MODEL: SATURN 2000
2000KW, 480V, 3P, 60H
PARTS # :

Contents

DESCRIPTION

Simplex Planet Series Load Banks are precision test instruments specifically designed to apply discrete, selectable electrical load to a power source while measuring the response of the generator to the applied load. They also provides a means for routine maintenance exercise to assure long term reliability and readiness of the standby generator. Exercise Load Banks eliminate the detrimental effects of unloaded operation of diesel engine generators.

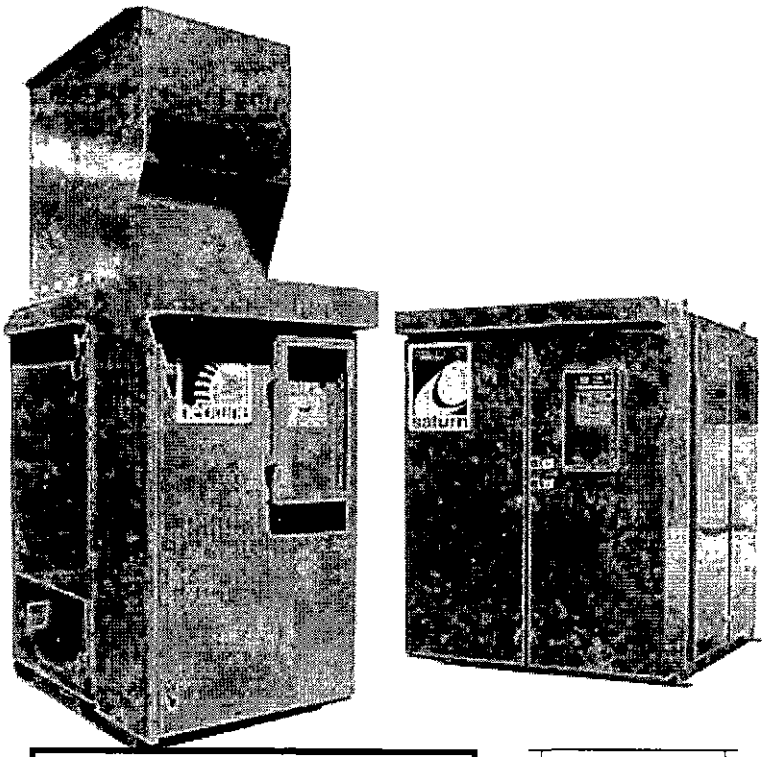
Planet Series Load Banks are available in various cabinet designs and capacities. Standard cabinets are rated as NEMA Type 3R outdoor weatherproof but are also available as NEMA Type 1 indoor. If desired, the Load Bank can be mounted on a trailer.

Power source testing is accomplished by applying resistive load steps at unity (1.0) power factor. *See the Load Bank Specifications Sheet in the front of this manual for the rating of your Load Bank.*

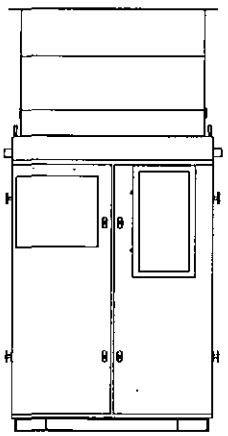
The photographs in this manual are examples only and may differ from your Load Bank.

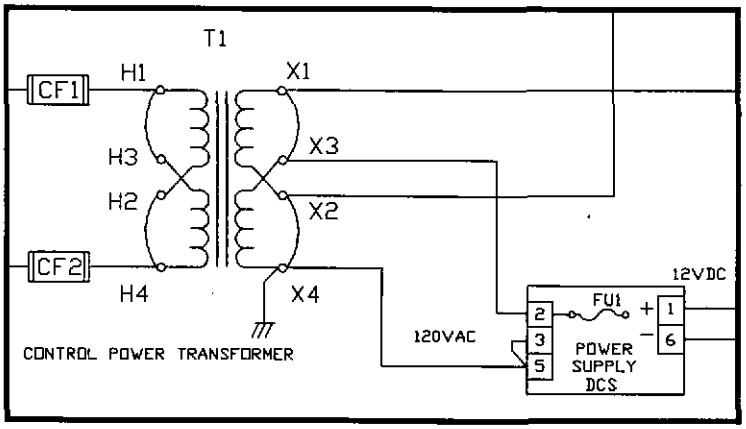
Load application is by magnetic contactor. All load branch circuits are protected by 200,000AIC class-T fuses.

Operating controls are located on Local and Remote Control Panels. The Control Panels contain printed circuit boards with 24VDC components. DC control power is supplied to the printed circuit boards by a 24VDC power supply located in the Load Bank. Common serviceable components include Control Fuses (CF1-CF2) and Power Supply Fuse (FU1). Lamps on the control panels indicate the Load Bank operating status. Control priority is determined by the "Load Bank Mode" selector switch: Off, Local-Manual, Local-Auto, Remote.



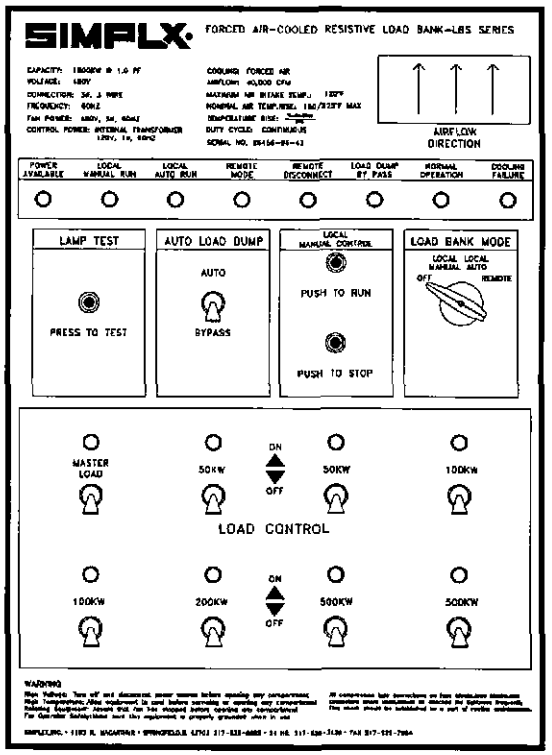
LOAD BANK	CAPACITY
Ceres (LBS-A)	5-60KW
Comet (LBS-B)	70-200KW
Mercury	5-400KW
Triton	150-400KW
Trident	450-750KW
Neptune	250-650KW
Mars	700-1400KW
Saturn	1500-3000KW





The Local Control Panel contains the following controls and indicator lamps:

1. Load Step switches and lamps,
2. Master Load switch and lamp,
3. Push to Run pushbutton,
4. Push to Stop pushbutton,
5. Power Available lamp,
6. Mode Selector switch,
   a. Local/Manual Run lamp,
   b. Local/Auto Run lamp,
   c. Remote Mode lamp,
   d. Remote Load Dump lamp,
7. Press to Test pushbutton,
8. Load Dump Bypass switch and lamp,
9. Normal Operation lamp, and
10. Cooling Failure lamp.

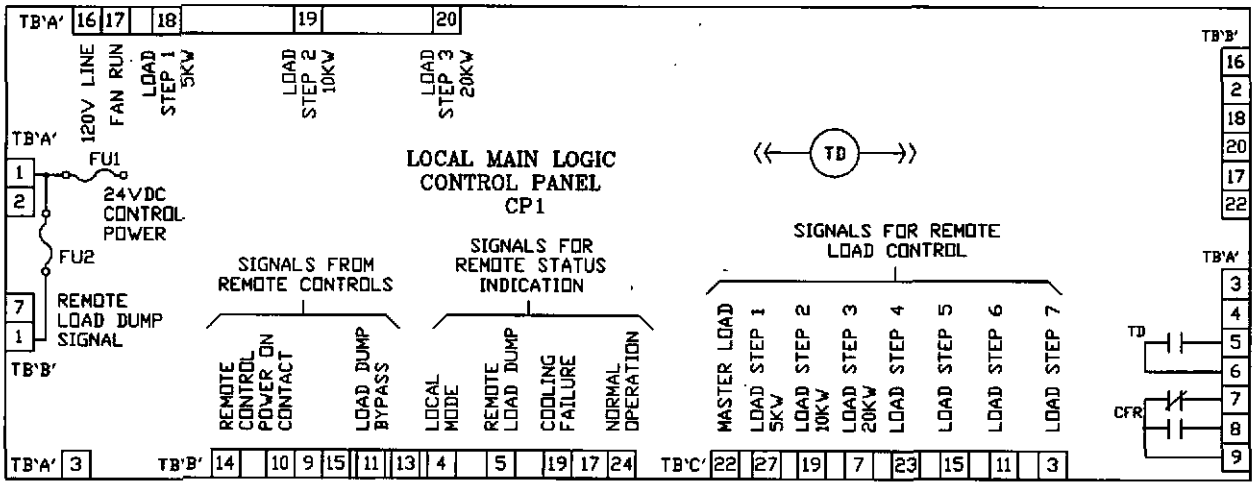


The "Power Available" lamp illuminates when the Load Bus is energized and Control Power is supplied to the system. The "Normal Operation" lamp illuminates when Control Power is available and the Cooling System is operating properly.

This Load Bank is protected against cooling failures (loss of cooling air flow, high intake or exhaust air temperature which could damage the Load Bank or present a safety hazard to the operator). When a cooling failure occurs the automatic safety features in the Control System immediately remove the load from the load source. The malfunction must be corrected and the Load Bank must be reset by pressing the "Push to Stop" pushbutton and then pressing the "Push to Run" pushbutton before the load can be re-applied.

References to Remote Control in this manual should be ignored if the Load Bank you are using is equipped with a Local Control Panel only.

References to Automatic Operation in this manual should be ignored if the Load Bank you are using is equipped with Manual Load Step Application only.



The Load Bank consists of three principal systems:

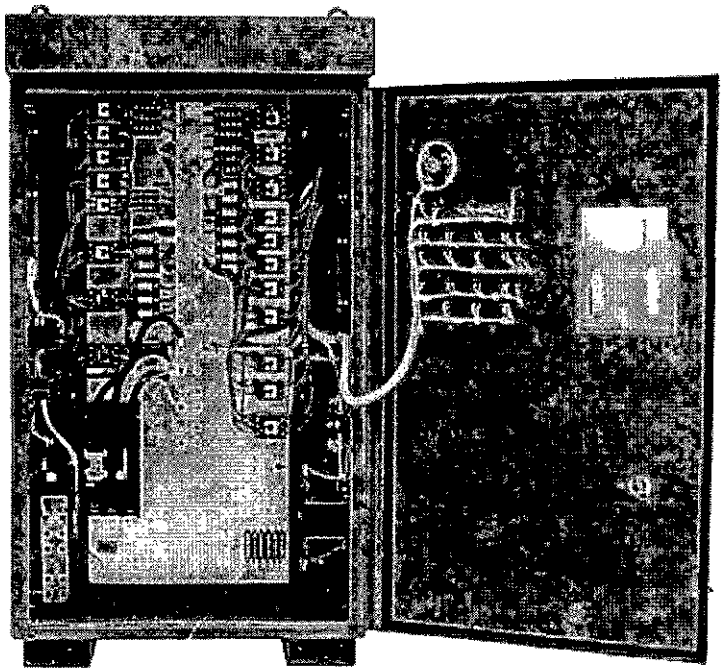
1. Control System
2. Cooling System
3. Load System

CONTROL SYSTEM

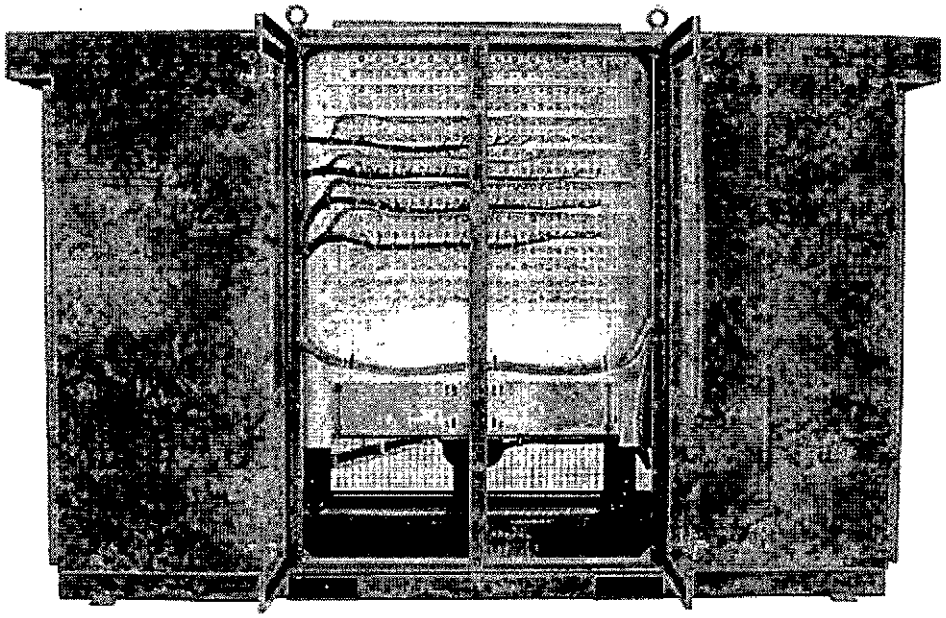
The Control System allows the operator to apply a desired load to the test source and measure the response of the test source to the load. This system also contains the circuitry utilized to disconnect the Load Bank from the test source in the event of cooling failures and/or improperly positioned operating controls. The Load Bank Control System components are located on the Local Main Logic Control Panel (CP1) printed circuit board.

Control power (120V) is supplied to the input of the 24VDC power supply (DCS) by one of the following methods:

1. control power transformer
2. line to neutral from the test source
3. external source



Control Section Interior



Resistive Load Bank

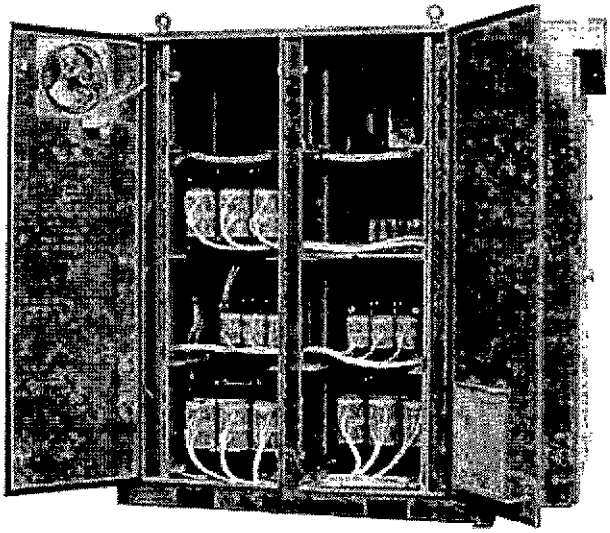
The 24VDC output of DCS is applied to the Local and Remote Main Logic Control panel circuit boards. 120V control power is applied to the coil of the Fan Motor Contactor (FMC) through terminal TB'A' 17 of the Main Logic Control Panel printed circuit board. Fan power is applied to the Fan Motor (MOT) through the Fan Circuit Breaker (FCB) and the Fan Motor Contactor (FMC) contacts.

In Auto Mode only, the FMC and the MOT remain de-energized until the "Push to Run" pushbutton is depressed or the run contacts close.

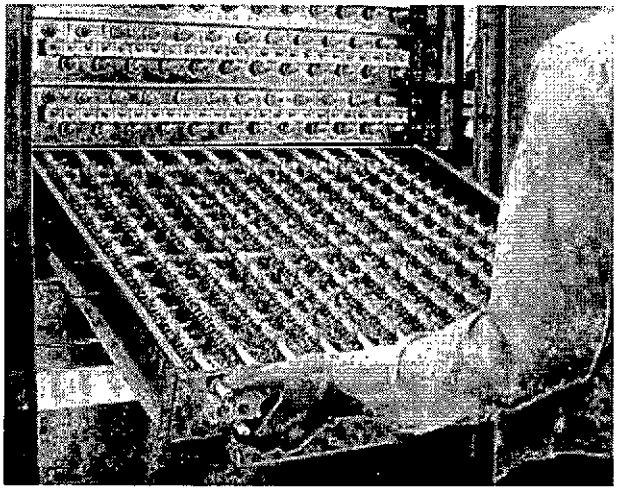
COOLING SYSTEM

Resistive Load Elements are cooled by a forced air system consisting of an aluminum fan blade directly driven or belt driven by a TEFC motor, turning at approximately 1750 RPM at 60Hz (1488RPM at 50Hz). The fan motor is energized by a 600V, 3 pole contactor and protected by a three pole, 100A frame circuit breaker.

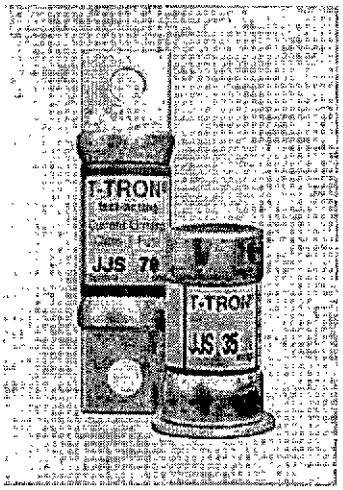
Reactive Load Elements (inductive or capacitive) are convection cooled or cooled by a forced air system. The forced air system consists of 12" fan shutter assemblies. The fans turn approximately 1550 RPM at 60Hz.



Reactive Load Bank



Resistive Load Elements



Fuses

LOAD SYSTEM

The Load System consists of independently controlled resistive and/or reactive load elements specifically designed for Load Bank systems. They are protected by 200,000AIC, 600VAC fuses.

Simplex Resistive Load Elements conservatively operate at approximately half the maximum temperature rating of the alloy (1080°F vs. 1920°F). For example:

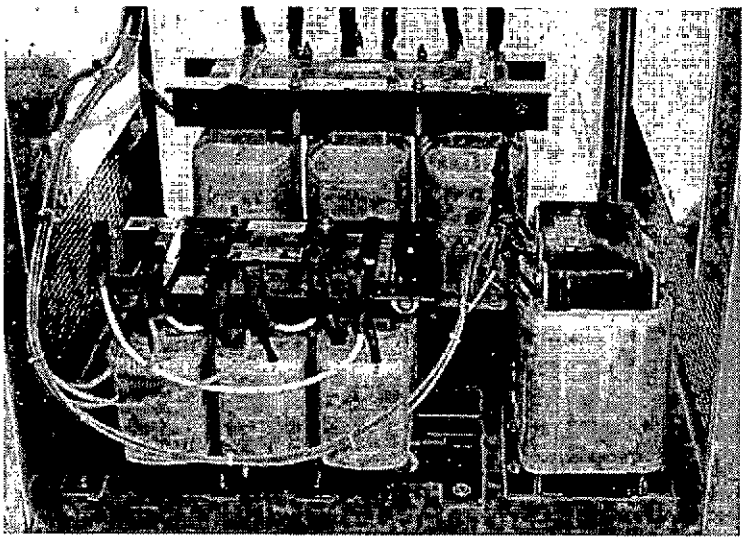
Alloy: FeCrAl

Ratings: 3333W@120V
4170W@139V

Connections: 120V wye (208V),
139V wye (240V, 3ø),
277V wye (480V, 3ø),
240 delta (240V, 3ø), or
480 delta (480V, 3ø).

See Parts Legend Drawing for specific elements used.

These elements are rigidly supported by high-temperature, ceramic-clad, stainless-steel supports. Element-to-element short circuits are virtually eliminated. The elements are assembled in discrete trays which are assembled in a vertical "stack". Each tray is independently serviceable without disturbing adjacent trays.



Reactive Load Elements

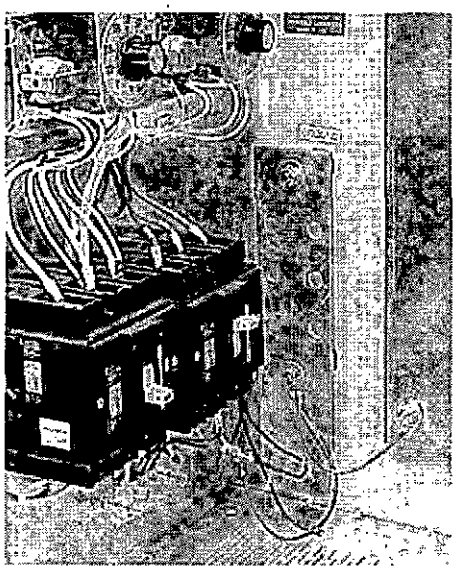
Reactive Load Elements are iron-core, non-saturable, air gap calibrated and air cooled. Standard elements have a temperature sensor embedded in the windings to detect element overheating and are varnish coated. Epoxy coatings are available for severe environments.

PRIMARY INSPECTION

Preventative visual inspections of the shipping crate and Load Bank is advised. Physical or electrical problems due to handling and vibration may occur. Never apply power to a Load Bank before performing this procedure. The following Nine Point/30 Minute Inspection is recommended before installation, as part of the 50 hour / 6 month maintenance schedule and whenever the Load Bank is relocated:

1. If crate shows any signs of damage examine the Load Bank in the corresponding areas for signs of initial problems.
2. Check the entire outside of the cabinet for any visual damage which could cause internal electrical or mechanical problems due to reduced clearance.
3. Inspect all hinged panels and doors for smooth and safe operation, try all latches and knobs.
4. Rotate and push all switches through all positions to ensure smooth operation.
5. Check cooling system by inspecting fan motor and blade. Slowly rotate blade by hand and note clearance of blade tip through its rotation near the housing. Observe free rotation of motor shaft.
6. Inspect all relays, timers, and control modules by opening all accessible panels. Make sure all components are secure in their bases and safety bails are in place. Spot check electrical connections for tightness. If any loose connections are found inspect and tighten all remaining connections.
7. Examine all accessible internal electrical components such as fuses, contactors and transformers. Check lugged wires at these components.

Cooling Fan



Control Section Components

8. Inspect bottom of crate/enclosure for any components that may have jarred loose during shipment such as indicator light lenses, switch knobs, etc.
9. Visually inspect element chamber for foreign objects, broken ceramic insulators, mechanical damage.

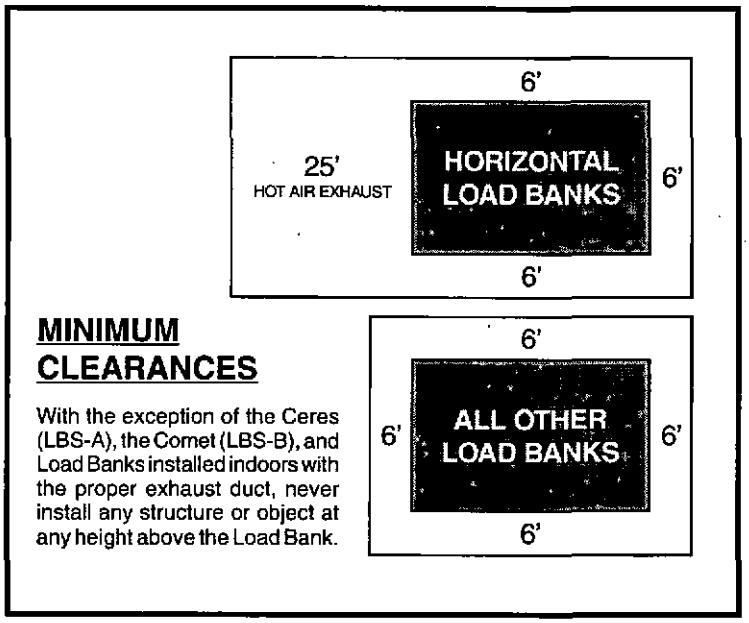
If any problems are observed during Primary Inspection call the Simplex Service Manager at 217-525-6995 (24hrs.)

INSTALLATION

LOCATION

Nema-3R Load Banks are intended for outdoor installation. Nema-1 Load Banks must be installed indoors. The load elements in this Load Bank are cooled by a forced air system which discharges through the top, sides or the back of the cabinet. This Load Bank will produce a large quantity of exhaust air. Location of the Load Bank is of prime importance and should be done by trained personnel. It is one of the most critical factors involved in safe operation. The Load Bank must be positioned and installed according to large airflow requirements.

- There must be a minimum clearance of 25 feet on the discharge side and 6 feet on all other sides for horizontal Load Banks. All other Load Banks require a mimimum clearance of 6 feet on all sides.
- Load Banks installed indoors must be equipped with an exhaust air duct of minimum back pressure (supplied by others) which routes all Load Bank hot exhaust air outdoors.
- With the exception of the Ceres (LBS-A), the Comet (LBS-B), and Load Banks installed indoors with the proper exhaust duct, never install any structure or object at any height above the Load Bank.
- Always locate the Load Bank in a secure area accessible by trained personal only.
- Use the eyehooks and forklift channels provided to position the Load Bank.
- Never point the exhaust at a nearby surface or object which may be adversely affected by high temperature.



MINIMUM CLEARANCES

With the exception of the Ceres (LBS-A), the Comet (LBS-B), and Load Banks installed indoors with the proper exhaust duct, never install any structure or object at any height above the Load Bank.

- Never operate the Load Bank in a confined space without regard for adequate intake of air and provision for exit of high temperature exhaust.
- Consider that the Load Bank and a nearby generator set may have to compete for cooling air.
- Never bounce hot exhaust air off nearby objects and allow it to recirculate through the cooling system.
- Never operate the Load Bank in proximity to a sprinkler system.

Failure to properly install this Load Bank may result in substantial damage to or the destruction of the Load Bank, adjacent equipment and the building in which the Load Bank is installed.

⚠ WARNING ⚠

Damage to the Load Bank due to improper installation is not covered by the Simplex Warranty.

⚠ WARNING ⚠

Do not store or operate in rain or spray unless unit is designed for this service or adequate protection is provided.

PROCEDURE

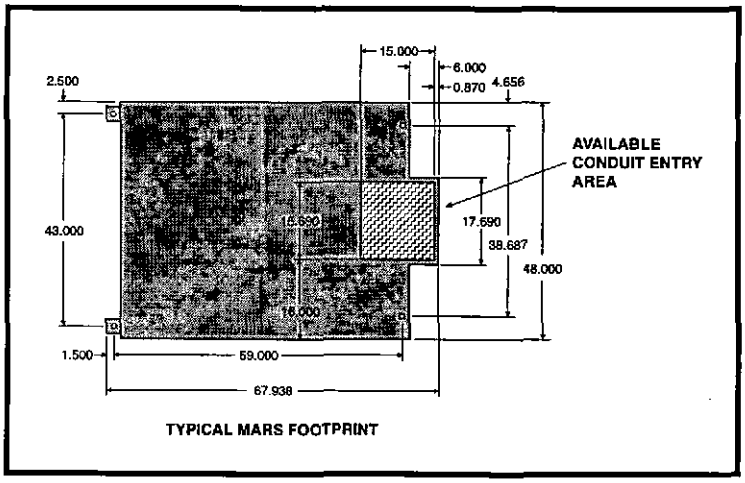
1. Confirm the test source is properly grounded and ground the Load Bank to its own independent ground.
2. Confirm all load command switches are in the "Off" position.
3. Confirm the Fan Circuit Breaker (FCB) is in the "Off" position.
4. Per load connection drawings cable the load source to the Load Bank.
5. Connect customer supplied Load Dump contacts to TB'LD' 1–2 or place the "Load Dump Mode" switch in the "Bypass" position.
6. Place the Fan Circuit Breaker (FCB) in the "On" position.

OPERATION

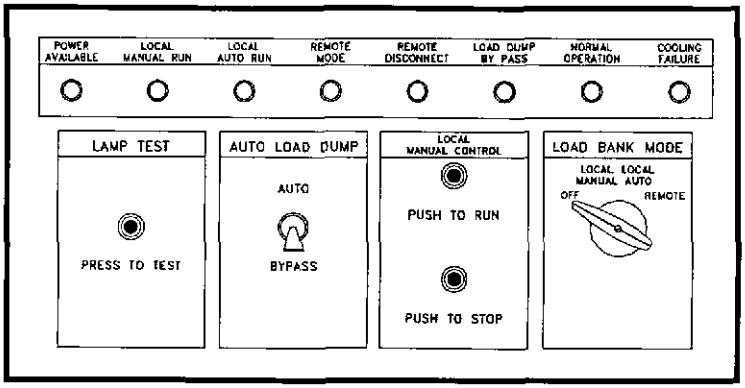
1. Place the "Load Bank Mode" switch in the "Local Manual", "Local Auto" or "Remote" position.
2. Start-up generator or bring other test source on line.

   If External Fan/Control Power is being used, depress the "Push to Run" pushbutton to energize the cooling fan before starting the generator to assure proper fan operation.
3. Adjust power source voltage and frequency.
4. Confirm the illumination of the "Power Available" lamp.
5. Press the "Push to Run" pushbutton to energize the cooling fan.

   A false "Cooling Failure" lamp indication will be present until the cooling fan creates sufficient airflow to close the Fan Pressure Switch (PS). The "Normal Operation" lamp illuminates and control voltage is supplied to the "Master Load" switch. With voltage supplied to the "Master Load" switch, the operator is now ready to apply load steps by programming the "Master Load" and load step switches.
6. Verify the illumination of the "Normal Operation" lamp before proceeding.
7. Visually observe correct fan operation and investigate any unusual fan related noises.
8. Check air intake for obstructions and confirm positive air flow.

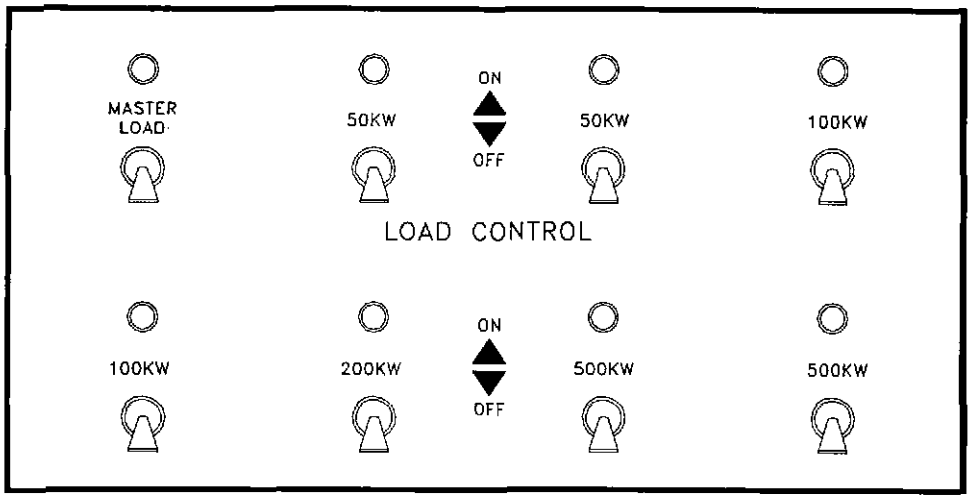


TYPICAL MARS FOOTPRINT



⚠ WARNING ⚠

Do Not allow the Load Bank to operate unattended for extended periods.



MANUAL

9. Select the desired load steps by placing them in the "On" position.

10. Place the "Master Load" switch in the "On" position.

    This simultaneously applies all of the load steps which are in the "On" position.

    Trim is achieved by flipping the load steps "On" and "Off" while the "Master Load" is in the "On" position.

11. Adjust source voltage and load. Monitor as needed.

⚠ WARNING ⚠

If a failure occurs the corresponding lamp will illuminate and the load will be de-energized. Before reapplying a load, the failure must be corrected and the system must be reset by turning the Load Bank "Off" then "On".

AUTOMATIC

When the operator places the Load Bank in automatic mode the Current Sensing Relays and Time Delay Relays (CSR and TDR) automatically apply load as needed. These relays are factory set to maintain a minimum net load on the generator equalling the Load Bank rating. Time delay is set at 3 seconds. If necessary, these relays can be field adjusted. The following example illustrates how they function:

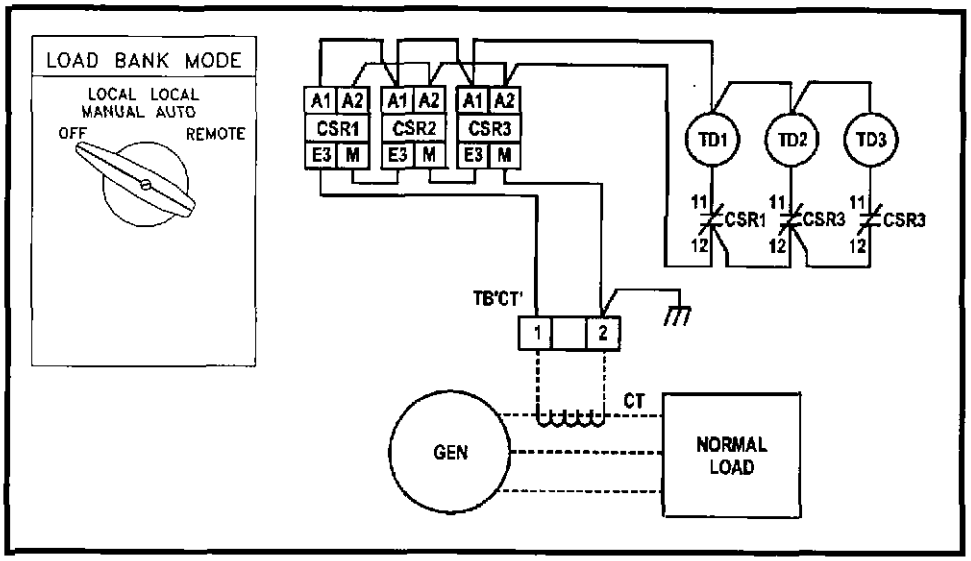
Example:

30KW Load Bank with three 10KW load steps

With normal load applied to the generator, equal to the Load Bank rating (30KW), no Load Bank load steps are energized.

Load Step #1 energizes when the normal load drops below 30KW after the time delay interval determined by TDR1.

Load Step #2 energizes when the normal load drops to 20KW after the time delay interval determined by TDR2.



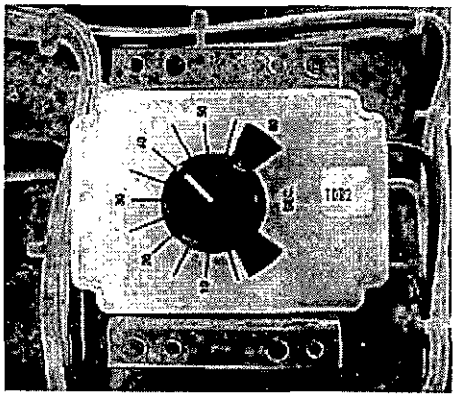
Load Step #3 energizes when the normal load drops to 10KW after the time delay interval determined by TDR3.

On the top of each Current Sensing Relay (CSR) dust cover there is an adjustment knob (3/4 turn potentiometer) with an arbitrary 0.05-1.0 scale. Turn the knob clockwise for a higher current pick-up point and counterclockwise for a lower current pick-up point.

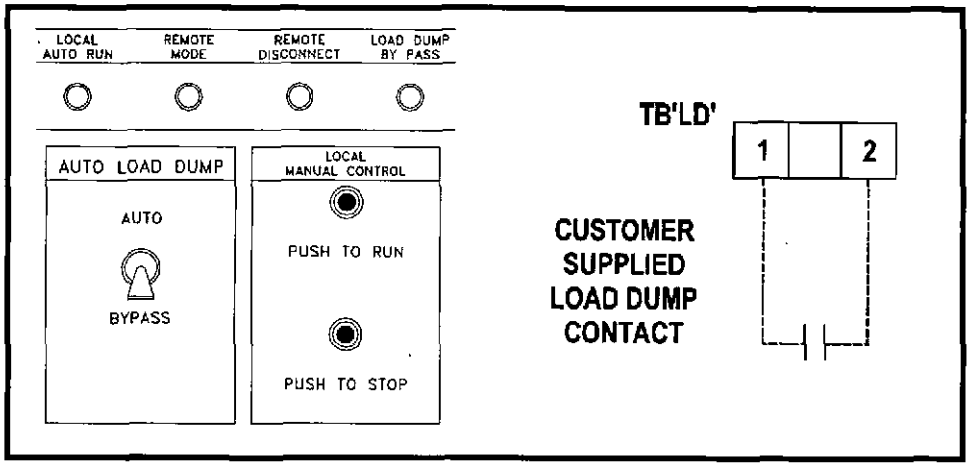
⚠ WARNING ⚠

If an automatic test is interrupted by a Load Bank failure, do not reset the Load Bank until the source of the failure has been determined.

Planet Series Load Banks utilize 60 second and/or 30 second Time Delay Relays (TDR). On the top of each TDR there is an adjustment knob (one turn potentiometer). The 60 second relay is adjustable form 0-60 seconds. The 30 second relay is adjustable from .1 to 30 seconds. Follow the directions on the white stickers for each potentiometer to adjust the set points.



60 Second TDR



LOAD DUMP

This Load Bank contains a Load Dump feature which de-energizes all applied load when customer supplied contacts open. Normally closed to run, they are rated at 2A @ 24VDC and should be wired to TB'LD' 1–2. When these contacts open all applied load will be de-energized and the load section will be disabled. If desired, the cus-tomer may install automatic transfer switch contacts, a manual pushbutton or circuit breaker for this use.

The operator also has the option of bypassing these contacts and enabling the load section by flipping the "Auto Load Dump" switch to the "Bypass" position. This disables the load dump feature and illuminates the "Load Dump Bypass" lamp.

SHUTDOWN

1 De-energize the load.
2. Run the cooling fan for 5 minutes to assure a thorough cool down of all load elements (optional).
3. Place the "Fan/Control Power" switch in the "Off" position or press the "Push to Stop" pushbutton.

⚠ WARNING ⚠

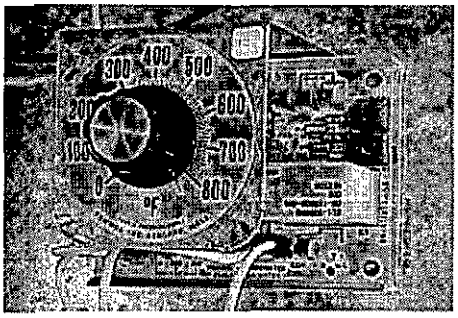
Always remove all power from the load bus and all fan/control power before servicing the Load Bank. Never operate or service a Load Bank that is not properly connected to an earthground.

FAILURE DETECTION

If a "Failure" occurs the corresponding lamp will illuminate and the load will be de-energized. Before reapplying a load, the failure must be corrected and the system must be reset by turning the Load Bank "Off" then "On".

This is a permissive/energize-to-run circuit in which all safety sensors must energize their control relays on normal operation before load can be applied. This system includes the following switches and relays:

1. Exhaust Temperature Switch (EXTS),
2. Pressure Switch (PS),
3. Intake Temperature Switch (INTS),
4. Cooling Failure Relay (CFR) and
5. Time Delay Relay (TDR).

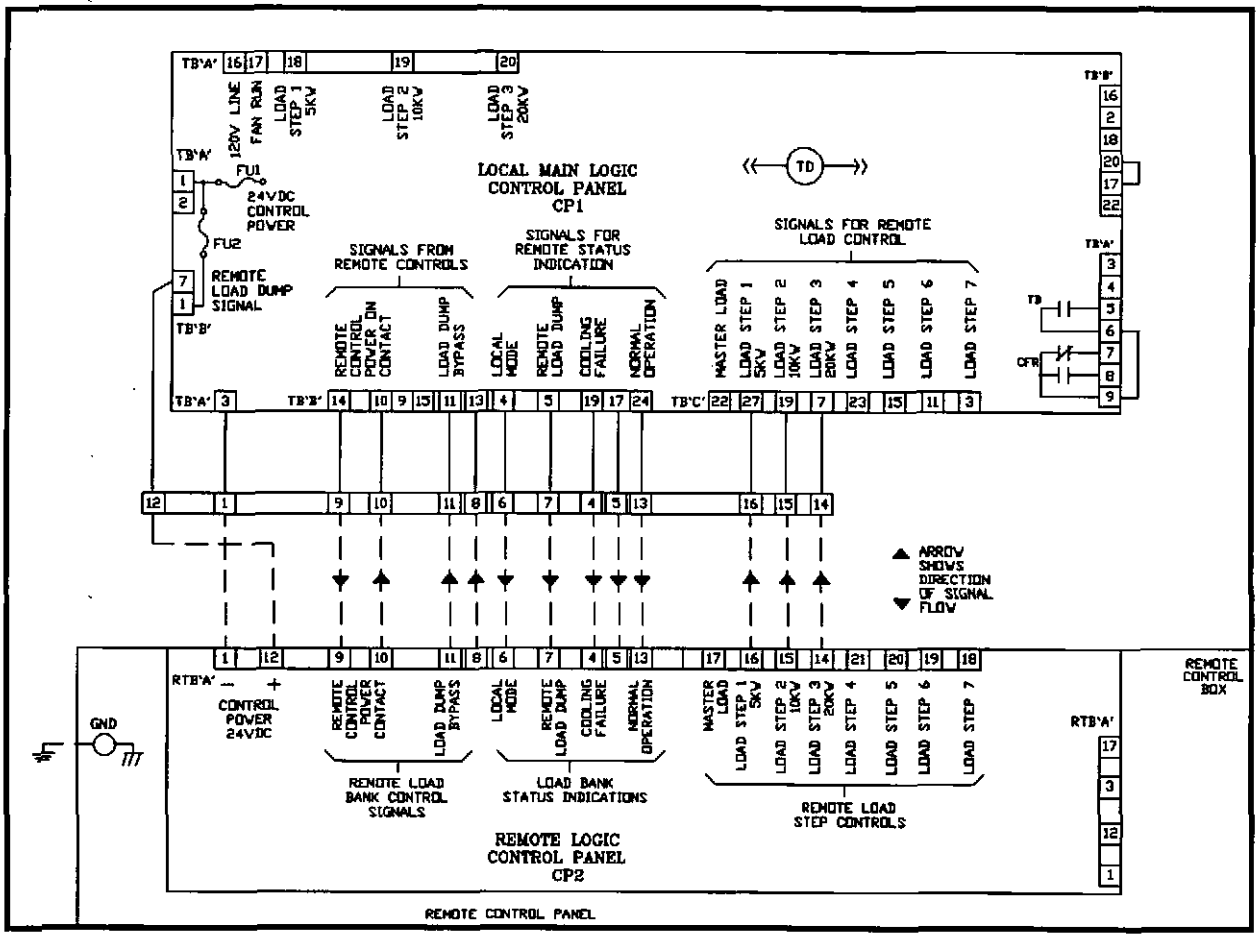


Thermocouple Temperature Switch

The exhaust temperature network consists of a type J thermocouple (TC) and a solid state thermocouple sensor (EXTS). The temperature switch has been factory adjusted for precise Load Bank over temperature protection under normal operating conditions. Unusual operating conditions may require field adjustment. The setpoint of the Exhaust Temperature Switch (EXTS) may be changed by rotating the adjustment knob on the variable resistor. Consult the Simplex Service Department (217-525-6995 24hrs) before changing the temperature switch setpoint.

REMOTE/AUXILIARY OPERATION

This Load Bank can be operated from a Remote Control Panel, supplied by Simplex or others, or any number of other devices including programmable controllers, personal, mini or mainframe computers, programmable timers, etc.



⚠ WARNING ⚠

Before attaching any remote auxiliary control device to the Load Bank consult the Simplex Service Department.

By supplying positive 24VDC signals (from the Load Bank DC supply only) to the Local Main Logic Control Panel the Load Bank operator is able to energize the cooling fan, apply load steps and monitor load bank failure systems from a remote control panel. The correct configuration of Load Bank Local and Remote Printed Circuit Board interconnections for remote control operation is shown in the illustration on the previous page.

Guidelines For A User Supplied Auxiliary Remote Load Bank Control Device

The device must have some means of switching 24VDC signals from the load bank power supply to the main printed circuit board (CP1) to control the load bank. The device should also have a means of monitoring 24VDC output signals from CP1 which annunciate Load Bank status and operation. 24VDC is supplied at terminals 1 (-) and 12 (+) of TB'RC' for this use.

To operate the Load Bank from any remote device the "Load Bank Mode" selector switch on the Local Control Panel must be placed in the "Remote" position. To energize the Load Bank cooling fan and control system the remote device must input a positive signal at Terminal 10 of TB'B'. To energize the load steps the device must input a positive signal on terminals 7, 19, 27, etc. Output signals from CP1 for Load Bank annunciation of remote control, load dump, cooling failure and normal operation will appear at TB'B' Terminals 14, 5, 19, and 24 respectively. Do not use the Load Bank 24VDC power supply to power any other auxiliary devices. It must be used only as a source for supplying control signals to the Load Bank printed circuit board.

Before attaching any remote auxiliary control device to the Load Bank consult the Simplex Service Department.

MAINTENANCE

The Load Bank has been designed to require minimum maintenance. All components have been chosen for a long, reliable life. Two basic intervals of maintenance are required: each operation and every 50 hours or 6 months (whichever comes first).

EACH OPERATION

The air intake screens and louvers, fan and cooling chamber, and exhaust openings must be checked for any obstructions or foreign objects. Due to the high volume of air circulated, paper and other items can be drawn into the air intakes. During Load Bank operation insure that air is exiting from the top exhaust vent.

The load branches should be checked for blown fuses or opened load resistors. To check the fuses or load resistors, operate the Load Bank from a balanced 3-phase source and check the three line currents. The three current readings should be essentially the same. If a sizeable difference is noted one or more load fuses or load resistors may have malfunctioned.

⚠ WARNING ⚠

For continued safety and for maximum equipment protection, always replace fuses with one of equal rating only.

EVERY 50 HOURS OR 6 MONTHS

Check the tightness of the electrical connections. The expansion and contraction caused by Load Bank operation may result in loose connections. The vibrations caused by the cooling fan may also loosen electrical connections. If the Load Bank is transported "over the road", the electrical connections should be checked for tightness at a shorter-than-normal time interval. See "Primary Inspection".

MOTOR LUBRICATION

Most Load Bank direct drive cooling fan motors are permanently lubricated and sealed and do not require lubrication.

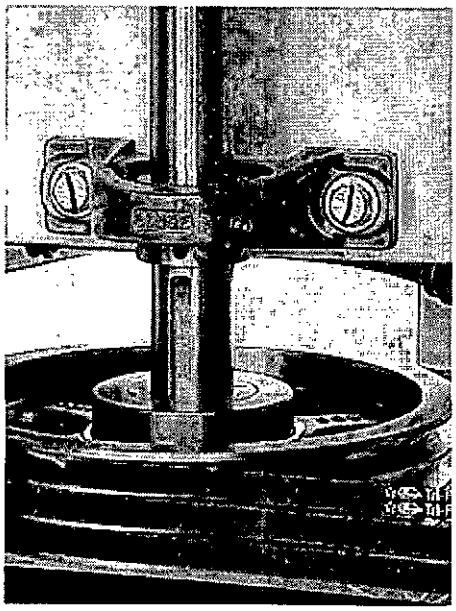
Inspect the fan motor supplied with your Load Bank for grease fittings. If the motor contains grease fittings you must lubricate the motor. Belt driven cooling fans have bearings which should be lubricated. Bearings should be lubricated every 50 hours of operation or 6 months whichever comes first.

The motor manufacturer recommends a two-year lubrication interval for motors used for normal, steady-running, light-duty, indoor loads, in relatively clean atmospheres.

Type of Grease

Use Westinghouse 5370IRY grease, un-less a special grease is specified on the nameplate. Some equivalent greases are:

Chevron SR1-2 - Standard Oil of California
Premium RB ----- Texaco, Inc.
Unirex N2 --------- Exxon
Dolium R ---------- Shell Oil Company
Rykon Premium - American Oil



Shaft and Grease Fitting

GREASING REFERENCE TABLE	
Shaft Diameter At Face of Bracket	**Amount of Grease to Add**
3/4" to 1 1/4"	1/8 cu.in. or 0.1 oz.
1 1/4" to 1 7/8"	1/4 cu.in. or 0.2 oz.
1 7/8" to 2 3/8"	3/4 cu.in. or 0.6 oz.
2 3/8" to 3 3/8"	2.0 cu.in. or 1.6 oz.

Procedure for Regreasing

When regreasing, stop the motor, remove the outlet plug and add the amount of grease suggested in the reference table. Use hand-lever gun only. Discontinue at once if grease appears at the outlet plug. This may occur before the specified amount of grease is used. Run the motor for about ten minutes before replacing the outlet plug.

⚠ WARNING ⚠

Overgreasing is a major cause of bearing and motor failure. Also make sure dirt and contaminants are not introduced when adding grease.

TROUBLESHOOTING

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

COOLING FAN MOTOR WILL NOT OPERATE

1. Inoperative Fan Circuit Breaker (CB)
2. Fan/Control Power not available/incorrect
3. Inoperative Fan Motor (MOT)
4. Fan Motor Contactor (FMC) de-energized
5. Restriction of air (intake or exhaust)
6. Fan pressure switch inoperative

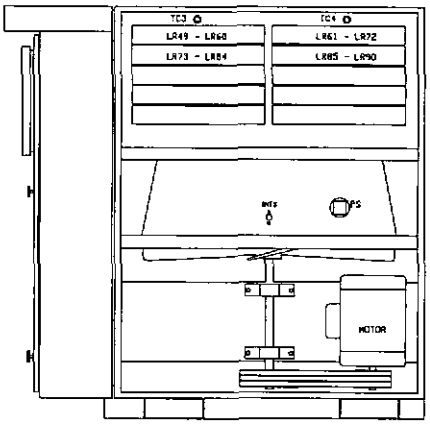
COOLING FAILURE INDICATED

Exhaust temp above EXTS setpoint:

1. Over temperature sensor failure
2. Fan failure
3. Air restriction (intake or exhaust)
4. Overvoltage condition present

Exhaust temp below EXTS setpoint:

1. Restriction of air (intake or exhaust)
2. Fan pressure switch inoperative
3. Overtemperature sensor failure



RIGHT SIDE VIEW
EXTERNAL PANELS REMOVED

TEST METERS DO NOT OPERATE PROPERLY

1. Meter voltage switch failure
2. Meter multiplier resistor inoperative
3. Improper positioning of meter voltage selector switch
4. Current transformer or current transformer wiring failure
5. Test meter failure
6. Meter fuses open

SOME LOAD STEPS CANNOT BE ENERGIZED

1. Inoperative load step switches
2. Open load step resistor(s)
3. Inoperative load step relays
4. Inoperative load step contactors
5. Open load step fuses

⚠ WARNING ⚠

When troubleshooting Load Bank systems always remove all test source power, fan/control power, anti-condensation heater power, etc.

DRAWINGS AND PARTS LIST

The drawings included in this manual are the most accurate source of part numbers for your Load Bank. When ordering replacement parts for Simplex Load Banks, always consult the Parts Drawing. When contacting the Simplex Service Department always have your work order and drawing number ready for reference. The Load Bank Specifications Sheet in the front of this manual lists all of the drawings included in this manual. The Work Order Number and the Drawing Numbers are also located on each drawing legend. *A typical drawing legend and parts list is illustrated below.*

SIMPLX®		SPRINGFIELD, ILLINOIS
SCALE :	APPROVED BY :	DRAWN BY : GB
DATE : 7/28/98		REVISED : 0
RESISTIVE LOAD BANK 2000KW,480V,3ø,60HZ		SATURN 2000 UL CONTROL SECTION
W.O. # 32711-98-43		DRAWING NUMBER 47B95558C

ITEM	QTY.	PART #	DESIG.	DESCRIPTION
1	120	47B95561	LR1-LR120	LOAD ELEMENTS POWR-WEB, 16,667W @ 480V
2	41	13012160	C1-C40 FMC	CONTACTOR 62A, 600V, 3POLE 120VAC COIL
3	4	14035500	CF1-CF4	FUSE 5A, 600V, 200KAIC
4	120	14086000	F1-F120	FUSE 70A, 600V, 200KAIC
5	2	15011500	[CF1-CF4]	FUSEBLOCK 30A, 600V, 2 POLE
6	1	24646020	MOT	MOTOR, 20HP, 3 PHASE 208-230/460VAC, TEFC 1800 RPM
7	1	13828000	[MOT]	FAN BLADE, 60" 50000CFM
8	1	12046340	FCB	FAN CIRCUIT BREAKER 100A FRAME, 50A TRIP, 3 POLE, 600V
9	1	25673000	TB'E'	TERMINAL BLOCK 30A, 600V, 24 LINE
10	1	25672000	TB'CP1' TB'LD' TB'CF' TB'CT' TB'PC'	TERMINAL BLOCK 30A, 600V, 15 LINE
11	2	25457000	T1, T2	TRANSFORMER, 1000VA 480/240: 240/120V
12	3	24771000	K1-K3	GENERAL PURPOSE RELAY 10A, 3PDT, 120VAC COIL
13	3	24891000	[K1-K3]	RELAY BASE 11 PIN SCREW TRM
14	1	25256500	PS	PRESSURE SWITCH, SPDT DIFFERENTIAL SENSING
15	1	25309650	INTS	INTAKE TEMP SWITCH SPST, OPENS @ 120 DEG F
16	4	25309560	EXTS1-4	EXHAUST TEMP SWITCH OPENS @ 75 DEG F ABOVE NORMAL OPERATING TEMP
17	4	25512400	TC1-4	THERMOCOUPLE, TYPE J (FOR EXTS)

APPENDIX A - ABBREVIATIONS USED IN THIS MANUAL

Listed below are abbreviations of terms found on Simplex Load Bank Systems. When following a load bank drawing utilize this guide to define abbreviated system and component names. As this is a master list, drawings and text pertaining to your equipment may not contain all these terms.

AC-Alternating current

AIC-Ampere interrupting current-maximum short circuit fault current a component can safely interrupt

AM-Ammeter

AMSW- Ammeter selector switch-selects any phase for current reading

CF-Control fuse

CFM-Cubic feet per minute-used to rate fan air flow capacity and load bank cooling requirement

CFR-Cooling failure relay-normally energized relay in cooling failure subsystem

CPC-Control power contactor

CPF-Control power fuse

CT-Current transformer- used in metering circuits

DC-Direct current

EXTS-Exhaust air temperature switch

FCB-Fan circuit breaker-circuit breaker in series with fan control power

FCVR-Fan control voltage relay-normally energized relay on relay sub-panel

FM-Frequency meter-monitors frequency of test source

FMC-Fan motor contactor-controls power to fan motor

FMSW-Frequency meter switch

FPS-Fan power switch-used to energize cooling system

GFB-Ground fault breaker

GBTR-Ground breaker tripped relay

HVR-High voltage relay

Hz-Hertz-cycles per second, measurement of frequency

IFCV-Incorrect fan/control voltage

INTS-Intake air temperature switch

K-Relay coil/contact designation

KVA-Kilovolt amperes

KVAR-Kilovolt amperes-reactive

KW-Kilowatts

KWM-Kilowatt meter

KWT-Kilowatt meter transducer

LM-Louver motor

LMC-Louver motor contactor

LR-Load resistive element

LX-Load reactive element

L1-Line 1

L2-Line 2

L3-Line 3

MCB-Main circuit breaker

MDS-Main Disconnect Switch

MF-Meter fuse

MLB-Main Load Bus

MOT-Motor

NEMA-National electrical manufacturer's association

ODP-Open, drip-proof-refers to motor enclosure

OVR-Overvoltage relay-relay used in overvoltage failure system, located on relay sub-panel

OLR-Overload relay-used for motor protection

OTR-Overtemperature relay-used in failure system

PF-Power factor-in resistive only loads expressed as unity (1.0), in inductive loads expressed as lagging, in capacitive loads expressed as leading

PAR-Control power available relay-relay energized when control power is available

PFM-Power factor meter

PS-Pressure switch-switch used to detect fan failure

RR-Reset relay

RTM-Running time meter-keeps time log of equipment use.

TB-Terminal block

TDR-Time delay relay-relay which times out before contacts change state

TEFC-Totally enclosed, fan cooled-refers to motor enclosure

TEAO-Totally enclosed, air-over-refers to motor enclosure

UPS-Uninterruptable power source

V-Voltage

VSR-Voltage sensing relay

XCB-Reactive load controlling circuit breaker

APPENDIX B - CALCULATIONS & FORMULAS

The following calculations are used to determine the actual kilowatt load being applied by the Load Bank, when line voltages and currents are known (at 1.0 power factor).

3 Phase

1. Read all three line currents and find the average reading.
2. Read all three line-to-line voltages and find the average reading.
3. Multiply the average current times the average voltage.
4. Multiply the answer of step #3 times the square root of 3 (1.732).
5. Divide the answer of step #4 by 1000. The answer is the actual kilowatts of load being applied by the Load Bank.

Single Phase

1. Determine the line current.
2. Determine the line-to-line voltage.
3. Multiply the line current times the line-to-line voltage.
4. Divide the answer of step #3 by 1000.
5. The answer of step #4 is the actual kilowatts being applied by the load bank.

EXAMPLES

Using line voltages and currents:

3 Phase

Current Readings	Voltage Readings
$A_1 = 249A$	$V_{1-2} = 481V$
$A_2 = 250A$	$V_{2-3} = 479V$
$A_3 = 254A$	$V_{3-1} = 483V$

$$\text{Average Current} = \frac{A_1 + A_2 + A_3}{3}$$

$$= \frac{249+250+254}{3}$$

$$= 251A$$

$$\text{Average Voltage} = \frac{V_{1-2} + V_{2-3} + V_{3-1}}{3}$$

$$= \frac{481 + 479 + 483}{3}$$

$$= 481V$$

$$\text{Kilowatts} = \frac{\text{Volts x Amps x } 1.732}{1000}$$

$$= \frac{481 \times 251 \times 1.732}{1000}$$

$$= 209.1KW$$

Single Phase

Current Reading: 150A Voltage Reading: 240V

$$\text{Kilowatts} = \frac{\text{Volts x Amps}}{1000}$$

$$= \frac{150 \times 240}{1000}$$

$$= 36.1KW$$

The following calculations are used to determine the amount of current when the desired amount of kilowatts is applied at 1.0 power factor.

3 Phase

1. Multiply the desired amount of kilowatts to be applied by 1000.
2. Multiply the operating voltage times the square root of 3 (1.732)
3. Divide the answer of step #1 by the answer of step #2.
4. The answer of step #3 is the average line current with the desired kilowatts applied at 1.0 power factor.

Single phase

1. Multiply the desired amount of kilowatts to be applied by 1000.
2. Divide the answer of step #1 by the operating voltage.
3. The answer of step #2 is the average line current with the desired amount of kilowatts applied at 1.0 power factor.

The following calculations are used to determine a step kilowatt rating at other than a rated voltage. This is accomplished by referencing the load step to a KW value at a known voltage.

1. Determine the new unrated operating voltage.
2. Divide the new operating voltage by the reference voltage.
3. Square the answer of step #2.
4. Multiply the answer of step #3 times the reference kilowatt value of the load step which the new kilowatt rating is desired.
5. The answer of step #4 is the kilowatt rating of the load step at the new voltage.

EXAMPLES

When desired amount of kilowatts is applied at 1.0 PF:

3 Phase

Applied: 50KW Operating Voltage: 480V

$$\text{Amperage} = \frac{\text{KW} \times 1000}{\text{Volts} \times 1.732}$$

$$= \frac{50 \times 1000}{480 \times 1.732}$$

$$= \frac{50{,}000}{831.36}$$

$$= 60.1$$

Single Phase

Applied: 25KW Operating Voltage: 240V

$$\text{Amperage} = \frac{\text{KW} \times 1000}{\text{Volts}}$$

$$= \frac{25 \times 1000}{240}$$

$$= \frac{25{,}000}{240}$$

$$= 104.2$$

Determining step KW at other than rated voltage:

Applied: 80KW Operating Voltage: 450V
Rated Voltage: 480V

$$\text{Step KW} = (\text{Oper. Volt.} \div \text{Rated Volt.})^2 \times \text{Applied KW}$$

$$= (450 \div 480)^2 \times 80$$

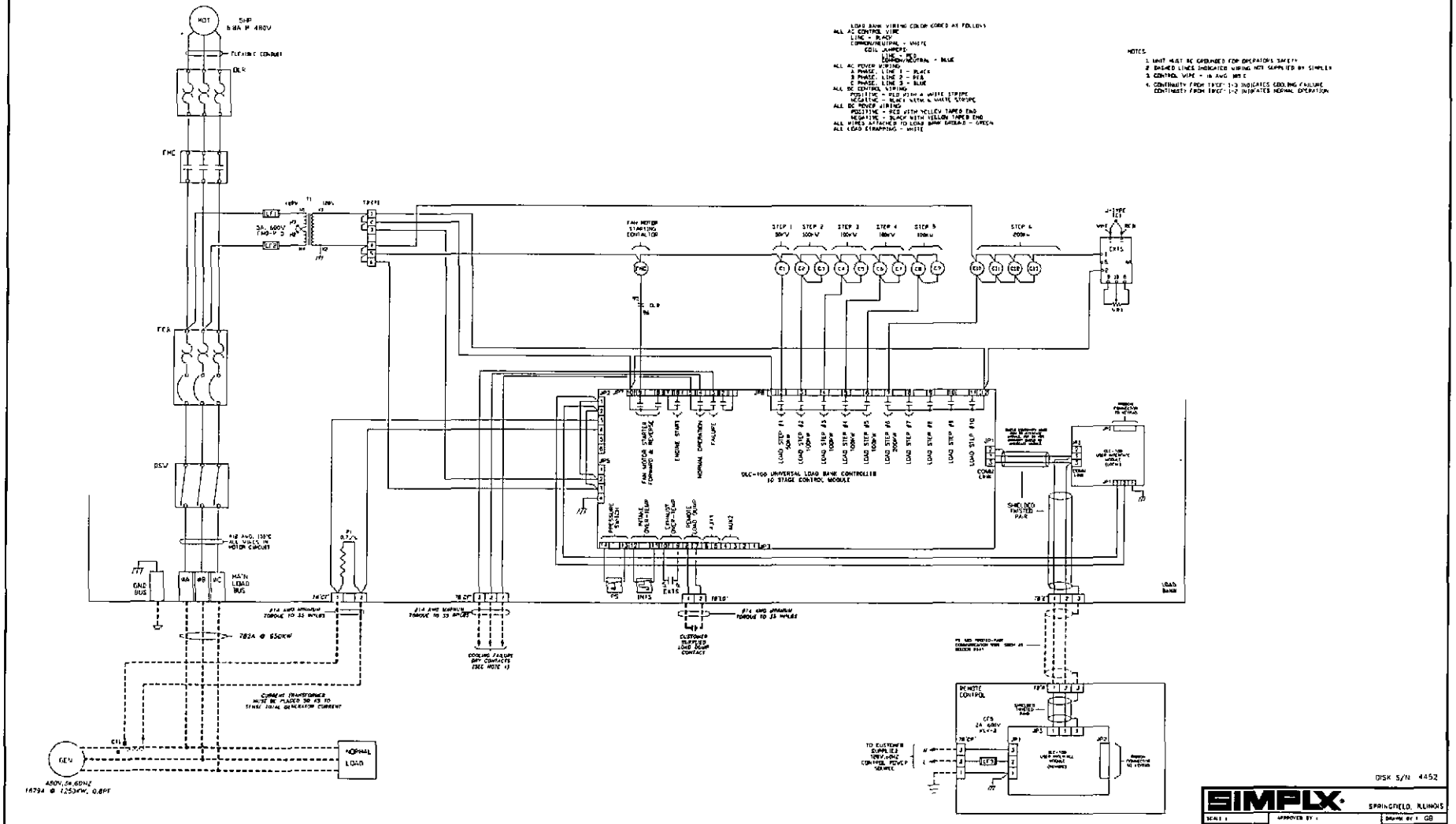
$$= .9375^2 \times 80$$

$$= 70.3$$

FORMULAS

		Alternating Current	Direct Current
Kilowatts	1 phase	$\frac{\text{Volts x Amps x PF*}}{1000}$	$\frac{\text{Volts x Amps}}{1000}$
	3 phase	$\frac{\text{1.732 x Volts x Amps x PF*}}{1000}$	
Amperes *(KW known)*	1 phase	$\frac{\text{KW x 1000}}{\text{Volts x PF}}$	$\frac{\text{KW x 1000}}{\text{Volts}}$
	3 phase	$\frac{\text{KW x 1000}}{\text{1.732 x Volts x PF}}$	
KVA	1 phase	$\frac{\text{Volts x Amps}}{1000}$	
	3 phase	$\frac{\text{1.732 x Volts x Amps}}{1000}$	
Amperes *(KVA known)*	1 phase	$\frac{\text{KVA x 1000}}{\text{Volts}}$	
	3 phase	$\frac{\text{KVA x 1000}}{\text{1.732 x Volts}}$	
KVAR	1 phase	$\frac{\text{Volts x Amps x } \sqrt{1-PF^2}}{1000}$	
	3 phase	$\frac{\text{1.732 x Volts x Amps x } \sqrt{1-PF^2}}{1000}$	

*Power Factor, expressed as decimal.
(Resistive Load Bank PF is 1.0)



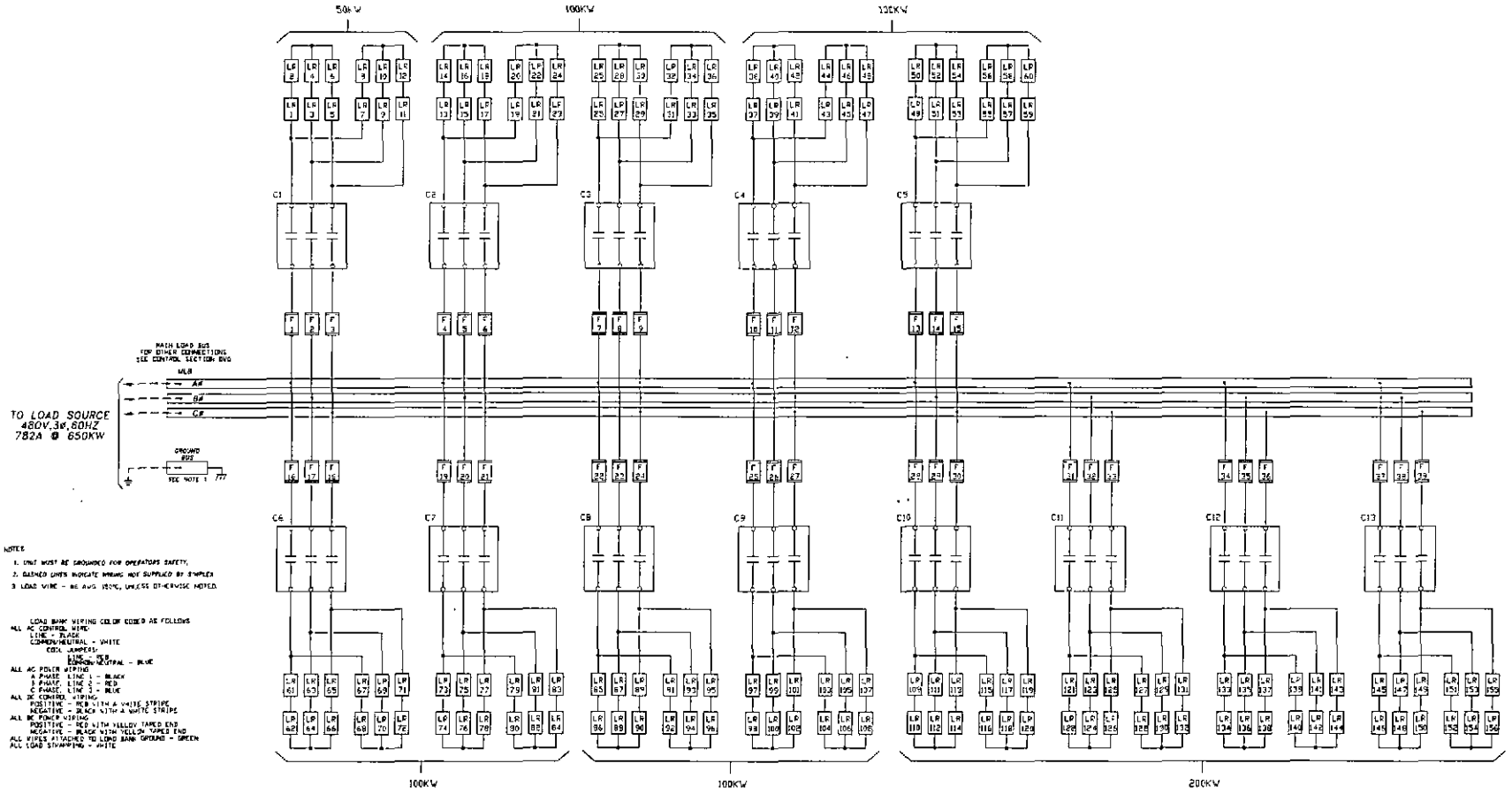
DISK S/N 4452

SIMPLX SPRINGFIELD, ILLINOIS

SCALE:	APPROVED BY:	DRAWN BY: GB
DATE: 7-26-01		REVISED:

RESISTIVE LOAD BANK 650KW,480V,3Ø,60HZ — NEPTUNE-650 UL CONTROL SECTION

W.O.# 47585-01-43 — DRAWING NUMBER 47B120393



NOTES

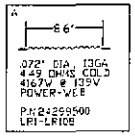
1. UNIT MUST BE GROUNDED FOR OPERATORS SAFETY.
2. DASHED LINES INDICATE WIRING NOT SUPPLIED BY SIMPLEX
3. LOAD WIRE - #6 AWG 167°C, UNLESS OTHERWISE NOTED.

LOAD BANK WIRING COLOR CODED AS FOLLOWS
ALL AC CONTROL WIRE:
LINE - BLACK
COMMON/NEUTRAL - WHITE
COIL JUMPERS:
LINE - TAN
COMMON/NEUTRAL - BLUE
ALL AC POWER WIRING
A PHASE, LINE 1 - BLACK
B PHASE, LINE 2 - RED
C PHASE, LINE 3 - BLUE
ALL DC CONTROL WIRING
POSITIVE - RED WITH A WHITE STRIPE
NEGATIVE - BLACK WITH A WHITE STRIPE
ALL DC POWER WIRING
POSITIVE - RED WITH YELLOW TAPED END
NEGATIVE - BLACK WITH YELLOW TAPED END
ALL WIRES ATTACHED TO LOAD BANK GROUND - GREEN
ALL LOAD STAMPING - WHITE

DISK S/N: 4452

SIMPLX. SPRINGFIELD, ILLINOIS

SCALE :	APPROVED BY :	DRAWN BY : GB
DATE : 7-25-01		REVISED :
RESISTIVE LOAD BANK 650KW,480V,3ø,60HZ		NEPTUNE-650 UL LOAD SECTION
W.O.# 47585-01-43		DRAWING NUMBER 478120394



ENGINEERING

ELEMENT TYPE	PART NUMBER	OHMS	VOLTAGE	WATTAGE	QTY	TOTAL WATTS
A	24299500	4.49	139	4167	156	650,000

TOTAL WATTS FOR LOAD BANK 650,000

TESTING

OHMS	CALCULATED WATTS V^2/R	TOTAL WATTS

TOTAL WATTS FOR LOAD BANK ____

COMPARE

INSTRUCTIONS:

ENGINEERING DEPARTMENT–
FILL OUT ONE OF THESE FORMS FOR ALL LOAD BANKS USING NON-STANDARD ELEMENTS. FIND ELEMENT(S) USED IN TABLE AT LEFT AND TRANSFER ELEMENT DATA TO TABLE ABOVE. COMPUTE TOTAL WATTS FOR THE LOAD BANK AND SIGN BELOW.

TESTING DEPARTMENT–
MEASURE LOAD ELEMENT RESISTANCE. CALCULATE WATTAGE FOR EACH ELEMENT TYPE, MULTIPLY TIMES QUANTITY AND CALCULATE LOAD BANK TOTAL WATTAGE. COMPARE TO ENGINEERING LOAD ELEMENT DATA ABOVE. FILL OUT TABLE AT ABOVE RIGHT AND SIGN BELOW.

ENGINEER GB

ENGINEER APPROVAL ____

TEST TECH. ____

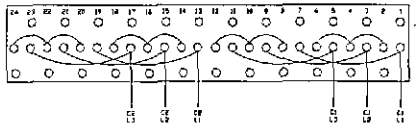
DISK S/N 4452

SIMPLX. SPRINGFIELD, ILLINOIS

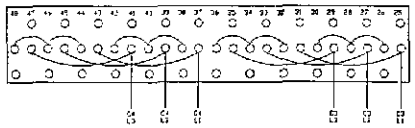
SCALE:	APPROVED BY:	DRAWN BY: GB
DATE: 7-25-01		REVISED:
RESISTIVE LOAD BANK 650KW,480V,3Φ,60HZ		NEPTUNE-650 UL NON-STD ELEMENTS
W.O. #47585-01-43		DRAWING NUMBER 47B120395

REAR OF TRAYS

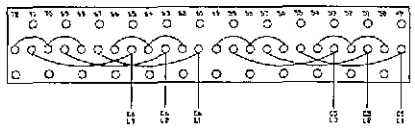
TRAY 1 OF 7



TRAY 2 OF 7

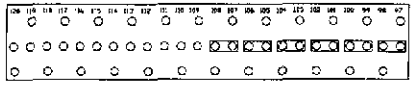


TRAY 3 OF 7

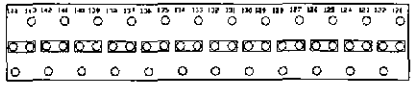


TRAY 4 OF 7

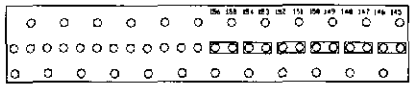
TRAY 5 OF 7



TRAY 6 OF 7

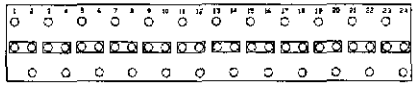


TRAY 7 OF 7



FRONT OF TRAYS

#8 AWG, 150°C TRAY 1 OF 7



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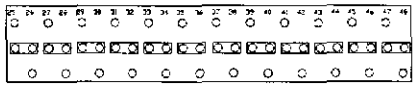
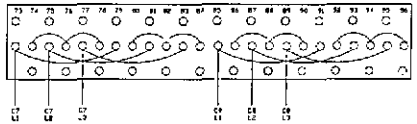


#8 AWG, 150°C TRAY 3 OF 7

#8 AWG, 150°C TRAY 4 OF 7



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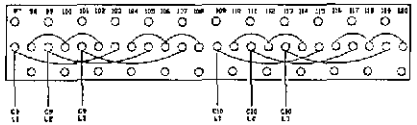
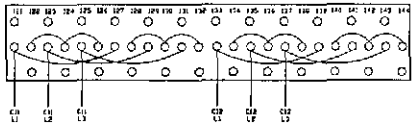
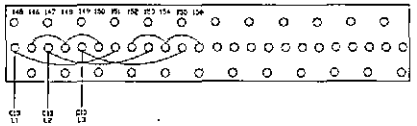


#8 AWG, 150°C TRAY 6 OF 7



#8 AWG, 150°C TRAY 7 OF 7



DISK S/N: 4452

SIMPLX SPRINGFIELD, ILLINOIS

SCALE:	APPROVED BY:	DRAWN BY: CB
DATE: 7-26-01		REVISED:

RESISTIVE LOAD BANK 650KW,480V,3ø,60HZ

NEPTUNE-650 UL STRAPPING DIAGRAM

W.O.# 47585-01-43

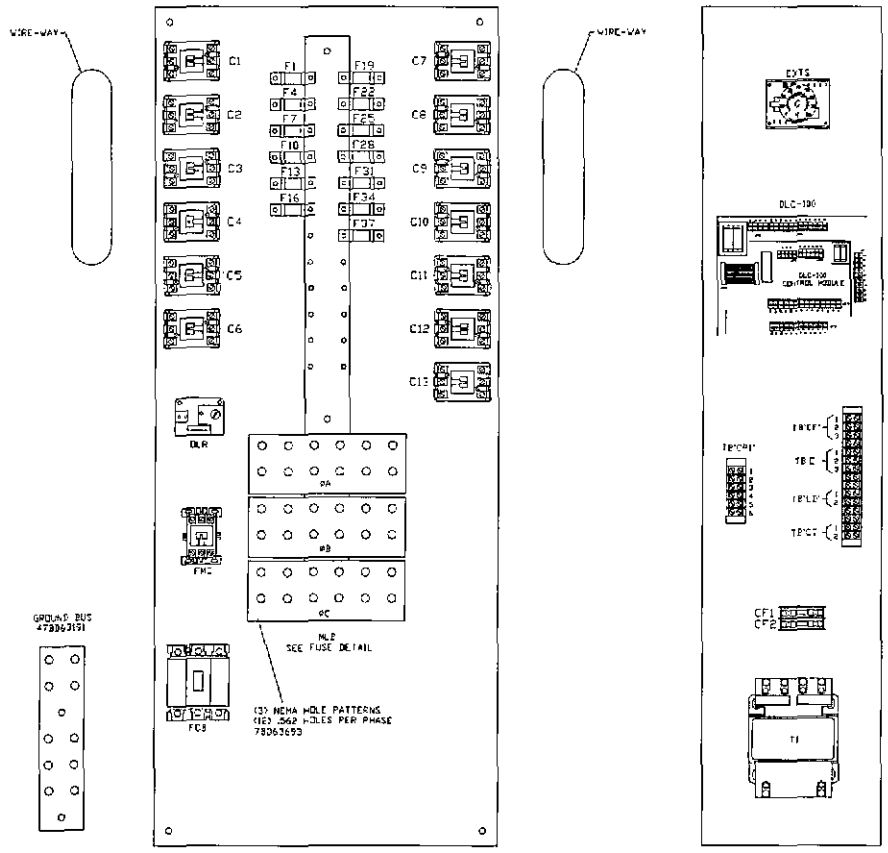
DRAWING NUMBER 476120399

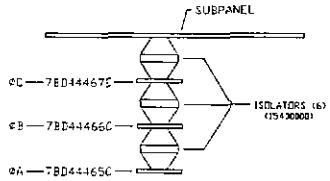
ITEM	QTY	PART #	DESIG.	DESCRIPTION
1	156	24899500 47B120395	LR1-LR156	LOAD ELEMENTS 4167W @ 139V POWER-WEB
2	1	13013100	FMC	CONTACTOR 35A, 600V, 3 POLE 120VAC COIL
3	13	13021500	C1-C13	CONTACTOR 65A, 600V, 3 POLE 120VAC COIL
4	2	14035500	CF1-CF2	FUSE 5A, 600V, 200KAIC
5	1	14015000	CF3	FUSE 2A, 600V, 200KAIC
6	39	14056000	F1-F39	FUSE 70A, 600V, 200KAIC
7	1	15010000	(CF3)	FUSEBLOCK 30A, 600V, 1 POLE
8	1	15011500	(CF1-2)	FUSEBLOCK 30A, 600V, 2 POLE
9	1	24646000	MOT	MOTOR, 5HP, 3 PHASE 208-230/460VAC, TEFC 1800 RPM
10	1	13626000	(MOT)	FAN BLADE, 28" 12500CFM
11	1	12046300	FCB	FAN CIRCUIT BREAKER 100A FRAME, 15A TRIP 3 POLE, 600V
12	1	256670000	TB"CP1"	TERMINAL BLOCK 30A, 600V, 6 LINE
13	1	25670000	TB"CP" TB"P"	TERMINAL BLOCK 30A, 600V, 12 LINE
14	1	25671000	TB"CF" TB"CT" TB"E" TB"LD"	TERMINAL BLOCK 30A, 600V, 15 LINE
15	2	25457000	T1	TRANSFORMER, 1000VA 480/240:120V
16	1	24827790	OLR	OVERLOAD RELAY 3 POLE 600V 6-18A ADJUSTABLE
17	1	25317000	DSW	DISCONNECT SWITCH 3P, 40A, 480V, 20 HP

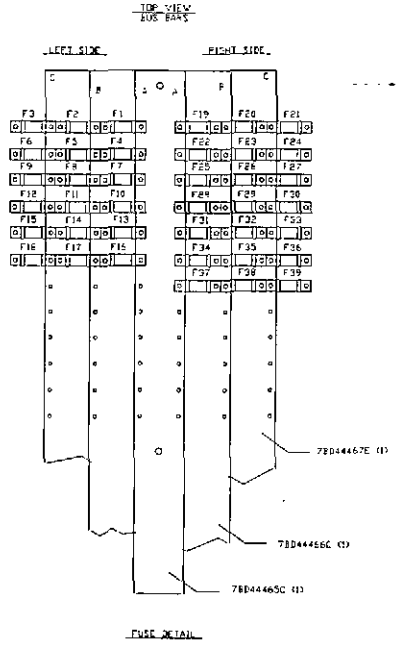
ITEM	QTY.	PART #	DESIG	DESCRIPTION
18	1	25256500	PS	PRESSURE SWITCH, SPDT DIFFERENTIAL SENSING
19	1	25309650	INTS	INTAKE TEMP SWITCH SPST, OPENS @ 120 DEG F
20	1	25309560	EXTS	EXHAUST TEMP SWITCH OPENS @ 75 DEG F ABOVE NORMAL OPERATING TEMP
21	AR	25512400	TC	THERMOCOUPLE, TYPE J (FOR EXTS)
22	1	24950007	DLC-100	UNIVERSAL LOAD BANK CONTROLLER, 10-STAGE 6-INPUTS, 14-OUTPUTS
23	1	24950005	(DLC-100)	LOCAL USER INTERFACE MODULE
24	1	--------	REMOTE	REMOTE USER INTERFACE MODULE
25	2	24166000	(DLC-100 REMOTE)	CONTROL KEYPAD SELF-ADHESIVE NAMEPLATE MEMBRANE SWITCH
26	AR	25554600	(DLC-100 REMOTE)	RS-485 COMM. CABLE #16AWG, SHIELDED TWISTED PAIR
27	2	78D44465C	MLB PHASE-A	MAIN LOAD BUS 0.250" X 3.000" X 30.500"
28	2	78D44466C	MLB PHASE-B	MAIN LOAD BUS 0.250" X 3.000" X 34.750"
29	2	78D44467E	MLB PHASE-C	MAIN LOAD BUS 0.250" X 3.000" X 39.000"
30	3	78D63693	(MLB)	NEMA BUS CONNECTOR 0.250" X 4.000" X 10.500"
31	1	47B063191	GND	GROUND BUS 0.250" X 3.000" X 12.250"
32	6	15400000	(MLB)	ISOLATOR 2.750"
33	1	--------	CT1	CURRENT TRANSFORMER 1500:5A, MODEL-125 6.31" WINDOW DIAMETER ITI 125-152

DSK S/N 4452

⚠ REMOVED ITEM #18 RENUMBERED ITEMS #19 -34	GB 8-28-01	
SIMPLX	SPRINGFIELD, ILLINOIS	
SCALE :	APPROVED BY :	DRAWN BY : GB
DATE : 7-26-01		REVISED :
RESISTIVE LOAD BANK, 650KW,480V,3ø,60Hz	NEPTUNE-650 UL LEGEND	
W.O. # 47585-01-43		DRAWING NUMBER 47B120397A







DRW S/M 4452

SIMPLX® SPRINGFIELD, ILLINOIS

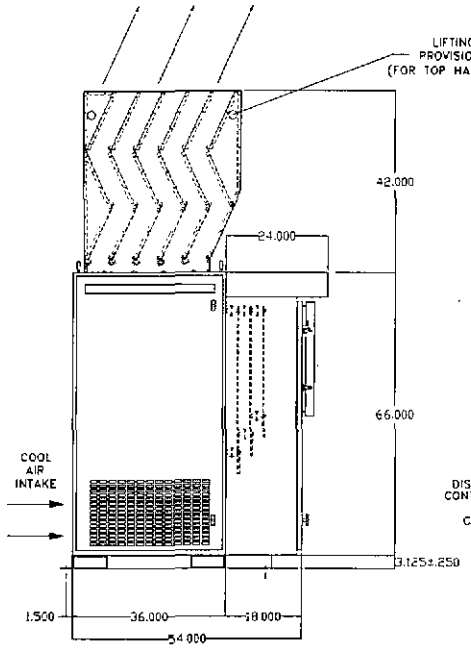
SCALE : -	APPROVED BY :	DRAWN BY : GH
DATE : 7-26-01		REVISED :

RESISTIVE LOAD BANK
650KW,480V,3ø,60Hz

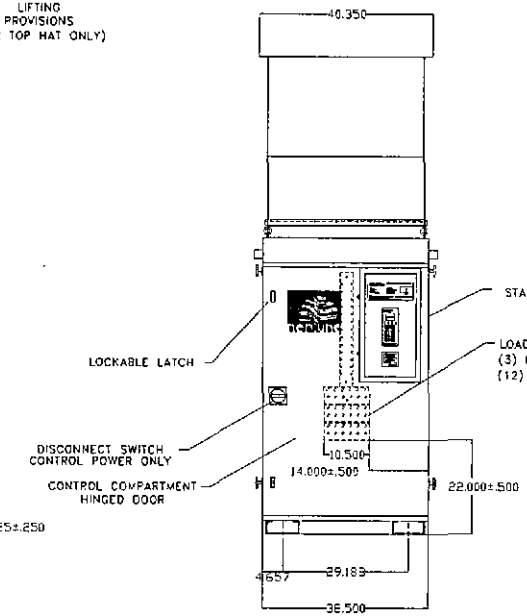
NEPTUNE-650 UL
SUBPANEL LAYOUT

W.O.# 47585-01-43

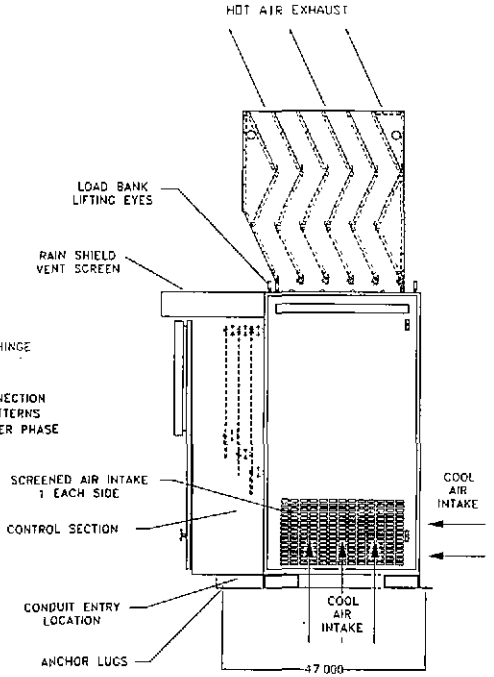
DRAWING NUMBER
47B0120395



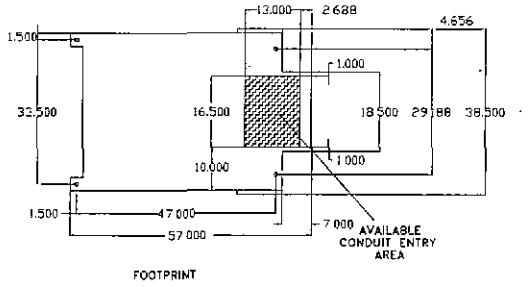
LEFT SIDE VIEW



FRONT VIEW



RIGHT SIDE VIEW



FOOTPRINT

NOTES:

1. BOTTOM OF CONTROL COMPARTMENT AVAILABLE FOR CONDUIT ENTRY.
2. CONSTRUCTION: ALL WELDED FORMED STEEL FRAME, DOORS, PANELS AND SKID. FORK LIFT TUBES 7GA HRS, OUTER SHELL 14GA HRS, BASE SKID, CONTROL BOX AND DOORS 14GA HRS, FAN/ELEMENT DOORS 16GA HRS ALL HINGES, EXTERIOR FASTENERS, AND EXTERIOR HARDWARE ARE STAINLESS STEEL EXHAUST HOOD IS GALVANIZED SHEET STEEL, RIVETED
3. PRIMER: SHERWIN WILLIAMS - RECOATABLE EPOXY PRIMER PART G - B67H5 (24702800) - PART H B67V5 (24702700) PAINT: SHERWIN WILLIAMS - POLANE HS PLUS POLYURETHANE FINISH COLOR: ASA 49 GRAY - F63HSA2036-3134 (24702800) CATALYST - V66V55 (24702801) / ACCELERATOR - V66B11 (24702802)
4. APPROXIMATE SHIPPING WEIGHT: 1,590 LBS TOTAL UNIT
   : 1,300 LBS LOAD BANK
   : 290 LBS TOP HAT

DSK S/N: 4452

SIMPLX. SPRINGFIELD, ILLINOIS

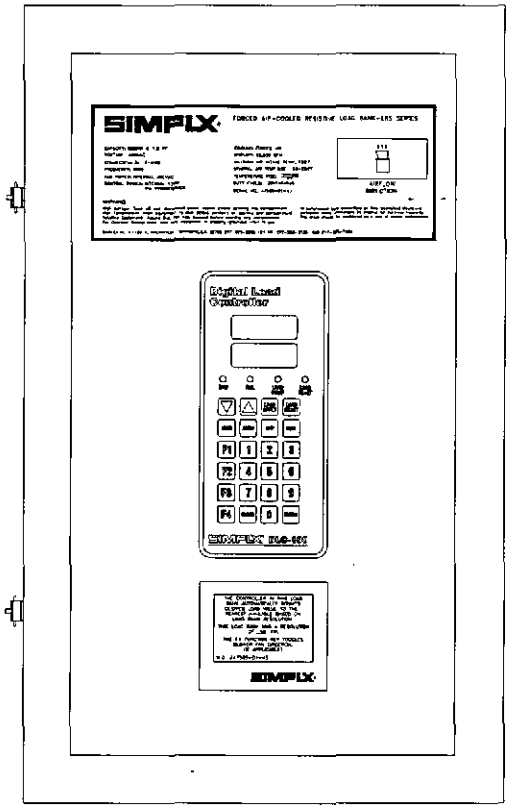
SCALE:	APPROVED BY:	DRAWN BY: GB
DATE: 7-27-01		REVISED:

RESISTIVE LOAD BANK
650KW,480V,3Ø,60Hz

NEPTUNE-650 UL
LOAD BANK PICTORIAL

W.O. # 47585-01-43

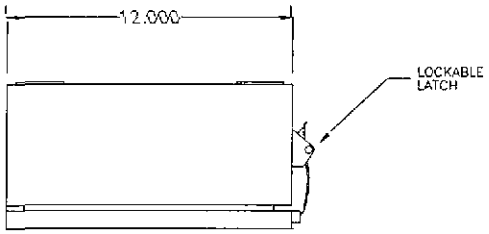
DRAWING NUMBER
4780120599

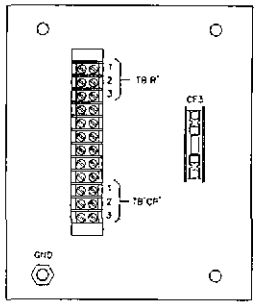


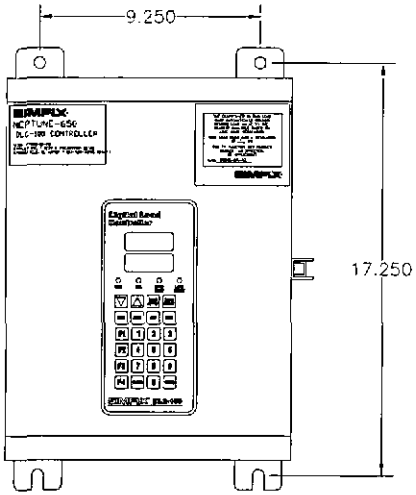
LOCAL CONTROL PANEL

DISK S/N: 4452

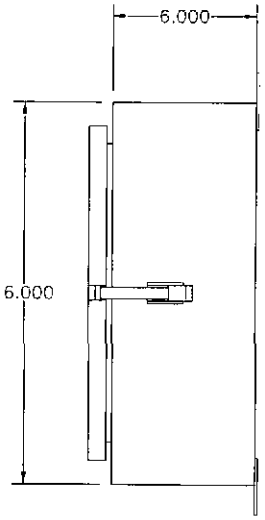
SIMPLX		SPRINGFIELD, ILLINOIS
SCALE: 1 = --	APPROVED BY:	DRAWN BY: CB
DATE: 7-26-01		REVISED:
RESISTIVE LOAD BANK 650KW,480V,3ø,60Hz		NEPTUNE-650 UL LOCAL CONTROL PANEL
WO# 47585-01-43		DRAWING NUMBER 47BD120400







(CONTROLS LOCATED ON COVER DOOR)



NOTES:

1. REMOTE IS NEMA-1.
2. FOR BOX CONSTRUCTION DETAILS. SEE DWG: 16BD105973C.
3. CONTROL DOOR DWG: 16BD116871.
4. PRIMER: RECOATABLE EPOXY
   FINISH: POLANE HS PLUS ASA-49 GRAY

DSK S/N: 4452

A	MOVED DLC KEY PAD TO CENTER OF THE CONTROL DOOR	GB 6-27-01

SIMPLX. SPRINGFIELD, ILLINOIS

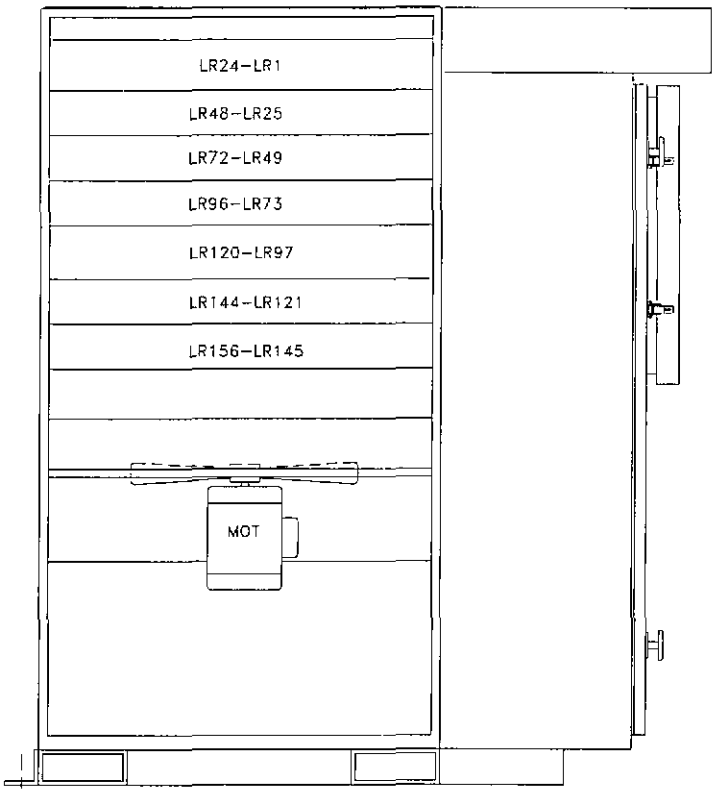
SCALE: NONE	APPROVED BY:	DRAWN BY: GB
DATE: 7-26-01		REVISED:

RESISTIVE LOAD BANK
650KW,480V,3ø,60Hz

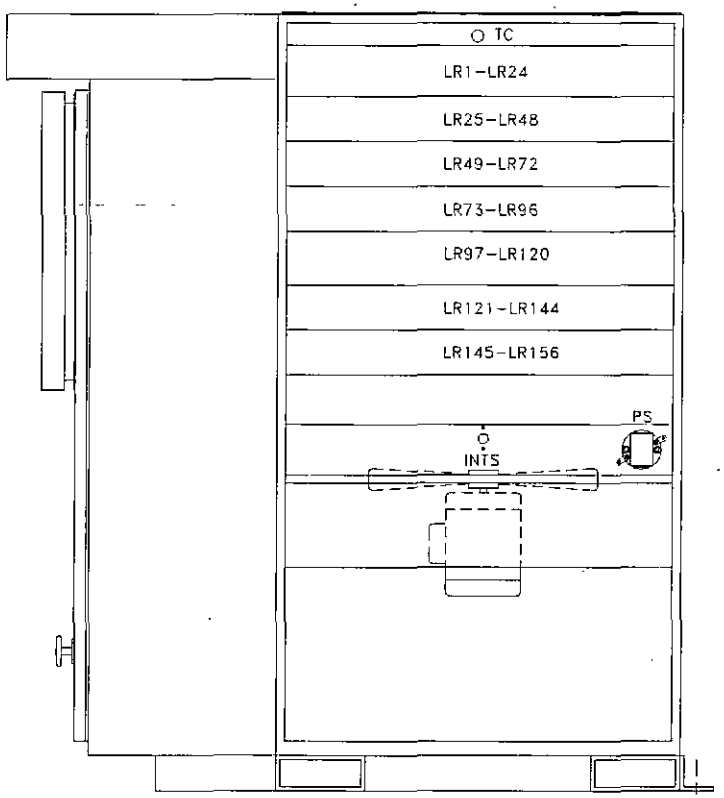
NEPTUNE-650 UL
REMOTE PANEL

W.O.# 47585-01-43

DRAWING NUMBER 47BD120401A



LEFT SIDE



RIGHT SIDE

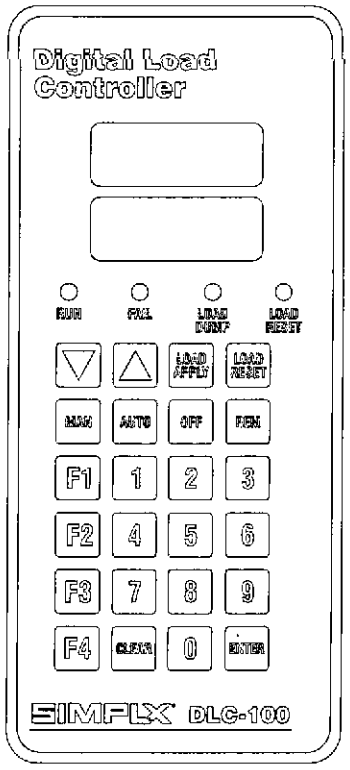
DISK S/N 452

SIMPLX. SPRINGFIELD, ILLINOIS

SCALE :	APPROVED BY :	DRAWN BY : GB
DATE : 7-28-01		REVISED :

RESISTIVE LOAD BANK 650KW,480V,3ø,60HZ — NEPTUNE-650 UL LOAD TRAY LAYOUT

W.O.# 47585-01-43 — DRAWING NUMBER 476D1204C2



FUSE REPLACEMENT CHART

CF1-CF2: 5A, 600V, 200KAIC
FNQ-R-5

CF3(REMOTE): 2A, 600V, 100KAIC
KLK-2

F1-F39: 70A, 600V, 200KAIC
JJS-70

NEPTUNE-650 UL
W.O.# 47585-01-43
NEMA-3R

SIMPLX

THE CONTROLLER IN THIS LOAD BANK AUTOMATICALLY ROUNDS DESIRED LOAD VALUE TO THE NEAREST AVAILABLE BASED ON LOAD BANK RESOLUTION.

THIS LOAD BANK HAS A RESOLUTION OF 50 KW.

THE F1 FUNCTION KEY TOGGLES BLOWER FAN DIRECTION. (IF APPLICABLE)

W.O. #47585-01-43

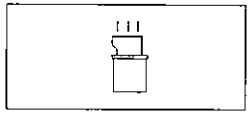
SIMPLX

SIMPLX

FORCED AIR-COOLED RESISTIVE LOAD BANK-LBS SERIES

CAPACITY: 650KW @ 1.0 PF
VOLTAGE: 480VAC
CONNECTION: 3Ø, 3-WIRE
FREQUENCY: 60Hz
FAN POWER: INTERNAL 480VAC
CONTROL POWER: INTERNAL 120V VIA TRANSFORMER

COOLING: FORCED AIR
AIRFLOW: 12,500 CFM
MAXIMUM AIR INTAKE TEMP.: 120°F
NOMINAL AIR TEMP.RISE: 156-250°F
TEMPERATURE RISE: $\frac{°F \times KW \times 3000}{CFM}$
DUTY CYCLE: CONTINUOUS
SERIAL NO. 47585-01-43



AIRFLOW DIRECTION

WARNING

High Voltage: Turn off and disconnect power source before opening any compartment.
High Temperature: Allow equipment to cool before servicing or opening any compartment.
Rotating Equipment: Assure that fan has stopped before opening any compartment.
For Operator Safety: Make sure this equipment is properly grounded when in use.

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

SIMPLEX,INC. · 1139 N. MACARTHUR · SPRINGFIELD,IL 62702 217-525-6995 · 24 HR. 217-528-3130 · FAX 217-525-7984

SIMPLX

NEPTUNE-650

DLC-100 CONTROLLER

W.O.# 47585-01-43
SIMPLEX, INC. ? 1139 N MACARTHUR BLVD.
SPRINGFIELD, IL 62702 ? 217-525-6995 (24HR.)

DISK S/N 4452

SIMPLX		SPRINGFIELD, ILLINOIS
SCALE: ~	APPROVED BY:	DRAWN BY: GB
DATE: 7-27-01		RE-REVISED:
RESISTIVE LOAD BANK 650KW,480VAC,3Ø,60Hz		NEPTUNE-650 UL NAMEPLATES
W.O.# 47585-01-43		DRAWING NUMBER 47BD120403