pressure.

****

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 is a differential pressure switch which 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 exhaust cooling air. These switches are electrically interlocked with the load application controls to prevent load application in the event of an overtemperature condition.

The control panel contains a CONTROL POWER ON-OFF switch with a CONTROL POWER light, blower power START and STOP pushbutton switches, a BLOWER POWER light, an AIR FAILURE light, a MASTER LOAD ON-OFF switch, a VOLTAGE SELECT switch for units with dual voltage capability, and individual KW LOAD STEP switches. The control panel also contains a fuse for control circuit protection.

Sized for mounting into a 19-inch rack enclosure, the control panel has a vertical height of 8.75 inches and requires a minimum of 4 inches of clearance behind the panel.

An optional Metering Package can be used to monitor volts, amps, frequency, kW, kVAR, and/or kVA.

The LSH Load Bank is fabricated using heavy-gauge aluminized sheet steel to make 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 on the inside of the contactor enclosure of the Load Bank.

Forklift channels are provided as standard.

The units are equipped with screen openings at the inlet and a louver at the outlet opening that provides 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.

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.

****

The single voltage designs (i.e., 600V, 480V, and 208V) are available with an automatic load shedder as an option. The load shedder adds and removes load steps automatically based on preset controller settings.

AUTO TRANSFER SWITCH CAPABILITY

The load control circuitry is factory designed in such a way that remote operation with a customer-supplied transfer switch may be incorporated into the circuit. The factory control circuitry will be wired to a terminal board whereas a transfer switch must be enabled and connects at the terminal board per the schematic.

AUTOMATIC OPERATION (Optional)

An Automatic Load Shed Controller (Controller) may be integrated into the control circuitry of the LSH Load Bank as an option. The Controller is designed to maintain a minimum load on a power source. A separately supplied current transformer provides the feedback signal required to operate the Controller. This feedback signal drives the Controller, which has field adjustable current setpoints. The Controller also incorporates field adjustable time delays to prevent repetitive load switching or initial overloading of the generator.

The Load Bank manual controls are paralleled by the automatic Controller. Automatic or manual mode may be chosen when the Load Shed option is provided with the Load Bank.

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.

****

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.

****

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 120EF.

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 may 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.

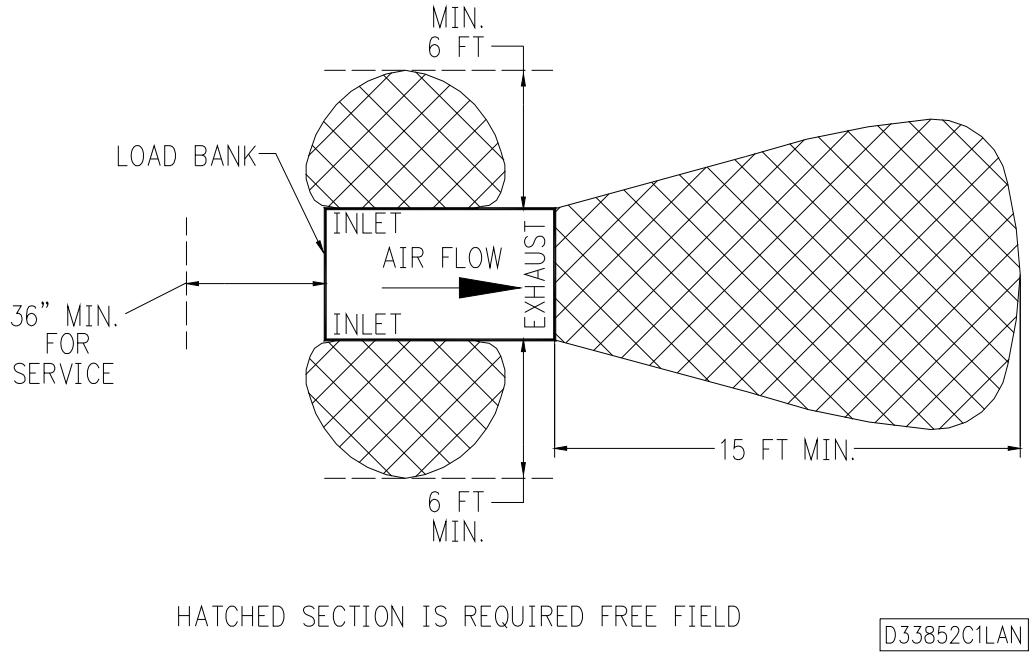

Figure 3-1. Load Bank Installation Airflow Clearance Requirements

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 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 made to be mounted in a 19-inch rack type enclosure. A NEMA 12 enclosure, option #1, A20712, can be used to house the control panel. Connect terminals of the Control Panel to terminals of the Load Bank as shown on the Schematic/Interconnection Diagram.

Connect terminals 1 and 2 on the Control Panel to a 120V, 60 Hz, or 110V, 50 Hz, single phase power source. Recommended minimum wire size is No. 14 AWG. See the Schematic/ Interconnection Diagram.

If 120 VAC is not available for control power, a step-down transformer must be used. An optional 500 VA control step-down transformer may be supplied with the Load Bank. The following transformer options are available:

Option #7	208V to 120V transformer
Option #8	240V to 120V transformer
Option #10	480V to 120V transformer
Option #11	600V to 120V transformer
Option #12	240/480V to 120V transformer

The identification plate is marked with the options that are contained in the unit.

ENCLOSURE HEATERS

The Load Bank contains 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 control power must be connected to TB11(3-4) as shown on the schematic.

BLOWER MOTOR CONNECTIONS

The blower circuit consists of fuses, motor starter contactor, overload relay, and the blower motor. The input power connections are directly wired to the main load bus.

Required power for the blower motor in standard LSH units is shown in the Table of Contents on page ii. Other blower motor voltages are available as options; and if the option is installed in the Load Bank, the identification plate will indicate the option number.

If the blower motor is to be connected to the source under test, make sure that the source voltage is within the range of the supplied motor. When operating the blower motor from the generator, an additional load of 750 watts is created.

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 should be pushed from the blower, across the resistor elements, and out the exhaust screen. If the blower rotation is incorrect, shut down the Load Bank and disconnect all power from it. Switch any two of the three blower input connections at terminals TB11 (28, 29, and 30). Reconnect power and verify that the blower rotates in the correct direction. This phase rotation check is mandatory every time the source or blower connections are changed.

If external blower power is provided, safe practice dictates that the blower power should be wired through a safety disconnect switch that can be locked out.

LOAD CONNECTIONS

A. The Load Bank has three load input bus bar connections marked A, B, and C which are located in the customer connection area. These connections are accessible by removing the access panel at the air intake side of the Load Bank. See outline drawing.

B. Terminations

On each of the load bus bars are two pairs of 0.562 diameter holes, spaced 1.75 inches apart, for attachment of load wiring terminations. (The holes are spaced 1.75 inches, both directions.) Use 1/2 inch hardware to attach terminal lugs to the bus bars. Two terminals may be attached to each bus bar, side by side. The load conductors should be sized in accordance with the National Electrical Code, Article 310, if not superseded by local codes.

AUTOMATIC CONTROLLER (Optional)

When an automatic Load Shed Controller (Option 3, 4, 5, or 6) is included with the Load Bank, installation of the current transformer on the main power bus as shown in Figure 3-2 is required. Wire the current transformer into the control circuitry as shown on the provided schematic.

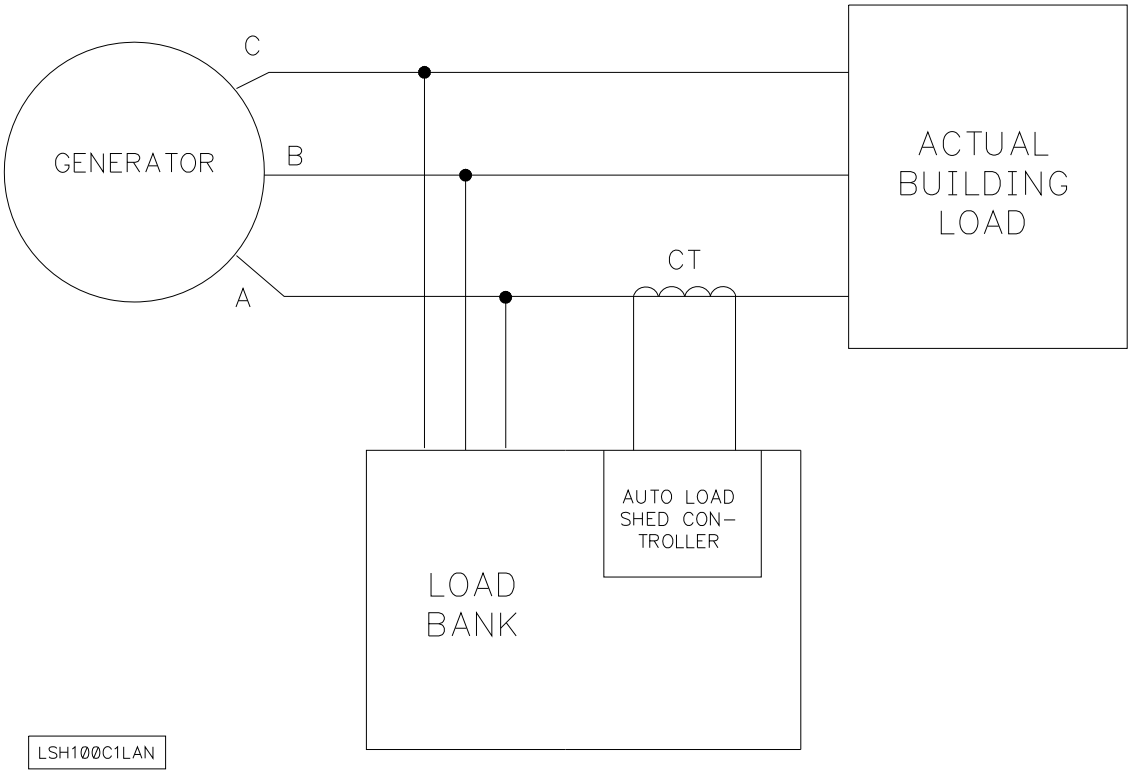

Figure 3-2

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W A R N I N G

Always put a short or shunt across the current transformer when servicing the Load Bank. Primary current flowing through an unshunted current transformer will destroy the transformer with possible harm to personnel.

****

Never allow the secondary of the current transformer to remain disconnected when primary current is passing through the transformer. If the Load Bank must be disconnected, put a short or shunt across the current transformer.

NOTE

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

GROUNDING

A permanent ground conductor must be connected to the Load Bank enclosure by an individual ground wire 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 generator frame and a good earth ground. The ground conductor should be sized per the National Electric Code Table 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) 573-7600.

****

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 Loadbank, 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 Loadbank.

   C. If a Control Transformer is the source of control power, 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

1. Place all switches on the control panel to the OFF position.

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

3. Place the VOLTAGE SELECT switch to the correct voltage to test the generator (dual voltage units only).

****

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.

DO make sure that the VOLTAGE SELECTOR switch is in the proper position before applying load (when applicable).

****

4. Place the CONTROL POWER switch to the ON position. A pilot light (DS1) will be energized, indicating control power is present.

5. Press the blower power START switch. The BLOWER POWER light (DS3) will be energized. Note that the AIR FAILURE indicator (DS2) 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. Also note direction of airflow. If airflow is not "OUT" the exhaust end, shut off the blower, disconnect power, and reverse any 2-phase connections to the blower.

****

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 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 air switch prevents the load from being applied (AIR FAILURE indicator light on), do not bypass the air switch. This will cause the Load Bank to burn up. Do not attempt to operate the unit until the problem is corrected. Refer to the SAFETY CONSIDERATIONS section of this manual.

****

6. With the MASTER LOAD and KW LOAD STEP switches in the OFF position, start the generator under test. Check for proper phase sequence.

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

8. By placing the MASTER LOAD 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 switch is closed (ON).

10. Shutdown procedure:

    a. Turn the MASTER LOAD switch and the LOAD STEP toggle switches to the OFF position. Allow the blower to run for several minutes to exhaust accumulated heat. This procedure is not required for maintaining Load Bank integrity, but it may guard operating personnel from possible burn injuries.

    b. Press the blower power STOP switch.

    c. Turn the POWER switch to the OFF position.

    d. Turn all safety switches to which the Load Bank may be connected to the OFF position. These should include (for operator and personnel safety):

        1) Blower circuit safety switch.
        2) Control circuit safety switch.
        3) Load power circuit breaker.

    If the strip heater is desired, to prevent problems of condensation, 120V control power must be connected as shown on the schematic.

****

W A R N I N G

DO NOT touch the 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.

****

AUTOMATIC OPERATION (for LSH Load Banks with Load Shedder option)

Complete the Automatic Controller installation by connecting the current transformer on the main power bus as shown in Figure 4-1. Wire the current transformer into the control circuitry as shown on the provided schematic.

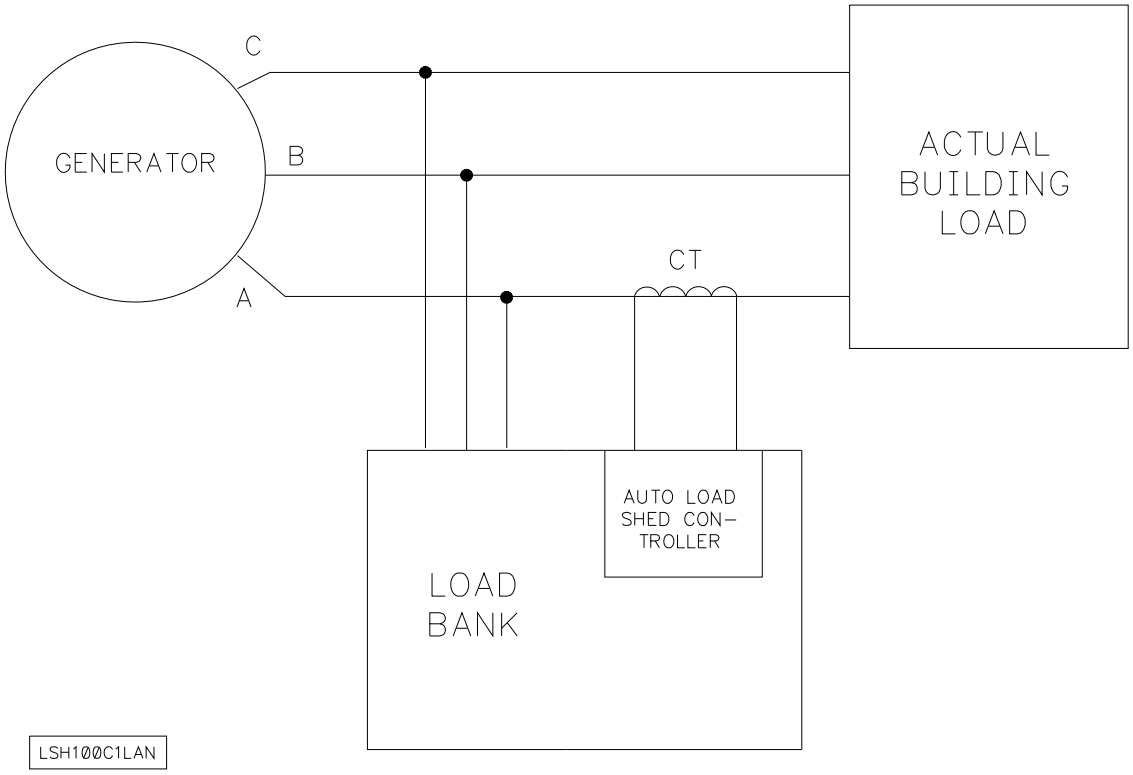


Figure 4-1

After connecting 120V control power per the schematic:

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. Place the POWER switch to the ON position. The POWER light (DS1) will be energized, indicating control power is present.

4. Place AUTO/MANUAL switch to AUTO.

5. Start the generator under test.

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.

OPTIONAL CONTROLLER OPERATION AND ADJUSTMENTS

****

W A R N I N G

Always put a short or shunt across the current transformer when servicing the Automatic Load Shed Controller. Primary current flowing through an unshunted current transformer will destroy the transformer with possible harm to personnel.

****

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 (Example)

System Ratings

Generator Resistive Rating = 250 kW @ 480 VAC, 3 PH.
Load Bank Shedder Capacity: 145 kW @ 480 VAC, 3 PH.
Load Steps: 10, 10, 25, 50, and 50 kW.
Actual Generator Output = Load Bank Load + Building Load.

Trip Point	BUILDING LOAD	LOAD BANK LOAD	ACTUAL GENERATOR OUTPUT	% OF GENERATOR
	0-<55 kW	145 kW	145-200 kW	(58%-80%)
TP.1	>,=55-<105 kW	95 kW	150-200 kW	(60%-80%)
TP.2	>,=105-<155 kW	45 kW	150-200 kW	(60%-80%)
TP.3	>,=155-<180 kW	20 kW	175-200 kW	(70%-80%)
TP.4	>,=180-<190 kW	10 kW	190-200 kW	(76%-80%)
TP.5	>,=190 kW	0 kW	BUILDING LOAD	(>,=76%)

At 0 KW building load, the Load Bank will provide 145 kW worth of load. Actual generator output will be 145 kW (58%), 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 load step, 50 kW, "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 58%, 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 300:5 will be used to monitor the building load. (Refer to Figure 4-1.) 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) = (55 * 577)/480,
= 66.1 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 = 300/5 or 60.

For TP.1 I(sense) = 66.1/60 or 1.1 amps. (55 kW)
For TP.2 I(sense) = 126 /60 or 2.1 amps. (105 kW)
For TP.3 I(sense) = 186 /60 or 3.1 amps. (155 kW)
For TP.4 I(sense) = 216 /60 or 3.6 amps. (180 kW)
For TP.5 I(sense) = 229 /60 or 3.8 amps. (190 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, R73 = TP.1
R60 = TP.2
R47 = TP.3
R34 = TP.4
R21 = TP.5

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.

ESD PRECAUTIONARY GUIDELINES

C A U T I O N

Certain circuit card assemblies and their components, typically integrated circuits, may be damaged by seemingly undetectable electrostatic discharge (ESD). Care must be exercised during handling/repair of these items. Use electrostatic discharge precautionary procedures.

The following guidelines are not necessarily all inclusive but rather serve as reminders for good shop practices for the handling/ repair of ESD sensitive circuit card assemblies and devices.

- Store ESD sensitive items in their original containers. These items are often marked with the symbol shown at the top of this page.
- Put on a grounded wrist strap before handling any ESD sensitive item.
- Clear work area of Styrofoam®*, plastic, and vinyl items such as coffee cups.
- Handle ESD items by the body, never the open edge connectors.
- Never slide ESD sensitive items over any surface.
- Transport ESD sensitive items in a static shielding container to a static-free work station.
- If a static-free work station is not available, ground the transport container before removing or inserting an ESD item.
- Electric tools used during repair should be grounded. For example, use only anti-static type solder suckers and grounded tip soldering irons. Discharge non-electric tools before use.
- Pack ESD items in static shielding containers before shipping them to Avtron for repair.

* Styrofoam® is a registered trademark of Dow Chemical.

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 maintenance procedures and a suggested maintenance schedule. These examples are not intended to be all-inclusive but must be accomplished to maintain the equipment in a proper, 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 and OPERATION sections of this manual.

****

DAILY

1. Remove any restriction 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 access panels and screens.

2. Inspect the load resistors for mechanical breakdown which is demonstrated by excessive sagging of the elements. Replace with new resistor elements as required.

3. Inspect for broken ceramic insulators. Replace with a new ceramic insulator if any cracks are found.

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

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

6. Verify that the AIRFLOW switch works properly.

7. 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.

****

W A R N I N G

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

****

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

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

10. Check the indicator lamps on the control panel.

ANNUALLY

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

SECTION VI

OPTIONS

The following options are available for Avtron Model LSH Load Banks. Not all options can be installed in the same unit.

OPTION	PART NO.	DESCRIPTION
1	A20712	Remote Control Panel Enclosure
2	C25671	Local Control Panel Enclosure
3	A29011-1	Load Shed Control -1
4	A29011-2	Load Shed Control -2
5	A29011-3	Load Shed Control -3
6	A29011-4	Load Shed Control -4
7	C25672-1	Control Xformer (208-230V)
8	C25672-2	Control Xformer (240V)
9	C25672-3	Control Xformer (400V)
10	C25672-4	Control Xformer (480V)
11	C25672-5	Control Xformer (600V)
12	C25672-6	Control Xformer (240/480V)
13	A29011-5	Load Shed Control
14	D34485-1	1 kW Resolution (208V)
15	D34485-2	1 kW Resolution (400V)
16	D34485-3	1 kW Resolution (480V)
17	D34485-4	1 kW Resolution (240/480V)
18	D34485-5	1 kW Resolution (600V)
19	D34485-6	1 kW Resolution (240V)

OPTION	PART NO.	DESCRIPTION
20	D34486-1	Digital Metering (2 CT, 100 Amp)
21	D34486-2	Digital Metering (2 CT, 200 Amp)
22	D34486-3	Digital Metering (2 CT, 300 Amp)
23	D34486-4	Digital Metering (2 CT, 500 Amp)
24	--	RESERVED FOR FUTURE OPTION
25	A29012	Blower Motor 1 PH, 110V, 60 Hz
26	A29013	Blower Motor 1 PH, 220V, 60 Hz
27	A29014	Blower Motor 1 PH, 110V, 50 Hz
28	A29015	Blower Motor 1 PH, 220V, 50 Hz
29	A29016	Blower Motor (208-230V, 60 Hz)
30	A29017	Blower Motor (400V, 50 Hz)
31	A29018	Blower Motor (480V, 60 Hz)
32	A29019	Blower Motor (600V, 60 Hz)
33	C25673	Blower Motor (240/480V, 60 Hz)
34	A29020	Internal Blower Connections
35	B29266	Addition of Casters
36	A33420	Reverse Power Relay (480V)
37	A33700	Reverse Power Relay (208V)
38	D34485-7	1 kW Resolution Option (300/600 V)
39	D34485-8	1 kW Resolution (240 V, 1 PH)
40	D34486-5	Digital Metering (1 CT, 300 Amp)

41	D34486-6	Digital Metering (1 CT, 500 Amp)
42	D34486-7	Digital Metering (1 CT, 800 Amp)
43	C27570	Front Cover, Hinged (Outdoor Duty)
44	A36210	Low Noise Operation (100 kW Maximum)
45 *	A36360	Remote Monitoring Contacts, Load Shed
50	A37407	Electric Heater, 400W

* Include sheet 2 of A36360 drawing.

REPLACEMENT PARTS LIST

SCHEMATIC REFERENCE	DESCRIPTION	AVTRON P/N	QTY/ UNIT
	OPTION 3 - LOAD SHED CONTROL	A29011-1	
A101	.PC BOARD ASSY, LOAD SHED	A22829	1
K50,51	.RELAY	350539	2
XK71	.AUXILIARY CONTACT	312401	1
	OPTION 4 - LOAD SHED CONTROL	A29011-2	
A101	.PC BOARD ASSY, LOAD SHED	A22829	1
K50,51	.RELAY	350539	2
XK71	.AUXILIARY CONTACT	312401	1
	OPTION 5 - LOAD SHED CONTROL	A29011-3	
A101	.PC BOARD ASSY, LOAD SHED	A22829	1
K50,51	.RELAY	350539	2
XK71	.AUXILIARY CONTACT	312401	1
	OPTION 6 - LOAD SHED CONTROL	A29011-4	
A101	.PC BOARD ASSY, LOAD SHED	A22829	1
K50,51	.RELAY	350539	2
XK71	.AUXILIARY CONTACT	312401	1
	OPTION 7 - CONTROL TRANSFORMER (208-230 VOLT)	C25672-1	
T1	.TRANSFORMER	370715	1
F210,211	.FUSE	324454	2
XF210-212	.FUSEBLOCK	324998	1
F212	.FUSE, 5A, 600V	324211	1
	OPTION 8 - CONTROL TRANSFORMER (240 VOLT)	C25672-2	
T1	.TRANSFORMER	370654	1
F210,211	.FUSE	324454	2
XF210-212	.FUSEBLOCK	324998	1
F212	.FUSE, 5A, 600V	324211	1
	OPTION 9 - CONTROL TRANSFORMER (400 VOLT)	C25672-3	
T1	.TRANSFORMER	370715	1
F210,211	.FUSE	324453	2
XF210-212	.FUSEBLOCK	324998	1
F212	.FUSE, 5A, 600V	324211	1

SCHEMATIC REFERENCE	DESCRIPTION	AVTRON P/N	QTY/ UNIT
	OPTION 10 - CONTROL TRANSFORMER (480 VOLT)	C25672-4	
T1	.TRANSFORMER	370654	1
F210,211	.FUSE	324453	2
XF210-212	.FUSEBLOCK	324998	1
F212	.FUSE, 5A, 600V	324211	1
	OPTION 11 - CONTROL TRANSFORMER (600 VOLT)	C25672-5	
T1	.TRANSFORMER	371032	1
F210,211	.FUSE	324452	2
XF210-212	.FUSEBLOCK	324998	1
F212	.FUSE, 5A, 600V	324211	1
	OPTION 12 - CONTROL TRANSFORMER (240/480 VOLT)	C25672-6	
T1	.TRANSFORMER	370654	1
XF212	.FUSEBLOCK	325065	1
F212	.FUSE, 5A, 600V	324211	1
K101	.RELAY, VOLT SENSE	350583	1
T40	.TRANSFORMER	370528	1
F440	.FUSE, 0.5A, 250V	324005	1
	.FUSEBLOCK	324964	1
K100,240	.RELAY	351687	2
K480	.RELAY (240V COIL)	350966	1
CB1	.CIRCUIT BREAKER	310336	1
	OPTION 13 - LOAD SHED CONTROL	A29011-5	
A101	.PC BOARD ASSY, LOAD SHED	A22829	1
K50,51	.RELAY	350539	2
XK71	.AUXILIARY CONTACT	312401	1
	OPTION 14 - LOAD BANK OPTION INSTALLATION (1,2,2 KW FINE LOAD STEP RESOLUTION - 208V)	D34485-1	
F51-53	.FUSE	324755	3
XF51-53	.FUSEHOLDER	325021	1
K10A-12A	.RELAY	350982	3
S1-3	.SWITCH, TOGGLE	360589	3
R12-26	.RESISTOR	A22098	15
	OPTION 15 - LOAD BANK OPTION INSTALLATION (1,2,2 KW FINE LOAD STEP RESOLUTION - 400V)	D34485-2	
F51-53	.FUSE	324480	3
XF51-53	.FUSEHOLDER	324977	1
K10A-12A	.RELAY	350982	3
S1-3	.SWITCH, TOGGLE	360589	3
R12-26	.RESISTOR	A29096	15

SCHEMATIC REFERENCE	DESCRIPTION	AVTRON P/N	QTY/ UNIT
	OPTION 16 – LOAD BANK OPTION INSTALLATION (1,2,2 KW FINE LOAD STEP RESOLUTION – 480V)	D34485-3	
F51-53	.FUSE	324480	3
XF51-53	.FUSEHOLDER	324977	1
K10A-12A	.RELAY	350982	3
S1-3	.SWITCH, TOGGLE	360589	3
R12-26	.RESISTOR	A16450	15
	OPTION 17 – LOAD BANK OPTION INSTALLATION (1,2,2 KW FINE LOAD STEP RESOLUTION – 240/480V)	D34485-4	
F51-53	.FUSE	324480	3
XF51-53	.FUSEHOLDER	324977	1
K10A-12A	.RELAY	350982	3
S1-3	.SWITCH, TOGGLE	360589	3
R12-26	.RESISTOR	A16450	15
	OPTION 18 – LOAD BANK OPTION INSTALLATION (1,2,2 KW FINE LOAD STEP RESOLUTION – 600V)	D34485-5	
F51-53	.FUSE	324479	3
XF51-53	.FUSEHOLDER	324977	1
K10A-12A	.RELAY	350982	3
S1-3	.SWITCH, TOGGLE	360589	3
R12-26	.RESISTOR	A22096	15
	OPTION 19 – LOAD BANK OPTION INSTALLATION (1,2,2 KW LOAD STEP RESOLUTION – 240V)	D34485-6	
S1-3	.SWITCH, TOGGLE	360589	3
R12-R26	.RESISTOR	A31995	15
F51-F53	.FUSE	324758	3
XF51-XF53	.FUSEHOLDER	325021	1
K10A,K11A,K12A	.RELAY	350982	3
	OPTION 20 – DIGITAL POWER METERING OPTION, V,A,F,KW, CT RATIO: 100:5	D34486-1	
CT1,2	.TRANSFORMER, CURRENT	371249	2
F100-102	.FUSE	324449	3
XF100-102	.FUSEBLOCK	324998	1
M1	.METER, POWER, MULTIFUNCTION	338344	1
	OPTION 21 – DIGITAL POWER METERING OPTION, V,A,F,KW, CT RATIO: 200:5	D34486-2	
CT1,2	.TRANSFORMER, CURRENT	371250	2
F100-102	.FUSE	324449	3
XF100-102	.FUSEBLOCK	324998	1
M1	.METER, POWER, MULTIFUNCTION	338344	1

SCHEMATIC REFERENCE	DESCRIPTION	AVTRON P/N	QTY/ UNIT
	OPTION 22 - DIGITAL POWER METERING	D34486-3	
	OPTION, V,A,F,KW, CT RATIO: 300:5		
CT1,2	.TRANSFORMER, CURRENT	370375	2
F100-102	.FUSE	324449	3
XF100-102	.FUSEBLOCK	324998	1
M1	.METER, POWER, MULTIFUNCTION	338344	1
	OPTION 23 - DIGITAL POWER METERING	D34486-4	
	OPTION, V,A,F,KW, CT RATIO: 500:5		
CT1,2	.TRANSFORMER, CURRENT	371251	2
F100-102	.FUSE	324449	3
XF100-102	.FUSEBLOCK	324998	1
M1	.METER, POWER, MULTIFUNCTION	338344	1
	OPTION 25 - 110V, SINGLE PHASE,	A29012	
	60 HZ (1HP) BLOWER		
B1	.MOTOR, AC (1HP)	341627	1
F203,204	.FUSE, 20 AMP	324283	2
K72	.OVERLOAD RELAY*	352045*	1
XK72	.BRACKET, RELAY MOUNTING*	408368*	1
	OPTION 26 - 220V, SINGLE PHASE,	A29013	
	60 HZ (1HP) BLOWER		
B1	.MOTOR, AC (1HP)	341627	1
F203,204	.FUSE, 10 AMP	324282	2
K72	.OVERLOAD RELAY*	352043*	1
XK72	.BRACKET, RELAY MOUNTING*	408368*	1
	OPTION 27 - 110V, SINGLE PHASE,	A29014	
	50 HZ (1HP) BLOWER		
B1	.MOTOR, AC (1HP)	341626	1
F203,204	.FUSE, 20 AMP	324283	2
K72	.OVERLOAD RELAY*	352045*	1
XK72	.BRACKET, RELAY MOUNTING*	408368*	1
	OPTION 28 - 220V, SINGLE PHASE,	A29015	
	50 HZ (1HP) BLOWER		
B1	.MOTOR, AC (1HP)	341626	1
F203,204	.FUSE, 10 AMP	324282	2
K72	.OVERLOAD RELAY*	352043*	1
XK72	.BRACKET, RELAY MOUNTING*	408368*	1
	OPTION 29 - 208-230V BLOWER (1HP),	A29016	
	3-PHASE 60 HZ		
B1	.MOTOR, AC (1HP)	341051	1

*If relay fails, replace relay and relay mounting bracket.

SCHEMATIC REFERENCE	DESCRIPTION	AVTRON P/N	QTY/ UNIT
	OPTION 30 - 400V BLOWER (1HP), 3-PHASE 50 HZ	A29017	
B1	.MOTOR, AC (1HP)	341629	1
	OPTION 31 - 460V BLOWER (1HP), 3-PHASE 60 HZ	A29018	
B1	.MOTOR, AC (1HP)	341051	1
	OPTION 32 - 575V BLOWER, 3-PHASE 60 HZ	A29019	
B1	.MOTOR, AC	341628	1
	OPTION 33 - 240-480V, 3-PHASE, 60 HZ BLOWER	C25673	
K71A, K73-77	.RELAY	351687	6
K72A	.RELAY, OVERLOAD*	350991*	1
XK72A	.BRACKET, RELAY MOUNTING*	408369*	1
F206-208	.FUSE, 4 AMP	324263	3
XF206-208	.FUSEHOLDER	324997	1
S15	.SWITCH, FAN ROTATION	360580	1
S16	.SWITCH, ROTARY BLOWER	620288	1
XS16	.KNOB	453602	1
	OPTION #36 - REVERSE POWER RELAY (480V)	A33420	
K100	.RELAY, REVERSE POWER	350680	1
K101,102	.RELAY, 3PDT	351060	2
XK101,102	.SOCKET, RELAY	358280	2
XK101,102	.HOLD DOWN SPRING	467550	2
F103-105	.FUSE, 1 AMP, 600V	324815	3
XF103-105	.FUSE HOLDER	324998	1
	OPTION #37 - REVERSE POWER RELAY (208V)	A33700	
K100	.RELAY, REVERSE POWER	350177	1
K101,102	.RELAY, 3PDT	351060	2
XK101,102	.SOCKET, RELAY	358280	2
XK101,102	.HOLD DOWN SPRING	467550	2
F103-105	.FUSE, 1 AMP, 600V	324815	3
XF103-105	.FUSE HOLDER	324998	1
	OPTION 38 – 1 KW RESOLUTION OPTION	D34485-7	
	.CONTROL PANEL MODIFICATION	A34844	1
S1,S2,S3	..SWITCH, TOGGLE	360589	3
R12-R26	.RESISTOR	A22096	15
F51-F53	.FUSE	324481	3
XF51-XF53	.FUSEHOLDER	324977	1
K10A,B, 11A,B, 12A,B	.RELAY	350982	6
XR12-XR26	.BRACKET, RESISTOR	408017	30

*If relay fails, replace relay and relay mounting bracket.

SCHEMATIC REFERENCE	DESCRIPTION	AVTRON P/N	QTY/ UNIT
	OPTION 39 – 1 KW RESOLUTION OPTION	D34485-8	
	.CONTROL PANEL MODIFICATION	A29095	1
S1,S2,S3	..SWITCH, TOGGLE	360589	3
R12-R26	.RESISTOR	A31995	15
F51-F53	.FUSE	324758	3
XF51-XF53	.FUSEHOLDER	325021	1
K10A,11A,12A	.RELAY	350982	3
XR12-XR26	.BRACKET, RESISTOR	408017	30
	OPTION 40 – DIGITAL METERING (1 CT, 300 AMP)	D34486-5	
	.CONTROL PANEL MODIFICATION	A29097	1
	..METER, DIGITAL, MULTIFUNCTION	338344	1
F100-F101	.FUSE, 1 AMP	324449	2
XF100-F101	.FUSEHOLDER	324998	1
CT1	.TRANSFORMER, CURRENT	370378	1
	OPTION 41 – DIGITAL METERING (1 CT, 500 AMP)	D34486-6	
	.CONTROL PANEL MODIFICATION	A29097	1
	..METER, DIGITAL, MULTIFUNCTION	338344	1
F100-F101	.FUSE, 1 AMP	324449	2
XF100-F101	.FUSEHOLDER	324998	1
CT1	.TRANSFORMER, CURRENT	371251	1
	OPTION 42 – DIGITAL METERING (1 CT, 800 AMP)	D34486-7	
	.CONTROL PANEL MODIFICATION	A29097	1
	..METER, DIGITAL, MULTIFUNCTION	338344	1
F100-F101	.FUSE, 1 AMP	324449	2
XF100-F101	.FUSEHOLDER	324998	1
CT1	.TRANSFORMER, CURRENT	370908	1
	OPTION 44 – LOW NOISE OPERATION (100 KW MAX)	A36210	
	.MOTOR, AC, 3/4 HP, 1140 RPM	341490	1
	.IMPELLER (1150 RPM) 20.00” DIA. ALUMINUM	406084	1
	OPTION 45 – REMOTE MONITORING CONTACTS, LOAD SHED	A36360	
K101,102	.RELAY	351060	2
XK101,102	.SOCKET, RELAY	358280	2
	OPTION 50 – ELECTRIC HEATER, 400W	A37407	
HR10	.HEATER, ELECTRICAL, 400W	352530	1
F103	.FUSE, 5AMP	324211	1
XF103	.FUSEHOLDER, 1 POLE	325065	1

REPLACEMENT PARTS LIST

SCHEMATIC REFERENCE	DESCRIPTION	MANUFACTURER and PART NO.	AVTRON P/N	QTY/ UNIT
	AVTRON MODEL LSH50 LOAD BANK, RESISTIVE, OUTDOOR		LSH50-D34087-1	
	.SCHEMATIC		D34092	REF
	.CONTROL PANEL		D33873-1	1
	..SCHEMATIC		D34092	REF
R100	..RESISTOR, 100K, 0.5 WATT, 10%		110048	1
F1	..FUSE, 5A, 600V	BUSSMANN FNQ-R-5	324475	1
XF1	..FUSEHOLDER	BUSSMANN HPS-RR	324985	1
DS1,DS3	..LIGHT, INDICATOR (AMBER)	DIALIGHT 249-7841-1433-574	329681	2
DS2	..LIGHT, INDICATOR (RED)	DIALIGHT 249-7841-1431-574	329682	1
K99	..RELAY	POTTER & BRUMFIELD T92S11A22-120	350539	1
S4-7,19,20	..SWITCH, TOGGLE	CARLINGSWTICH 2GK51-73	360589	6
S23	..SWITCH, PUSHBUTTON (RED)	ALLEN-BRADLEY 800T-B6D2	361873	1
S22	..SWITCH, PUSHBUTTON (BLACK)	ALLEN-BRADLEY 800T-A2D1	361874	1
K4	.RELAY		B14795	1
D	.RESISTANCE ELEMENT		A28608-1	6
E	.RESISTANCE ELEMENT		A28608-2	12
F, G	.RESISTANCE ELEMENT		A28608-12	6
F203-F205	.FUSE, 4A, 600V	BUSSMANN LPJ-4SP	324263	3
F11-16	.FUSE, 40A, 600V	BUSSMANN JJS-40	324419	6
XF203-205	.FUSEHOLDER	BUSSMANN JP60030-3PR	324997	1
XF11-16	.FUSEHOLDER	BUSSMANN T60060-3CR	324660	2
B1	.MOTOR	BALDOR ELECTRIC M3546T 230/460V	341051	1
K72	.RELAY, O/L*	SIEMENS 3RB2016-2PB0	350991*	1
XK72	.MOUNTING BRACKET, RELAY*	SIEMENS 3RB2913-0AA1	408369*	1
K1-3	.RELAY	DELTROL 21009-84-375TM-3PST-NO-30A120VAC	350982	3
K71	.RELAY	ALLEN-BRADLEY 100-C09D10	351687	1

*IF RELAY FAILS, REPLACE RELAY AND RELAY MOUNTING BRACKET.

SCHEMATIC REFERENCE	DESCRIPTION	MANUFACTURER and PART NO.	AVTRON P/N	QTY/ UNIT
HR1	.HEATING ELEMENT	CHROMALOX PCN132919 (100W)	352026	1
S12	.SWITCH, SENSING, RANGE 0.5 ±0.02 IN W.C. - 2.0 IN W.C., 300 VA, 115-277 VAC, INCLUDES LINE NUT AND FERRULE CONNECTORS	(08275) AFS-271 PER DESC	360772	1
S11	.SWITCH, TEMP	SELCO OA-80	363099	1
	.IMPELLER, FAN	AIR TURBINE PROPELLER S-20-11-HD 7/8 DIA	406038	1
	.TUBE, INSULATOR		411141	240
	.TUBE, INSULATOR		411145	24
	.TUBE, INSULATOR		411181	48
	.TUBE, INSULATOR		411182	96
S13,S14	.SWITCH, TEMP	SIEMENS SE-L250	491021	2

APPENDIX

LOAD BANK
TROUBLESHOOTING GUIDE

NOTE

Servicing should always be done only by trained, qualified service technicians.

****

W A R N I N G

Be sure that all sources of power to the Load Bank are disconnected before servicing.

****

PROBLEM	POSSIBLE CAUSES/REMEDIES
1. Load Bank main power fails to come on.	a. Main switch or circuit breaker is not closed. b. Unit is not connected according to the Schematic/Interconnection Diagram. c. Terminals were damaged during shipment. d. Fuses are blown. (Check and replace as required.)* e. Fuse is blown in Load Bank control circuit. (Check and replace as required.)* f. Dirty or loose connection at Main Power Switch.
2. Blower motor does not operate.	a. Main switch or circuit breaker is not closed. b. Power is not connected to Load Bank blower circuit. c. External power source is inadequate. d. Motor fuses are blown. (Check and replace as required.)*

* When checking fuses for continuity, be sure to remove all fuses from clips (in fuseblock or Disconnect Switch). Test each fuse individually, out of circuit. (If tested in circuit, there is the possibility of feedback which causes false readings. A blown fuse may still check out OK.)

PROBLEM	POSSIBLE CAUSES/REMEDIES
2. Blower motor does not operate. (Cont.)	e. Motor overload is tripped. f. Motor start is malfunctioning. g. Main Power Switch is inoperative. h. Connections are broken or loose. i. Motor shaft does not turn due to improper lubrication. (Replace or repair as necessary.)
3. BLOWER FAILURE indicator lights, yet blower is operating.	a. Airflow restrictions present at Load Bank intake or exhaust. b. Improper fan blade rotation or phase reversal. (Check fan motor power connections for proper phase sequence.) c. Air Differential Pressure Switch is malfunctioning. d. Blower Fail Relay is malfunctioning.
4. Fan blade is broken or not turning.	a. Fan blade motion is obstructed. b. Fan blade is loose at hub or is not keyed properly.
5. Load step(s) cannot be energized.	a. A blower failure exists. (See problem 2.) b. MASTER LOAD Switch is inoperative. c. Control power is inadequate. d. Fuse is blown in Load Bank control circuit or individual branch circuit load fuse (if so equipped) is blown. (Check and replace as required.)* e. Blower Fail Relay is malfunctioning. f. Load step switch is inoperative. g. Load step contactor is inoperative. h. Magnetic contactor has an open coil. i. Load step resistor is open.

* When checking fuses for continuity, be sure to remove all fuses from clips (in fuseblock or Disconnect Switch). Test each fuse individually, out of circuit. (If tested in circuit, there is the possibility of feedback which causes false readings. A blown fuse may still check out OK.)

PROBLEM	POSSIBLE CAUSES/REMEDIES
6. Contactor "chattering" exists.	a. Contacts and/or core are dirty or corroded. b. Connections to contactor coil are loose. c. Control circuit line voltage is too low.
7. Load Bank or load step does not give rated load.	a. Applied load voltage is either derated or inadequate. b. Contactor does not close properly. c. Load step resistor element is open. d. One of the individual load branch circuit fuses is blown (if so equipped).
8. Disconnect Switch fuses are blown.	a. Fuses are undersized.* b. A short circuit exists in the blower or control circuit.*

* When checking fuses for continuity, be sure to remove all fuses from clips (in fuseblock or Disconnect Switch). Test each fuse individually, out of circuit. (If tested in circuit, there is the possibility of feedback which causes false readings. A blown fuse may still check out OK.)

DRAWINGS

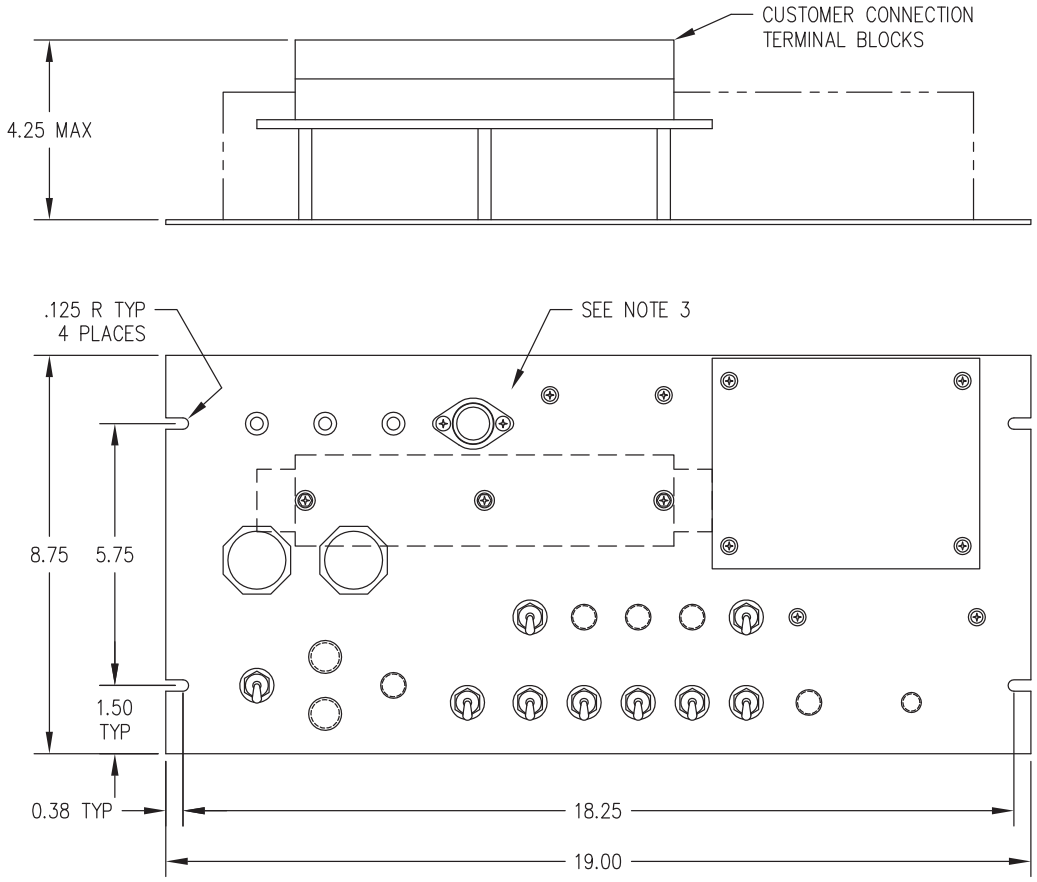
PROPRIETARY NOTE

This document contains information PROPRIETARY TO Avtron Load Bank branded products and systems by ASCO Power Technologies, LP. It is furnished solely to provide information sufficient for instruction, operation, maintenance, evaluation, and testing of the equipment herein disclosed; is not to be used for manufacturing or procurement; and is not to be disclosed to anyone other than persons in the Division, or the Company, or the Government, as the case may be, responsible for action relating to this document without the express written permission of ASCO Power Technologies, LP.

AVTRON

EMERSON Network Power

6255 Halle Drive, Cleveland, OH 44125-4615 - 216.573.7600 - f: 216.573.5953
www.EmersonNetworkPower.com/loadbank



FOR APPLICATION ENGINEERING USAGE ONLY

3. FRONT PANEL COMPONENT LAYOUT WILL VARY DEPENDING ON VOLTAGE REQUIREMENTS.
2. ALL DIMENSIONS ARE APPROX.
1. WEIGHT:

NOTES:

ECN NO.	REV LET.	CHANGE	CHG'D	CHK'D

		DATE
DRAWN	J.FLAUTO	12-27-02
CHECKED	J.FLAUTO	12-27-02
APPROVED	J.HUDSON	SCALE 3/8

MODEL LSH

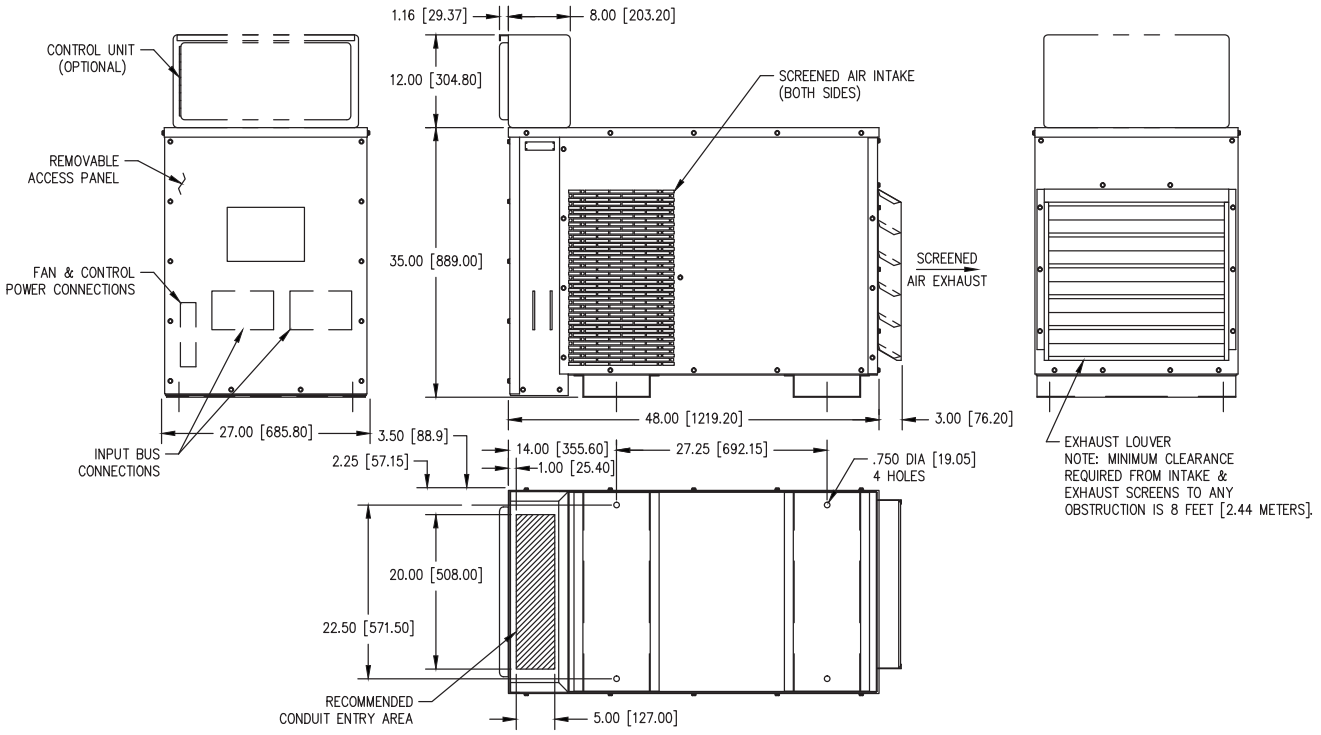
AVTRON MANUFACTURING, INC. INDEPENDENCE, OH

CONTROL PANEL

DRAWING NUMBER

SB3323

OUTLINE DRAWING



FOR APPLICATION ENGINEERING USAGE ONLY

REV. TO SHEET	ECN NO.	BY	APP.	DATE
B	LA1672	AVC	GG	9/26/14
	ACAD TEMPLATE UPDATED			
A	CF344	RGR	PPP	7/18/08
	ADD METRIC DIMENSIONS			

PROJECT NAME:

LOAD BANK, OUTDOOR

THIRD ANGLE PROJECTION

	BY	DATE
DRAWN BY	JJF	11/15/02
CHECKED	JJF	11/21/02
PROJECT APPROVAL	JPH	
FINAL APPROVAL		

MANUFACTURING TOLERANCES TO BE IN ACCORDANCE WITH ASCO PROCEDURE MP-I-003. FOR PLASTIC PARTS SEE MP-I-055

ASSEM. REF. NO.

ASCO® ASCO POWER TECHNOLOGIES, L.P.
FLORHAM PARK, NEW JERSEY 07932 U.S.A.

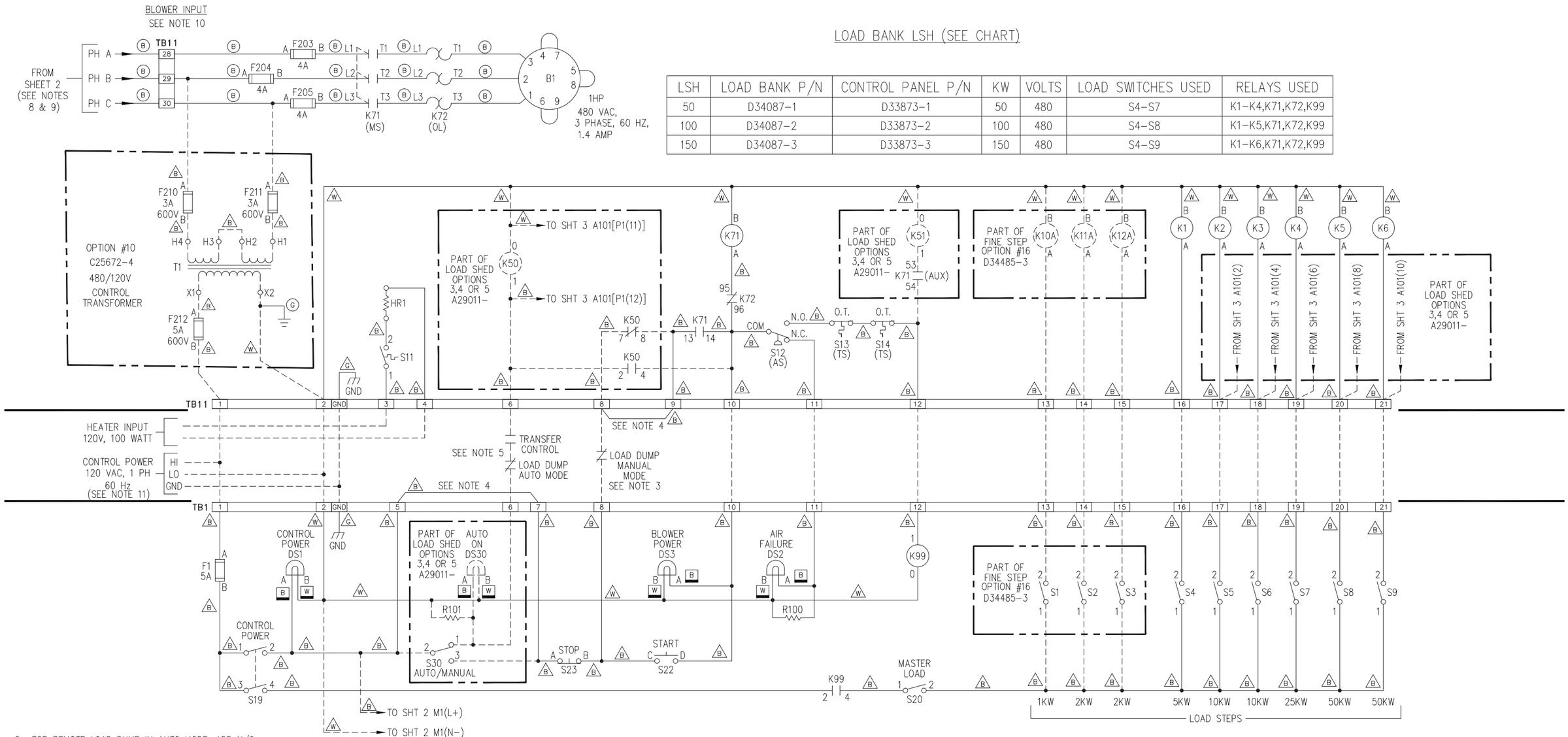
COMPUTER GENERATED DRAWING

SCALE 1/16" = 1" | SIZE BS

DWG. NO. SB3304

DRAWING REV. B | ECN NO. LA1672 | SHEET 1 OF 1

3. DIMENSIONS ARE IN INCHES AND [MM].
2. ALL DIMENSIONS ARE APPROX.
1. WEIGHT: 500 LBS [227 Kg] APPROX (LESS CONTROL UNIT)



LSH	LOAD BANK P/N	CONTROL PANEL P/N	KW	VOLTS	LOAD SWITCHES USED	RELAYS USED
50	D34087-1	D33873-1	50	480	S4-S7	K1-K4,K71,K72,K99
100	D34087-2	D33873-2	100	480	S4-S8	K1-K5,K71,K72,K99
150	D34087-3	D33873-3	150	480	S4-S9	K1-K6,K71,K72,K99

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

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

11- NOT REQUIRED WHEN CONTROL TRANSFORMER OPTION IS PRESENT.

10- IF EXTERNAL BLOWER POWER IS REQUIRED, REMOVE WIRING BETWEEN TB11 (28-30) AND THE MAIN BUS. CONNECT EXTERNAL VOLTAGE SUPPLY TO TB11 (28-30).

9- IF A METERING OPTION IS PRESENT, WIRING FROM PHASE A MUST PASS THROUGH CT1 AND WIRING FROM PHASE C MUST PASS THROUGH CT2.

8- IF AN OPTIONAL BLOWER MOTOR CIRCUIT FROM SHEET 3 IS PRESENT, DO NOT INSTALL WIRING BETWEEN BLOWER INPUT AND THE LOAD BUS.

7- 2P DENOTES TWO RESISTANCE ELEMENTS IN PARALLEL.

6- FUSE REPLACMENT CHART:

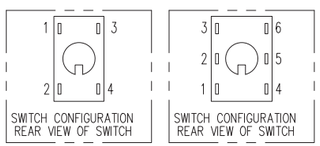
CONTROL

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.

CONTROL PANEL (SEE CHART)



DESIGNATION CODE
- AS - DENOTES AIRFLOW SWITCH (S12)
- ML - DENOTES MASTER LOAD (S20)
- MS - DENOTES MOTOR STARTER (K71)
- OL - DENOTES OVERLOAD RELAY (K72)
- TS - DENOTES OVERTEMP SWITCH (S13 & S14)

REV.				
H	LA2050	AVC	JPH	6/30/15
	REVISED BLOWER MOTOR			
G	LA1919	AVC	JPH	5/29/15
	REVISED PER ECN			
F	LA1780	AVC	GG	11/7/14
	ACAD TEMPLATE UPDATED			
E	LA1576	JRF	PPP	4/8/14
	SEE SHT 2			
D	LA1067	RGR	JPH	11/1/13
	ADD WIRE CODE PER ECN			
C	LA0394	JAF	CMK	8/23/10
	REVISED PER ECN			
B	CE071	JJF	DK	5/20/05
	REVISED PER ECN			
A	CD312	JJF	JPH	2/10/03
	REVISED PER ECN			

PROJECT NAME:

SCHEMATIC / INTCON DIAGRAM

THIRD ANGLE PROJECTION

	BY	DATE
DRAWN BY	JAF	11/15/02
CHECKED	JJF	12/3/02
PROJECT APPROVAL	JPH	12/3/02
FINAL APPROVAL	AV	12/3/02

MANUFACTURING TOLERANCES TO BE IN ACCORDANCE WITH ASCO PROCEDURE MP-1-003. FOR PLASTIC PARTS SEE MP-1-055

ASSEM. REF. NO.

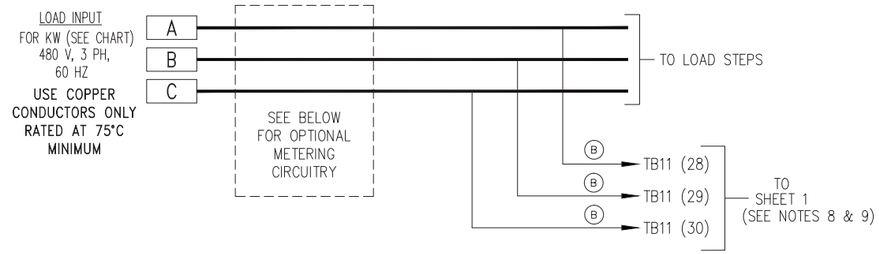
ASCO® ASCO POWER TECHNOLOGIES, L.P. FLORHAM PARK, NEW JERSEY 07932 U.S.A.

COMPUTER GENERATED DRAWING

SCALE 1:1 SIZE DS

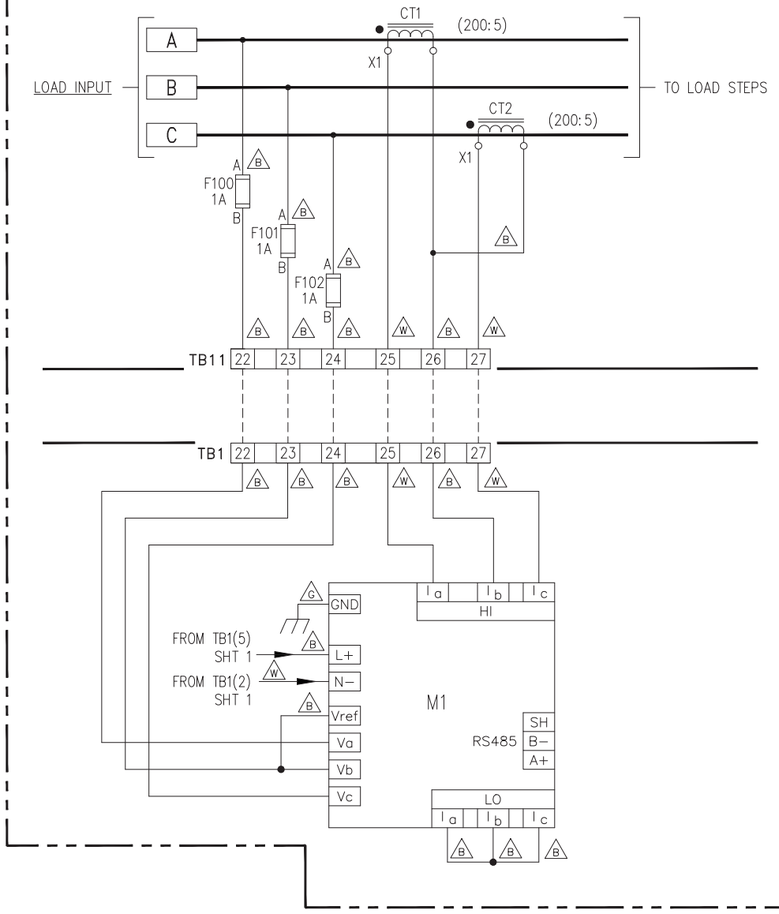
DWG. NO. D34092

DRAWING REV. H ECN NO. LA2050 SHEET 1 OF 3

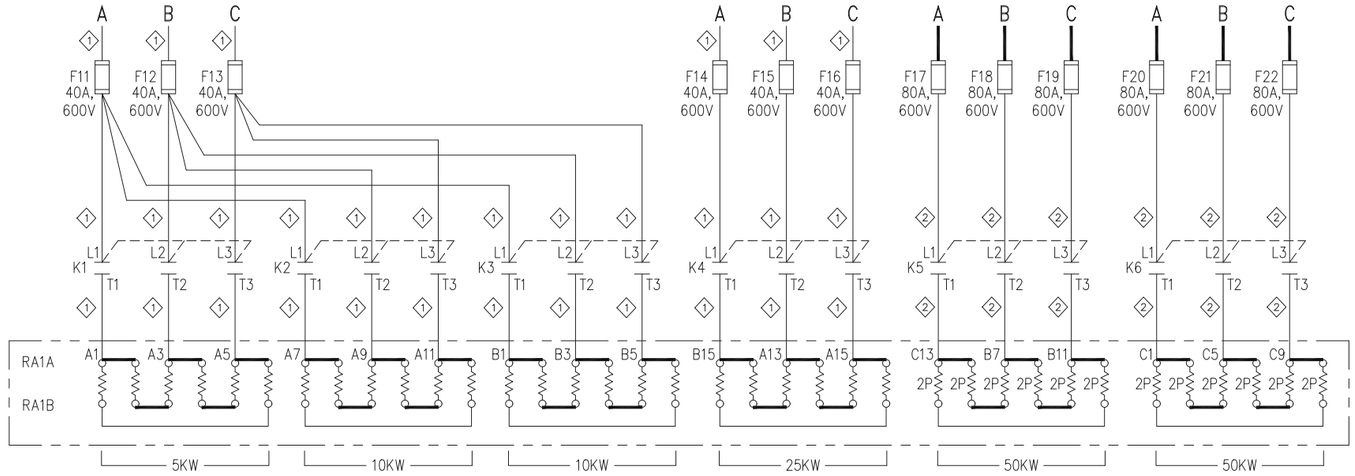


METER OPTION (SEE CHART)

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



LOAD BANK LSH (SEE CHART)



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.

SEE SHEET 1 FOR NOTES AND WIRE CODE

REV. TO SHEET	ECN NO.	BY	APP.	DATE
G	LA1919	AVC	JPH	5/29/15
	REVISED PER ECN			
F	LA1780	AVC	GG	11/7/14
	ACAD TEMPLATE UPDATED			
E	LA1576	JRF	PPP	4/8/14
	REVISED "K4" PER ECN			
D	LA1067	RGR	JPH	11/1/13
	ADD WIRE CODE PER ECN			
C	LA0394	JAF	CMK	8/23/10
	REVISED PER ECN			
B	CE071	JJF	DK	5/20/05
	REVISED PER ECN			

PROJECT NAME:

SCHEMATIC / INTCON DIAGRAM

THIRD ANGLE PROJECTION

	BY	DATE
DRAWN BY	JAF	11/15/02
CHECKED	JJF	12/3/02
PROJECT APPROVAL	JPH	12/3/02
FINAL APPROVAL	AV	12/3/02

MANUFACTURING TOLERANCES TO BE IN ACCORDANCE WITH ASCO PROCEDURE MP-I-003. FOR PLASTIC PARTS SEE MP-I-055

ASSEM. REF. NO.

COMPUTER GENERATED DRAWING

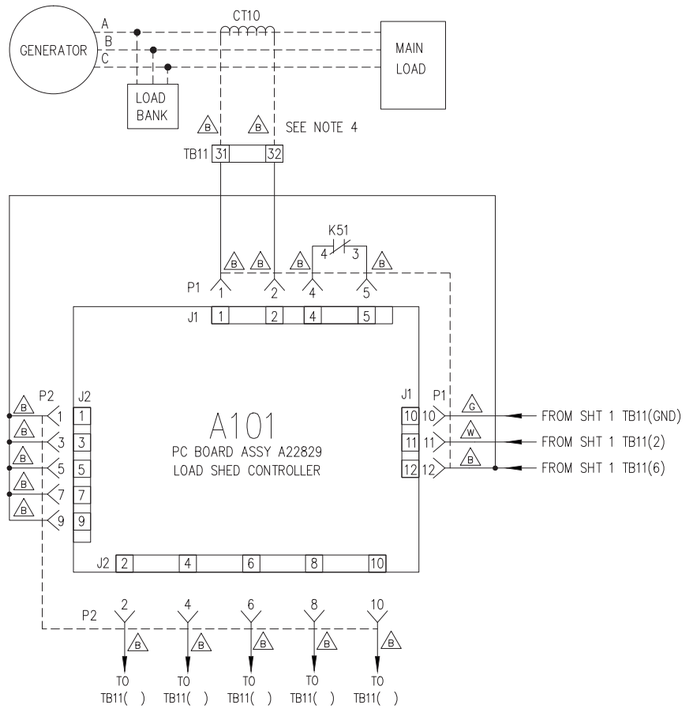
SCALE 1:1 SIZE DS

DWG. NO. D34092

DRAWING REV. H ECN NO. LA2050 SHEET 2 OF 3

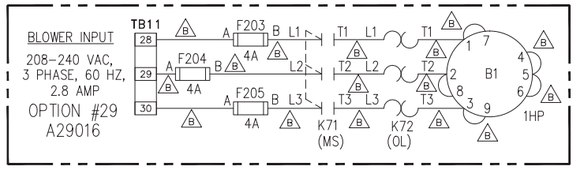
ASCO® ASCO POWER TECHNOLOGIES, L.P. FLORHAM PARK, NEW JERSEY 07932 U.S.A.

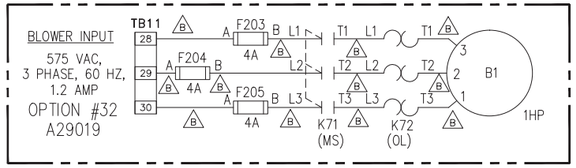
PART OF LOAD SHED OPTIONS 3,4 OR 5 A29011-

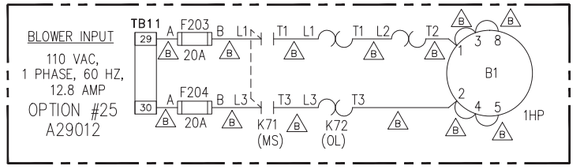


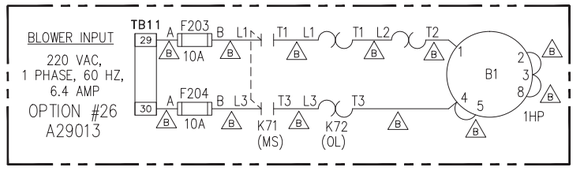
LOAD SHED OPTION #	PC BD. TERMINAL	A101 (P2) 2	4	6	8	10	
		WIRE FROM ABOVE POINTS TO LOAD BANK (TB11)					
A29011-1		17	18	19	NC	NC	45KW CONTROL
A29011-2		17	18	19	20	NC	95KW CONTROL
A29011-3		17	18	19	20	21	145KW CONTROL

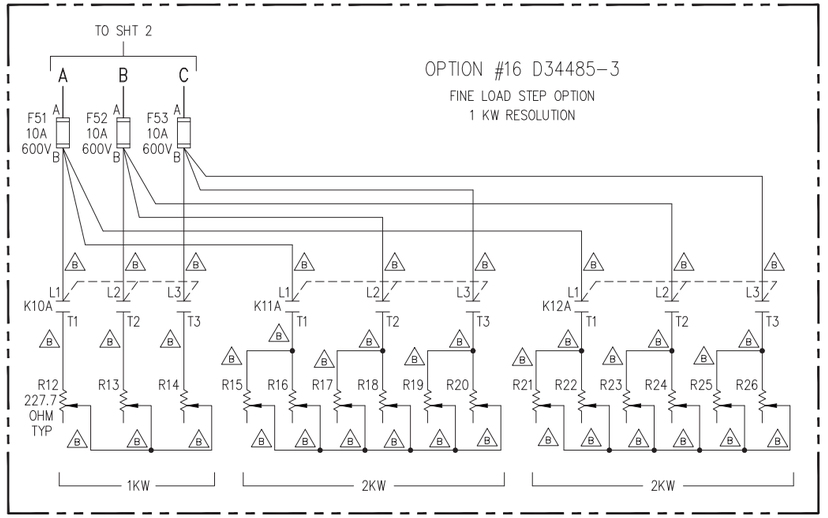
4. DASHED LINES REPRESENT CUSTOMER WIRING.
3. ADJUST VARIABLE RESISTORS ON PC BOARD A101 (R26,R39,R52,R65 & R78) TO 3 SECONDS, ADJUST (R14) TO 5 SECONDS.
2. ADJUST VARIABLE RESISTORS ON PC BOARD A101 (R21,R34,R47,R60 & R73) PER PROJECT NOTES.
1. ALL WIRING TO BE BLACK #16 AWG (PN 390008) UNLESS OTHERWISE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

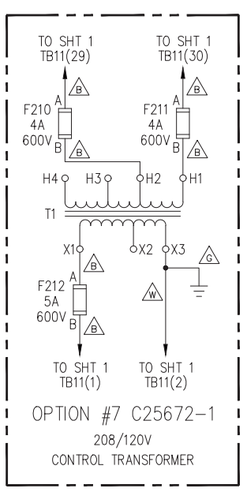


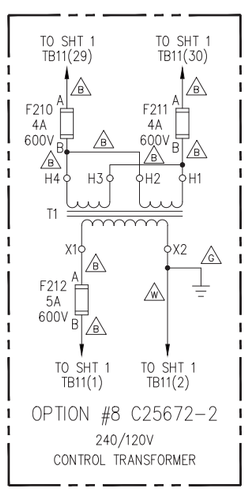


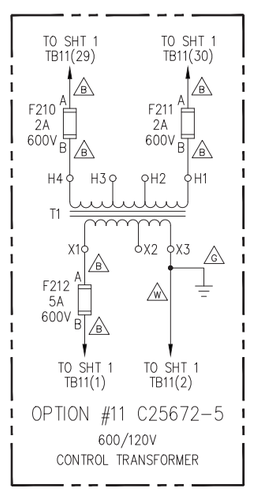












SEE SHEET 1 FOR NOTES AND WIRE CODE

REV.				
G	LA1919	AVC	JPH	5/29/15
	REVISED PER ECN			
F	LA1780	AVC	GG	11/7/14
	ACAD TEMPLATE UPDATED			
D	LA1067	RGR	JPH	11/1/13
	ADD WIRE CODE PER ECN			
C	LA0394	JAF	CMK	8/23/10
	REVISED PER ECN			
B	CE071	JJF	DK	5/20/05
	REV PER ECN			
A	CD312	JJF	JPH	2/10/03
	REV PER ECN			

PROJECT NAME:

SCHEMATIC / INTCON DIAGRAM

THIRD ANGLE PROJECTION

	BY	DATE
DRAWN BY	JAF	11/15/02
CHECKED	JJF	12/3/02
PROJECT APPROVAL	JPH	12/3/02
FINAL APPROVAL	AV	12/3/02

MANUFACTURING TOLERANCES TO BE IN ACCORDANCE WITH ASCO PROCEDURE MP-I-003. FOR PLASTIC PARTS SEE MP-I-055

ASSEM. REF. NO.

COMPUTER GENERATED DRAWING

SCALE 1:1 SIZE DS

DWG. NO. D34092

DRAWING REV. H ECN NO. LA2050 SHEET 3 OF 3

ASCO® ASCO POWER TECHNOLOGIES, L.P. FLORHAM PARK, NEW JERSEY 07932 U.S.A.

50 KW, 480V, 3 PH, 60HZ LOAD STEPS: 5,10,10,25 BLOWER MOTOR CIRCUIT BREAKER 304 SST EXHAUST LOUVER			150 KW, 480V, 3 PH, 60HZ LOAD STEPS: 5,10,10,25,50,50			100 KW, 480V, 3 PH, 60HZ LOAD STEPS: 5,10,10,25,50			50 KW, 480V, 3 PH, 60HZ LOAD STEPS: 5,10,10,25							
												50	←	←	FUSEHOLDER	
												49	←	←	FUSEHOLDER	
XF11-16	2	324660	XF11-16	2	324660	XF11-16	2	324660	XF11-16	2	324660	48	←	←	FUSEHOLDER	
		NR	XF203-205	1	324997	XF203-205	1	324997	XF203-205	1	324997	47	←	←	FUSEHOLDER	
												46	←	←	FUSE	
		NR	F17-22	6	324420	F17-19	3	324420			NR	45	←	←	FUSE, 80A, 600V	
F11-16	6	324419	F11-16	6	324419	F11-16	6	324419	F11-16	6	324419	44	←	←	FUSE, 40A, 600V	
												43	←	←	FUSE	
												42	←	←	FUSE	
		NR	F203-F205	3	324263	F203-F205	3	324263	F203-F205	3	324263	41	←	←	FUSE, 4A, 600V	
F	6	A28608-12	F, G, H	30	A28608-12	F, G	18	A28608-12	F	6	A28608-12	40	←	←	RESISTANCE ELEMENT	
E	12	A28608-2	E	12	A28608-2	E	12	A28608-2	E	12	A28608-2	39	←	←	RESISTANCE ELEMENT	
D	6	A28608-1	D	6	A28608-1	D	6	A28608-1	D	6	A28608-1	38	←	←	RESISTANCE ELEMENT	
	1	A28597		1	A28597		1	A28597		1	A28597	37	←	←	PLATE, IDENT	
	48	A21179		96	A21179		72	A21179		48	A21179	36	←	←	BUSHING, SUPPORT ROD	
	19	A17912		52	A17912		35	A17912		19	A17912	35	←	←	BUS BAR	
	2	B15905		2	B15905		2	B15905		2	B15905	34	←	←	LABEL, INSTRUCTION, WARNING	
	1	B15896		1	B15896		1	B15896		1	B15896	33	←	←	LABEL, INSTRUCTION, WARNING	
A,B,C	3	B28873	A,B,C	3	B28873	A,B,C	3	B28873	A,B,C	3	B28873	32	←	←	BUS BAR, LOAD CONNECTION	
		NR		1	A21400		1	A21400		1	A21400	31	←	←	LABEL, UL	
	24	B22519-22		48	B22519-22		36	B22519-22		24	B22519-22	30	←	←	ROD, ELEMENT SUPPORT	
	1	B19706		1	B19706		1	B19706		1	B19706	29	←	←	BRACKET, SWITCH	
CB1	1	310437			NR			NR			NR	28	←	←	CIRCUIT BREAKER	
		NR	K5,K6	2	B14796	K5	1	B14796			NR	27	←	←	RELAY	
K1-K4	4	B14795	K1-K4	4	B14795	K1-K4	4	B14795	K1-K4	4	B14795	26	←	←	RELAY	
	1	B15871		1	B15871		1	B15871		1	B15871	25	←	←	LABEL, INSTRUCTION, WARNING	
	2	B15869		2	B15869		2	B15869		2	B15869	24	←	←	LABEL, INSTRUCTION, WARNING	
	2	B15868		2	B15868		2	B15868		2	B15868	23	←	←	LABEL, INSTRUCTION, WARNING	
	1	C25593		1	C25593		1	C25593		1	C25593	22	←	←	SUPPORT, RESISTOR	
	2	C25653		2	C25653		2	C25653		2	C25653	21	←	←	BRACKET, MOTOR MOUNTING	
	1	C25652		1	C25652		1	C25652		1	C25652	20	←	←	SUPPORT, MOTOR	
	1	C25651		1	C25651		1	C25651		1	C25651	19	←	←	COVER, BOTTOM	
	1	C25650-1		1	C25650-1		1	C25650-1		1	C25650-1	18	←	←	TOP COVER, LOAD BANK	
	1	C25661		1	C25661		1	C25661		1	C25661	17	←	←	FRONT COVER, LOAD BANK	
	2	C25567		2	C25567		2	C25567		2	C25567	16	←	←	HEAT SHIELD	
	1	C20562		1	C20562		1	C20562		1	C20562	15	←	←	SIGN, WARNING, DANGER	
	1	D48040		1	D34092		1	D34092		1	D34092	14	←	←	SCHEMATIC	
	1	D33873-1		1	D33873-3		1	D33873-2		1	D33873-1	13	←	←	CONTROL PANEL	SUPPLIED SEPARATE
	1	D48039		1	D36289		1	D36289		1	D36289	12	←	←	LOUVER ASSY	
	1	D34361		1	D34361		1	D34361		1	D34361	11	←	←	SUPPORT, COMPONENT MTG	
	1	D34360		1	D34360		1	D34360		1	D34360	10	←	←	PANEL, AIR EXHAUST	
	1	D34359-2		1	D34359-2		1	D34359-2		1	D34359-2	9	←	←	ACCESS PANEL, SIDE	
	1	D34359-1		1	D34359-1		1	D34359-1		1	D34359-1	8	←	←	ACCESS PANEL, SIDE	
	1	D34358		1	D34358		1	D34358		1	D34358	7	←	←	CUSTOMER CONNECTION BOX	
	1	D34357		1	D34357		1	D34357		1	D34357	6	←	←	SUB STRUCTURE, LOAD BANK	
	2	D34356		2	D34356		2	D34356		2	D34356	5	←	←	FORKLIFT CHANNEL	
	1	D34355		1	D34355		1	D34355		1	D34355	4	←	←	VENTURI, FAN	
	1	D34354-2		1	D34354-2		1	D34354-2		1	D34354-2	3	←	←	SUPPORT, ELEMENT	
	1	D34354-1		1	D34354-1		1	D34354-1		1	D34354-1	2	←	←	SUPPORT, ELEMENT	
	1	D34353		1	D34353		1	D34353		1	D34353	1	←	←	BASE, LOAD BANK	
REF DESIGNATOR	NO. REQD	PART NO.	REF DESIGNATOR	NO. REQD	PART NO.	REF DESIGNATOR	NO. REQD	PART NO.	REF DESIGNATOR	NO. REQD	PART NO.	ITEM NO.	NO. REQD	PART NO.	DESCRIPTION	MATERIAL
LSH50 D34087-4			LSH150 D34087-3			LSH100 D34087-2			LSH50 D34087-1			LIST OF MATERIAL				

7. CONTROL PANEL (ITEM 13) SHIPS SEPARATE.
6. FILL UNUSED COMPONENT MOUNTING HOLES WITH #8 TFS. ITEM 7 ONLY.
5. ATTACH COMPONENTS USING REF DESIGNATORS FOR LOCATION ATTACH USING HARDWARE INDICATED.
4. LABEL ELEMENT SUPPORTS (ITEMS 2 & 3) WITH "RA1A, RA1B, 1-16" AS SHOWN USING A TEMPLATE, PRODUCTION DECAL OR INK STAMPING.
3. APPLY PENETROX (PN 950122) OR EQUIVALENT TO UNPLATED COPPER BUS BEFORE ATTACHING LUGGED WIRES OR FUSES TO BUS.
2. ALL EXTERIOR HARDWARE TO BE STAINLESS STEEL.
1. MARK REFERENCE DESIGNATORS .12 HIGH MINIMUM USING PRODUCTION DECALS AND OR INK STAMPING. SPRAY OVER INK STAMPING WITH CLEAR ACRYLIC LACQUER. REFERENCE DESIGNATORS SHALL BE LOCATED ADJACENT TO COMPONENTS SO THAT THEY REMAIN VISIBLE AFTER WIRING.

REV. TO SHEET	ECN NO.	BY	APP.	DATE
L	LA1780	AVC	GG	11/7/14
	ACAD TEMPLATE UPDATED			
K	LA0872	JRF	CMK	1/12/12
	REVISED PER ECN			
J	LA0770	RGR	CMK	9/12/11
	REVISED PER ECN			
H	LA0383	RGR	CMK	8/11/10
	REVISED PER ECN			
G	LA0334	RGR	DK	6/21/10
	REVISED PER ECN			
F	LA0290	JAF	DK	4/29/10
	REVISED PER ECN			
E	CE548	JJF	JPH	9/19/06
	REVISED SHEET 2			
D	CD626	JAF	JWE	3/26/04
	REVISED PER ECN			
C	CD524	JJF	JPH	10/29/03
	REVISED SHEET 2			
B	CD337	JJF	JPH	3/31/03
	REVISED SHEET 3			
A	CD275	JAF	JPH	1/15/03
	REVISED SHT 4 PER ECN			

PROJECT NAME:

LOAD BANK, RESISTIVE, OUTDOOR (480 V, 3 PH, 60 HZ, 5 KW RES)
OUTLINE DRAWING SB3304

THIRD ANGLE PROJECTION

	BY	DATE
DRAWN BY	JJF	9/19/02
CHECKED	JJF	11/26/02
PROJECT APPROVAL	JPH	11/26/02
FINAL APPROVAL	AV	12/2/02

MANUFACTURING TOLERANCES TO BE IN ACCORDANCE WITH ASCO PROCEDURE MP-I-003. FOR PLASTIC PARTS SEE MP-I-055

ASSEM. REF. NO.

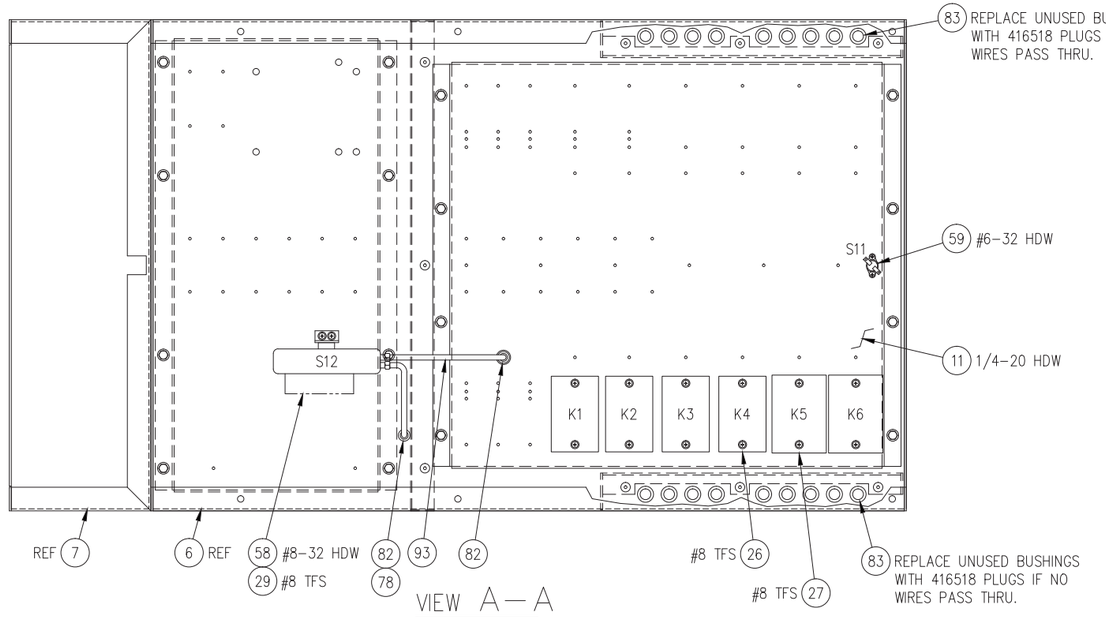
ASCO® ASCO POWER TECHNOLOGIES, L.P. FLORHAM PARK, NEW JERSEY 07932 U.S.A.

COMPUTER GENERATED DRAWING

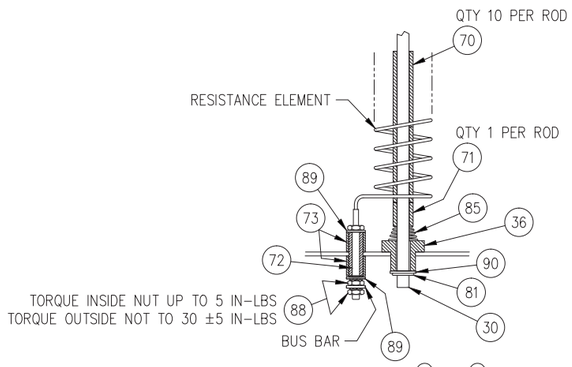
SCALE 1:1 SIZE DS

DWG. NO. D34087

DRAWING REV. L ECN NO. LA1780 SHEET 1 OF 5

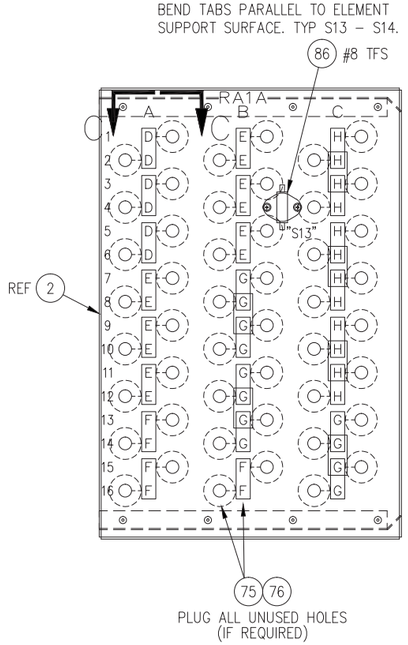


VIEW A—A

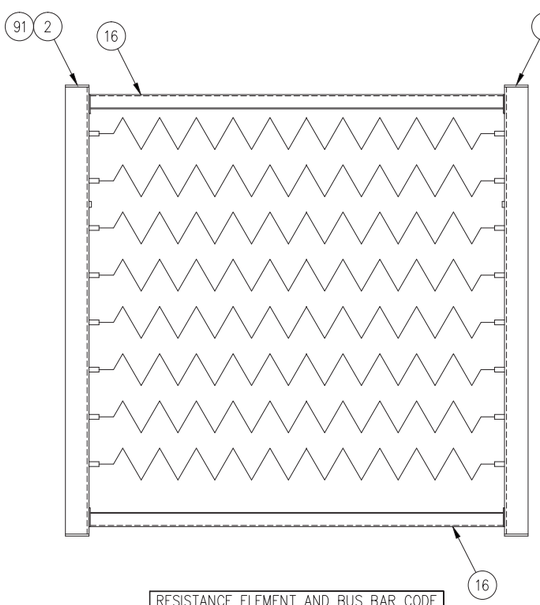


SECTION C—C

SCALE: 1/2

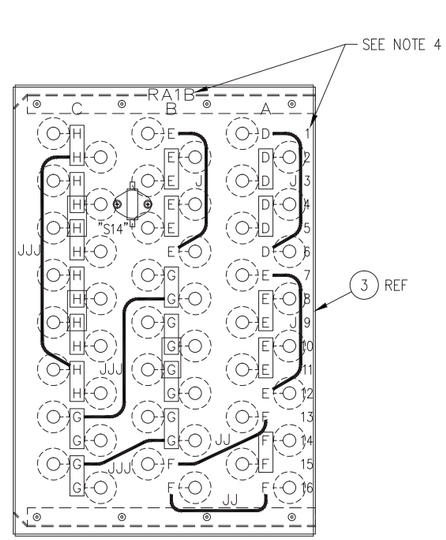


PLUG ALL UNUSED HOLES (IF REQUIRED)



RESISTANCE ELEMENT AND BUS BAR CODE		
SYMBOL	ITEM NO.	DESCRIPTION
D	38	RESISTANCE ELEMENT
E	39	RESISTANCE ELEMENT
F, G, H	40	RESISTANCE ELEMENT
○ ○	35	BUS BAR

DETAIL B



J —— DENOTES #16 AWG WIRE JUMPER (PN 390008).
JJ —— DENOTES #10 AWG WIRE JUMPER (PN 390016).
JJJ —— DENOTES #8 AWG WIRE JUMPER (PN 390019).

NOTE: DO NOT PUT BUS BARS OR JUMPERS WHERE THEIR IS NO ELEMENT.

SEE SHEET 1 FOR NOTES

REV. TO SHEET	ECN NO.	BY	APP.	DATE
L	LA1780	AVC	GG	11/7/14
	ACAD TEMPLATE UPDATED			
H	LA0383	RGR	CMK	8/11/10
	REVISED PER ECN			
A	CD275	JAF	JPH	1/15/03
	REVISED PER ECN			

PROJECT NAME:

LOAD BANK, RESISTIVE, OUTDOOR
(480 V, 3 PH, 60 HZ, 5 KW RES)

THIRD ANGLE PROJECTION

	BY	DATE
DRAWN BY	JJF	9/19/02
CHECKED	JJF	11/26/02
PROJECT APPROVAL	JPH	11/26/02
FINAL APPROVAL	AV	12/2/02

MANUFACTURING TOLERANCES TO BE IN ACCORDANCE WITH ASCO PROCEDURE MP-I-003. FOR PLASTIC PARTS SEE MP-I-055

ASSEM. REF. NO.

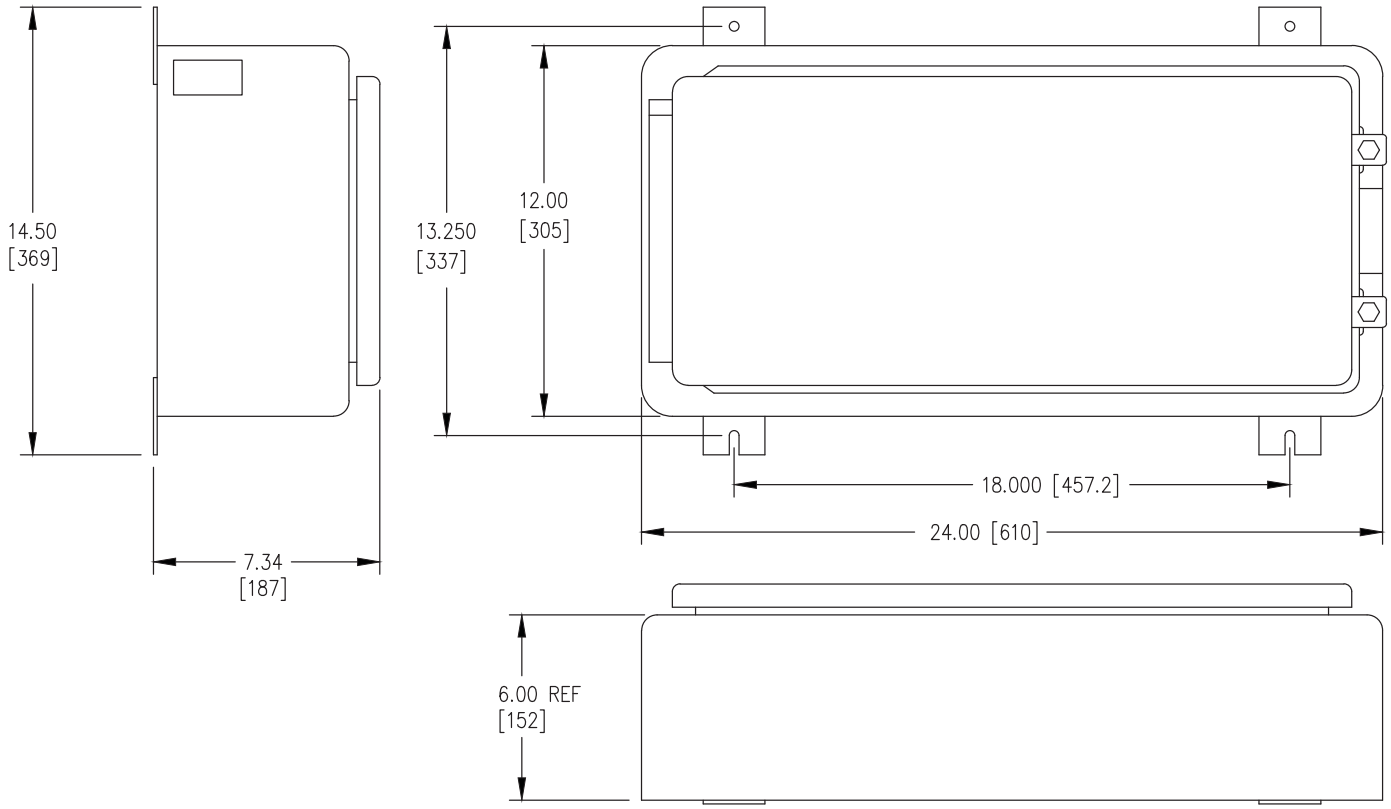
ASCO® ASCO Power Technologies, L.P. FLORHAM PARK, NEW JERSEY 07932 U.S.A.

COMPUTER GENERATED DRAWING

SCALE 1/4" = 1" | SIZE DS

DWG. NO. D34087

DRAWING REV. L | ECN NO. LA1780 | SHEET 4 OF 5



2. ALL DIMENSIONS ARE APPROX. IN INCHES [mm].
1. WEIGHT: 38 LBS [17.3 KGS].
NOTES:

REV. TO SHEET	ECN NO.	BY	APP.	DATE
B	LA2191	JRF	JPH	9/15/15
	REVISED TITLEBLOCK			
A	LA0352	RGR	DK	6/30/10
	ADD METRIC DIMS			

FOR APPLICATION ENGINEERING USAGE ONLY

PROJECT NAME:

ENCLOSURE, WALL MOUNT (OUTLINE)

THIRD ANGLE PROJECTION

	BY	DATE
DRAWN BY	BW	2/4/86
CHECKED		
PROJECT APPROVAL		
FINAL APPROVAL	RJS	2/4/86

MANUFACTURING TOLERANCES TO BE IN ACCORDANCE WITH ASCO PROCEDURE MP-I-003. FOR PLASTIC PARTS SEE MP-I-055

ASSEM. REF. NO.

ASCO® ASCO POWER TECHNOLOGIES, L.P.
FLORHAM PARK, NEW JERSEY 07932 U.S.A.

COMPUTER GENERATED DRAWING

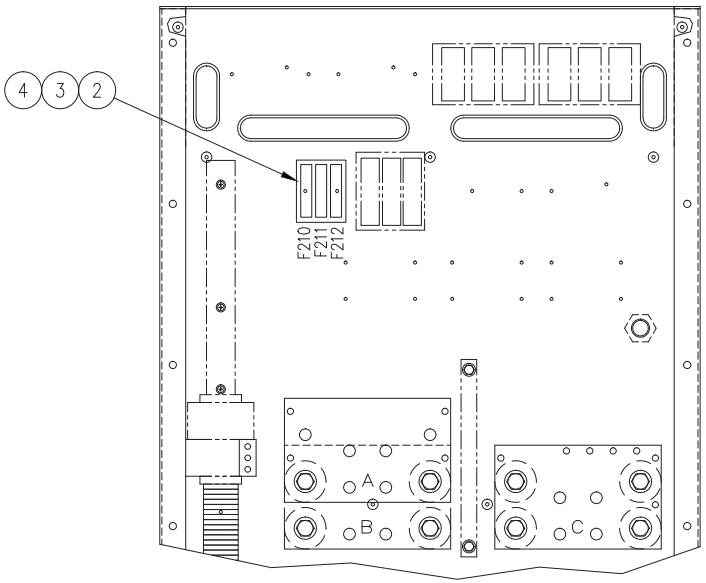
SCALE 1/4" = 1" | SIZE BS

DWG. NO. SB1635

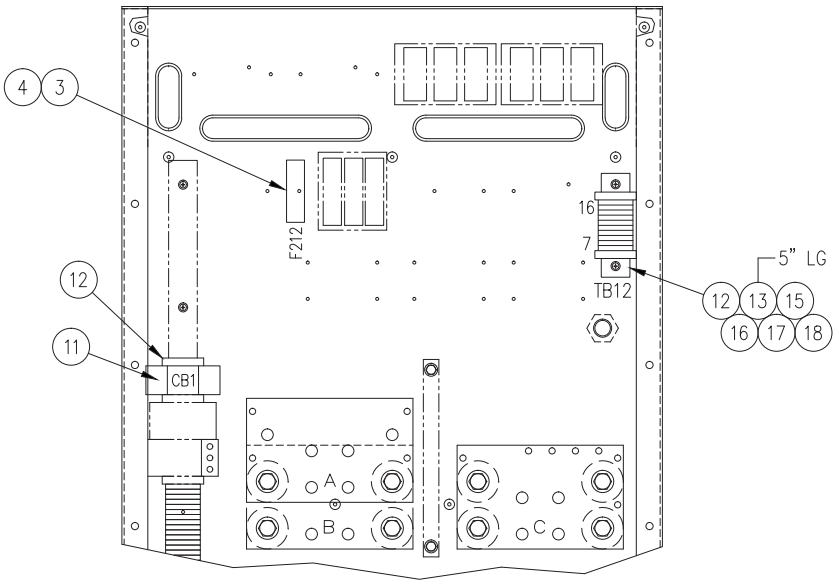
DRAWING REV. B | ECN NO. LA2191 | SHEET 1 OF 1

REVISIONS				
ECN NO.	REV	DESCRIPTION	DATE	APPROVED
CD287	A	ADDED TB12 TO C25672-6. SEE SH 2. J.FLAUTO	1/13/03	J.HUDSON
CD297	B	ON C25672-1/-4: ITEM 3 WAS PN 324615. ITEM 4 WAS PN 324744. SEE SHEET 2.	J.FLAUTO 2-11-03	J.HUDSON
CD774	C	ON C25672-3, ITEM 1 WAS PN 370715. J.FLAUTO	8-23-04	J.HUDSON

CUSTOMER CONNECTION BOX
(COVER REMOVED)
C25672-1 THRU C25672-5



CUSTOMER CONNECTION BOX
(COVER REMOVED)
C25672-6



OPTION #10 480 VOLT			OPTION #9 400 VOLT			OPTION #8 240 VOLT			OPTION #7 208-230 VOLT							
		NR			NR			NR			NR	18	←	←	MARKER STRIP, 11-20	
		NR			NR			NR			NR	17	←	←	MARKER STRIP, 1-10	
		NR			NR			NR			NR	16	←	←	END COVER	
		NR			NR			NR			NR	15	←	←	TERMINAL BLOCK	
		NR			NR			NR			NR	14	←	←	CONTROL PANEL MODIFICATION	SEE NOTE 4
		NR			NR			NR			NR	13	←	←	RAIL, MOUNTING	
		NR			NR			NR			NR	12	←	←	END BRACKET	
		NR			NR			NR			NR	11	←	←	CIRCUIT BREAKER	
		NR			NR			NR			NR	10	←	←	RELAY (240V COIL)	
		NR			NR			NR			NR	9	←	←	RELAY	
		NR			NR			NR			NR	8	←	←	FUSEBLOCK	
		NR			NR			NR			NR	7	←	←	FUSE, 0.5A, 250V	
		NR			NR			NR			NR	6	←	←	TRANSFORMER	
		NR			NR			NR			NR	5	←	←	RELAY, VOLT SENSE	
F212	1	324211	F212	1	324211	F212	1	324211	F212	1	324211	4	←	←	FUSE, 5A, 600V	
XF210-212	1	324998	XF210-212	1	324998	XF210-212	1	324998	XF210-212	1	324998	3	←	←	FUSEBLOCK	
F210,211	2	324453	F210,211	2	324453	F210,211	2	324454	F210,211	2	324454	2	←	←	FUSE	
T1	1	370654	T1	1	370140	T1	1	370654	T1	1	370715	1	←	←	TRANSFORMER	
REF DES	NO. REQD	PART NO.	REF DES	NO. REQD	PART NO.	REF DES	NO. REQD	PART NO.	REF DES	NO. REQD	PART NO.	ITEM NO.	NO. REQD	PART NO.	DESCRIPTION	MATERIAL
C25672-4			C25672-3			C25672-2			C25672-1			LIST OF MATERIAL				

SEE SHEET 2 FOR NOTES

UNLESS OTHERWISE SPECIFIED THE ABOVE NOTES APPLY

LSH	LSH
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

DRAWN	FACKELMANN	11/26/02
CHECKED	J.FLAUTO	11/27/02
ENG APVD	J.HUDSON	11/26/02
APVD PROD	A.VYSOTSKY	12/2/02

AVTRON MANUFACTURING INC
7900 E.PLEASANT VALLEY ROAD
INDEPENDENCE, OH 44131-5529

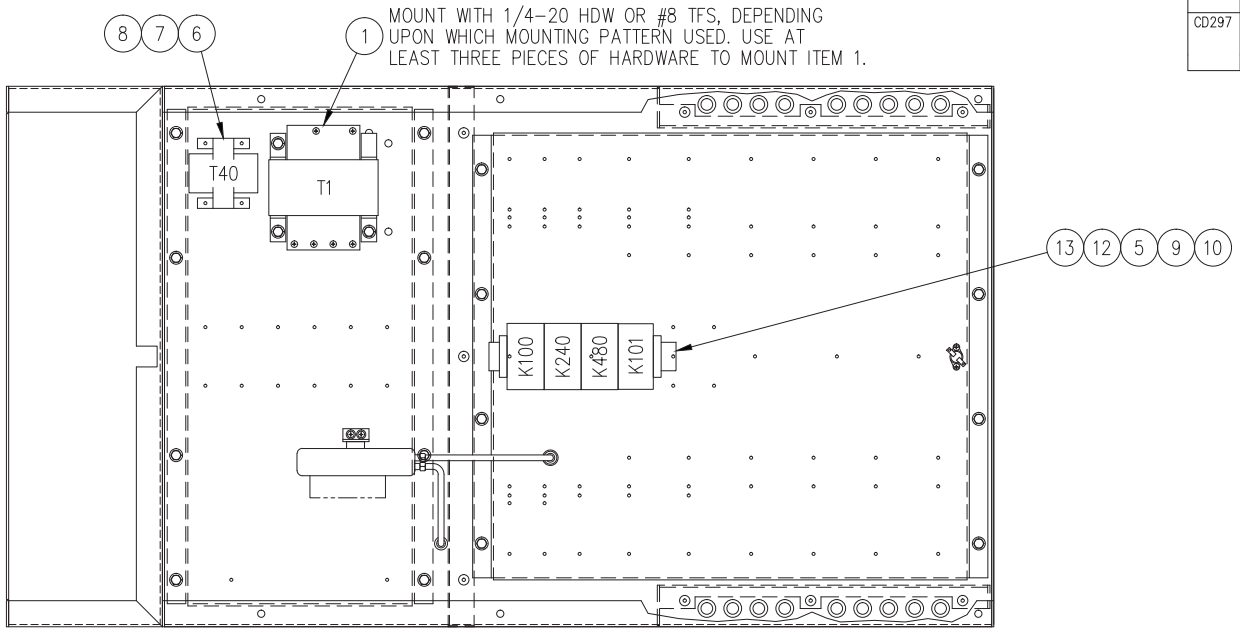
OPTIONS CONTROL TRANSFORMER

IMF ☐ PSF ☒

SIZE	CAGE NO.	DWG. NO.	REV
C	01014	C25672-	C

SCALE 1/1 MODEL LSH SHEET 1 OF 2

REVISIONS				
ECN NO.	REV	DESCRIPTION	DATE	APPROVED
CD287	A	ON ASSY C25672-6; ITEM 12 WAS QTY 3, ITEM 13 WAS QTY 9". ADDED ITEMS 15-18.	J.FLAUTO 1/13/03	J.HUDSON
CD297	B	ON C25672-5: ITEM 3 WAS PN 324615. ITEM 4 WAS 324744. ON C25672-6: ITEM 3 WAS PN 324618. ITEM 4 WAS PN 324744. REVISED NOTE AT ITEM 1 TO INCLUDE #8 TFS.	J.FLAUTO 2-11-03	J.HUDSON



TOP VIEW
(COVER REMOVED)

OPTION #12 240/480 VOLT			OPTION #11 600 VOLT			ITEM NO.	NO. REQD	PART NO.	DESCRIPTION	MATERIAL
XTB2	2	364296			NR	18			MARKER STRIP, 11-20	
XTB12	2	364295			NR	17			MARKER STRIP, 1-10	
XTB12	1	364292			NR	16			END COVER	
TB12(7-16)	10	364289			NR	15			TERMINAL BLOCK	
	1	A29027			NR	14			CONTROL PANEL MODIFICATION	SEE NOTE 4
	14in	408189			NR	13			RAIL MOUNTING	
	5	364291			NR	12			END BRACKET	
CB1	1	310336			NR	11			CIRCUIT BREAKER	
K480	1	350966			NR	10			RELAY (240V COIL)	
K100,240	2	351687			NR	9			RELAY	
XF440	1	324964			NR	8			FUSEBLOCK	
F440	1	324005			NR	7			FUSE, 0.5A, 250V	
T40	1	370528			NR	6			TRANSFORMER	
K101	1	350583			NR	5			RELAY, VOLT SENSE	
F212	1	324211	F212	1	324211	4			FUSE, 5A, 600V	
XF212	1	325065	XF210-212	1	324998	3			FUSEBLOCK	
		NR	F210,211	2	324452	2			FUSE	
T1	1	370654	T1	1	371032	1			TRANSFORMER	
REF DES	NO. REQD	PART NO.	REF DES	NO. REQD	PART NO.	ITEM NO.	NO. REQD	PART NO.	DESCRIPTION	MATERIAL
C25672-6			C25672-5			LIST OF MATERIAL				

5. MARK APPROPRIATE OPTION NUMBER ON LOAD BANK IDENTIFICATION TAG.
4. OPTION 12 REQUIRES CONTROL PANEL MODIFICATIONS. FOLLOW INSTRUCTIONS ON A29027. WIRE PER SCHEMATIC OPTION 12 WIRING.
3. MOUNT COMPONENTS WITH #8 TFS UNLESS OTHERWISE NOTED.
2. WIRE COMPONENTS PER TOP LEVEL SCHEMATIC.
1. MARK REFERENCE DESIGNATORS .12 HIGH MINIMUM USING PRODUCTION DECALS AND OR INK STAMPING. SPRAY OVER INK STAMPING WITH CLEAR ACRYLIC LACQUER. REFERENCE DESIGNATORS SHALL BE LOCATED ADJACENT TO COMPONENTS SO THAT THEY REMAIN VISIBLE AFTER WIRING.

UNLESS OTHERWISE SPECIFIED THE ABOVE NOTES APPLY

AVTRON MANUFACTURING INC.
7900 E.PLEASANT VALLEY ROAD
INDEPENDENCE, OH 44131-5529

OPTIONS
CONTROL TRANSFORMER

SIZE	CAGE NO.	DWG. NO.	REV
C	01014	C25672-	C

SCALE 1/1 | MODEL LSH | SHEET 2