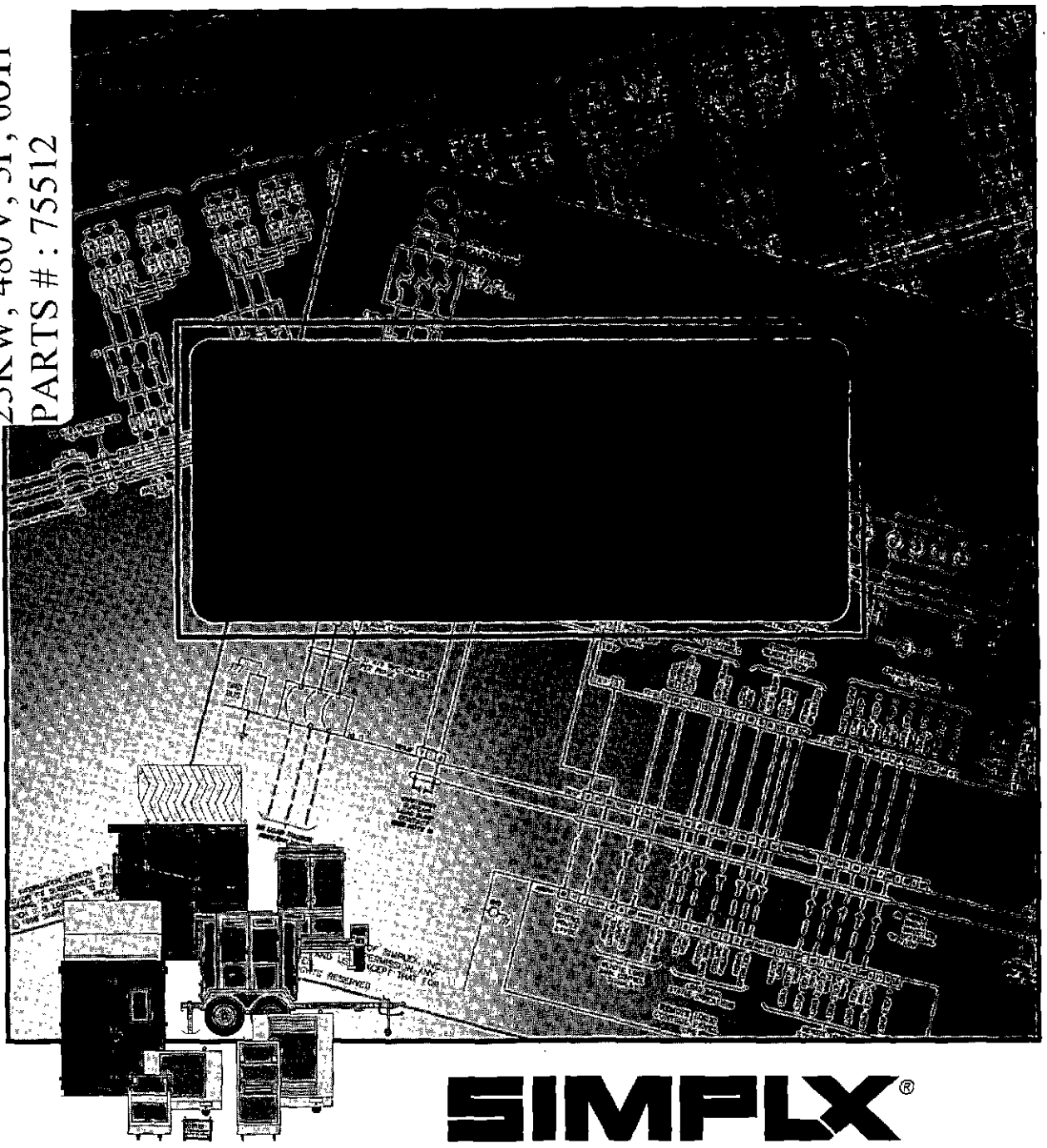
LOAD BANK TECHNICAL MANUAL

MODEL: LBD 40
25KW, 480V, 3P, 60H
PARTS # : 75512



SIMPLX®

LOAD BANKS & FUEL SUPPLY SYSTEMS

Simplex Inc., 1139 N. MacArthur Blvd., Springfield, IL 62702-2314
217-525-6995 (24 hr.) • Fax: 217-525-7984
www.simplexdirect.com

LOAD BANK
TECHNICAL MANUAL

Customer: Katolight Corp.

Work Order: 49406-01-42

Model: LBD 40 UL

January 2002

(File: 49406.p65; Disk: SDCX151)

Contents

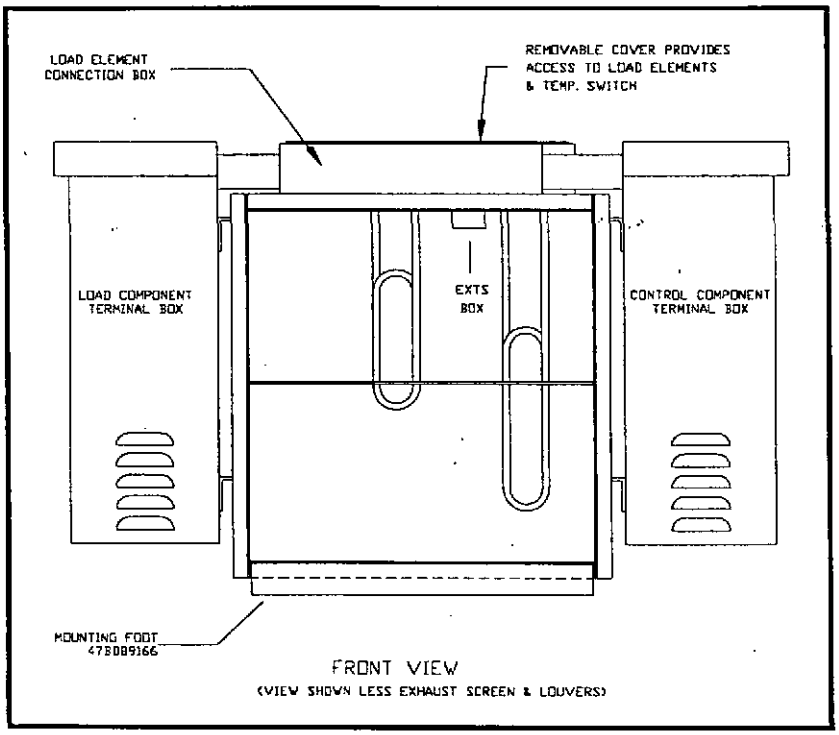
Simplex, Inc., 1139 N. MacArthur Blvd., Springfield, IL 62702-2314 • 217-525-6995 (24 Hr.) • Fax 217-525-7984

DESCRIPTION

Simplex LBD Series Load Banks are a special form of stationary, resistive, forced air-cooled Load Bank which utilizes the air outflow of an engine radiator for cooling of the load elements. They are 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 provide a means for routine maintenance exercise to assure long term reliability and readiness of the standby generator. Exercise Load Banks eliminate the detrimental effects of unloaded operation of diesel engine generators.

Simplex LBD Series Load Banks are intended for use with water cooled engine generator sets equipped with unit mounted radiators. These Load Banks are built per customer specifications and can be installed in numerous ways, including direct bolted attachment to the radiator, mounting within an air duct, wall mounting over the air outflow opening, indoors or outdoors. This Load Bank is equipped with duct-angle mounting feet. The cabinet is rated NEMA Type 3R outdoor weatherproof.

Power source testing is accomplished by applying resistive load steps at unity (1.0) power factor.



Part of Pictorial Drawing 47BD124157

SPECIFICATIONS

Capacity:	40KW @ 1.0 PF
Voltage:	480V
Connection:	3-Wire
Frequency:	60Hz
Control Power:	120V Internal Transformer
Temperature Rise:	$°F = \frac{KW \times 3000}{CFM}$
Duty Cycle:	Continuous
Serial Number:	49406-01-42

⚠ 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.

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

This Load Bank may be operated in Manual or Automatic Load Regulating Modes. Operating controls are located on a Local Control Panel. Load Bank control is via a Programmable Logic Controller (PLC). Common serviceable components include Control Fuses (CF1-CF2) and Load Application Fuses (F1–F9). Lamps on the control panels indicate the Load Bank operating status.

The Control Panel contains the following components:

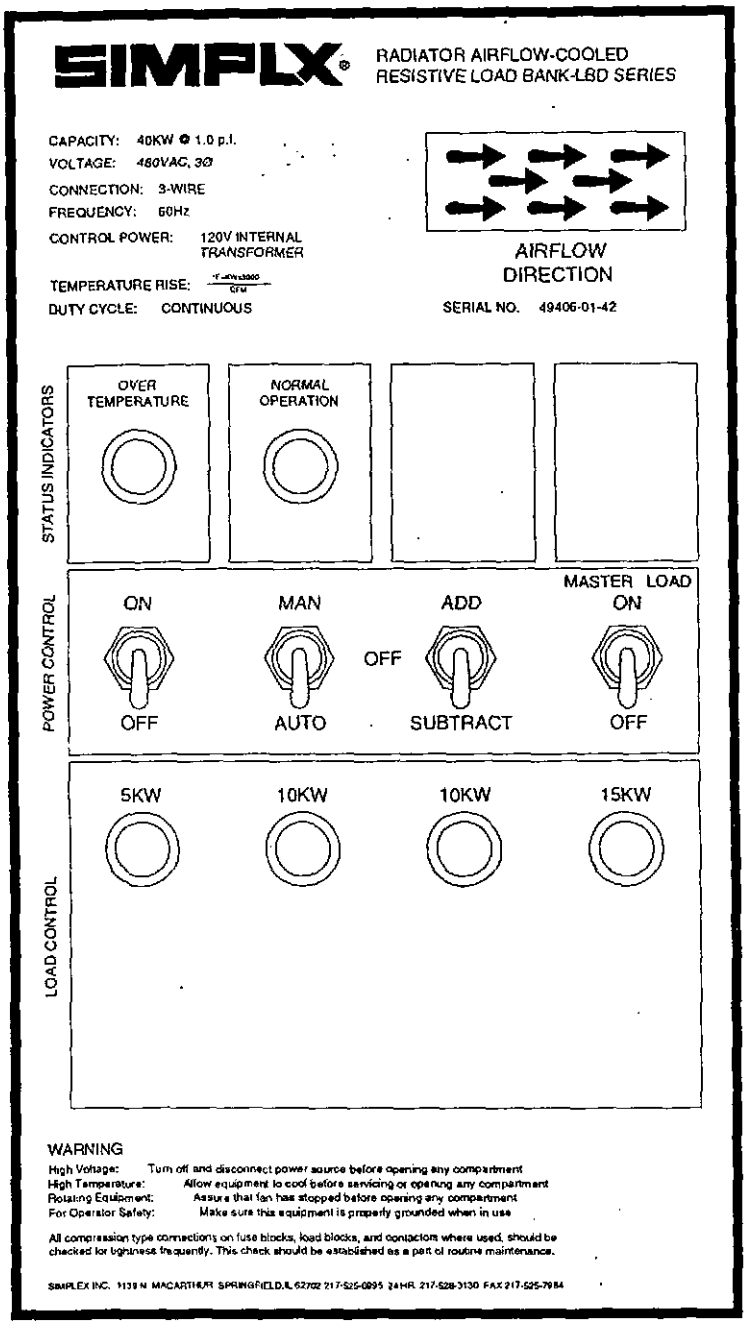
1. Over Temperature and Normal Operation indicator lamps
2. Power Control switches:
   a. On/Off
   b. Manual/Auto
   c. Add/Off/Subtract
   d. Master Load
3. Load step indicator lamps

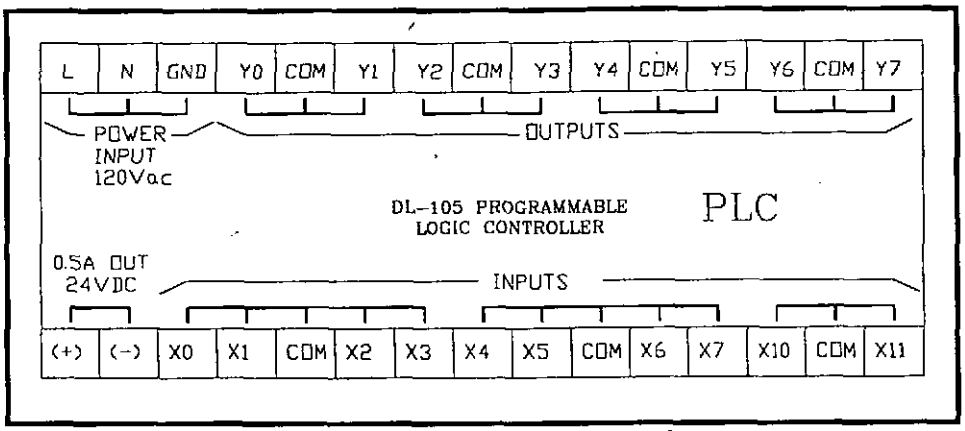
The "Normal Operation" lamp illuminates when Control Power is available and the Cooling System is operating properly.

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 opera-

⚠ 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".





Part of Control Section Drawing 47B124153

tor). 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 control system must be reset by turning the Load Bank "Off" then "On" before the load can be re-applied.

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. Load Bank control is via a Programmable Logic Controller (PLC).

Control power is supplied internally via the Main Load Bus (MLB) and the Control Power Transformer (T1).

LOAD SYSTEM

Simplex LBD Series Load Banks are built up in fused branch circuits of not more than 70A each and protected by 600V, 200,000AIC class-T fuses. All wiring and devices within the branch circuit are rated in accordance with the fuse rating. Branch circuit fusing of the elements virtually eliminates the danger of short circuit of the load elements and consequent catastrophic damage to the load bank.

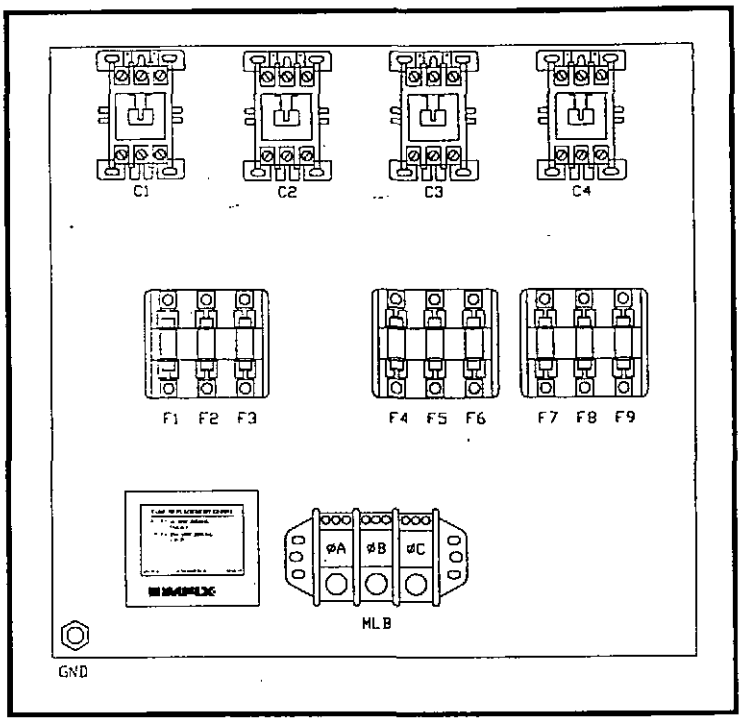
These Load Banks utilize UL Recognized Pow'r Rod Load Elements. These elements are totally enclosed, sealed and weatherproof. Pow'r Rod elements consist of nickel-chromium resistance wire electrically insulated and sealed within a metallic sheath. The hazard of electric shock to personnel and the danger of short circuit by foreign object penetration are reduced since the elements are electrically dead on the outside. They will not fatigue from engine or air-blast vibrations and will not sag or stretch if overheated. The sheath material is "incolloy", a rustproof nickel alloy with a very high temperature rating (1600°F). These elements do not require a cool down period.

See Parts Legend Drawing for specific elements used.

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. 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.



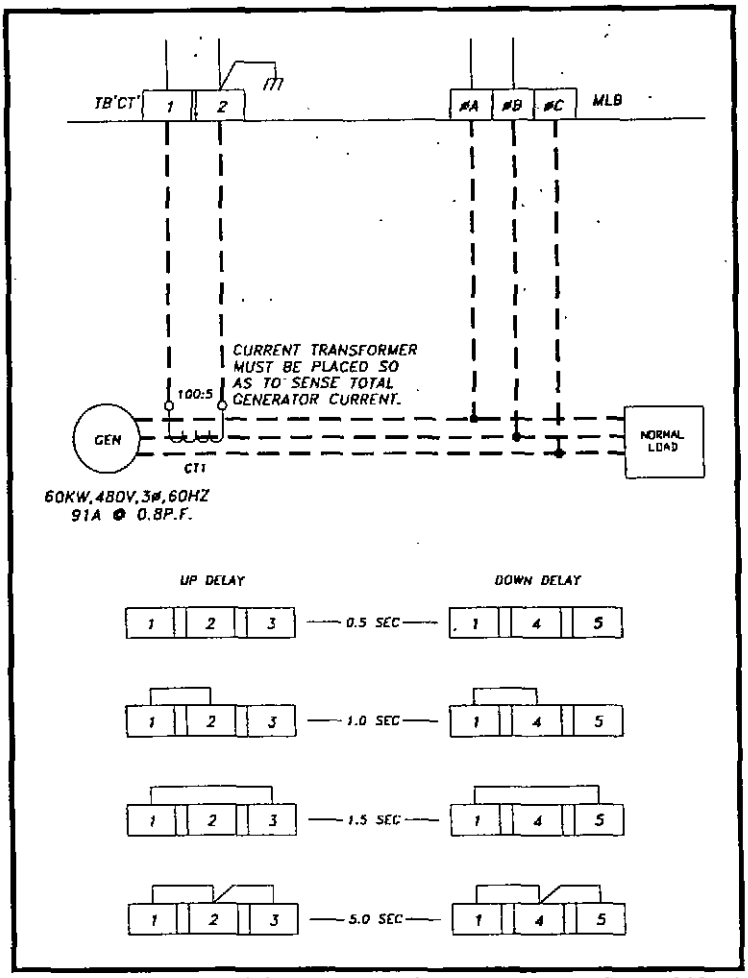
Part of Subpanel Drawing 47BD124158

6. Examine all accessible internal electrical components such as fuses, contactors and transformers. Check lugged wires at these components.
7. Inspect bottom of crate/enclosure for any components that may have jarred loose during shipment such as indicator light lenses, switch knobs, etc.
8. 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

1. Using the mounting feet provided attach the Load Bank with bolts per specifications.
2. Confirm the test source is properly grounded and ground the Load Bank to its own independent ground.
3. Confirm all load command switches are in the "Off" position.
4. *See Control/Load Section Drawing 47B124153A.*
   a. Cable the load source to the Main Load Bus (MLB) on the Load Bank as shown. Consult NEC for proper wire size.
   b. Place the Current Transformer (CT1) in a position to sense total generator current and connect it to TB'CT' 1–2 as shown. Consult NEC for proper wire size.
   c. Using #14AWG copper wire minimum with a torque of 35 in. lbs., connect customer supplied Load Dump contacts to TB'LD' 1–2 or jumper if not used.
      Open contacts to disengage load.
      Close contacts to enable load.
   d. Using #14AWG copper wire minimum with a torque of 35 in. lbs., connect customer supplied Load Bank status indicators to TB'CF' 16–18 if desired.
      Continuity between TB'CF' 1–3 indicates Normal Operation.
      Continuity between TB'CF' 1–2 indicates Over Temperature.
   e. Jumper contacts at TB'TD' for Automatic Operation Delay 'Up' and 'Down' settings as desired.



Parts of Control Section Drawing 47B1224153A

OPERATION

1. Start-up generator or bring other test source on line.
2. Adjust power source voltage and frequency.
3. Place the "Control Power" "On/Off" switch in the "On" position.
4. Place the "Control Power" "Manual/Auto" switch in the "Manual" or "Auto" position.
5. Verify the illumination of the "Normal Operation" lamp before proceeding.

MANUAL

6. Select the desired load via the "Control Power" "Add/Subtract" switch.
7. Place the "Master Load" switch in the "On" position to apply the load selected.
8. Using the "Add/Subtract" switch trim the load as desired.
9. Adjust source voltage and load. Monitor as needed.

AUTOMATIC

When the operator places the Load Bank in automatic mode the Programmable Logic Controller (PLC) and the Current Sensing Relay automatically applies load as needed. These relays are factory set to maintain a minimum net load on the generator approximately equal to 60% of generator full load rating. Time delay is set via jumpers at TB'TD'. The following example illustrates how they function:

Example:

60KW Load Bank on a 100KW Generator

With no normal load applied to the generator, the Load Bank will step up to approximately 60% of generator rating (60KW, or approximately full Load Bank rating).

As normal load comes on-line, the Load Bank will step down to maintain total generator load of approximately 60% of generator rating until the entire Load Bank is off-line.

As normal load varies, the Load Bank will add and subtract steps as necessary to maintain generator load at approximately 60% of generator rating.

⚠ 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.

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.

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 customer may install automatic transfer switch contacts, a manual pushbutton or circuit breaker for this use.

SHUTDOWN

1 De-energize the load.
2. Place the "Control Power" "On/Off" switch in the "Off" position.

OVER TEMPERATURE DETECTION

If an "Over Temperature" occurs the corresponding lamp illuminates and the load de-energizes. Before reapplying a load, the failure must be corrected and the system must be reset by turning the Load Bank "Off" then "On". This detection system consists of the following components:

1. Exhaust Temperature Switch (EXTS)
2. Over Temperature Relay (OTR)
3. Control Power Relay (CPR)

MAINTENANCE

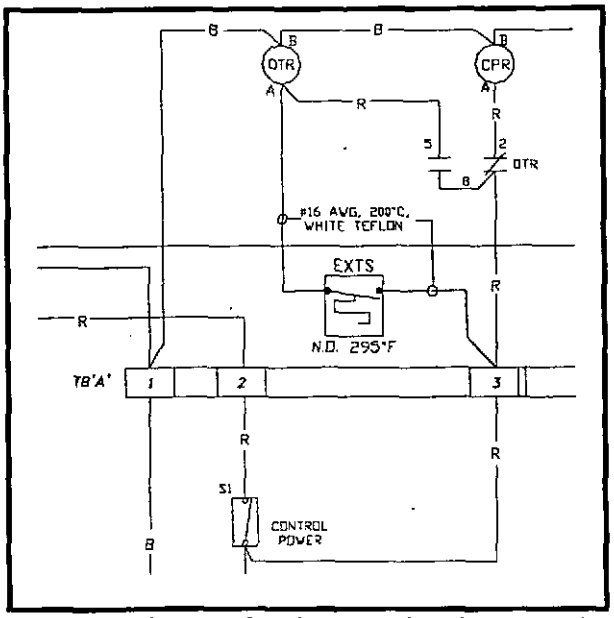
The Load Bank has been designed to require minimum maintenance. All components have been chosen for a long, reliable life. Two basic intervals of maintenance are required: each operation and every 50 hours or 6 months (whichever comes first).

EACH OPERATION

The air intake screens and louvers, 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 there is positive airflow.

⚠ WARNING ⚠

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



Part of Control Section Drawing 47B124153A

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.

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. Vibrations 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".

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.

⚠ WARNING ⚠

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

⚠ WARNING ⚠

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

OVER TEMPERATURE INDICATED

Exhaust temp above EXTS setpoint:

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

Exhaust temp below EXTS setpoint:

1. Restriction of air (intake or exhaust)
2. Overtemperature sensor failure

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

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 Work Order Number and the Drawing Numbers are also located on each drawing legend. *A typical drawing legend and parts list is illustrated at right.*

SIMPLX® SPRINGFIELD, ILLINOIS

SCALE :	APPROVED BY :	DRAWN BY : GB
DATE : 10-30-00		REVISED :

RESISTIVE LOAD BANK 25KW,480V,3ø,60HZ
LBS-MINI-25 CONTROL/LOAD SECTION

W.O. # 42329-00-43
DRAWING NUMBER 47B114099A

ITEM	QTY.	PART #	DESIG.	DESCRIPTION
1	3	24304500 (24304540)	LR1-LR3	LOAD ELEMENTS, 1667W@277V OPERATING AT 1667W@277V 12", INCOLLOY SHEATH
2	6	24309500 (24309520)	LR4-LR9	LOAD ELEMENTS, 3333W@277V OPERATING AT 3333W@277V 18", INCOLLOY SHEATH
3	4	13013100	C1-C3 FMC	CONTACTOR 35A, 600V, 3POLE 120VAC COIL
4	2	13906000	CF1-CF2	FUSE 0.5A, 600V, 200KAIC
5	3	14043000	F1-F3	FUSE 10A, 600V, 200KAIC
6	6	14057500	F4-F9	FUSE 20A, 600V, 200KAIC
7	1	15011500	[CF1-CF2]	FUSEBLOCK 30A, 600V, 2 POLE
8	3	15013000	[F1-F9]	FUSEBLOCK 30A, 600V, 3 POLE
9	1	25649500	MLB	MAIN LOAD BLOCK, 175A, 600V, 3POLE, LINE CONS: 2/0-#14AWG, 1 CONN./PH
10	1	25663600	TB'CT'	TERMINAL BLOCK 30A, 600V, 2 LINE
11	1	25667000	TB'TD'	TERMINAL BLOCK 30A, 600V, 6 LINE
12	1	25672000	TB'A'	TERMINAL BLOCK 30A, 300V, 18 LINE
13	1	12046300	FCB	FAN CIRCUIT BREAKER 100A FRAME, 15A TRIP 3-POLE, 600V
14	1	24634000	MOT	FAN MOTOR 208-230/460V, 2.3FLA, 0.5HP 1750RPM, .625DIA., 56-FRAME
15	1	13820500	[MOT]	FAN BLADE 4350CFM @ 1850RPM 18" DIA., 0.625DIA., 0.25HP
16	1	25450000	T1	TRANSFORMER, 150VA 480/240:240/120V MACHINE TOOL CLASS

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	$\frac{\text{1.732 x Volts x Amps x } \sqrt{1-PF^2}}{1000}$	

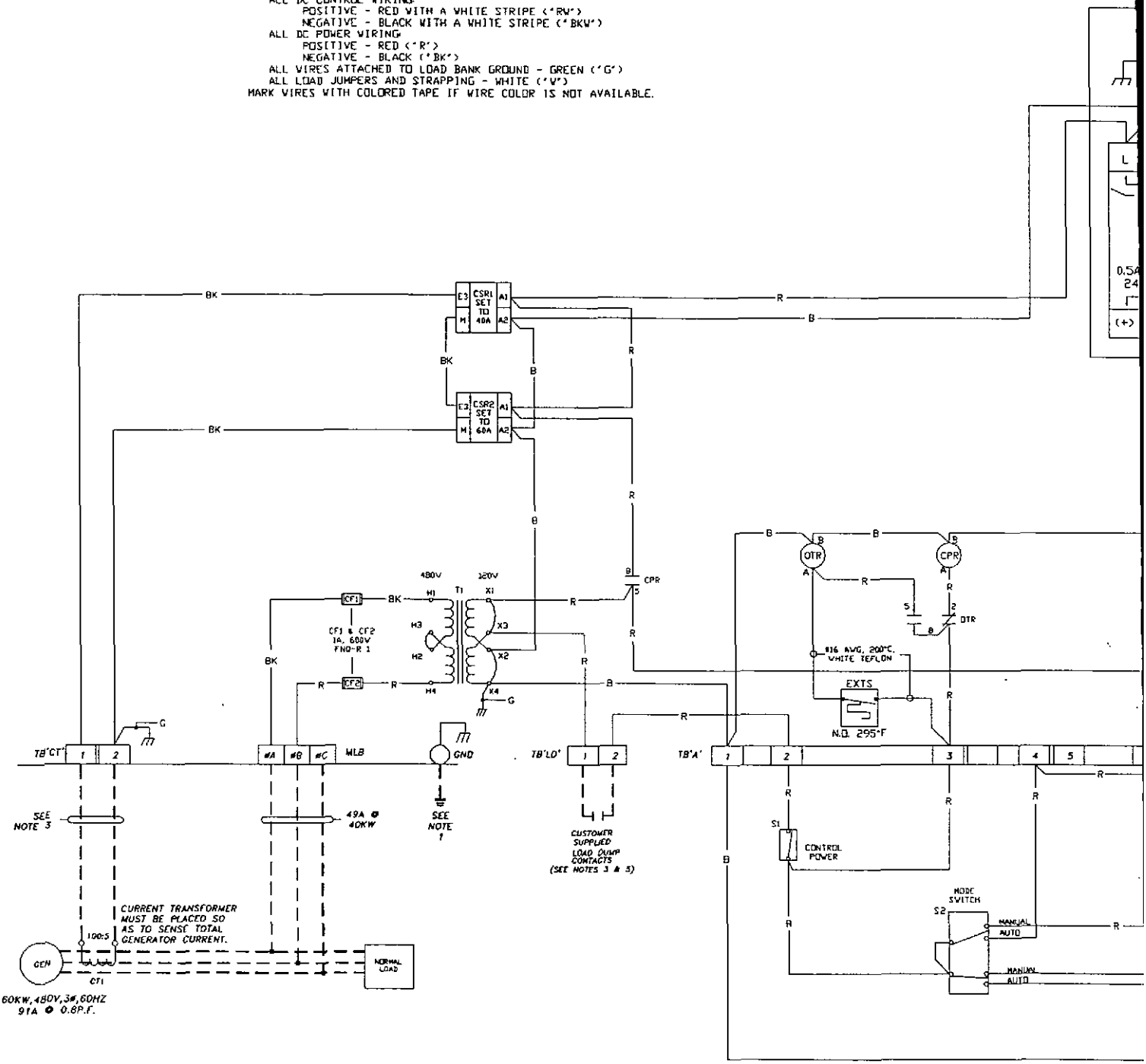
*Power Factor, expressed as decimal.
(Resistive Load Bank PF is 1.0)

APPENDIX C - DRAWINGS

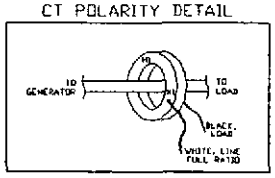
Title	Drawing
Control	47B124153A
Load	47B124154
Strapping	47B124155
Parts Legend	47B124156
Pictorial	47BD124157
Subpanel	47BD124158
Nameplates	47BD124159A

LOAD BANK WIRING COLOR CODED AS FOLLOWS:
- ALL AC CONTROL WIRE JUMPERS:
  - LINE SIDE, 'A' SIDE OF COIL - RED ('R')
  - COMMON (GROUND OR NEUTRAL), 'B' SIDE OF COIL - BLUE ('B')
- ALL AC POWER WIRING:
  - A PHASE, LINE 1 - BLACK ('BK')
  - B PHASE, LINE 2 - RED ('R')
  - C PHASE, LINE 3 - BLUE ('B')
- ALL DC CONTROL WIRING:
  - POSITIVE - RED WITH A WHITE STRIPE ('RW')
  - NEGATIVE - BLACK WITH A WHITE STRIPE ('BKW')
- ALL DC POWER WIRING:
  - POSITIVE - RED ('R')
  - NEGATIVE - BLACK ('BK')
- ALL WIRES ATTACHED TO LOAD BANK GROUND - GREEN ('G')
- ALL LOAD JUMPERS AND STRAPPING - WHITE ('W')

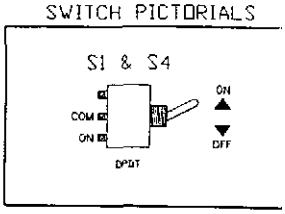
MARK WIRES WITH COLORED TAPE IF WIRE COLOR IS NOT AVAILABLE.



CT POLARITY DETAIL

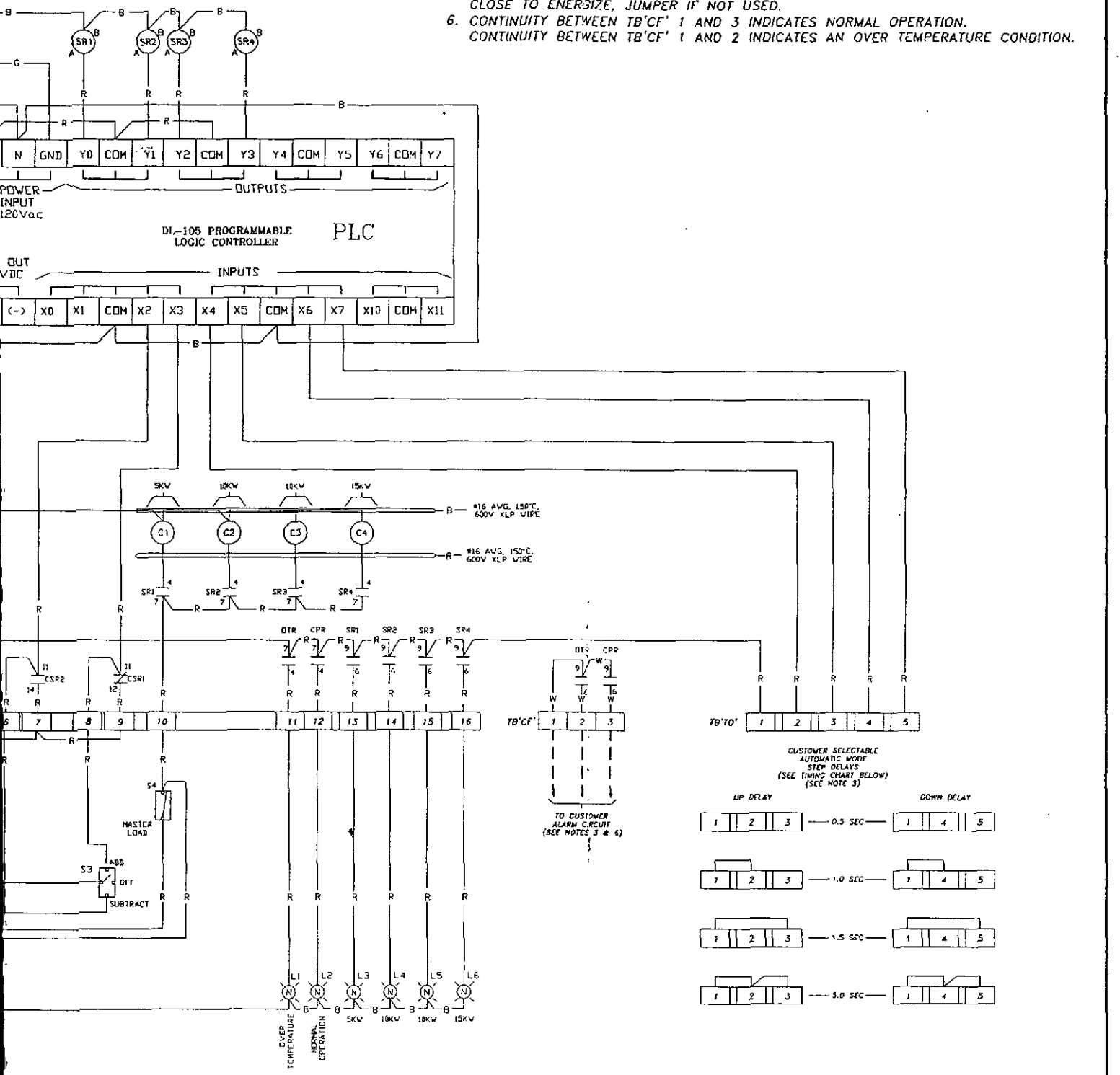


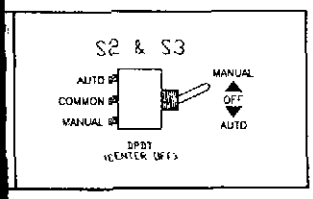
SWITCH PICTORIALS



NOTES;

1. UNIT MUST BE GROUNDED FOR OPERATOR'S SAFETY.
2. DASHED LINES INDICATE WIRES NOT SUPPLIED BY SIMPLEX.
3. #14 AWG COPPER WIRE, TORQUE TO 35 IN*LBS.
4. ALL CONTROL WIRE #16 AWG, 105°C, UNLESS OTHERWISE NOTED
   ALL LOAD WIRE #12 AWG, 150°C UNLESS OTHERWISE NOTED
5. LOAD DUMP CONTACT: OPEN TO DISENGAGE THE LOAD,
   CLOSE TO ENERGIZE, JUMPER IF NOT USED.
6. CONTINUITY BETWEEN TB'CF' 1 AND 3 INDICATES NORMAL OPERATION.
   CONTINUITY BETWEEN TB'CF' 1 AND 2 INDICATES AN OVER TEMPERATURE CONDITION.





DISK S/N: 4455

A	REVISED AUTOMATIC WIRING CIRCUIT	DRAWN BY : BK DATE : 1/18/02

SIMPLX® SPRINGFIELD, ILLINOIS

SCALE :	APPROVED BY :	DRAWN BY : BK
DATE : 1/15/02		REVISED : 1

RESISTIVE LOAD BANK
40KW,480V,3Ø,60Hz

LBD-40 UL
CONTROL SECTION

W.O. # 49406-01-42

DRAWING NUMBER
47B124153A

NOTES:

1. *UNIT MUST BE GROUNDED FOR OPERATOR'S SAFETY.*
2. *DASHED LINES INDICATE WIRES NOT SUPPLIED BY SIMPLEX.*
3. *ALL CONTROL WIRE #16 AWG, 105°C, UNLESS OTHERWISE NOTED*
   ALL LOAD WIRE #12 AWG, 150°C, UNLESS OTHERWISE NOTED.

LOAD BANK WIRING COLOR CODED AS FOLLOWS:

ALL AC CONTROL WIRE JUMPERS:
- LINE SIDE, "A" SIDE OF COIL - RED ("R")
- COMMON (GROUND OR NEUTRAL), "B" SIDE OF COIL - BLUE ("B")

ALL AC POWER WIRING:
- A PHASE, LINE 1 - BLACK ("BK")
- B PHASE, LINE 2 - RED ("R")
- C PHASE, LINE 3 - BLUE ("B")

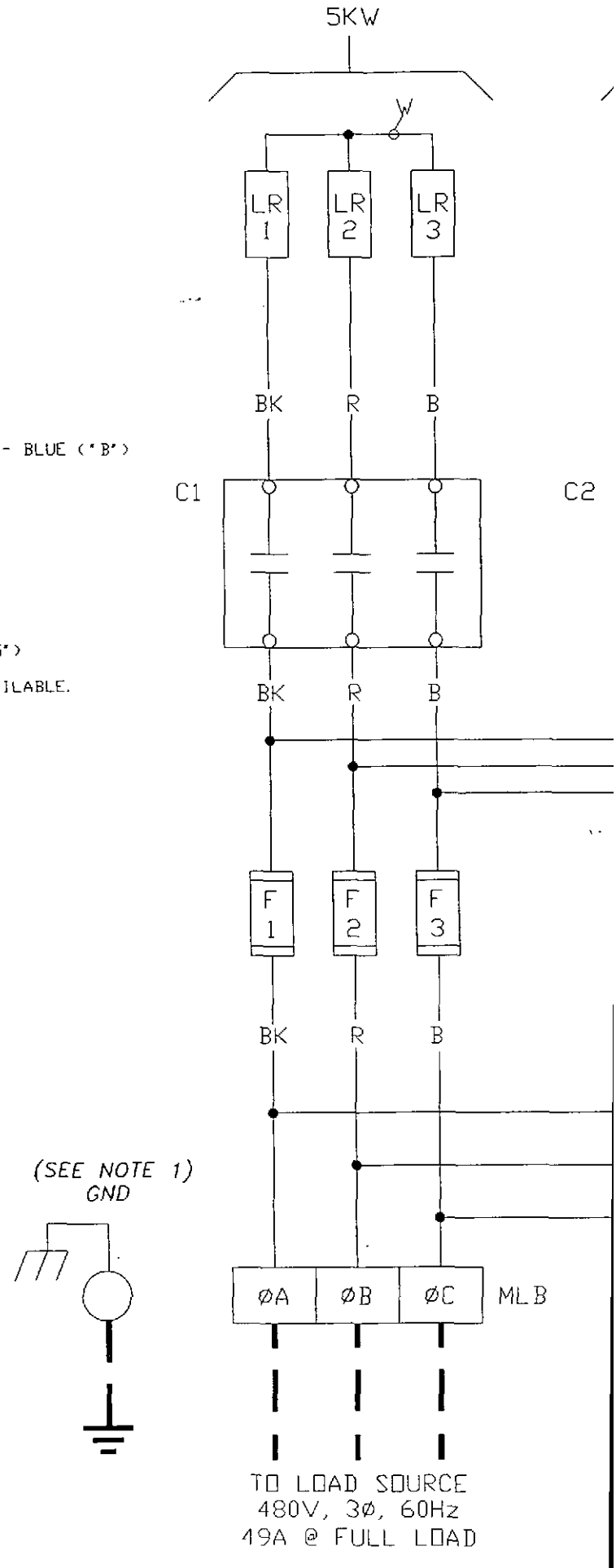
ALL DC CONTROL WIRING:
- POSITIVE - RED WITH A WHITE STRIPE ("RW")
- NEGATIVE - BLACK WITH A WHITE STRIPE ("BKW")

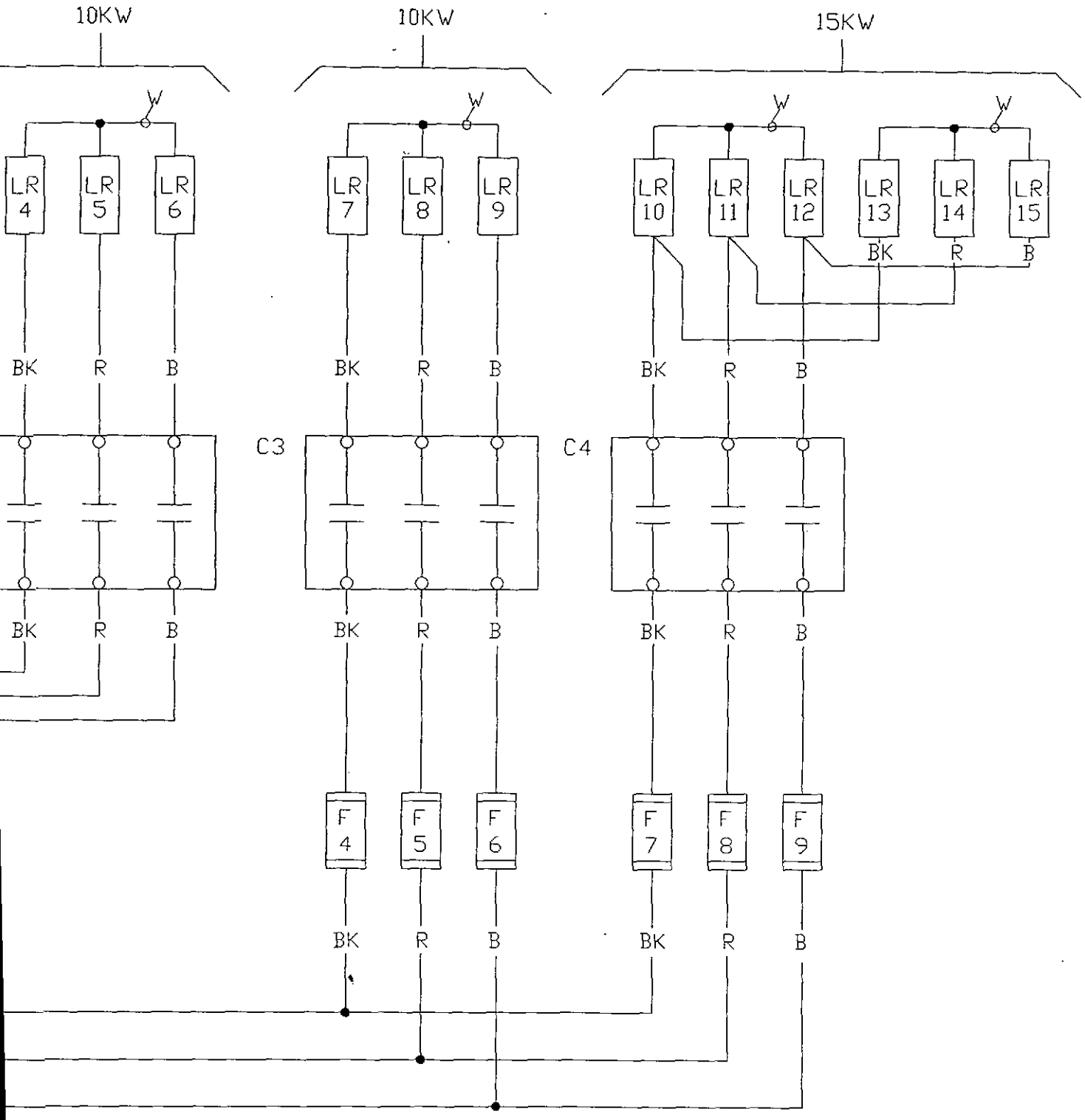
ALL DC POWER WIRING:
- POSITIVE - RED ("R")
- NEGATIVE - BLACK ("BK")

ALL WIRES ATTACHED TO LOAD BANK GROUND - GREEN ("G")

ALL LOAD JUMPERS AND STRAPPING - WHITE ("W")

MARK WIRES WITH COLORED TAPE IF WIRE COLOR IS NOT AVAILABLE.





DISK S/N: 4455

SIMPLX® SPRINGFIELD, ILLINOIS

SCALE :	APPROVED BY :	DRAWN BY : BK
DATE : 1/16/02		REVISED :

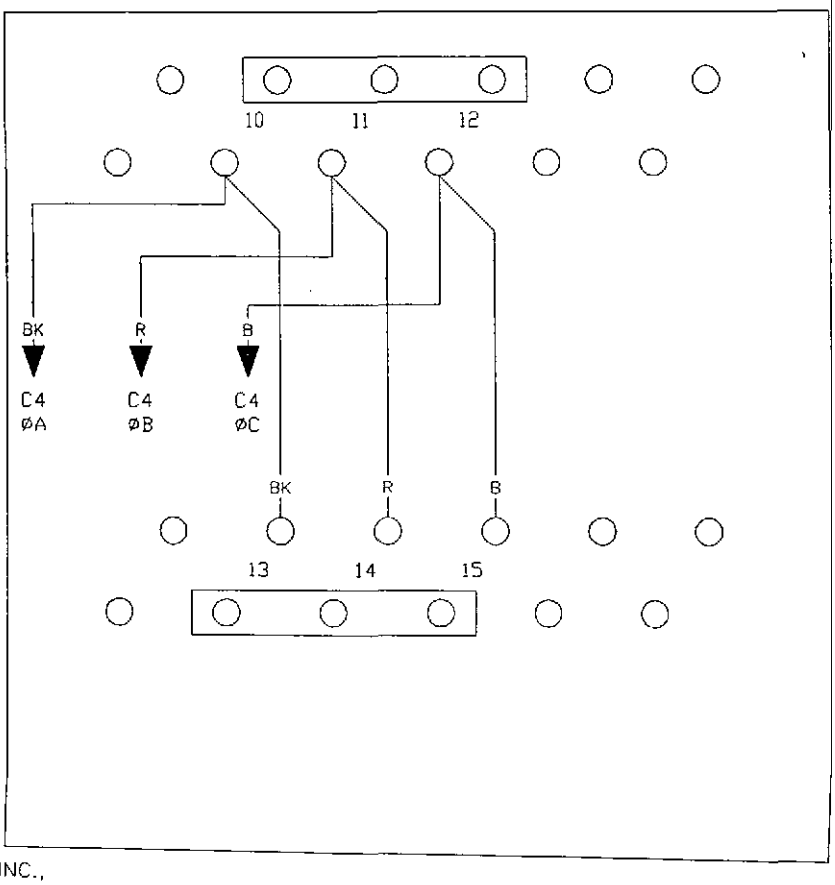
RESISTIVE LOAD BANK
40KW,480V,3ø,60HZ

LBD-40 UL
LOAD SECTON

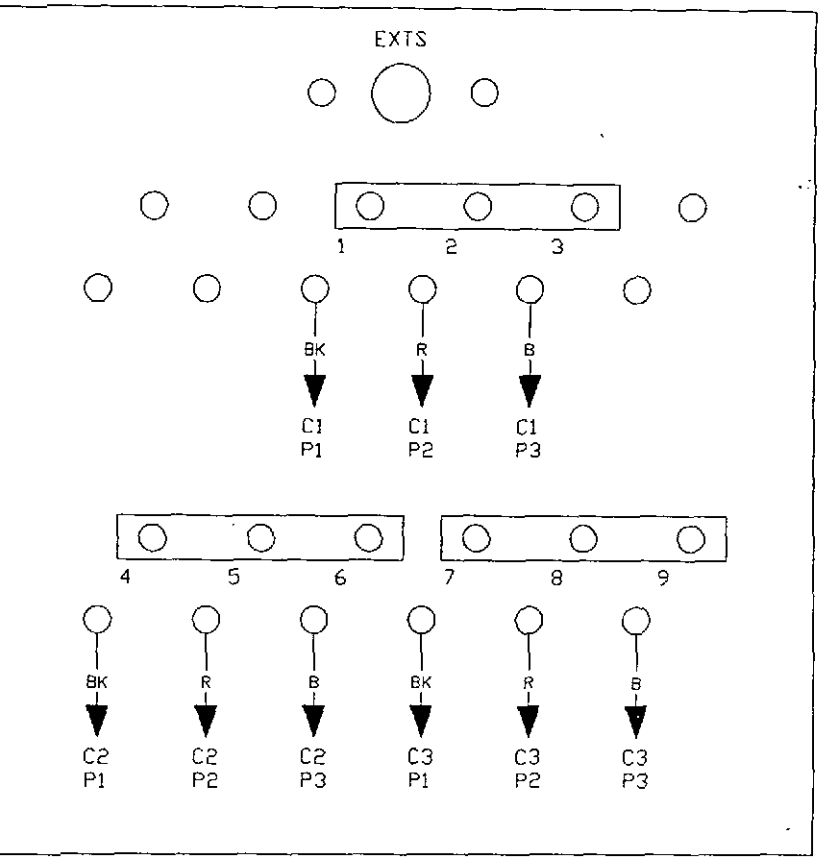
W.O.# 49406-01-42

DRAWING NUMBER
47B124154

W.O.# 49406	KATOLIGHT
ENGINEER- BC	#12 AW(



CORP	LBD-40 UL	1/17/02
150°C WHITE WIRE UNLESS OTHERWISE MARKED.		2 TRAYS



DISK S/N: 4455

SIMPLX® SPRINGFIELD, ILLINOIS

SCALE :	APPROVED BY :	DRAWN BY : BC
DATE : 1/17/02		REVISED :

RESISTIVE LOAD BANK
40KW,480V,3Φ,60Hz

LBD-40 UL
LOAD STRAPPING

W.O.# 49406-01-42

DRAWING NUMBER
47B123155

ITEM	QTY	PART#	DESIG	DESCRIPTION
1	6	24304540	LR1-LR3 LR13-LR15	LOAD ELEMENTS, 1667W@277V OPERATING AT 1667W @ 277V 12", INCOLLOY SHEATH
2	9	24309520	LR4-LR12	LOAD ELEMENTS, 3333W@277V OPERATING AT 3333W @ 277V 18", INCOLLOY SHEATH
3	4	13013100	C1-4	CONTACTOR 35A, 600V, 3POLE 120VAC, 50/60Hz COIL
4	2	14004000	CF1,2	FUSE, TIME DELAY 1A, 600V, 200KAIC
5	9	14057500	F1-9	FUSE, VERY FAST ACTING 20A, 600VAC, 200KAIC
6	1	15011500	[CF1,2]	FUSEBLOCK 30A, 600V, 2 POLE *QUICK-CONNECT*
7	3	15013000	[F1-9]	FUSEBLOCK 30A, 600V, 3 POLE
8	1	25649500	MLB	MAIN LOAD BLOCK, 175A 600V, 3POLE, LINE CONS: 2/0-#14AWG, 1 CONN/ϕ
9	1	25670000	TB`CF' TB`TD' TB`CT'	TERMINAL BLOCK 30A, 600V, 12 LINE
10	1	25672000	TB`A' TB`LD'	TERMINAL BLOCK 30A, 600V, 18 LINE
11	1	25309790	EXTS UL	EXHAUST TEMP SWITCH NO, CLOSE @ TEMP >295°F
12	1	7BD56534B	[EXTS] UL	EXTS BOX
13	1	24951011	PLC	PROGRAMMABLE CONTROLLER 10 AC INPUTS, 8 OUTPUTS 120VAC POWER
14	1	25453000	T1	TRANSFORMER, 300VA 480/240V:240/120V

ITEM	QTY	PART#	DESIG	DESCRIPTION
15	6	24771000	CPR,OTR SR1-4	GENERAL PURPOSE RELAY 10A, 240VAC, 3PDT 120VAC COIL
16	6	24891000	[CPR,OTR, SR1-6]	RELAY BASE 11 PIN SCREW TRM
17	2	24752500	CSR1,2	CURRENT SENSOR RELAY 0.0035-10A, 120V, SPDT
18	1	25438100	CT1	CURRENT TRANSFORMER 100/5, 50-400Hz 1.12" WINDOW DIAMETER
19	2	25303031	S1,4	SWITCH 3R DPST, TOGGLE (SCW-TRM, SEALING)
20	2	25303025	S2,3	SWITCH 3R DPDT, CENTER-OFF, TOGGLE (SCW-TRM, SEALING)
21	6	16750600	[L1-6]	O-RINGS FOR PSB/NEON LAMP BASE
22	6	16750500	[L1-6]	O-RINGS FOR PSB/NEON LENS
23	6	24261500	L1-6	LIGHT-BASE 125V, NEON, FOR B2A BULB
24	6	24250500	[L1-6]	LIGHT-BULB NEON, 125V, B2A HIGH BRIGHTNESS
25	6	24272001	[L1-6]	LENS CLEAR CYLIND. CLEAR

DISK S/N: 4455

SIMPLX® SPRINGFIELD, ILLINOIS

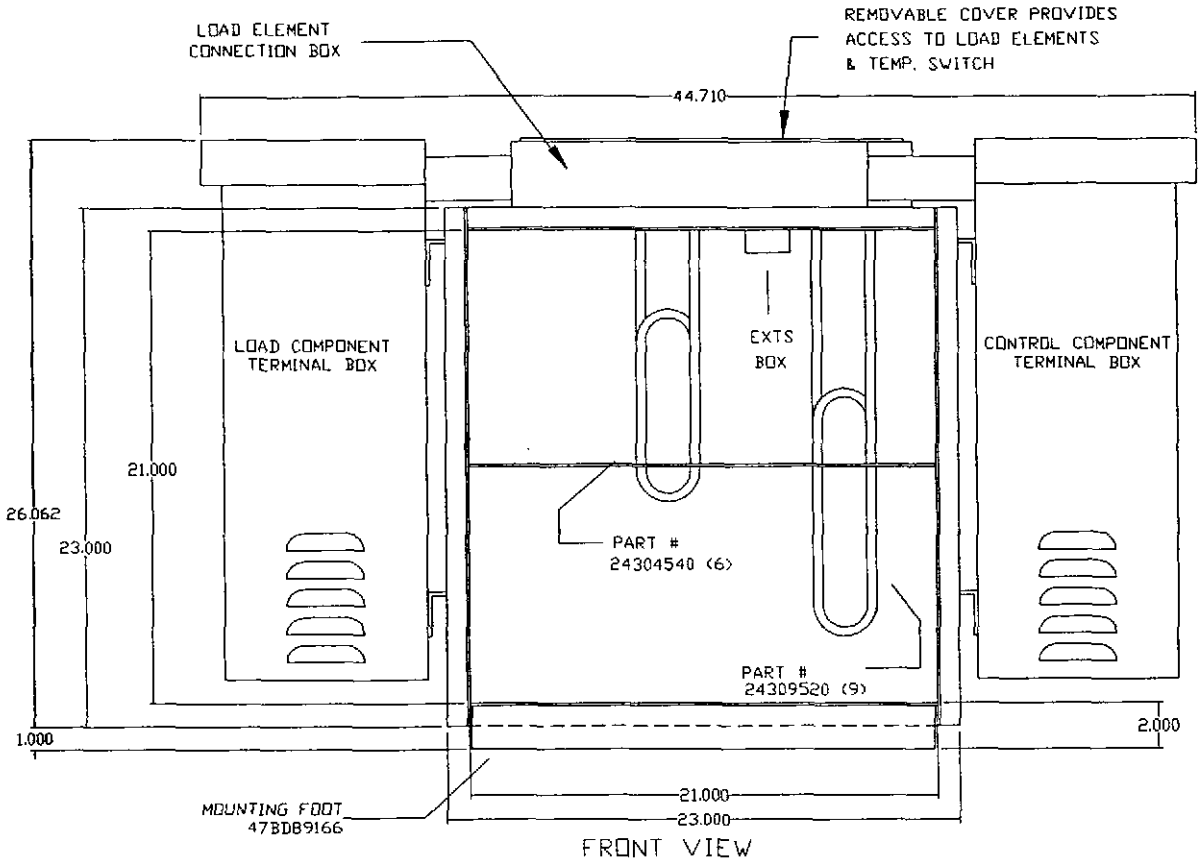
SCALE :	APPROVED BY :	DRAWN BY : BC
DATE : 1/16/02		REVISED :

RESISTIVE LOAD BANK
40KW,480V,3ø,60Hz

LBD-40 UL
LEGEND

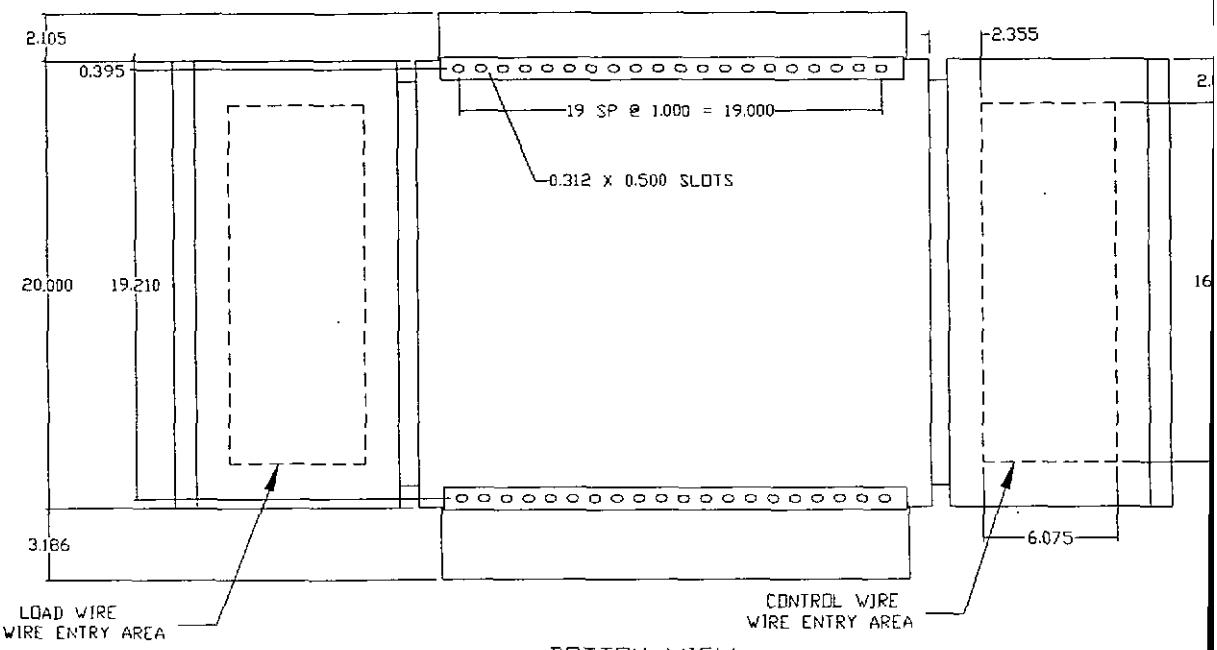
W.O.# 49406-01-42

DRAWING NUMBER
47B124156

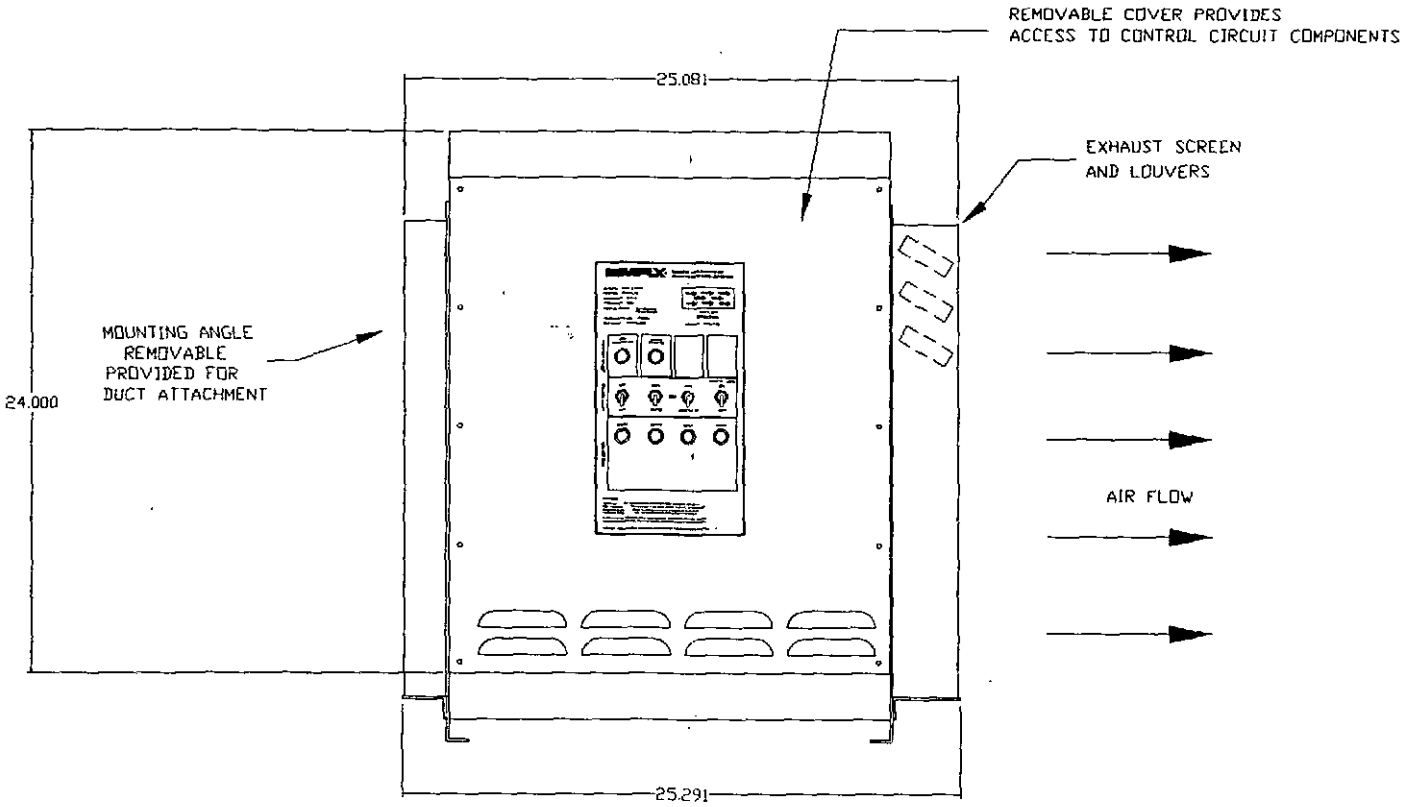


FRONT VIEW

(VIEW SHOWN LESS EXHAUST SCREEN & LOUVERS)



BOTTOM VIEW



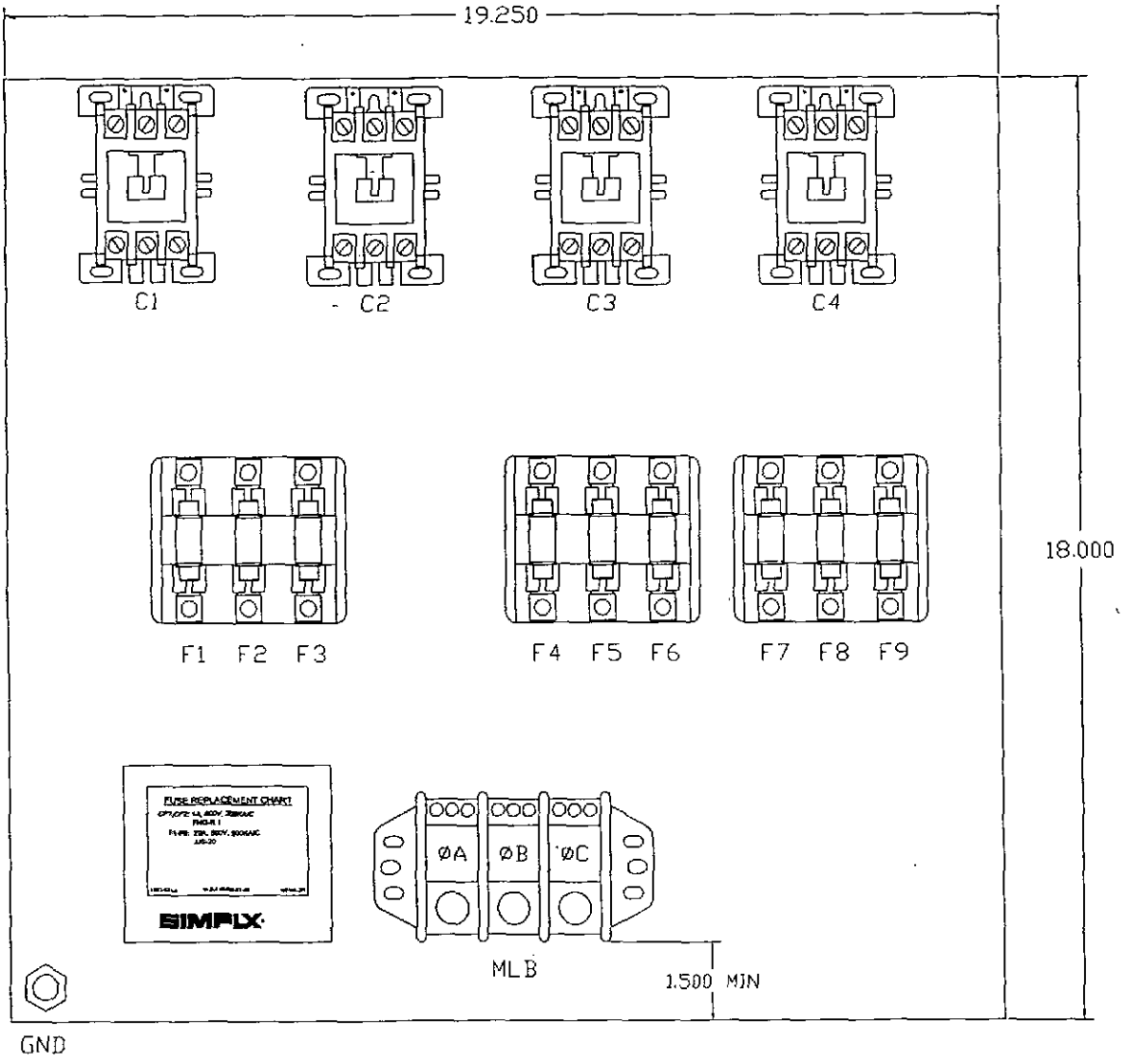
SIDE VIEW
(SHOWING CONTROL PANEL)

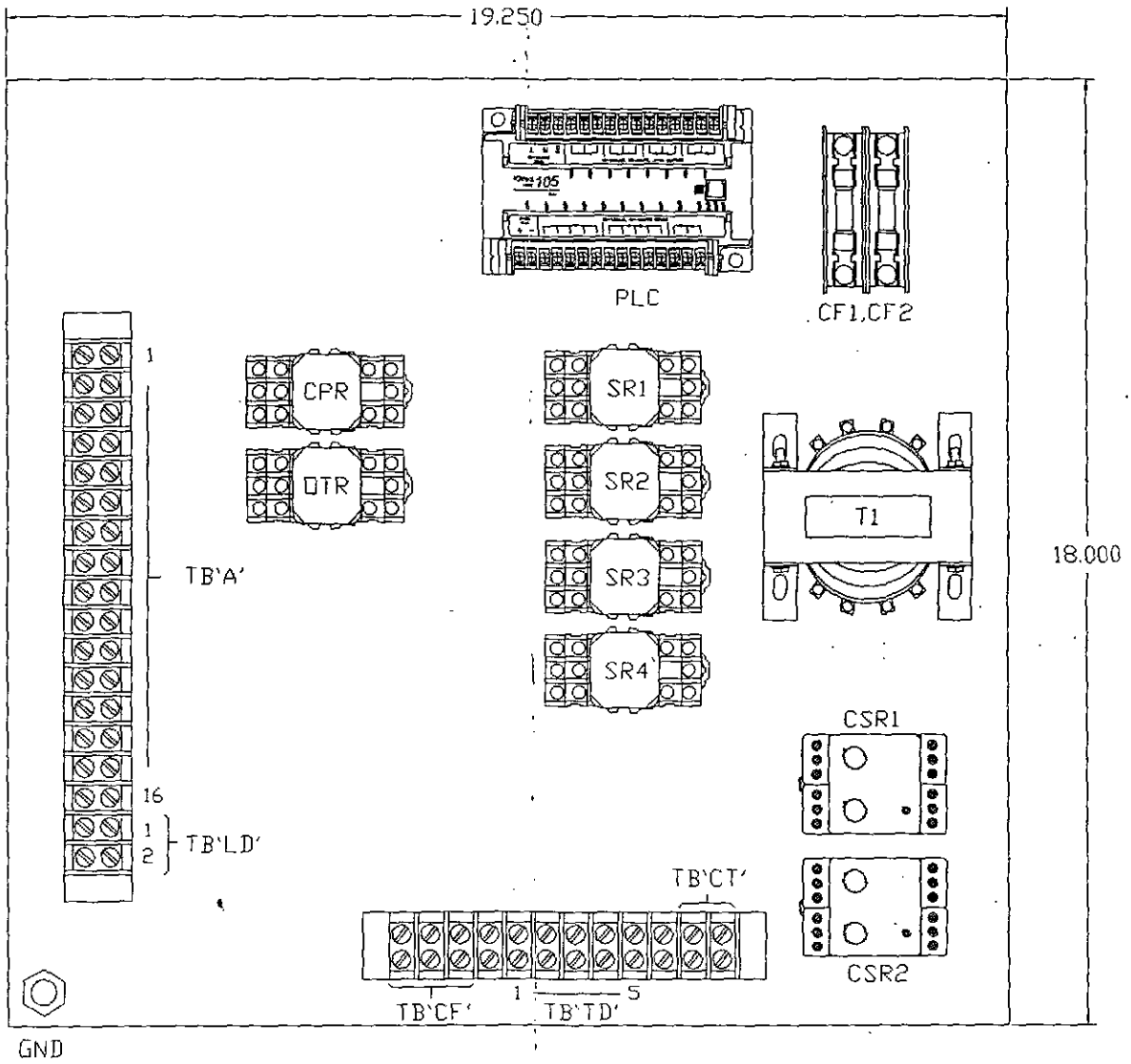
NOTES:

1) CONTROL & ELEMENT BOX
   MATERIAL - 14 GA. GALV.
2) DUCT FRAME MATERIAL - 12 GA. GALV.
3) CONDUIT - 2" ALUMINUM TUBING
4) NEMA 3R

DISK S/N: 4455

SIMPLX®			SPRINGFIELD, ILLINOIS
SCALE : 1=1"	APPROVED BY :		DRAWN BY : BC
DATE : 1/17/02			REVISED :
RESISTIVE LOAD BANK 40KW,480V,3ø,60Hz			LBD-40 UL PICTORIAL
W.O. # 49406-01-42			DRAWING NUMBER 47BD124157





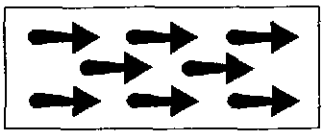
DISK S/N: 4455

SIMPLX® SPRINGFIELD, ILLINOIS			
SCALE : 1=1"	APPROVED BY :	DRAWN BY : BC	
DATE : 1/17/02		REVISED :	
RESISTIVE LOAD BANK 40KW,480V,3ø,60Hz		LBD-40 UL SUBPANEL LAYOUT	
W.O.# 49406-01-42		DRAWING NUMBER 47BD124158	

SIMPLX®

RADIATOR AIRFLOW-COOLED
RESISTIVE LOAD BANK-LBD SERIES

CAPACITY: 40KW @ 1.0 p.f.
VOLTAGE: 480VAC, 3Ø
CONNECTION: 3-WIRE
FREQUENCY: 60Hz
CONTROL POWER: 120V INTERNAL TRANSFORMER
TEMPERATURE RISE: $\frac{°F = KW \times 3000}{CFM}$
DUTY CYCLE: CONTINUOUS



AIRFLOW DIRECTION

SERIAL NO. 49406-01-42

STATUS INDICATORS

OVER TEMPERATURE	NORMAL OPERATION		
.688	.688		

POWER CONTROL

ON	MAN		ADD	MASTER LOAD ON
0.50	0.50	OFF	0.50	0.50
OFF	AUTO		SUBTRACT	OFF

LOAD CONTROL

5KW	10KW	10KW	15KW
.688	.688	.688	.688

A

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

FUSE REPLACEMENT CHART

CF1,CF2: 1A, 600V, 200KAIC
FNQ-R 1

F1-F9: 20A, 600V, 200KAIC
JJS-20

LBD-40 UL W.O.# 49406-01-42 NEMA-3R

SIMPLX®

DISK S/N: 4455

A	ALL STEPS WERE MARKED 80KW.	DRAWN BY : BC DATE : 1/22/02

SIMPLX® SPRINGFIELD, ILLINOIS

SCALE : 1=1"	APPROVED BY :	DRAWN BY : BC
DATE : 1/16/02		REVISED : 1

RESISTIVE LOAD BANK
40KW,480V,3ø,60Hz

LBD-40 UL
NAMEPLATES

W.O.# 49406-01-42

DRAWING NUMBER
47BD124159A

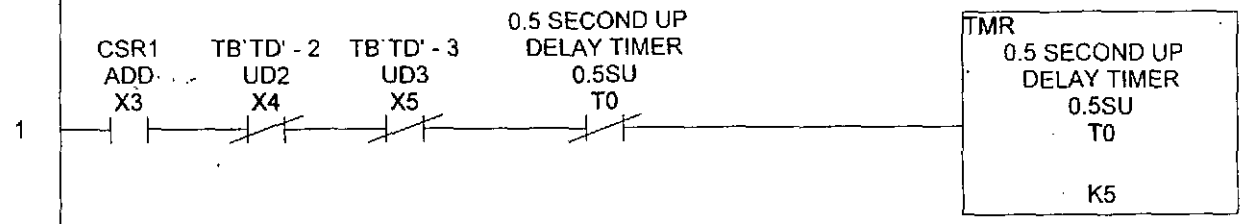
WORK ORDER: 49406

LBD-40 UL

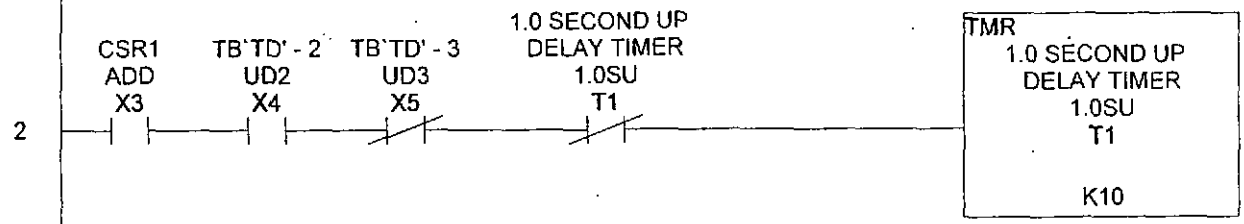
40KW, 480VAC, 3-PHASE, 60Hz
5KW STEP RESOLUTION
DL-105 PLC
PROGRAM: 49406PLC
DISK: 4455
DRAWING: 47B124153A
DirectSOFT

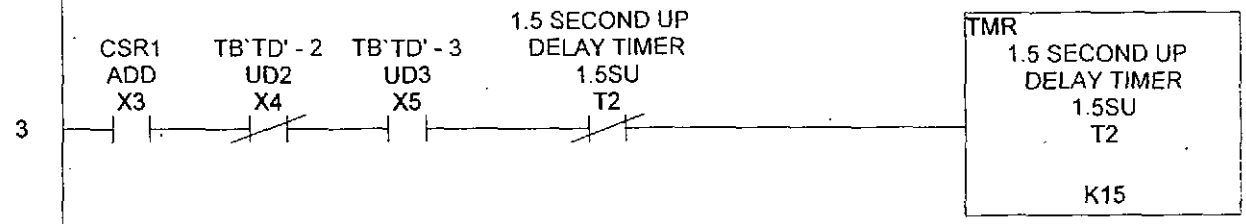
The following rungs establish which timer is used for the step-up delay based on customer input to terminal block TB`TD':

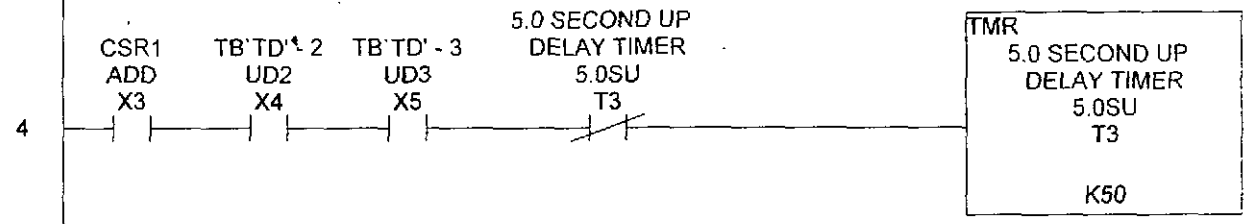
When this timer is energized, it counts 5 x 0.1sec and then closes/opens it's contacts. When the NC T0 contact in front of the timer opens, the timer de-energizes, and the count value is reset.



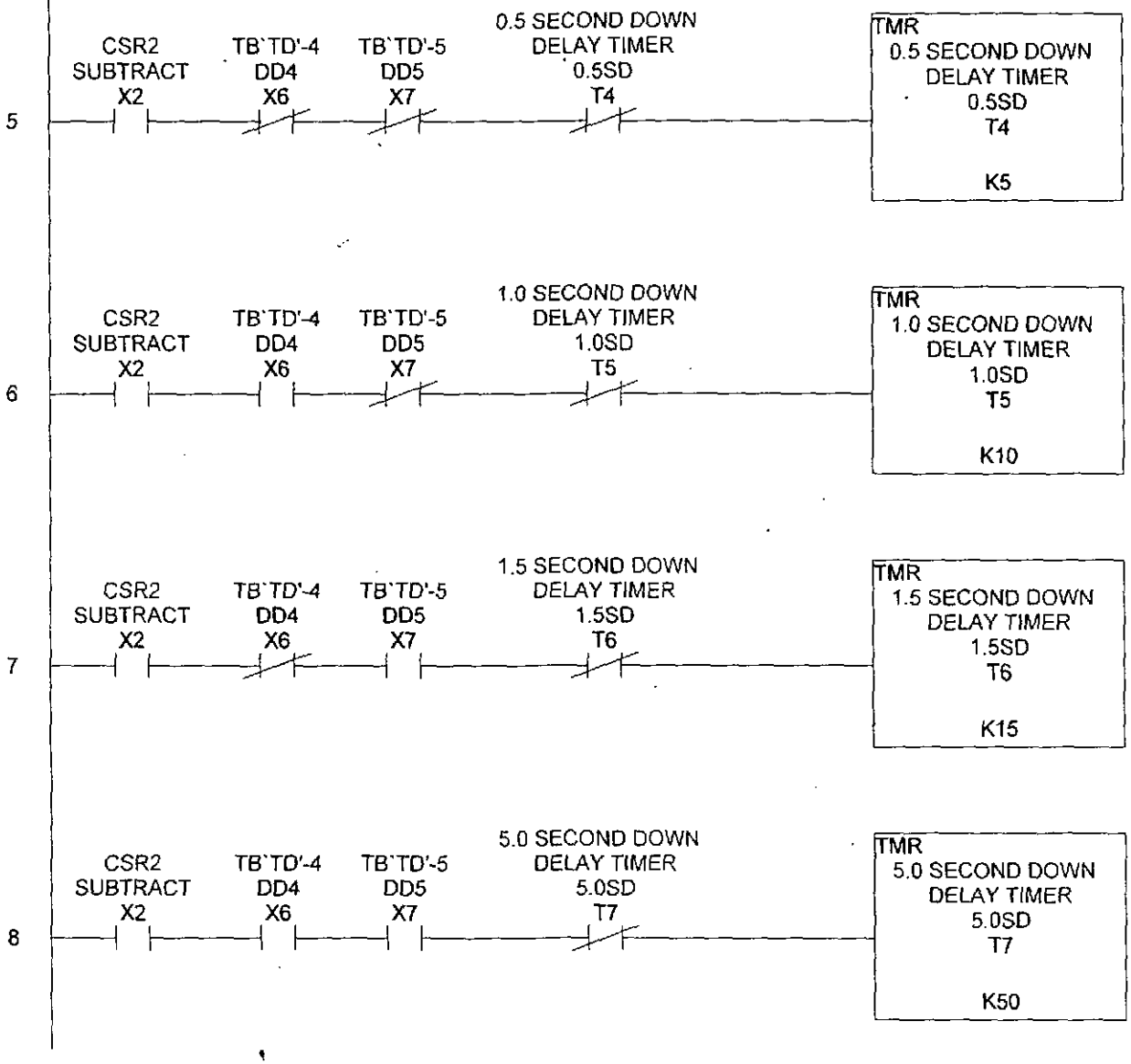
Initialize remaining up timers:



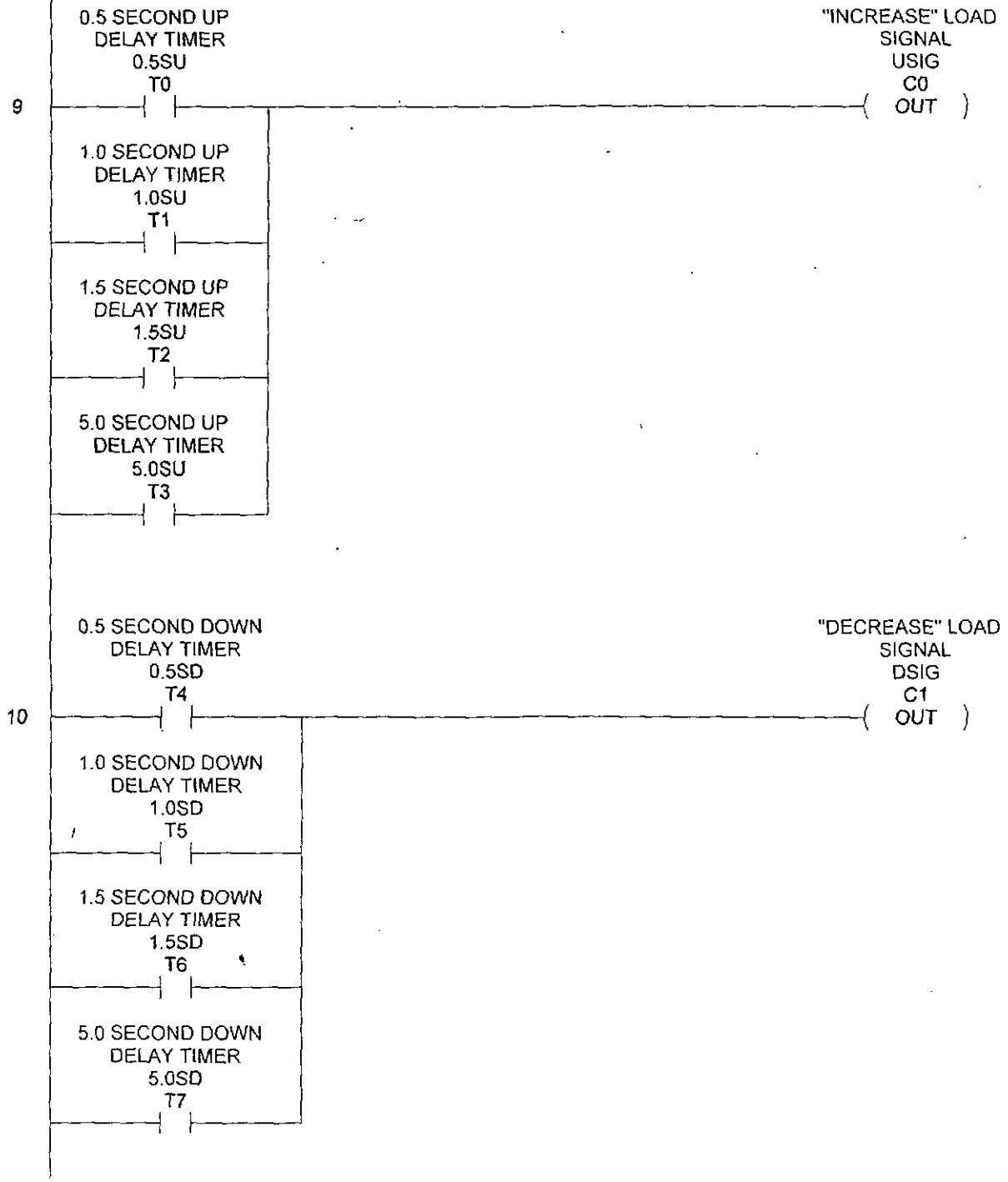




Determine the step down delay in the same fashion:



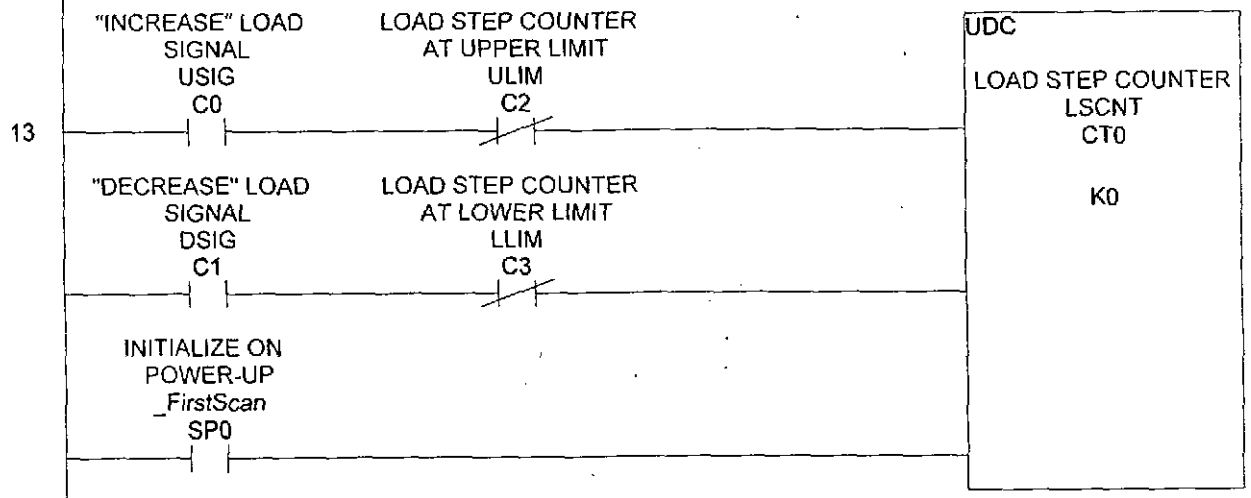
Translate up and down timer inputs into a single "increase load" or "decrease load" signal.



Setting up the Load Step Counter:

Set the upper and lower limits of the counter:

Define the counter:



Determining which load steps are on at what counts of the Load Step Counter: