AVTRON MODEL K975A
OUTDOOR RESISTIVE LOAD BANK
Part Number K975A 994213

2500 kW, 480 VAC, 3 PH, 60 Hz

Cleveland, Ohio

November 20, 2013

PROPRIETARY NOTE

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WARRANTY

The last page of this document contains an express limited warranty. The provisions of this warranty cover any and all rights extended to holders of Avtron Loadbank, Inc. equipment.

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AVTRON LOADBANK, INC.
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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 proven reliable 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 K975A Load Bank is an industrial test unit designed to be used outdoors safely. However, because the purpose of the Load Bank is to dissipate electrical energy, there are inherent dangers to operators and equipment. These dangers are 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 blowers. If there is any restriction or stoppage of airflow, the Load Bank may overheat and may even start a fire. It is recommended that:

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

2. Run an approved ground wire from the Load Bank ground lug to the generator frame. Run an approved ground wire from the generator frame to a good earth ground.

3. Do not bypass the AIRFLOW safety switches or the OVERTEMPERATURE safety switches to prevent nuisance tripping. The switches drop out 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 the access panels are removed. Personal injury from electrical shock or from the moving blower blades may result if all sources of power are not disconnected before servicing. Maintenance work must be done only by qualified personnel.

6. The Load Bank must be used in a cool, well ventilated area as described in the INSTALLATION section of this manual. Do not allow exhaust air to recirculate through the Load Bank.

7. Venting the heated air from the exhaust toward overhead cables, sprinkler systems, or into a room with insufficient volume or "Make-Up" air is a potential hazard. The Load Banks should be used in a cool, well ventilated area.

8. Allow cool room air to pass into the unit to cool the elements. Do not allow the unit to be placed where hot exhaust air can recirculate back through the unit causing a constant rise in cooling air temperature.

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 the 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 intakes or exhausts of the Load Bank. A blockage would 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/or fire hazards.

12. Consideration should be given to mounting surface material due to hot air exhaust.

13. Operators must not operate the Load Bank with the access panels or screens removed. To do so would expose the operator and other persons to possible personal injury from electrical shock or from the moving fan blades.

14. Emergency Shutdown Procedure

    A. In an emergency, press the STOP/RESET button located on the remote control panel, this will disconnect both the load steps and fan/motor.

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

16. 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.

17. K975A 994213 has special quick connect cam-lok style connectors for load connection. All connectors must be fully engaged and share current before load is applied. Keep connector covers on all locations when not in use, during transit, and during storage.

18. Louver cover plates must be removed from all four locations prior to operation. Replace covers for storage and transport.

19. Read and heed all **WARNING** and **CAUTION** statements in the manual.

SECTION II

DESCRIPTION

Avtron Part Number K975A 994213 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 of the K975A Load Bank is 2500 kW at 480 VAC, 3-phase, 60 Hz. The load steps are 50, 50, and (24) at 100 kW.

The K975A 994213 Load Bank contains two 15 H.P. blower motors that operate from 480 volts, 3-phase, 60 Hz, and provide the necessary cooling air for the load elements. The blower motors derive voltage from the main bus and are controlled by motor starter contactors. Overcurrent protection is provided by fuses and overload relays. When an external source is used for blower and control power, its voltage may be independent of the LOAD voltage of the generator under test. The blower air delivery is 27,000 CFM at 1.4 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 motors operating. Inadequate cooling airflow will result in resistor elements overheating and a definite fire hazard.

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Two airflow switches are provided to monitor the flow of cooling air. These differential pressure switches are electrically interlocked with the load application controls to prevent load application if the blowers are not working properly.

Two thermocouples are provided to sense the exhaust air temperature. The sensors are located at the top of each exhaust heater case. The thermocouples are wired to an adjustable temperature sensor set at a trip point of 350°F. If the trip point is exceeded, it will prevent load application.

****

C A U T I O N

Voltage must not be connected to the Load Bank resistance elements if the airflow switches have not closed. It is the customer's responsibility to ensure all load is dropped if an air failure is detected. DO NOT jumper out any air switches to prevent nuisance tripping.

****

C A U T I O N

Voltage must not be connected to the Load Bank resistive elements if any fault (overtemperature, motor overload, air failure) is indicated. It is the customer's responsibility to ensure all load is dropped if any fault or alarm is detected.

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The K975A Load Bank is fabricated using heavy-gauge aluminized sheet steel to make a rigid structure. Mounted within the structure are the load element resistor assemblies, the blower assemblies, and the necessary load step contactors, motor starters, motor overload relays, fuses, and customer connection bus bars. The cooling air is drawn in from one end, forced across the resistor elements, and exhausted out the opposite end. The component enclosure compartment has a temperature controlled heater that may be used to prevent condensation on the inside of the contactor enclosure of the Load Bank.

The units are equipped with louvers (with travel/storage covers) on the inlet and outlet openings that protect the motors and resistor assemblies from the weather. The Load Bank uses a formed sheet metal base to facilitate handling by a forklift truck. Bolt holes are supplied in the base to permit permanent mounting to a pad.

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W A R N I N G

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 may be applied to the load circuit of the Load Bank. The applied kW with a lower voltage is computed with the following formula:

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

CONTROL PANELS

The K875A 994213 Load Bank utilizes a local panel as the interface between the Load Bank and the Intelligent Handheld Terminal (IHT). The control panel contains a STATUS: UNIT ON TEST light, START pushbutton, a STATION SELECT switch, and a STOP/RESET push button. The control panel also includes the connection for the IHT.

The K975A 994213 Load Bank utilizes two local, integrally mounted control panels. The first local control panel (997419) is the interface between the Load Bank and the Intelligent Handheld Terminal (IHT), and is used with the unit is operating under Sigma control. The control panel contains a STATUS: UNIT ONT TEST light, START pushbutton, a STATION SELECT switch, and a STOP/RESET pushbutton. The control panel also includes the connection for the IHT.

The second control panel (997420) is a manual control panel that is used as a toggle-switch back-up for the Sigma control system. A key-switch selects between the Sigma control panel and the Manual control panel.

The manual control panel contains the OPERATION CONTROL Key-Switch, a CONTROL POWER Switch, the BLOWER START and STOP pushbuttons, as well as a MASTER LOAD switch, and toggle switches of 2 x 50 KW and 24 x 100 KW. Indicators include lamps indicated

TOP AND BOTTOM OVERTEMPERATURE, TOP AND BOTTOM AIR-FAIL, and BLOWER POWER.

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 switches, 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 or OVERTEMPERATURE SWITCHES. 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 60,000 CFM or greater is required. Exhaust temperature can exceed 280° in approximately 3 minutes without the proper ventilation.

The exhaust air may be in excess of 280°F under full load conditions. 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 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 36 inches 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 120°F.

3. Provide a minimum of 8 feet from any obstruction for exhaust clearance to prevent air restrictions and to limit air recirculation. For thermal considerations, provide a minimum clearance of 30 feet from any temperature sensitive object. The heated exhaust air stream will damage temperature sensitive items if they are positioned within the 30 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 36" 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.

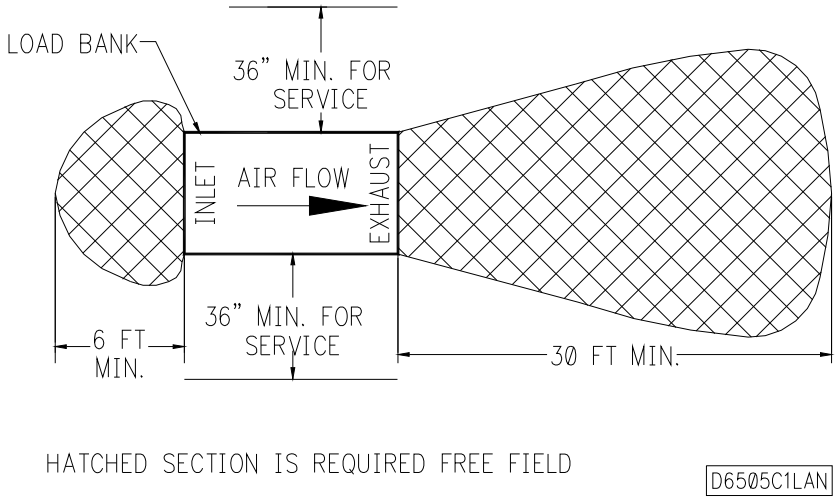

Figure 3-1. Load Bank Installation Airflow Clearance Requirements

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 blowers, inadequate cooling may result and damage to the Load Bank can occur. Improper positioning may also result in the air switches being deactivated, thus dropping the load.

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.

The strip heaters are powered from an externally supplied 120 VAC, 1 PH, 60 Hz source. Refer to the Load Bank schematic diagram 997418.

LOCAL CONTROL PANEL

The local control panel is mounted to the lower access panel covering the lower resistor assemblies on the right side of the Load Bank (when facing the intake) and is wired to the Load Bank.

The control circuit operates from a 120V, single phase, 60 Hz, 15 amp source that is derived from the main load bus from a 3000 VA, 480/120V control transformer.

FAN/BLOWER MOTOR CONNECTION

The fan/blower circuit consists of fuses, a motor starter contactor, an overload relay, and the fan motor. The blower input power connections are wired to TB2(1-3) located on the relay panel assembly and are then wired directly to the main Load Bank bus.

Required power for the blower motor is 480V, 3-phase, 60 Hz, 42 amps/phase.

Make sure that the correct phase rotation is wired to the fan motor. Improper phase rotation will cause the fan to run in the reverse direction. The cooling air should be pushed from the fan, across the resistor elements, and out the top exhaust hood/duct. This phase rotation check is mandatory each time the source or fan connections are changed.

If external 480 volt power is provided, safe practice dictates that the fan power be wired through a safety disconnect switch that can be locked out.

LOAD CONNECTIONS

On K975A 994213 units, quick connect cam-lok style connectors are installed on the outside corner of the Load Bank frame. All nine connections per phase and the three ground connections must be made prior to applying any load. The connectors are provided with mating connectors. Use these mating connectors on interconnection load cable. Interconnection cable (by others) should be 4/0 cable.

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W A R N I N G

Cam-lok style connectors are factory-wired internally to the load bus within the Load Bank. Unused connections will be live. It is mandatory to use all nine connections per phase. Any exposed connection requires a factory-provided protective cap be installed. Any lost, damaged, or heat stressed cam-lok style connector or cover must be replaced prior to use. Failure to follow these precautions may result in death or injury to personnel.

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The ampacities of these load connections are shown on schematic diagram 997418 and outline drawing SB3833.

After installation/connections are complete, verify proper phase to phase clearances on all load wiring, bus bar, and hardware. Adjust or insulate to suit if required.

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 nut in the Load Bank, located within the control compartment, for this connection. This ground conductor should be run with the load power conductors to provide the lowest impedance fault path. The ground must be connected to both the power source frame and to a good earth ground. The ground conductor should be sized per the National Electrical 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.

D. Remove louver travel/storage covers.

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

A. Ensure lugs are properly crimped. On units supplied with cam-lok mating connectors, these devices must be used. On K975A 994213 unit, the mating connector cam-lok devices which are factory supplied must be used.

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. 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.

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W A R N I N G

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

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   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.

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

   B. Turn on all the load steps. 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

Refer to the Intellight Handheld Terminal (IHT) Quickstart Guide for operation of the Load Bank.

****

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 not apply DC voltages as the contactors do not have arc blowout magnets. Also, the reactive load sections will react as low impedance short circuit paths, resulting in a definite fire hazard.

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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.

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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 may be applied to the load circuit of the Load Bank. The applied kW with a lower voltage is computed with the following formula:

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

****

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. Also, the reactive load sections will react as low impedance short circuit paths, resulting in a definite fire hazard.

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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 examples of scheduled maintenance procedures 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 only by qualified personnel.

****

W A R N I N G

Personal injury from electrical shock or from the moving fan blades 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.

5. On K975A 994213 units, inspect all cam-lok style connections on both the Load Bank and interconnection cable. Any signs of heat stress dictate a replacement connector. Verify that all cam-lok protective caps are properly secured to unit.

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 insulators with a new ceramic insulator if any cracks are found.

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. Verify that the airflow switches work properly.

6. 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.

7. 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.

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

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

10. Check the indicator lamps on the control panel.

ANNUALLY

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

PARTS REPLACEMENT

Access to any component is easily made with the removal of the cover panels. Replaceable components are listed in the Replacement Parts List. Avtron maintains an inventory of normally used items.

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C A U T I O N

When replacing fuses attached to bus bars, tighten wire connection before the fuse is attached to the bus bar. Improper assembly may result in damage to the fuse elements and cause premature fuse failure.

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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 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 K975A LOAD BANK, OUTDOOR	K975A-994213	
	.SCHEMATIC	997418	REF
	.INSTALLATION, CAMLOK CONNECTORS	D41573	1
J1-9	..RECEPTACLE, BROWN	315577	9
J10-18	..RECEPTACLE, ORANGE	315576	9
J19-27	..RECEPTACLE, YELLOW	315575	9
J28-30	..RECEPTACLE, GREEN	315064	3
	..PROTECTIVE CAP	428028	30
RA1	.RESISTOR ASSEMBLY	D24712	1
	..RESISTOR ELEMENT	605820	48
	..INSULATOR	411141	960
	..SPRING	473042	96
	..PIN, SPRING CLIP	461156	96
RA2	.RESISTOR ASSEMBLY	D24712	1
	..RESISTOR ELEMENT	605820	48
	..INSULATOR	411141	960
	..SPRING	473042	96
	..PIN, SPRING CLIP	461156	96
RA3	.RESISTOR ASSEMBLY	D26614	1
	..RESISTOR ELEMENT	A23312	18
	..RESISTOR ELEMENT	605820	30
	..INSULATOR	411141	960
	..SPRING	473042	96
	..PIN, SPRING CLIP	461156	96
RA4	.RESISTOR ASSEMBLY	D24712	1
	..RESISTOR ELEMENT	605820	48
	..INSULATOR	411141	960
	..SPRING	473042	96
	..PIN, SPRING CLIP	461156	96
RA5	.RESISTOR ASSEMBLY	D24712	1
	..RESISTOR ELEMENT	605820	48
	..INSULATOR	411141	960
	..SPRING	473042	96
	..PIN, SPRING CLIP	461156	96
RA6	.RESISTOR ASSEMBLY	D26614	1
	..RESISTOR ELEMENT	A23312	18
	..RESISTOR ELEMENT	605820	30
	..INSULATOR	411141	960
	..SPRING	473042	96
	..PIN, SPRING CLIP	461156	96
	.RELAY ASSEMBLY	997417	1
K6-29	..RELAY	351885	24
R1	..RESISTOR, 150 OHMS 100W	156015	1
S1	..SWITCH, TEMP	363099	1
K4,5	..RELAY	B14796	2
XF206-209	..FUSEHOLDER	324980	2
F207	..FUSE, 10 AMP	324128	1
F206,208,209	..FUSE, 5 AMP	324211	3
K64,65,74,75	..RELAY	B14711	4
F10-15	..FUSE, 80 AMP	324420	6

SCHEMATIC REFERENCE	DESCRIPTION	AVTRON P/N	QTY/ UNIT
F16-87	..FUSE, 150 AMP	324463	72
CT1,2,3	..TRANSFORMER, CURRENT, 3200:5	370050	3
S4,5,6	..CONTROLLER, TEMP	491017	3
XS4,5,6	..SOCKET	358311	3
XS6	..THERMOCOUPLE	A24741	1
XF210-212	..FUSEHOLDER	324496	1
K41-43	..RELAY, 120V, 4 POLE	350676	3
K99	..RELAY, 24 VDC, 4 POLE	350605	1
CR99	..RECTIFIER	354585	1
F210,211	..FUSE, 6 AMP	324393	2
F212	..FUSE, 15 AMP	324346	1
	.CONTROL PANEL	D49545	1
D49545	..PCB, DEDICATED I/O	PR01288	1
DS1	..PILOT LIGHT (YELLOW)	EI00817	1
S2	..PUSHBUTTON (RED)	EI00683	1
S1	..PUSHBUTTON (GREEN)	EI00684	1
	..LED, YELLOW, 24VAC	EI01047	1
	..LED, RED, 24VAC	EI00734	1
	..LED, GREEN, 24VAC	EI01046	1
	..LAMP HOLDER	EI00685	3
	..CONTACT BLOCK, NO	EI00686	2
	..CONTACT BLOCK, NC	EI00687	1
S500	..SWITCH, SELECTOR	EI00744	1
XS500	..CONNECTOR	EI01845	1
	.COMPONENT ASSEMBLY	D49453	1
F200-205	..FUSE, 30 AMP	324284	6
XF200-205	..FUSEBLOCK	324997	2
K61,71	..RELAY (WITH AUX)	B14711	2
S2,3	..SWITCH, SENSING	360772	2
K62,72	..RELAY, OVERLOAD	350980	2
XK62,72	..BRACKET, MOUNTING	408304	2
K130,131	..RELAY, 24 VDC, 4 POLE	350605	2
CR130,131	..RECTIFIER	354585	2
B1,2	.PANEL, FAN	D30842-3	2
	.CONTROL ASSEMBLY	997419	1
PS2	..SUPPLY, POWER, 24 VDC, 2A	EI01681	1
PS1	..SUPPLY, POWER, 24 VDC, 1A	EI01680	1
K100-126	..RELAY, 24 VDC, FORM C, W/SOCKET	EI01531	27
PT1-3	..POTENTIAL TRANSFORMER W/DIVIDER	EI00136	3
PT4,5	..TRANSFORMER, 0-415V	EI00430	2
A2	..ASSEMBLY, BURDEN, CT	PR00997	1
A1	..CONTROLLER, SIGMA 2	PR01229	1
XA1	..CONNECTOR, 3 POSITION	EI01648	1
XA1	..CONNECTOR, 10 POSITION	EI01652	6
XA1	..CONNECTOR, 9 POSITION	EI01651	3
XPT1-5	..RESISTOR, 16 OHM	EO00404	5
XPT1-5	..RESISTOR, 10 OHM	EO00403	5
XA1	..CONNECTOR, 7 POSITION	EI01650	1
XF500-505	..FUSEHOLDER	324998	2
F500-505	..FUSE, 1 AMP	324815	6
XS4-5	.THERMOCOUPLE	A23313	2
T1	.TRANSFORMER, 3KVA	371460	1
B3-5	.FAN	322190	3
	.CONNECTOR SET KIT	A33917	1
PH A	..CONNECTOR, FEMALE, BROWN	315725	9
PH B	..CONNECTOR, FEMALE, ORANGE	315726	9

SCHEMATIC REFERENCE	DESCRIPTION	AVTRON P/N	QTY/ UNIT
PH C	..CONNECTOR, FEMALE, YELLOW	315727	9
GND	..CONNECTOR, FEMALE, GREEN	315068	3
	.FILTER	432483	2
	.TERMINAL, HAND HELD OPERATOR	PR00517	1

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 Loadbank, Inc. 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 Avtron Loadbank, Inc.

AVTRON LOADBANK

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Limited Warranty

This Warranty is given ONLY to purchasers who buy for commercial or industrial use in the ordinary course of each purchaser's business.

General:

Avtron Loadbank, Inc. products and systems are in our opinion the finest available. We take pride in our products and are pleased that you have chosen them. Under certain circumstances we offer with our products the following One Year Limited Warranty Against Defects in Material and Workmanship.

Please read your Warranty carefully. This Warranty sets forth our responsibilities in the unlikely event of defect and tells you how to obtain performance under this Warranty.

ONE YEAR LIMITED WARRANTY
AGAINST DEFECTS IN MATERIAL AND WORKMANSHIP

Terms of Warranty:

The foregoing Limited Warranty is conditioned upon User's compliance with the following:

1. The Avtron Product is deployed in accordance with Avtron specifications and state and local codes and standards, including installation by an electrician licensed in the state where used if required.

2. The Avtron Product is maintained in accordance with Avtron instructions and used under normal conditions for the purposes intended by Avtron.

As provided herein, the Avtron product is warranted to be free of defects in material and workmanship for a period of one year from date of first use by the User, or fifteen months from the date of shipment, whichever expires first. The product shipment date will be determined only from the Avtron bill of lading. If any part or portion of the Avtron product fails to conform to the Warranty within the Warranty period, Avtron, at its option, will furnish new or factory remanufactured products for repair or replacement of that portion or part. This is a parts Warranty ONLY that does not include services; all services shall be provided by a qualified service provider.

Warranty Extends to First Purchaser for Use, Non-transferable:

This Warranty is extended to the first person, firm, association or corporation for whom the Avtron product specified herein is originally deployed for use (the "User") in the fifty United States or Canada . This Warranty is not transferable or assignable without the prior written permission of Avtron.

Assignment of Warranties:

Avtron assigns to User any warranties which are made by manufacturers and suppliers of components of, or accessories to, the Avtron product and which are assignable, but Avtron makes NO REPRESENTATIONS as to the effectiveness or extent of such warranties, assumes NO RESPONSIBILITY for any matters which may be warranted by such manufacturers or suppliers and extends no coverage under this Warranty to such components or accessories.

Drawings, Descriptions:

Avtron warrants for the period and on the terms of the Warranty set forth herein that the Avtron product will conform to the descriptions contained in the certified drawings, if any, applicable thereto, to Avtron's final invoices, and to applicable Avtron product brochures and manuals current as of the date of product shipment ("Descriptions"). Avtron does not control the use of any Avtron product. Accordingly, it is understood that the Descriptions are NOT WARRANTIES OF PERFORMANCE and NOT WARRANTIES OF FITNESS FOR A PARTICULAR PURPOSE.

Warranty Claims Procedure:

Within a reasonable time, but in no case to exceed thirty (30) days, after User's discovery of a defect, User shall contact Avtron service department at **www.avtronloadbank.com** and select the support tab or by phone at **(216) 573-7600** and request a return authorization number for products to be returned. Subject to the limitations specified herein, Avtron will repair or replace, at its option, without charge for materials, subsequent to its inspection the defective product shipped to Avtron with a return authorization number.

Avtron products shipped to Avtron without a return authorization number may be refused and returned freight collect to User at User's expense. Avtron products shipped by User to Avtron which have incurred freight damage due to User's improper packaging of the product will not be covered by this Warranty and any repairs or replacement parts, components or products needed will be invoiced in the full current price amount and returned freight collect to User.

If replacement parts, components or products are shipped or caused to be shipped by Avtron prior to inspection of the product claimed to be defective, the replacement parts, components or products shall be invoiced in the full current price amount and

shipped freight collect F.O.B. Avtron's facility. If Avtron's inspection determines that the returned item(s) is covered by this warranty, User will be issued a credit in an amount equal to the parts prices previously invoiced. Warranty coverage will be provided only after Avtron's inspection discloses the claimed defect and shows no signs of treatment or use which would void the coverage of this Warranty. All defective products and component parts replaced under this warranty become the property of Avtron.

Warranty Performance of Component Manufacturers:

It is Avtron's practice, consistent with its desire to remedy Warranty defects in the most prompt and effective manner possible, to cooperate with and utilize the services of component manufacturers and their authorized representatives in the performance of work to correct defects in the product components. Accordingly, Avtron may utilize third parties in the performance of Warranty work, including repair or replacement hereunder, where, in Avtron's opinion, such work can be performed in less time, with less expense, or in closer proximity to the Avtron product.

Items Not Covered By Warranty:

THIS WARRANTY DOES NOT COVER DAMAGE OR DEFECT CAUSED BY misuse, improper application, wrong or inadequate electrical current or connection, negligence, inappropriate on site operating conditions, repair by non-Avtron designated personnel, accident in transit, tampering, alterations, a change in location or operating use, exposure to the elements, water, or other corrosive liquids or gases, Acts of God, theft, installation and/or deployment contrary to Avtron's recommendations or specifications, or in any event if the Avtron serial number has been altered, defaced, or removed.

THIS WARRANTY DOES NOT COVER shipping costs, installation costs, or maintenance or service items and further, except as may be provided herein, does NOT include labor costs or transportation charges arising from the replacement of the Avtron product or any part thereof or charges to remove or reinstall same at any premises of User.

REPAIR OR REPLACEMENT OF A DEFECTIVE PRODUCT OR PART THEREOF DOES NOT EXTEND THE ORIGINAL WARRANTY PERIOD.

THE PRODUCTS LISTED IN THIS WARRANTY ARE NOT FOR USE IN THE CONTROL AREA OR ANY REACTOR CONNECTED OR SAFETY APPLICATIONS OR WITHIN THE CONTAINMENT AREA OF A NUCLEAR FACILITY OR FOR INTEGRATION INTO MEDICAL DEVICES.

Limitations:

THIS WARRANTY IS IN LIEU OF AND EXCLUDES ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE.

USER'S SOLE AND EXCLUSIVE REMEDY IS REPAIR OR REPLACEMENT OF THE AVTRON PRODUCT AS SET FORTH HEREIN.

IF USER'S REMEDY IS DEEMED TO FAIL OF ITS ESSENTIAL PURPOSE BY A COURT OF COMPETENT JURISDICTION, AVTRON'S RESPONSIBILITY FOR PROPERTY LOSS OR DAMAGE SHALL NOT EXCEED THE NET PRODUCT PURCHASE PRICE.

IN NO EVENT SHALL AVTRON ASSUME ANY LIABILITY FOR INDIRECT, SPECIAL, INCIDENTAL, CONSEQUENTIAL OR EXEMPLARY DAMAGES OF ANY KIND WHATSOEVER, INCLUDING WITHOUT LIMITATION LOST PROFITS, BUSINESS INTERRUPTION OR LOSS OF DATA, WHETHER ANY CLAIM IS BASED UPON THEORIES OF CONTRACT, NEGLIGENCE, STRICT LIABILITY, TORT, OR OTHERWISE.

Miscellaneous:

NO SALESPERSON, EMPLOYEE OR AGENT OF AVTRON IS AUTHORIZED TO ADD TO OR VARY THE TERMS OF THIS WARRANTY. Warranty terms may be modified, if at all, only in writing signed by an Avtron officer.

Avtron obligations under this Warranty are conditioned upon Avtron timely receipt of full payment of the product purchase price and any other amounts due. Avtron reserves the right to supplement or change the terms of this Warranty in any subsequent warranty offering to User or others.

In the event that any provision of this Warranty should be or becomes invalid and/or unenforceable during the warranty period, the remaining terms and provisions shall continue in full force and effect.

This Warranty shall be governed by, and construed under, the laws of the State of Ohio, without reference to the conflict of laws principles thereof.

This Warranty represents the entire agreement between Avtron and User with respect to the subject matter herein and supersedes all prior or contemporaneous oral or written communications, representations, understandings or agreements relating to this subject.

This Quickstart guide, along with the in-built help, will help you get the best out of your Sigma IHT.

The Sigma Intelligent Hand-held Terminal (IHT) provides full load control and three-phase instrumentation on any Froment Sigma-equipped load bank.

1. Connect up the Load Bank

Read the load bank manual before use and take special note of all the safety warnings.

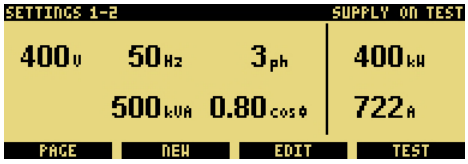
Keep people well away. Close all doors. Ensure cables and earthing are adequate. Risks include fire and burns from the hot air outlet and electric shock.

Before you can start using the IHT to test the supply, the load bank and supply must be cabled up.

- After connecting the power cables between the load bank and supply, ensure the IHT is plugged into the Load Bank IN socket.
- Ensure that the supply on test is operational and any circuit breakers are closed.
- Power-up the Load Bank control circuit.

  Both the load bank 'Stop' and 'Start' lamps will light up. After about 15 seconds the 'Start' lamp will go out, you can now press the 'Start' button.

If you look at the IHT you will briefly see the startup logo and, assuming all is well, the **SETTINGS** page with the **SUPPLY ON TEST** details will be finally displayed.

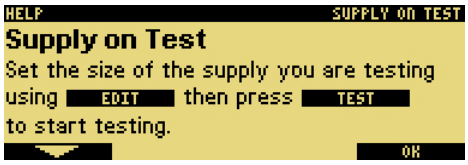


The top line of the screen is the status line. This always displays where you are (such as **SETTINGS**, **TEST** or **OPTIONS**) and what page you are on. So **SETTINGS 1-2**, shows that you are in settings on page 1 of 2.

The bottom line displays the function key labels. This indicates the purpose of the function keys F1 to F4.

2. Help

It is quite possible that when you pick up the IHT for the first time you will see the **SUPPLY ON TEST** help page.



Help is displayed automatically on the settings and test pages after 12 seconds with no activity. This automatic help will only be displayed once.

- You can press the Up and Down function keys (**F1** and **F2**) to scroll through the help.
- Press OK (the **F4** key) when you have finished.

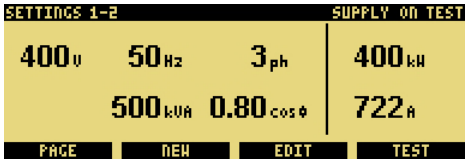
A **HELP** function key is available which provides context sensitive help for all messages and options pages.

3. Set the Supply Size

You need to set the details of the supply on test before applying any load.

The **SUPPLY ON TEST** details on the first **SETTINGS** page are used to calculate percent load and to avoid over-loading the supply. A warning symbol is displayed if the load bank may not be large enough to test the supply.

When in **SETTINGS** you can press the **+** and **–** keys to quickly change the screen contrast.

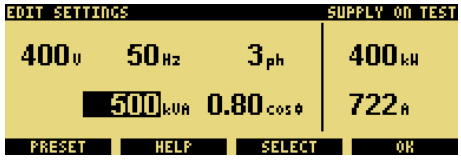


- Press NEW from **SETTINGS**.

  By pressing **NEW** the voltage, frequency and number of phases will be set automatically using the measured values. The supply size (kVA) can then be edited.

  The supply must be present on the load bank bus-bars for the automatic setting to work. Note that the **NEW** function is not available when load is applied (the green LED illuminated).

  Use **EDIT** if you want to manually change the supply details.



- Press either PRESET or use the **+** and **–** keys to set the size of the supply in kVA.

  HELP provides further information on each selected item. You can press **SELECT** to change between kVA, Power Factor, V, Hz or Phase.

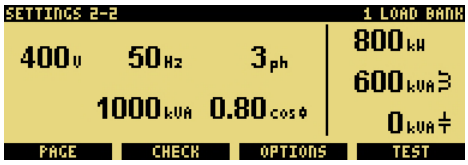
- When the supply size is set correctly press OK.

You are now ready to start load testing, so:

- Press TEST (now turn over and look at section 5 Apply Load).

4. Settings and Options

- Press PAGE, when in **SETTINGS**, to view the second page.



From the second **SETTINGS** page you can look at the load bank capacity or change **OPTIONS**.

CHECK will search for any new load banks and reset any load bank errors.

There are five options pages that control how your IHT system looks and works.

- Press OPTIONS

- The options are enabled or disabled by pressing the + and – keys.

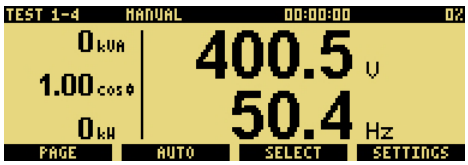
  You can press **HELP** for further information on the selected item or press **SELECT** to change between items. Press **PAGE** to change to the next page.

- When finished press OK to go back to **SETTINGS**.
- Then press TEST, to start testing

The **OPTIONS** are automatically saved so you only need to set them once.

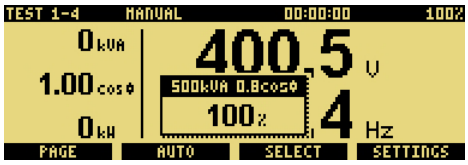
5. Apply Load

There are four **TEST** pages; which offer different views of the instrumentation. When you select **TEST** for the first time the following page is displayed.



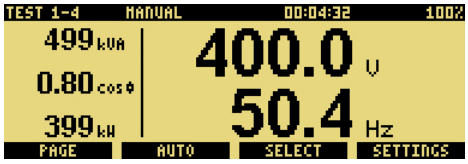
You can select and apply load on any of the four **TEST** pages in the same way.

- Select the required load using the **+** and **–** keys. By default load control is in percentages. The screen will change to show the load selected pop-up.



  Pressing the **SELECT** key changes between load control in %, kW or kVA and power factor. If a resistive-only load bank is used, then the selection will be % and kW only.

- Apply the load by pressing the green **I** key. The load selected pop-up will disappear and the green LED on the IHT will light up.



  The selected load pop-up will disappear after 3 seconds or when another key is pressed, but selected load is always displayed on the right of the status line.

  Each time you press **I**, load correction will ensure you get the exact load requested. Load correction can be enabled and disabled from **OPTIONS**.

- Load can be removed at any time by pressing the red **O** key.

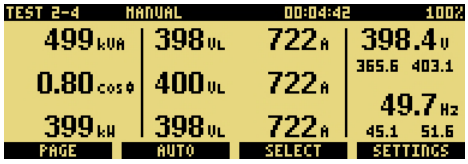
The first **TEST** instrumentation page shows the real-time Voltage and Frequency in large fonts, together with the power in kVA, cos Φ and kW. Along the top, the Status line shows that we are in **MANUAL**, and 4 minutes and 32 seconds has elapsed since the last load accept. The selected load is displayed on the top right of the status line.

Use this page when initially adjusting the AVR and governor settings.

6. View the Instrumentation

- Press PAGE to change to the next instrumentation page. After four presses of PAGE you will be back to page one.

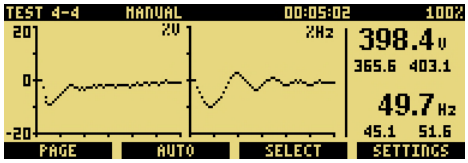
The next two **TEST** pages shows all the true rms three-phase measurements of Voltage (V), Frequency (Hz), Current (A), Power (both kW and kVA) and Power Factor (Cos Ø).



The second and third instrumentation pages provide all the electrical data required when full-load testing. Displayed on the right are the voltage and frequency; below each are the maximum and minimum values for the last load change.

Note that page two shows line-line voltages, whereas page three shows line-neutral voltages

The fourth **TEST** page provides a graphical view of the voltage and frequency when the last load was applied.



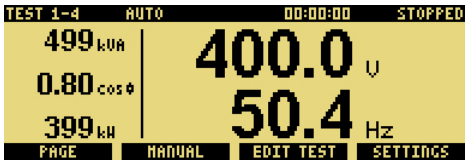
The voltage and frequency graphs display the first 6 seconds of the last load change, as a percentage of the supply voltage and frequency rating.

Use this page when testing governor and AVR transient response.

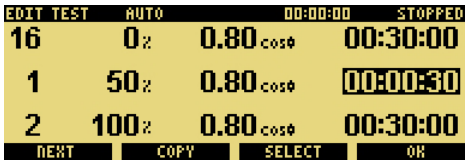
7. Using Automatic Load Control

At any time you can change between manual and automatic load control.

- Press AUTO for automatic load control. Press **F2** again to return to **MANUAL**.



- A pre-programmed sequence of up to 16 loads can set up by pressing the EDIT TEST key.



  Again, use the **+** and **–** keys to change the selected value. Press **SELECT** to select either %, cos Φ or time.

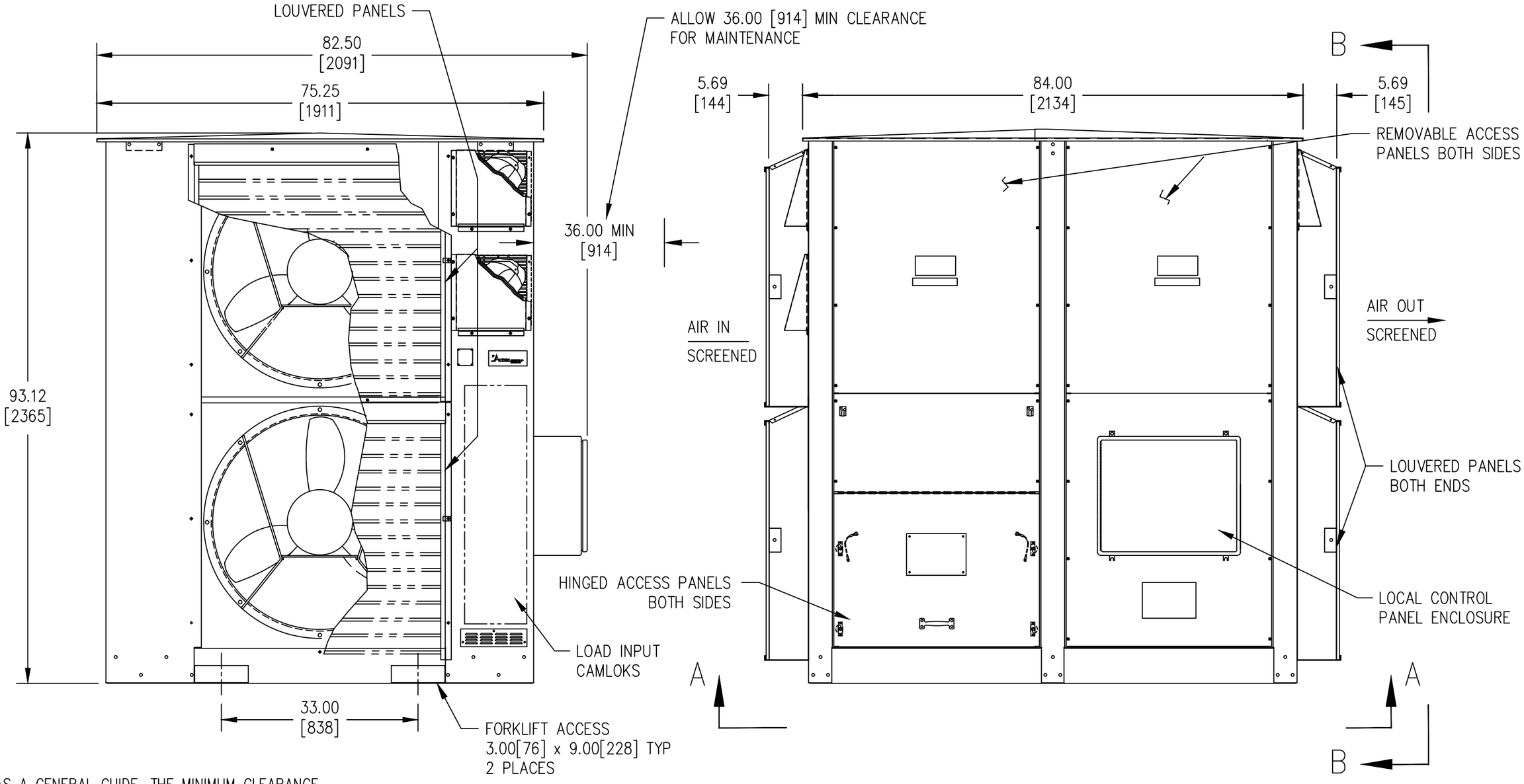
  Pressing **NEXT** moves down to the next line. You can press **COPY** to copy the selected value down to the next line.

- Press OK to exit **EDIT TEST**.
- Pressing the green **I** key will start the sequence.
- Load can be removed, and the automatic sequence stopped, by pressing the red **O** key.

The status of the automatic test is shown on the right of the status line.

Any sequence that is running will be paused if **MANUAL**, **EDIT TEST** or **SETTINGS** are pressed. Pressing **I** will restart a paused load sequence.

Whilst the test is running the **+** and **-** keys can be used to quickly override the selected load. Press **I** to apply the new load selected.



3. AS A GENERAL GUIDE, THE MINIMUM CLEARANCE REQUIRED FROM ANY OBSTRUCTION IS:
   6 FT [1829] ON INLET
   3 FT [914] ON SIDES
   8 FT [2438] ON EXHAUST
   REVIEW MANUAL FOR DETAILED INSTALLATION AND SITE CONDITIONS.
2. ALL DIMENSIONS ARE APPROX. INCHES & [METRIC]
1. WEIGHT: APPROX 3600 LBS [1633] KG

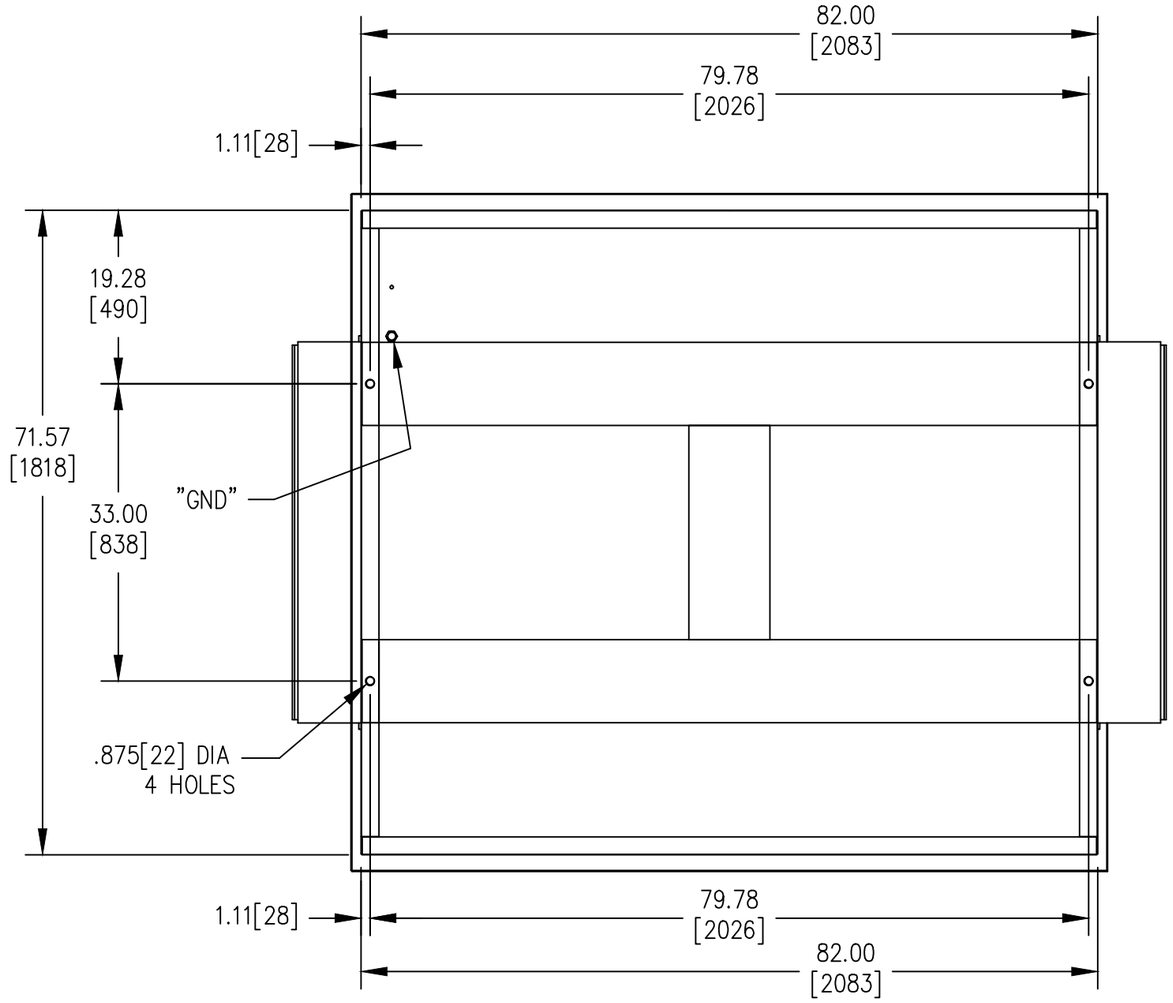
NOTES:

FOR APPLICATION ENGINEERING USAGE ONLY

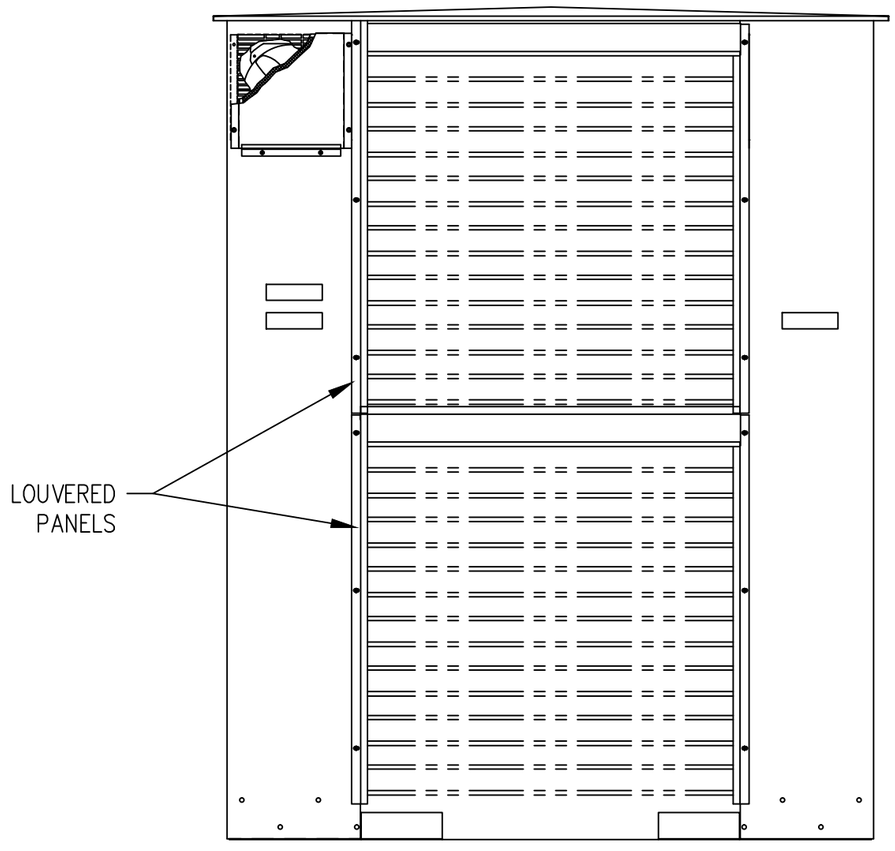
ECN NO.	REV LET.	CHANGE	CHG'D	CHK'D

DRAWN Fackelmann	DATE 2/26/07	AVTRON MANUFACTURING, INC. INDEPENDENCE, OH
CHECKED J.FLAUTO	2/26/07	
APPROVED P.PIAZZA	SCALE 1/16	LOAD BANK (OUTDOOR)

DRAWING NUMBER
SB3833
SHT 1 OF 2
OUTLINE DRAWING



VIEW A–A



VIEW B–B

FOR APPLICATION ENGINEERING USAGE ONLY

NOTES:

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

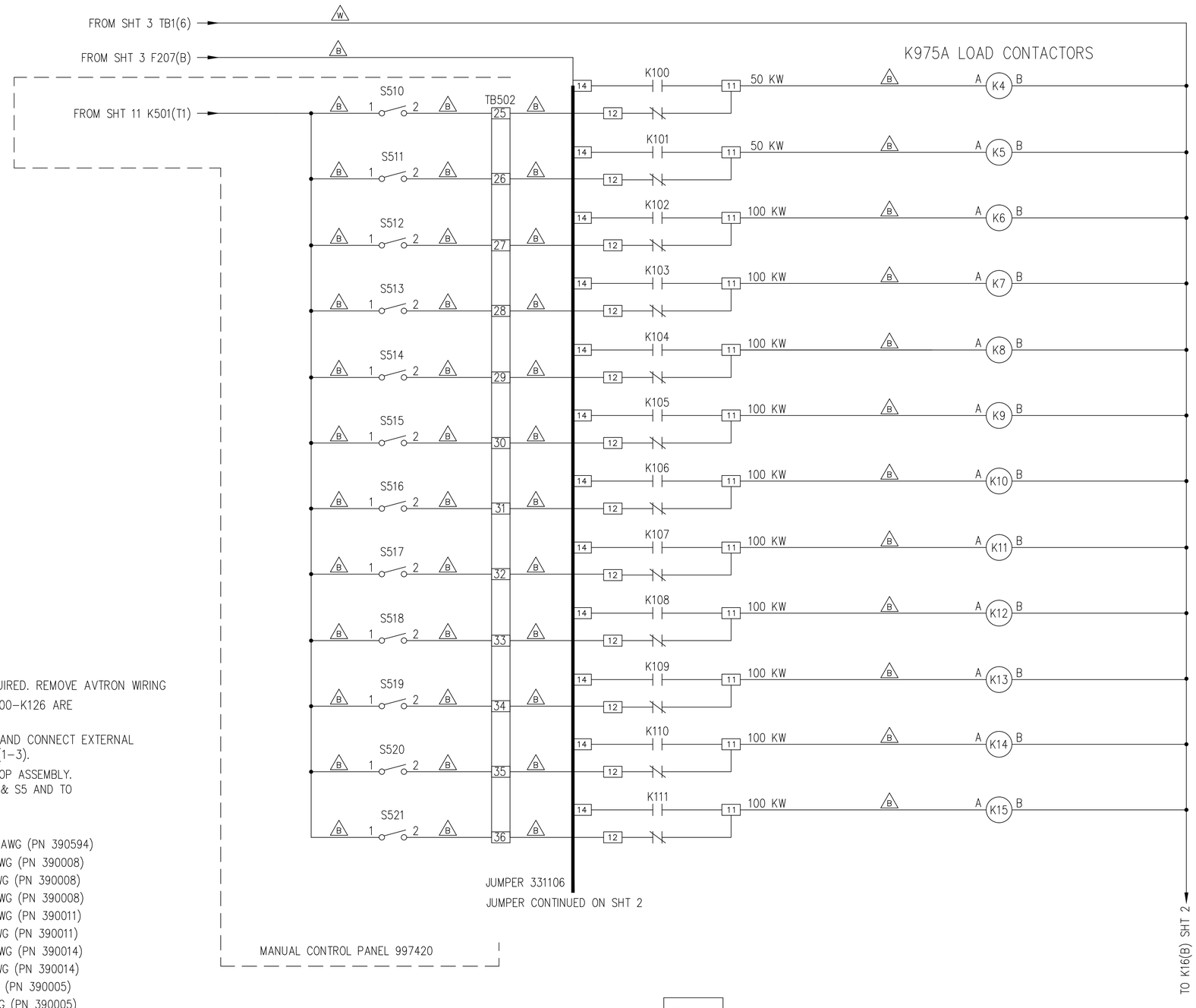
AVTRON MANUFACTURING, INC.
INDEPENDENCE, OH

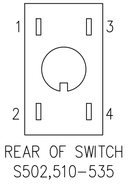
LOAD BANK (OUTDOOR)

DRAWING NUMBER
SB3833
SHT 2

OUTLINE DRAWING

REVISIONS				
ECN NO.	REV	DESCRIPTION	DATE	APPROVED
LA1427	A	REVISED PER ECN J.FRANK	11/25/13	B.DIXON





REAR OF SWITCH
S502,510–535

5. IF EXTERNAL BLOWER POWER IS REQUIRED. REMOVE AVTRON WIRING
4. DIODES SHOWN ACROSS COILS OF K100–K126 ARE INTERNAL TO RELAYS.
3. FROM TB2(1–3) TO MAIN LOAD BUS AND CONNECT EXTERNAL 480V, 3 PH, 60 HZ SOURCE TO TB2(1–3).
2. THERMOCOUPLE A24741 IS WIRED AT TOP ASSEMBLY. SET THERMOCOUPLE TO 375℉ FOR S4 & S5 AND TO 140℉ FOR S6.
1. WIRE CODE

- (SH) INDICATES WIRE TO BE SHIELDED 20 AWG (PN 390594)
- △B INDICATES WIRE TO BE BLACK #16 AWG (PN 390008)
- △W INDICATES WIRE TO BE WHITE #16 AWG (PN 390008)
- △G INDICATES WIRE TO BE GREEN #16 AWG (PN 390008)
- (B) INDICATES WIRE TO BE BLACK #14 AWG (PN 390011)
- (W) INDICATES WIRE TO BE WHITE #14 AWG (PN 390011)
- △B INDICATES WIRE TO BE BLACK #12 AWG (PN 390014)
- △W INDICATES WIRE TO BE WHITE #12 AWG (PN 390014)
- [R] INDICATES WIRE TO BE RED #18 AWG (PN 390005)
- [BL] INDICATES WIRE TO BE BLUE #18 AWG (PN 390005)
- [W] INDICATES WIRE TO BE WHITE #18 AWG (PN 390005)
- ◇1 INDICATES WIRE TO BE BLACK #10 AWG (PN 390016)
- ◇3 INDICATES WIRE TO BE BLACK #6 AWG (PN 390323)
- ◇5 INDICATES WIRE TO BE BLACK #2 AWG (PN 390325)
- [B] INDICATES WIRE TO BE BLACK #22 AWG (PN 390001)
- [W] INDICATES WIRE TO BE WHITE #22 AWG (PN 390001)

UNLESS OTHERWISE SPECIFIED THE ABOVE NOTES APPLY

FORM 832D-LB, 2/20/2012

NEXT ASSY	USED ON
K975A994213	K975A994213

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	B.DIXON	9/5/13
CHECKED	B.DIXON	9/5/13
ENG APVD	B.DIXON	9/5/13
APVD PROD	R.SUTICH	9/27/13
SCALE		
MODEL		

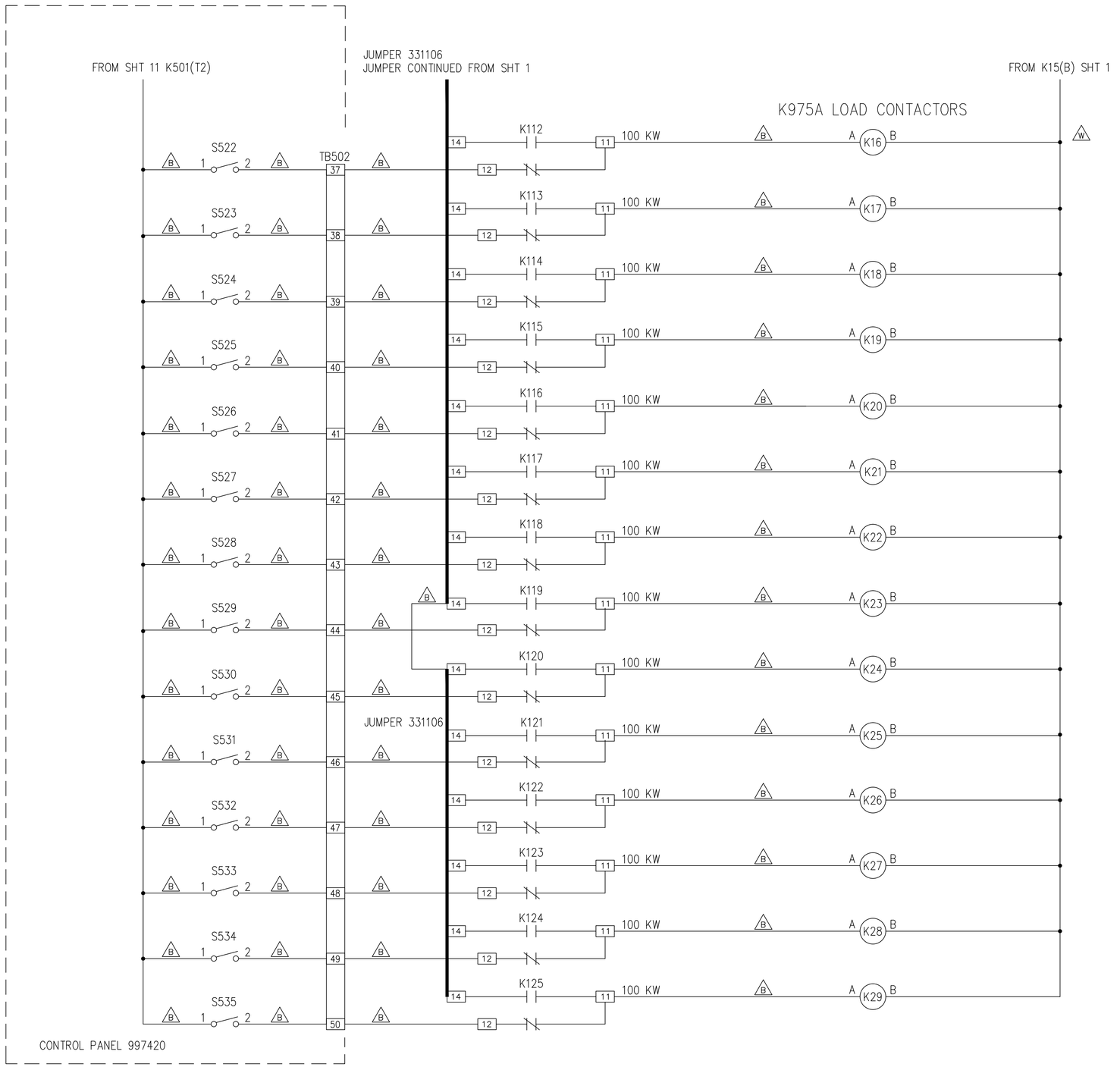
AVTRON
6255 HALLE DRIVE
CLEVELAND, OH 44125

SCHEMATIC DIAGRAM,
LOAD BANK
(2500KW, 480V, 3 PH, 60HZ)

IMF ☒
PSF ☐

CAGE NO.	DWG. NO.	SHEET	REV
6J744	997418	1 OF 14	A

REVISIONS				
ECN NO.	REV	DESCRIPTION	DATE	APPROVED



UNLESS OTHERWISE SPECIFIED THE ABOVE NOTES APPLY

FORM 832D2-LB, 2/20/2012

SCALE 1/1

MODEL K975A

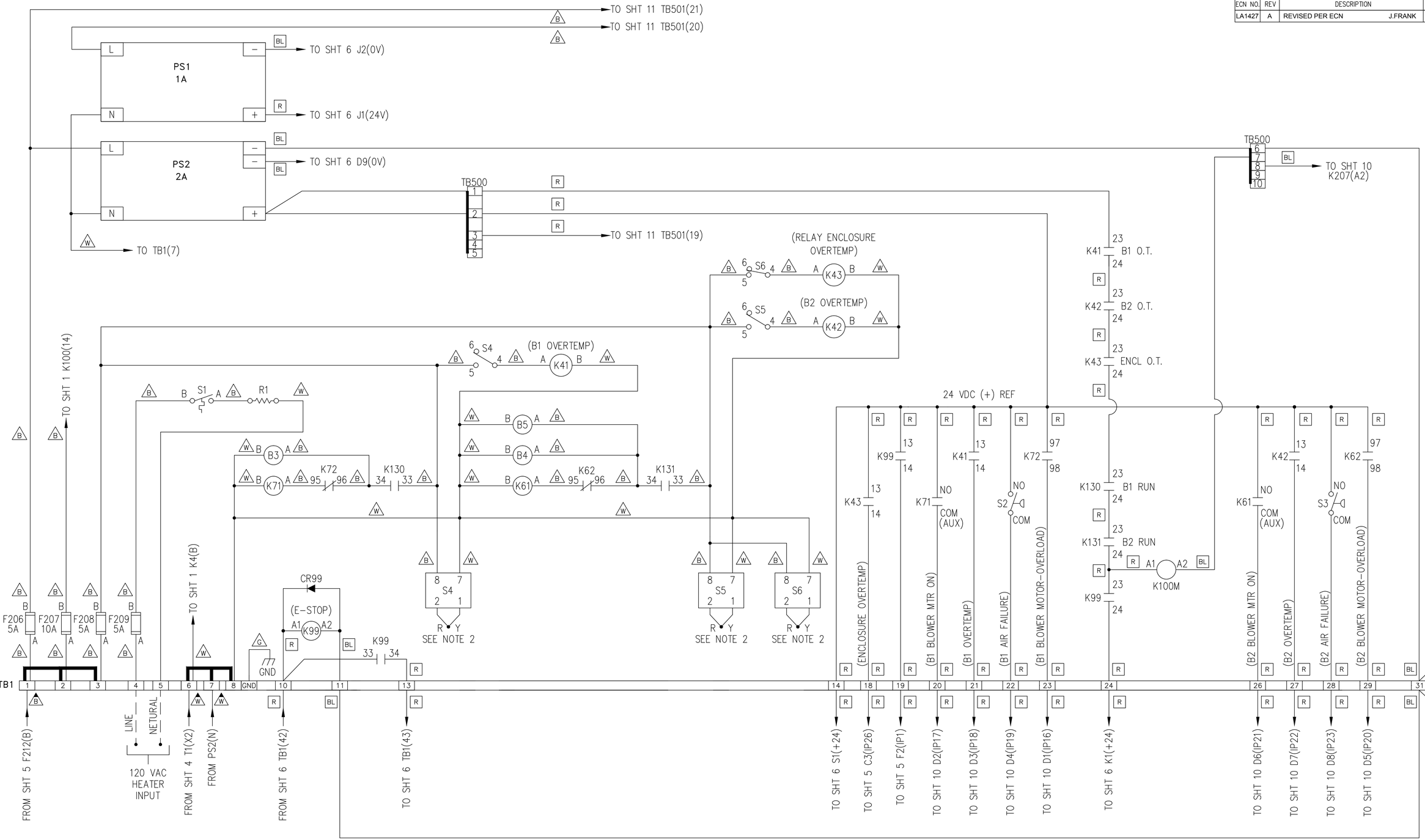
AVTRON

6255 HALLE DRIVE
CLEVELAND, OH 44125

SCHEMATIC DIAGRAM
LOAD BANK
(2500 KW, 480V, 3 PH, 60 HZ)

CAGE NO.	DWG. NO.	SHEET	REV
6J744	997418	2	A

REVISIONS				
ECN NO.	REV	DESCRIPTION	DATE	APPROVED
LA1427	A	REVISED PER ECN J.FRANK	11/25/13	B.DIXON



SEE SHEET 1 FOR NOTES

UNLESS OTHERWISE SPECIFIED THE ABOVE NOTES APPLY

FORM 832D2-LB, 2/20/2012

SCALE 1/1

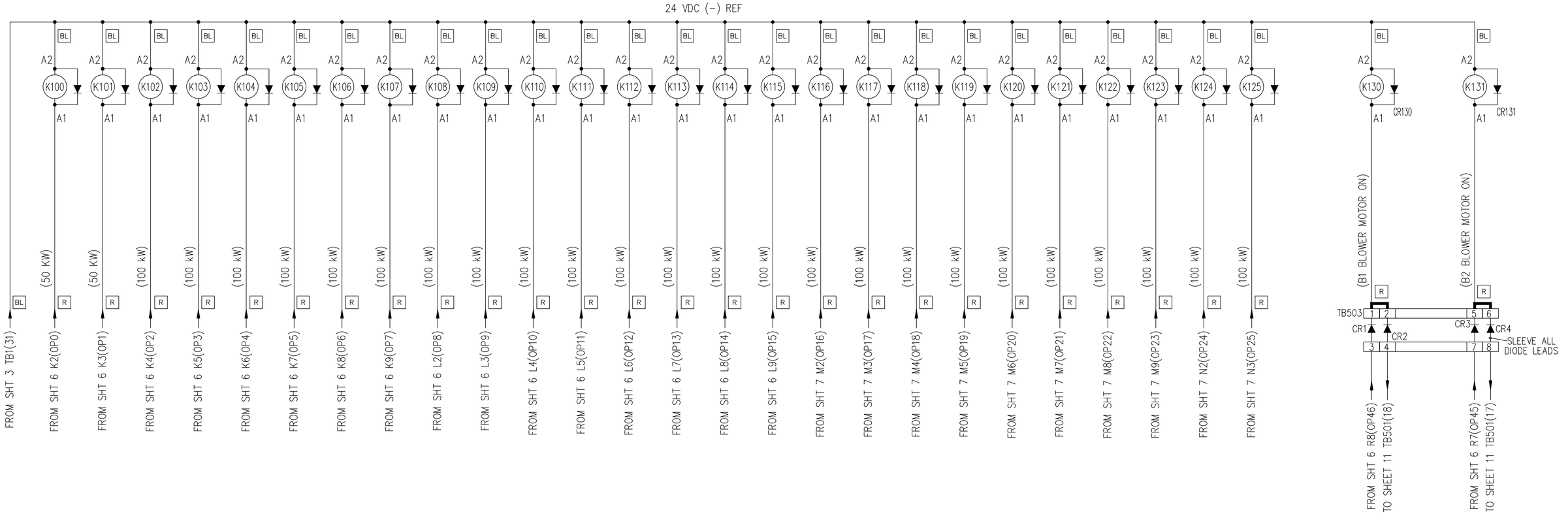
MODEL K975A

AVTRON
6255 HALLE DRIVE
CLEVELAND, OH 44125

SCHEMATIC DIAGRAM
LOAD BANK
(2500 KW, 480V, 3 PH, 60 HZ)

CAGE NO.	DWG. NO.	SHEET	REV
6J744	997418	3	A

REVISIONS				
ECN NO.	REV	DESCRIPTION	DATE	APPROVED
LA1427	A	REVISED PER ECN J.FRANK	11/25/13	B.DIXON



SEE SHEET 1 FOR NOTES

UNLESS OTHERWISE SPECIFIED THE ABOVE NOTES APPLY

FORM 832D2-LB, 2/20/2012

SCALE 1/1

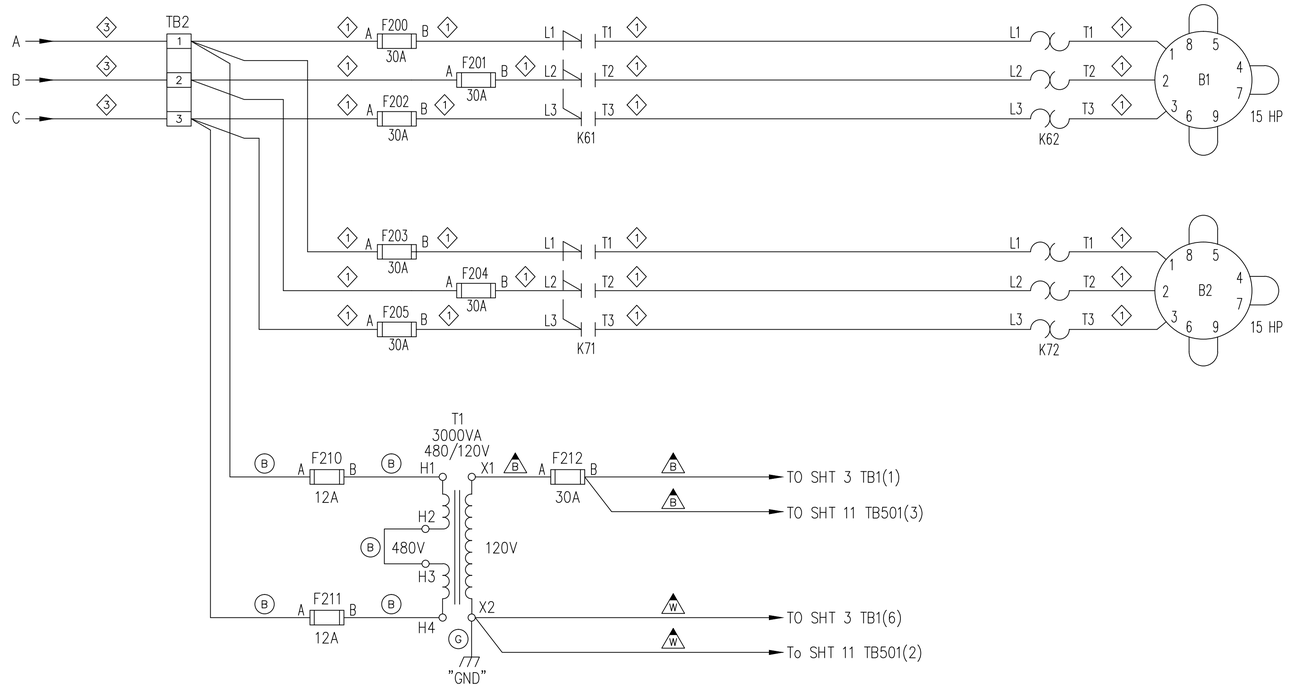
MODEL K975A

AVTRON
6255 HALLE DRIVE
CLEVELAND, OH 44125

SCHEMATIC DIAGRAM
LOAD BANK
(2500 KW, 480V, 3 PH, 60 HZ)

CAGE NO.	DWG. NO.	SHEET	REV
6J744	997418	4	A

REVISIONS				
ECN NO.	REV	DESCRIPTION	DATE	APPROVED
LA1427	A	REVISED PER ECN J.FRANK	11/25/13	B.DIXON



SEE SHEET 1 FOR NOTES

UNLESS OTHERWISE SPECIFIED THE ABOVE NOTES APPLY

FORM 832D2-LB, 2/20/2012

AVTRON
6255 HALLE DRIVE
CLEVELAND, OH 44125

SCHEMATIC DIAGRAM
LOAD BANK
(2500 KW, 480V, 3 PH, 60 HZ)

SCALE	CAGE NO.	DWG. NO.	SHEET	REV
1/1	6J744	997418	5	A

MODEL K975A

REVISIONS				
ECN NO.	REV	DESCRIPTION	DATE	APPROVED
LA1427	A	REVISED PER ECN J.FRANK	11/25/13	B.DIXON

A1

SIGMA 2 CONTROLLER
LOAD BANK MODULE PR01229
INPUT/OUTPUT ASSIGNMENTS

INPUTS

FROM SHT 3 TB1(23)	B1 BLOWER MOTOR OVERLOAD	D1	IP16
FROM SHT 3 TB1(20)	B1 BLOWER MOTOR ON	D2	IP17
FROM SHT 3 TB1(21)	B1 OVER TEMP	D3	IP18
FROM SHT 3 TB1(22)	B1 AIR FAILURE	D4	IP19
FROM SHT 3 TB1(29)	B2 BLOWER MOTOR OVERLOAD	D5	IP20
FROM SHT 3 TB1(26)	B2 BLOWER MOTOR ON	D6	IP21
FROM SHT 3 TB1(27)	B2 OVER TEMP	D7	IP22
FROM SHT 3 TB1(28)	B2 AIR FAILURE	D8	IP23
FROM SHT 6 PS2(-)		D9	0V
	RESET	F1	IP0
FROM SHT 3 TB1(19)	EMERGENCY STOP	F2	IP1
		F9	0V
FROM SHT 3 TB1(18)	ENCLOSURE OVERTEMP	C3	IP26
		C9	0V
		E9	0V
S500 2	TB4 10	E5	IP12
S500 3	TB4 11	E6	IP13
S500 5	TB4 12	E7	IP14
S500 7	TB4 13	E8	IP15
FROM SHT 3 PS1 (+)		J1	+24V
FROM SHT 3 PS1 (-)		J2	0 V
		J3	GND

SIGMA CONTROL PANEL D49545

OUTPUTS

0V	K10		FROM SHT 3 TB1(31)
0P7	K9	100 KW	TO SHT 4 K107(A1)
0P6	K8	100 KW	TO SHT 4 K106(A1)
0P5	K7	100 KW	TO SHT 4 K105(A1)
0P4	K6	100 KW	TO SHT 4 K104(A1)
0P3	K5	100 KW	TO SHT 4 K103(A1)
0P2	K4	100 KW	TO SHT 4 K102(A1)
0P1	K3	50 KW	TO SHT 4 K101(A1)
0P0	K2	50 KW	TO SHT 4 K100(A1)
+24	K1		FROM SHT 3 TB1(24)
0V	L10		
0P15	L9	100 KW	TO SHT 4 K115(A1)
0P14	L8	100 KW	TO SHT 4 K114(A1)
0P13	L7	100 KW	TO SHT 4 K113(A1)
0P12	L6	100 KW	TO SHT 4 K112(A1)
0P11	L5	100 KW	TO SHT 4 K111(A1)
0P10	L4	100 KW	TO SHT 4 K110(A1)
0P9	L3	100 KW	TO SHT 4 K109(A1)
0P8	L2	100 KW	TO SHT 4 K108(A1)
+24	L1		TO SHT 7 +24(M1)
0V	S10		
0P55	S9	E-STOP	OUTPUT HI IF SIGMA O.K.
0P53	S7	TEST INDICATOR	
0P49	S3	OFF INDICATOR	
0P48	S2	START INDICATOR	
+24	S1		FROM SHT 3 TB1(14)
0V	R10		
0P46	R8	BLOWER MOTOR ON (FAN 0)	TO SHT 4 TB503(3)
0P45	R7	BLOWER MOTOR ON (FAN 1)	TO SHT 4 TB503(4)
0P42	R4		
+24	R1		TO 0V(M10) SHT6

TB1

GND	G	GND
42	TO SHT 3 TB1(10)	1
	K99 REF ONLY	
43	TO SHT 3 TB1(13)	2
44		3
45		4
46		5
47		6
49		8
48		7
50	STOP/RESET	9

SIGMA CONTROL PANEL D49545

S1 START

S2 STOP/RESET

1 — STATUS: SUPPLY ON TEST
2 — STOP INDICATOR
3 — START INDICATOR
4 — GN S1
5 — RD S2
6 — YEL DS1
7 — STOP/RESET
8
9

SEE SHEET 1 FOR NOTES

UNLESS OTHERWISE SPECIFIED THE ABOVE NOTES APPLY

FORM 63202-LB, 2/20/2012

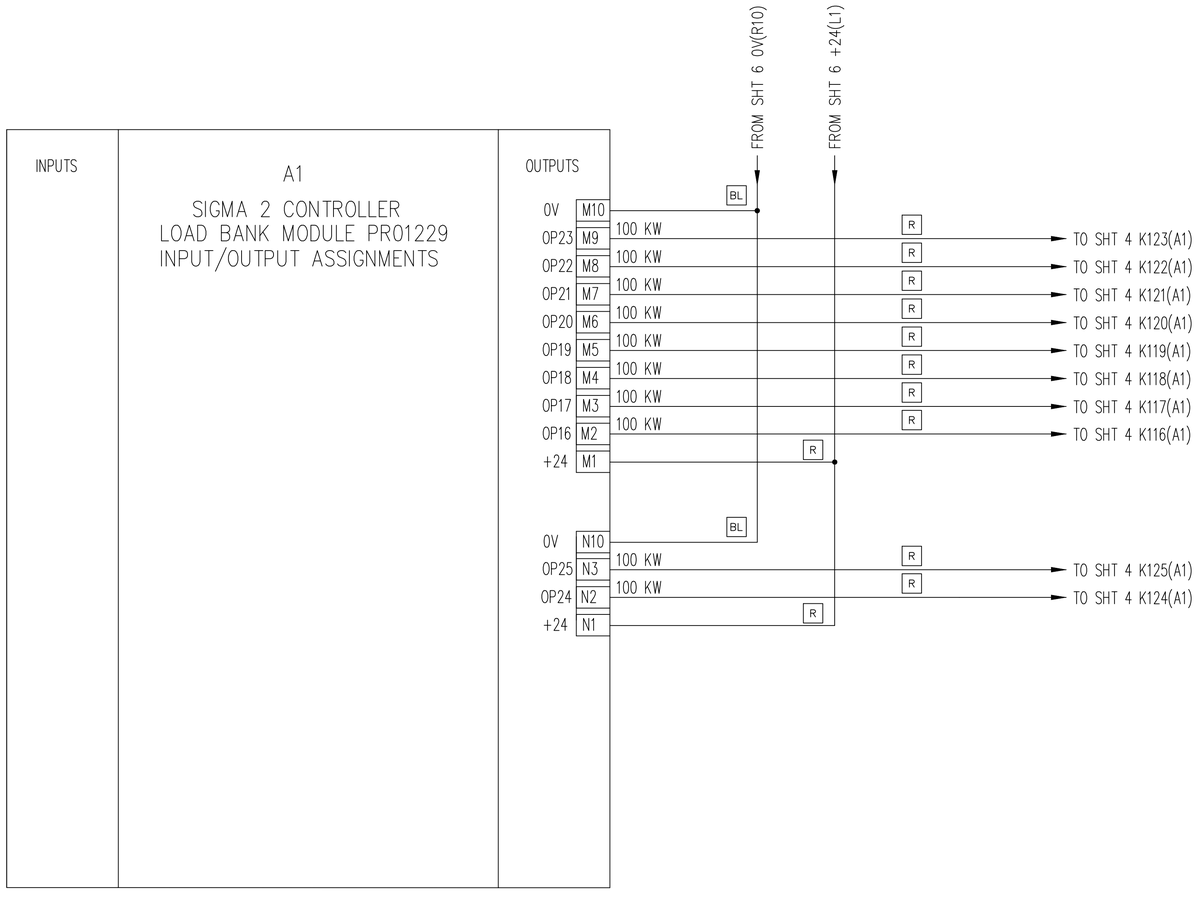
AVTRON
6255 HALLE DRIVE
CLEVELAND, OH 44125

SCHEMATIC DIAGRAM
LOAD BANK
(2500 KW, 480V, 3 PH, 60 HZ)

SCALE	CAGE NO.	DWG. NO.	SHEET	REV
1/1	6J744	997418	6	A

MODEL K975A

REVISIONS				
ECN NO.	REV	DESCRIPTION	DATE	APPROVED
LA1427	A	REVISED PER ECN J.FRANK	11/25/13	B.DIXON



SEE SHEET 1 FOR NOTES

UNLESS OTHERWISE SPECIFIED THE ABOVE NOTES APPLY

FORM 63210-LB, 2/20/2012

SCALE 1/1

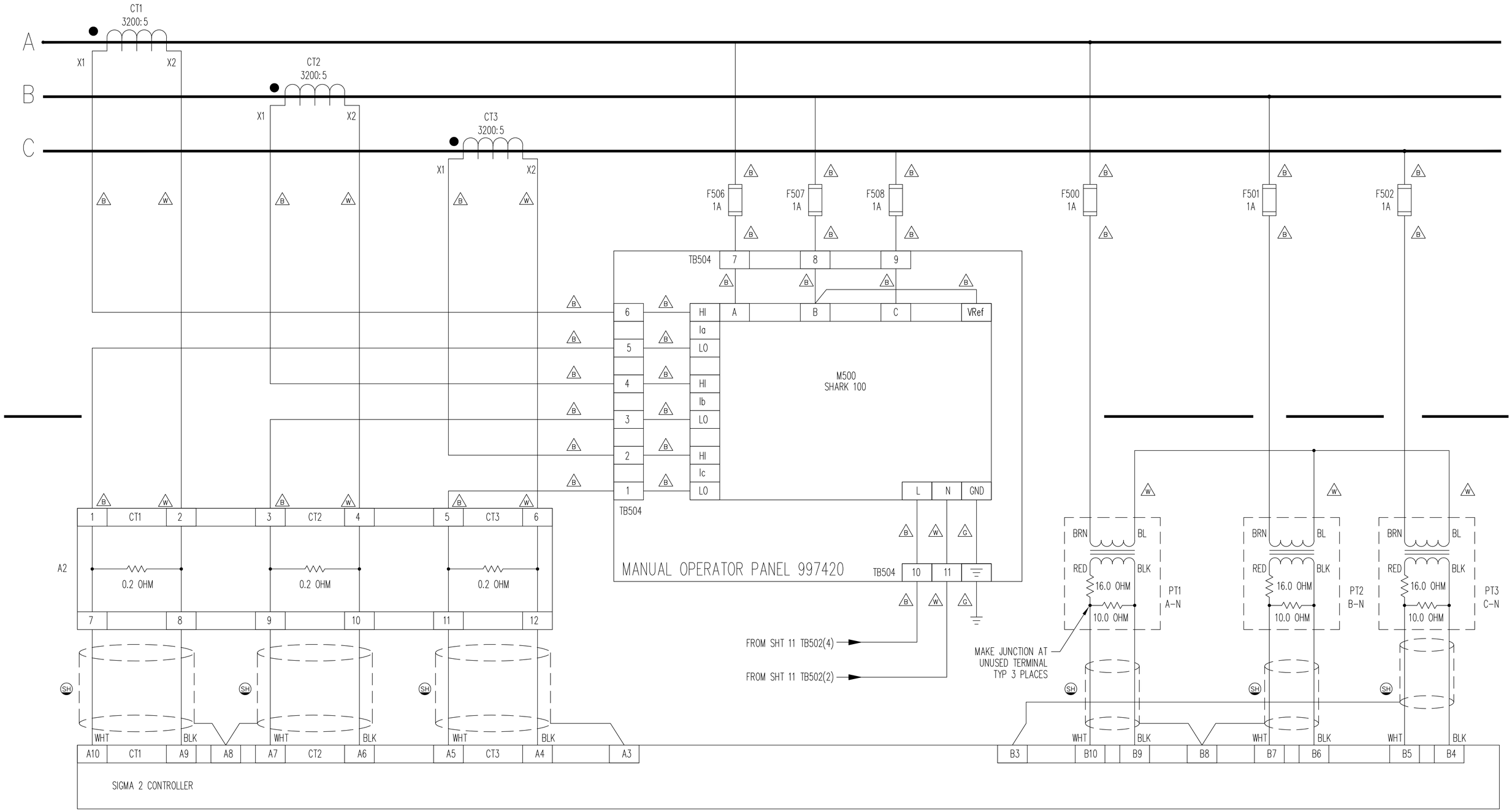
MODEL K975A

AVTRON
6255 HALLE DRIVE
CLEVELAND, OH 44125

SCHEMATIC DIAGRAM
LOAD BANK
(2500 KW, 480V, 3 PH, 60 HZ)

CAGE NO.	DWG. NO.	SHEET	REV
6J744	997418	7	A

REVISIONS				
ECN NO.	REV	DESCRIPTION	DATE	APPROVED



SEE SHEET 1 FOR NOTES

UNLESS OTHERWISE SPECIFIED THE ABOVE NOTES APPLY

FORM 832D2-LB, 2/20/2012

SCALE 1/1

MODEL K975A

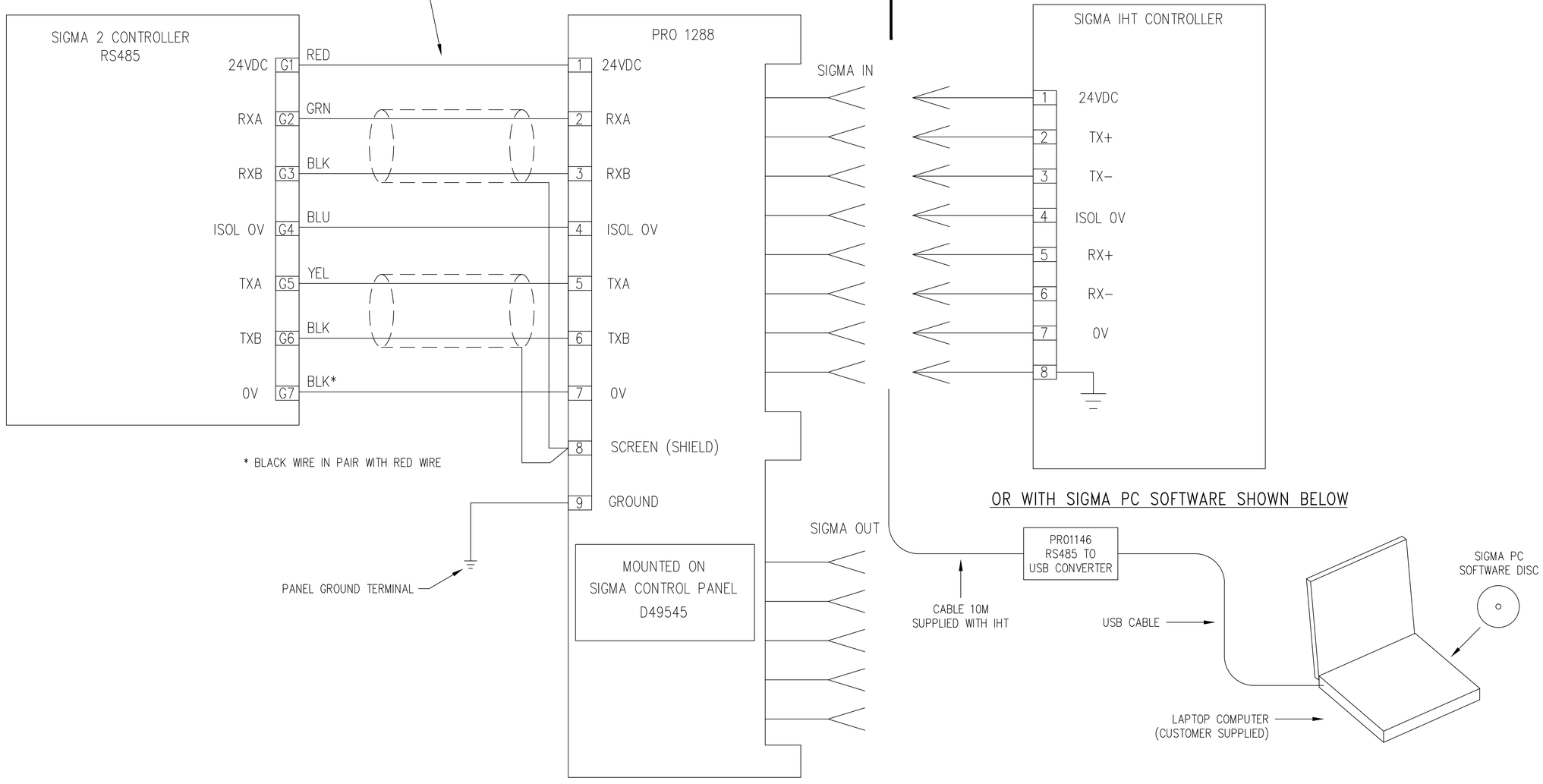
AVTRON
6255 HALLE DRIVE
CLEVELAND, OH 44125

SCHEMATIC DIAGRAM
LOAD BANK
(2500 KW, 480V, 3 PH, 60 HZ)

CAGE NO.	DWG. NO.	SHEET	REV
6J744	997418	8	A

REVISIONS				
ECN NO.	REV	DESCRIPTION	DATE	APPROVED

AVTRON WIRING: BELDEN 9731 CABLE (AVTRON PN 391103) OR EQUAL
THESE MUST BE RUN IN A DEDICATED INDIVIDUAL
BUNDLE WITH NO OTHER WIRING



SEE SHEET 1 FOR NOTES

UNLESS OTHERWISE SPECIFIED THE ABOVE NOTES APPLY

FORM 832D2-LB, 2/20/2012

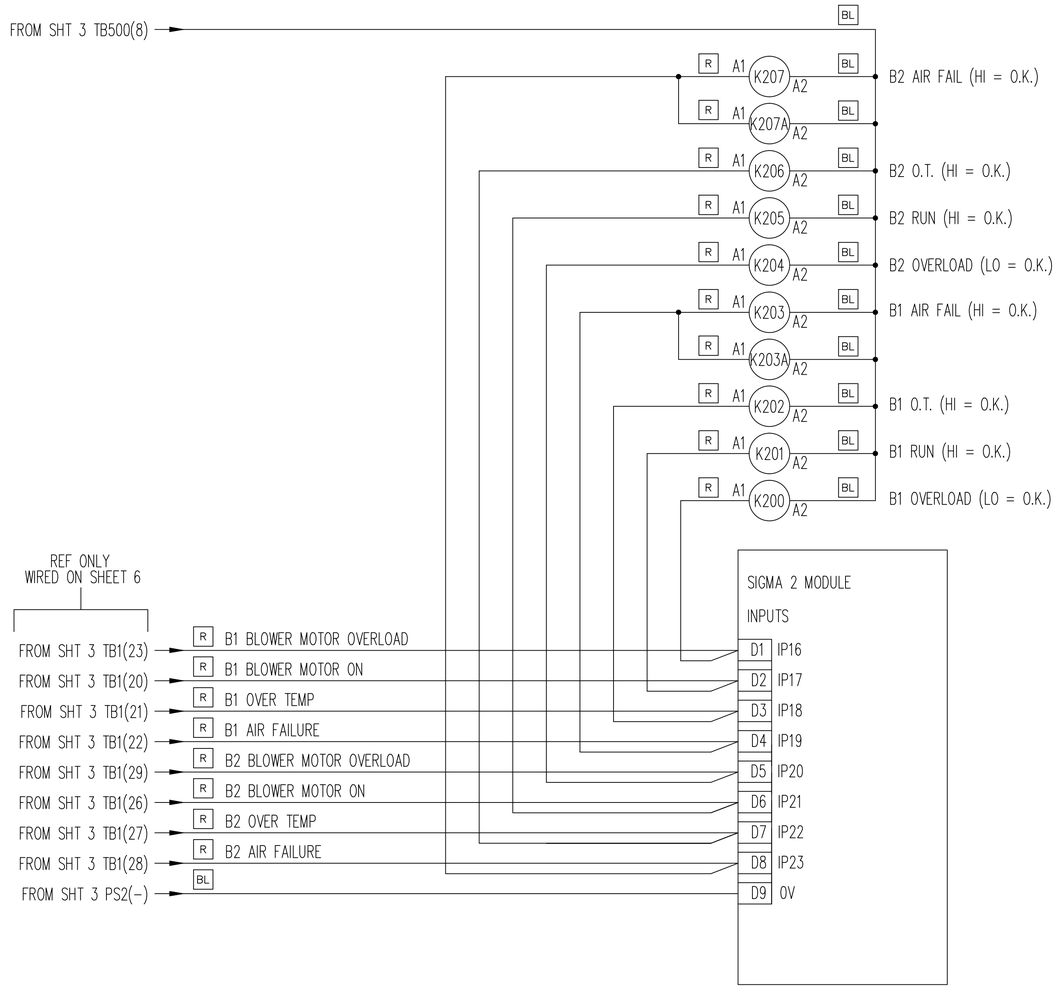
AVTRON
6255 HALLE DRIVE
CLEVELAND, OH 44125

SCHEMATIC DIAGRAM
LOAD BANK
(2500 KW, 480V, 3 PH, 60 HZ)

SCALE	CAGE NO.	DWG. NO.	SHEET	REV
1/1	6J744	997418	9	A

MODEL K975A

REVISIONS				
ECN NO.	REV	DESCRIPTION	DATE	APPROVED
LA1427	A	REVISED PER ECN J.FRANK	11/25/13	B.DIXON



SEE SHEET 1 FOR NOTES

UNLESS OTHERWISE SPECIFIED THE ABOVE NOTES APPLY

FORM 832D2-LB, 2/20/2012

SCALE 1/1

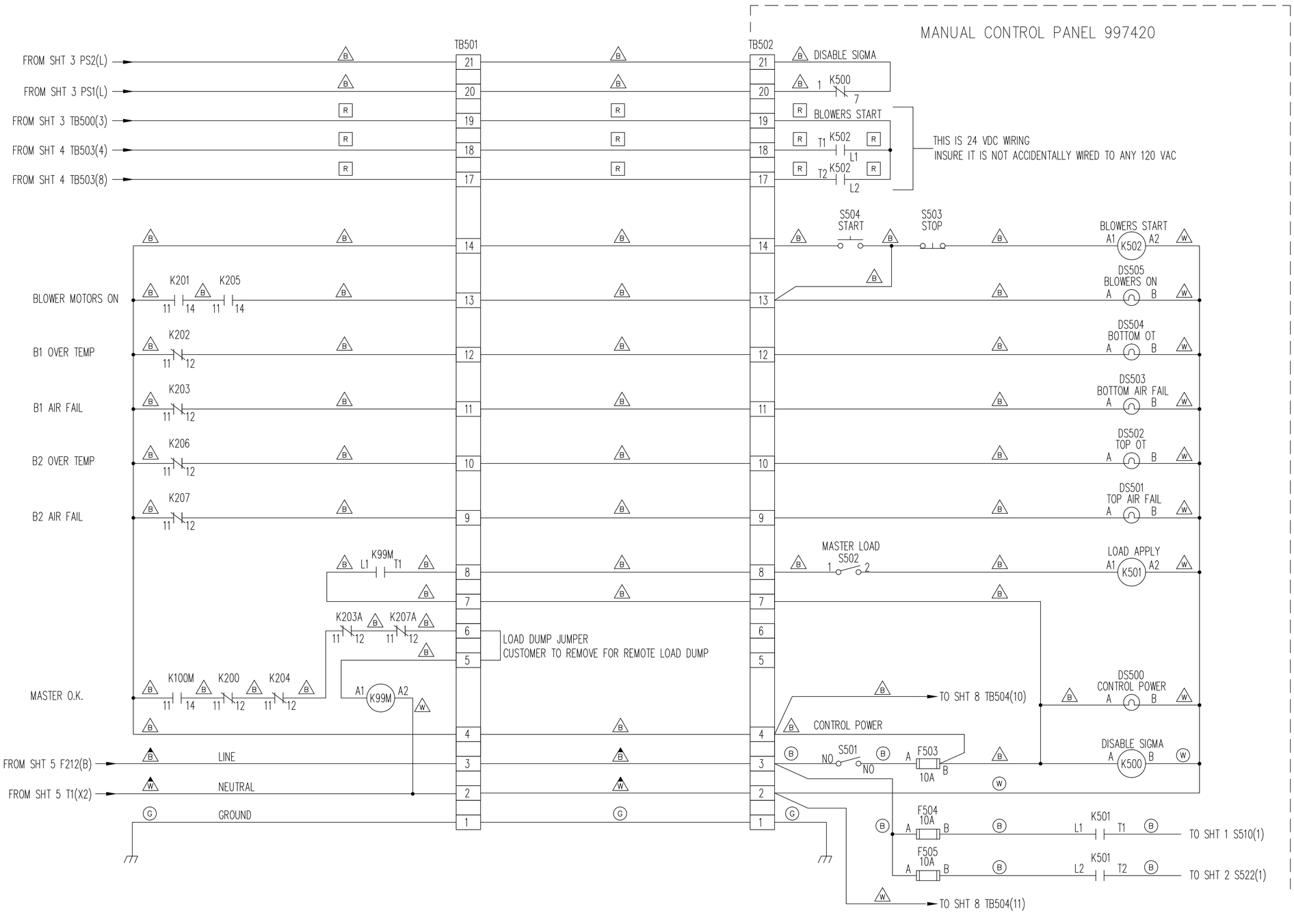
MODEL K975A

AVTRON
6255 HALLE DRIVE
CLEVELAND, OH 44125

SCHEMATIC DIAGRAM
LOAD BANK
(2500 KW, 480V, 3 PH, 60 HZ)

CAGE NO.	DWG. NO.	SHEET	REV
6J744	997418	10	A

REVISIONS				
ECN NO.	REV	DESCRIPTION	DATE	APPROVED
LA1427	A	REVISED PER ECN J.FRANK	11/25/13	B.DIXON



SEE SHEET 1 FOR NOTES

UNLESS OTHERWISE SPECIFIED THE ABOVE NOTES APPLY

FORM 832D2-LB, 2/20/2012

AVTRON
6255 HALLE DRIVE
CLEVELAND, OH 44125

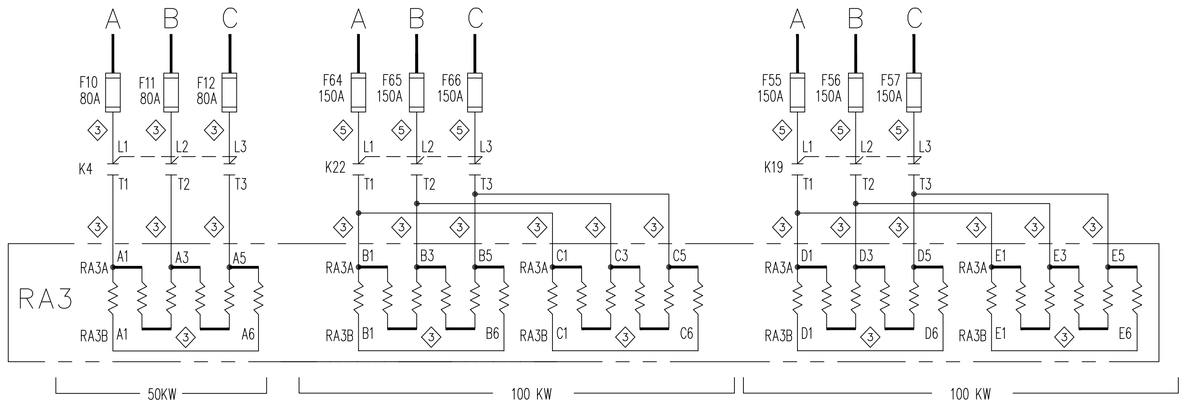
SCHEMATIC DIAGRAM
LOAD BANK
(2500 KW, 480V, 3 PH, 60 HZ)

SCALE	CAGE NO.	DWG. NO.	SHEET	REV
1/1	6J744	997418	11	A

MODEL K975A

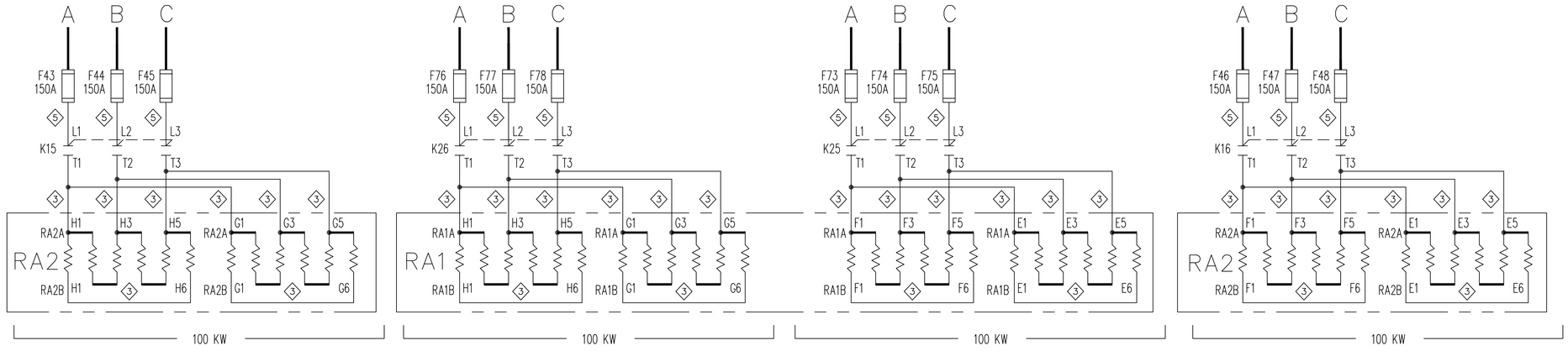
REVISIONS				
ECN NO.	REV	DESCRIPTION	DATE	APPROVED

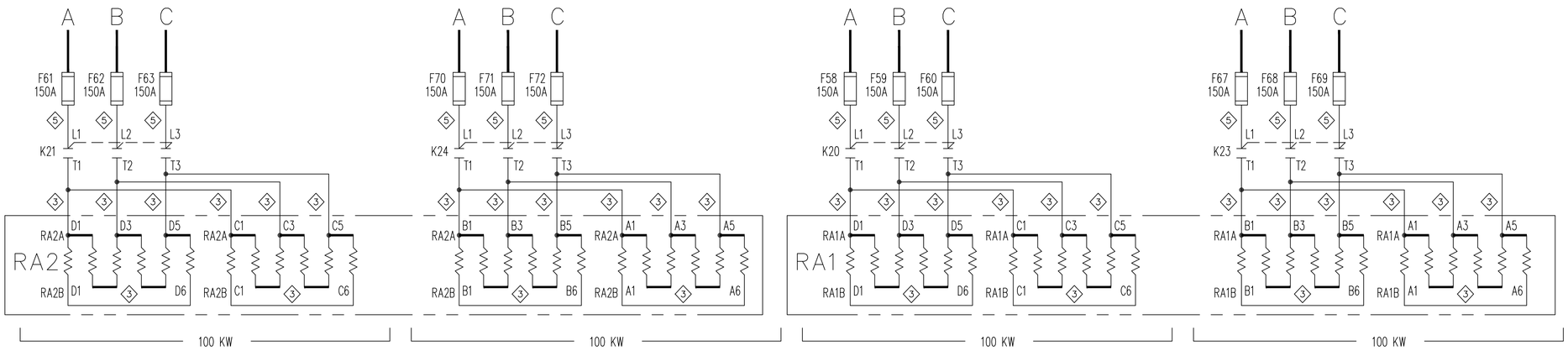
LOAD BANK K975A994213



LOAD INPUT
2500 KW, 480 V,
3 PH, 60 HZ,
3005 AMP/PHASE

A
B
C





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

SEE SHEET 1 FOR NOTES

UNLESS OTHERWISE SPECIFIED THE ABOVE NOTES APPLY

FORM 832D2-LB, 2/20/2012

AVTRON
6255 HALLE DRIVE
CLEVELAND, OH 44125

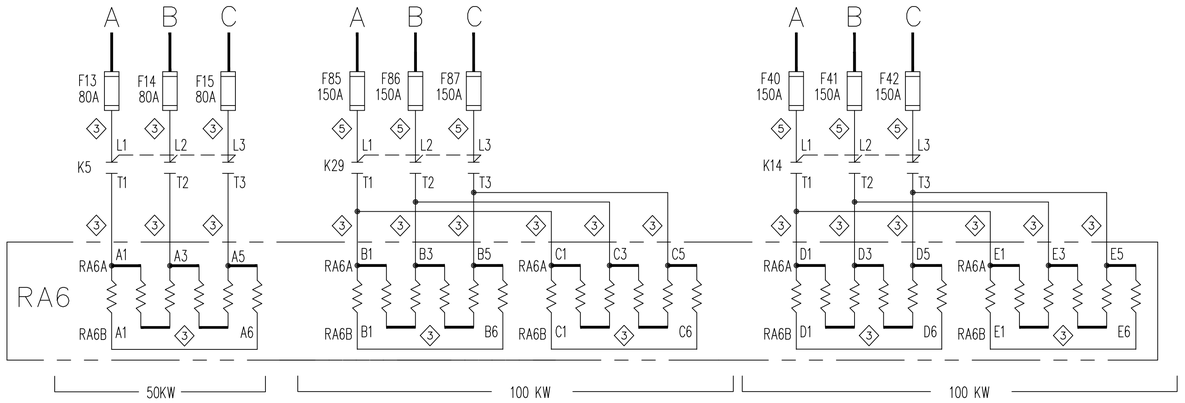
SCHEMATIC DIAGRAM
LOAD BANK
(2500 KW, 480V, 3 PH, 60 HZ)

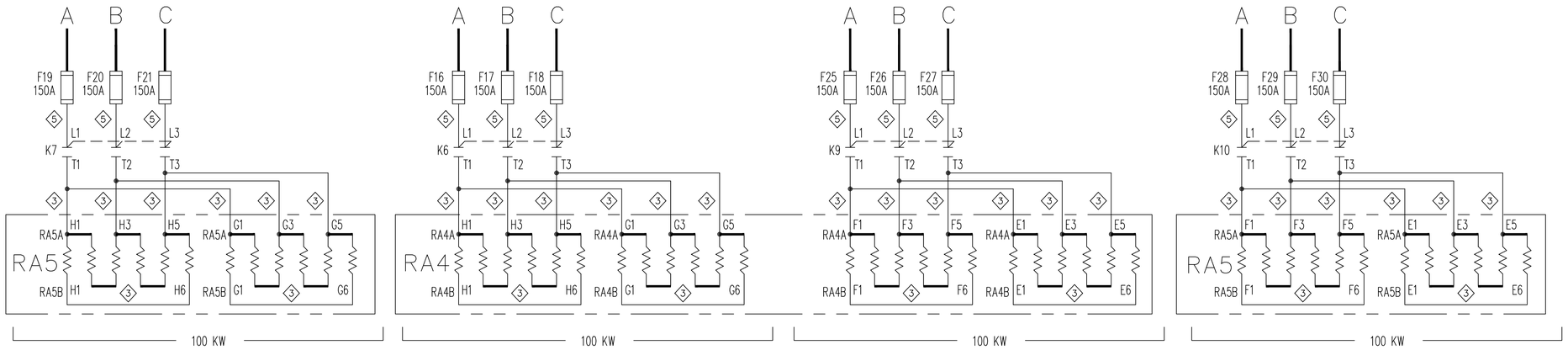
SCALE	CAGE NO.	DWG. NO.	SHEET	REV
1/1	6J744	997418	12	A

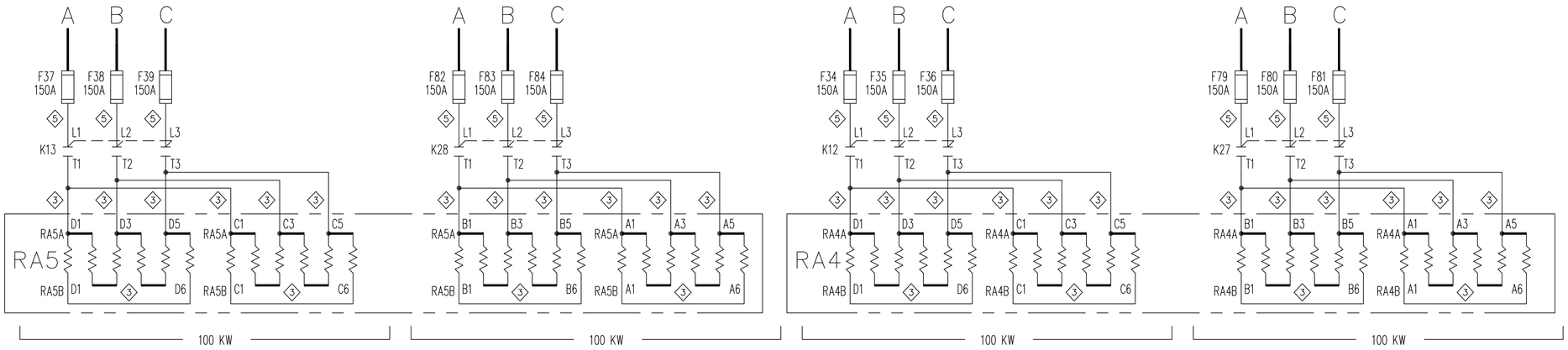
MODEL K975A

LOAD BANK K975A994213

REVISIONS				
ECN NO.	REV	DESCRIPTION	DATE	APPROVED







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

SEE SHEET 1 FOR NOTES
UNLESS OTHERWISE SPECIFIED THE ABOVE NOTES APPLY
FORM 832D2-LB, 2/20/2012

SCALE 1/1
MODEL K975A

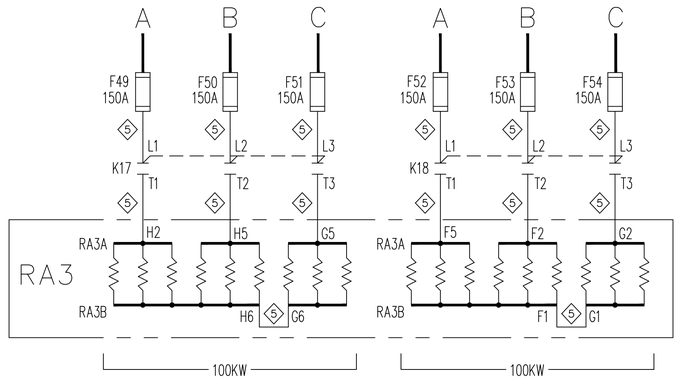
AVTRON
6255 HALLE DRIVE
CLEVELAND, OH 44125

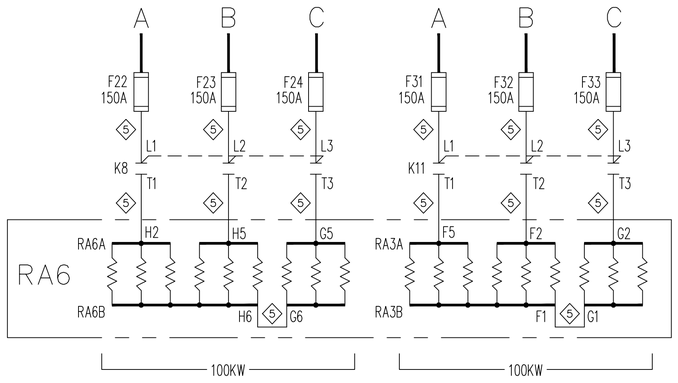
SCHEMATIC DIAGRAM
LOAD BANK
(2500 KW, 480V, 3 PH, 60 HZ)

CAGE NO.	DWG. NO.	SHEET	REV
6J744	997418	13	A

REVISIONS				
ECN NO.	REV	DESCRIPTION	DATE	APPROVED

LOAD BANK K975A994213





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

SEE SHEET 1 FOR NOTES

UNLESS OTHERWISE SPECIFIED THE ABOVE NOTES APPLY

FORM 83ZD2-LB, 2/20/2012

SCALE 1/1

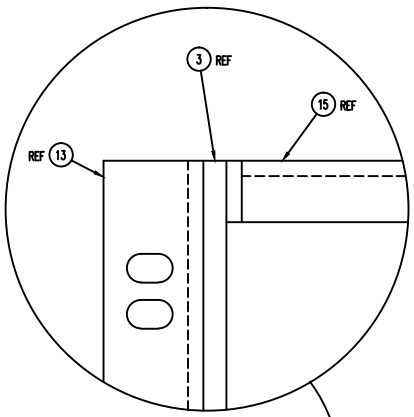
MODEL K975A

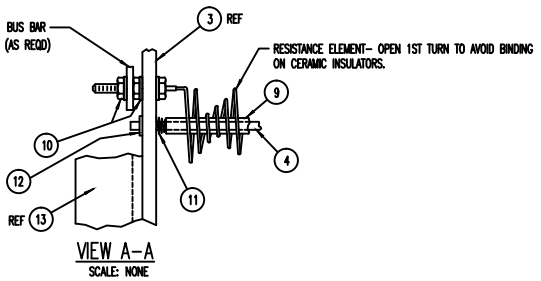
AVTRON
6255 HALLE DRIVE
CLEVELAND, OH 44125

SCHEMATIC DIAGRAM
LOAD BANK
(2500 KW, 480V, 3 PH, 60 HZ)

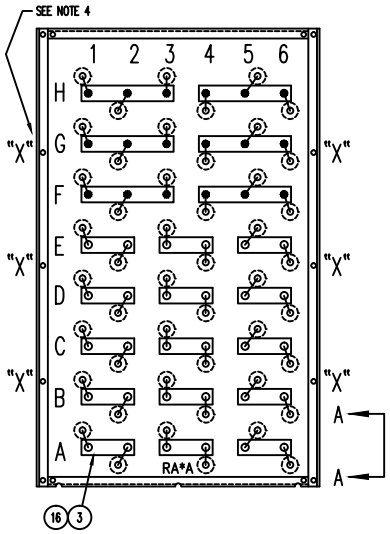
CAGE NO.	DWG. NO.	SHEET	REV
6J744	997418	14	A

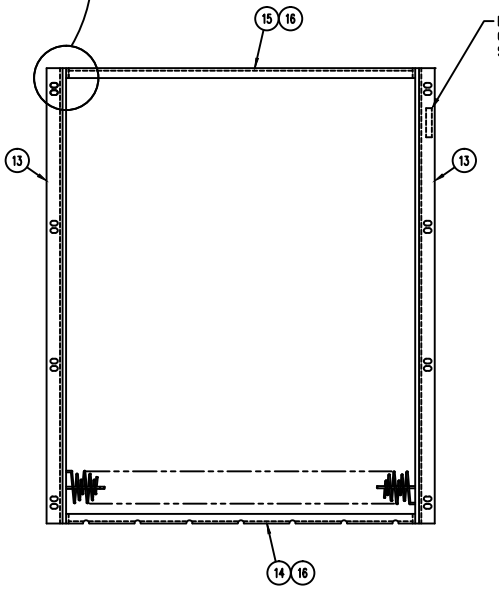
REVISIONS				
ECN NO.	REV	DESCRIPTION	DATE	APPROVED
CE769	A	ITEM 1 WAS C22184 QTY 1, 13 WAS FACKELMANN 501917 QTY 16, ADDED ITEMS 14-16 & NOTE 4, REVISED PICTORIAL PER ECN	3/7/07	D.KOZAR
LA0836	B	ADDED PICTORIAL VIEW OF RESISTOR ELEMENT RAYNER	12/9/11	J.FEASTER

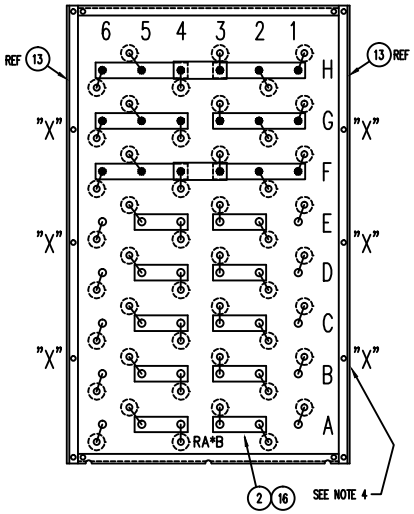




VIEW A-A
SCALE: NONE







RES ELEMENT & BUS BAR CODE		
SYM	ITEM NO	DESCRIPTION
●	5	RESISTOR ELEMENT
○	6	RESISTOR ELEMENT
⊡	7	BUS BAR
⊡	8	BUS BAR

ITEM NO.	NO. REQD	PART NO.	DESCRIPTION	MATERIAL
16	28	540230	RIVET	
15	1	C23233	PANEL, TOP	
14	1	C22229	PANEL, BOTTOM	
13	4	B23251	SUPPORT, ANGLE	
12	96	461156	PIN, SPRING CLIP	
11	96	473042	SPRING	
10	192	523205	NUT ASSEMBLY	
9	960	411141	INSULATOR	
8	12	602708	BUS BAR	
7	27	A17912	BUS BAR	
6	30	605820	RESISTOR ELEMENT	
5	18	A23312	RESISTOR ELEMENT	
4	48	A17914	ROD ELEMENT SUPPORT	
3	1	C18774	TERMINAL BOARD	
2	1	C18773	TERMINAL BOARD	
1				

LIST OF MATERIAL

4. INSTALL RIVETS (ITEM 16) FROM THE INSIDE/AIRFLOW SIDE FOR THE SIX LOCATIONS MARKED BY AN "X". INSTALL ALL OTHERS FROM THE OUTSIDE. (TYP BOTH SIDES)
3. "#" SEE TOP ASSEMBLY FOR NUMBER.
2. USE PRODUCTION DECALS TO LABEL "RA1A", "RA1B" ETC.. ON THE APPROPRIATE TERMINAL BOARDS.
1. INK STAMP PART No. 0.12 HIGH MIN & SPRAY OVER WITH CLEAR ACRYLIC LACQUER OR USE DEVICE LABEL.

UNLESS OTHERWISE SPECIFIED THE ABOVE NOTES APPLY

K975A	K975A
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	Demin	6/17/96
CHECKED	FLAUTO	6/19/96
ENG APVD	KOZAR	6/20/96
APVD PROD	WELSH	6/24/96

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

RESISTOR ASSY
(UL LOAD BANK)

IMF ☐ PSF ☒

SIZE	CAGE NO.	DWG. NO.	REV
D	01014	D26614	B

SCALE FULL | MODEL K975 | SHEET 1 OF 1

SYM TO D24713