LOAD BANK
TECHNICAL MANUAL
(LBD Series)

Customer: XXXXXX

Work Order: XXXXX-XX-XX

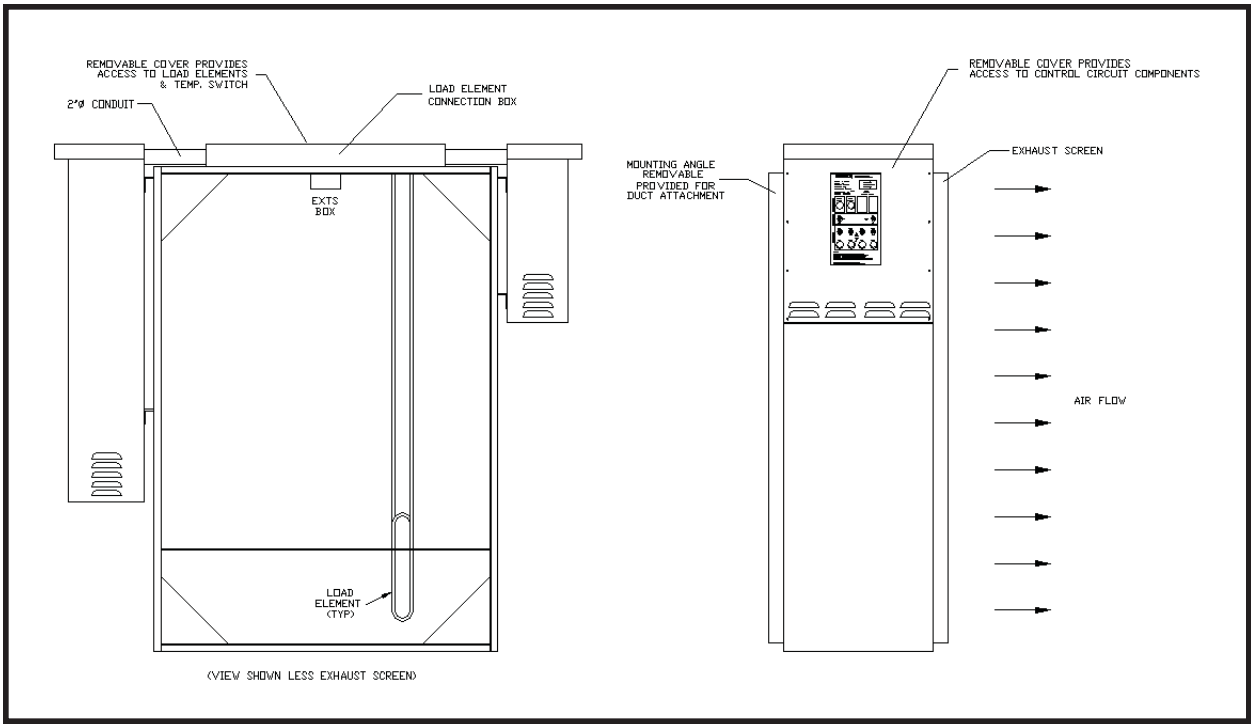
Model: LBD Cosentini

April 2011

(File: LBDCos5p.indd)

Contents

Simplex, Inc., 5300 Rising Moon Road, Springfield, IL 62711-6228 • 217-483-1600 • Fax 217-483-1616



Part of Typical Pictorial Drawing

DESCRIPTION

Simplex LBD Cosentini 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 Cosentini 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.

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.

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

The Control Panel contains the following components:

1. "Cooling Failure" and "Normal Operation" lamps
2. "Fan/Control Power" switches: "On/Off" or "Manual/Off/Auto"
3. Master Load and load step switches
4. Load step indicator lamps (if equipped)

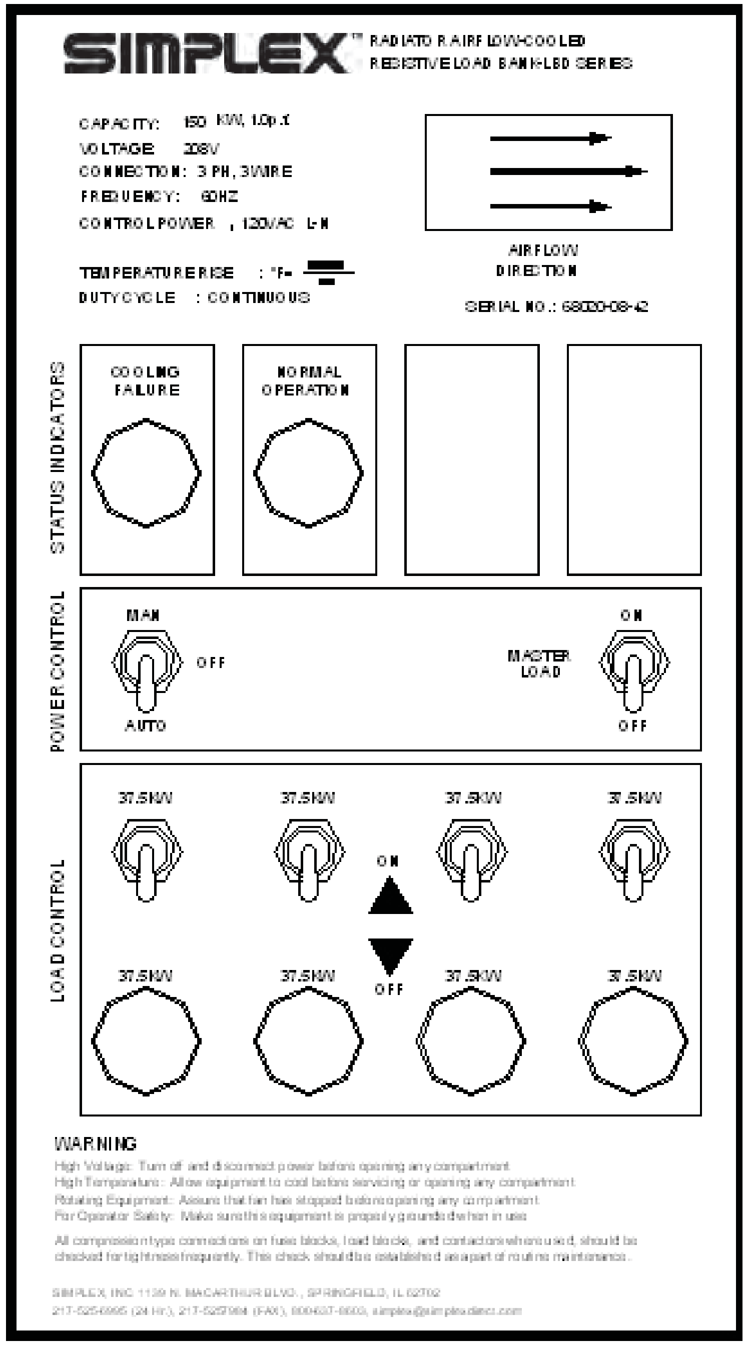
This Load Bank is protected against cooling failures (high exhaust air temperature which could damage the Load Bank or present a safety hazard to the operator). The "Normal Operation" lamp illuminates when Control Power is available and the Cooling System is operating properly. When a cooling failure occurs the automatic safety features in the Control System immediately remove the load from the test source and illuminates the "Over Temperature" lamp. The malfunction must be corrected and the Load Bank must be reset by turning the Load Bank "Off" then "On" before the load can be re-applied.

The Load Bank consists of two principal systems:

1. Control System
2. 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 a cooling failure. The Load Bank Control System is comprised of a Programmable Logic Controller (PLC) and 120V discrete components. Control Power (120V) is usually supplied to the Load Bank via the test source line to neutral.



Control source power is sensed by the Kilowatt Transducer (KWT). The Voltage Sensing Relay (VSR) monitors the Main Load Bus (MLB). When the generator supplies voltage to the Main Load Bus (MLB) the relay energizes. VSR contacts close. The circuit to the PLC is completed when the Control Power Relay (CPR) energizes and closes its contacts. If the generator voltage is removed, the VSR de-energizes. VSR contacts open and interrupt the power path to the PLC. This prevents the automatic control circuitry from energizing load steps when the load source is not active.

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.

Pow'r Rod Load Elements

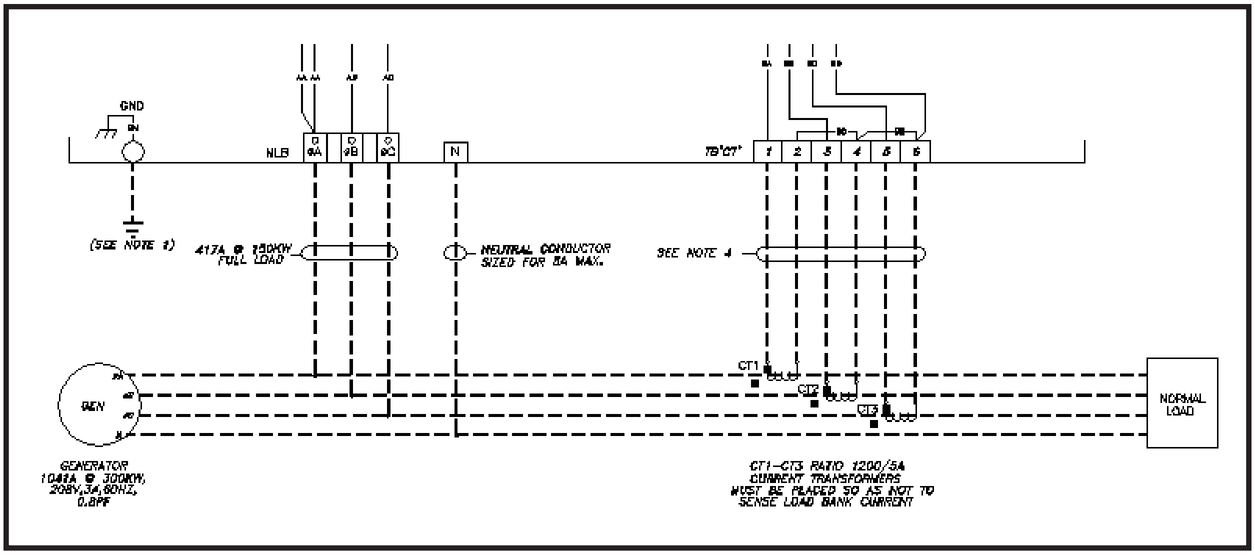
Simlpex Pow'r Rod Load Elements are UL recognized. These elements are totally enclosed, sealed and weatherproof. Pow'r Rod elements consist of nickel-chromium resistance wire electrically insulated and sealed within a metallic sheath. The hazard of electric shock to personnel and the danger of short 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.

PRIMARY INSPECTION

Preventative visual inspection of the shipping crate and Load Bank must be performed before installation. Physical or electrical problems due to handling and vibration may occur during shipment.

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. Rotate and push all switches through all positions to ensure smooth operation.
4. Inspect the bottom of crate/enclosure for any components that may have jarred loose during shipment such as indicator light lenses, switch knobs, etc.
5. Visually inspect element chamber for foreign objects and mechanical damage.

If any problems are observed during Primary Inspection call the Simplex Service Manager at 217-483-1600 (24hrs.)



Part of Typical Control Section Drawing

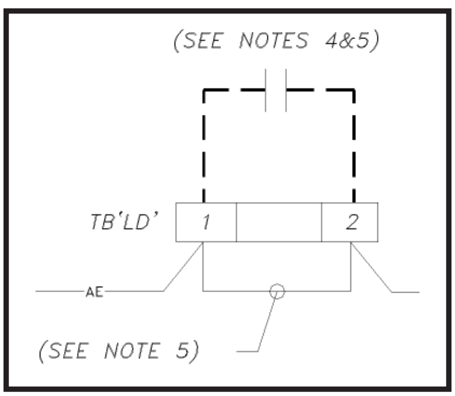
INSTALLATION

1. Confirm the test source is properly grounded.
2. *See Pictorial Drawing.* Using holes, brackets and angles provided, mount the Load Bank.
3. Ground the Load Bank to its own independent ground.
4. Confirm all switches on the control panel are in the "Off" position.
5. *See the Control Section Drawing.*
   a. If Load Dump feature is desired, remove the factory installed jumpe at TB'LD' 1–2 and connect customer supplied Load Dump contacts to TB'LD' 1–2 as shown.
   Open contacts to dump load.
   Close contacts to apply load.
   Consult NEC for proper wire size.

⚠ WARNING ⚠

Never operate or service a Load Bank that is not properly connected to an earthground.

   b. Place Current Transformers CT1, CT2 and CT3 in a position between the Generator and Load which does not sense Load Bank current.
   c. Using #14 AWG copper wire or greater with a torque of 35 in. lbs. connect TB'CT' 1–6 to CT1, CT2 and CT3 as shown.
   d. Connect the Main Load Bus (MLB) to the Generator.
   Consult NEC for proper wire size.



Part of Typical Control Section Drawing

OPERATION

1. Start-up generator or bring other test source on line.
2. Adjust power source voltage and frequency.
3. Place the "Control Power" switch in the "On" position or the "Manual or Auto" position.

MANUAL

4. Select the desired load steps by placing them in the "On" position.
5. 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.
6. Adjust source voltage and load. Monitor as needed.

AUTOMATIC

When the "Control Power" switch is placed in the "Auto" position, the Programmable Logic Controller (PLC) and the Watt Transducer (KWT) are used to sense power direction and magnitude and automatically maintain a preset load as well as act as a power sink.

Delay settings are adjustable via pots on the PLC. See the Control Section Drawing for your Load Bank for specific settings.

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.

⚠ 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.

⚠ WARNING ⚠

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

⚠ 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.

SHUTDOWN

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

COOLING FAILURE DETECTION

Excessive exhaust temperature is indicated as a “Cooling Failure” on the Control Panel. When a cooling failure occurs the automatic safety features immediately remove the load from the load source. The malfunction must be corrected and the Load Bank must be reset by turning the Load Bank “Off” then “On”.

The cooling failure detection system consists of the Exhaust Temperature Switch (EXTS) and the Programmable Logic Controller (PLC). These components are connected in series. Cooling air temperature above the EXTS setpoint, opens the EXTS and interrupts the power circuit to the Control Input on the PLC. The PLC senses the failure and disables all load step contactors.

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 openings, cooling chamber, and exhaust screens and louvers 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 exhaust side.

⚠ WARNING ⚠

If a failure occurs the corresponding status indicator will be present 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”.

⚠ WARNING ⚠

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

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. The vibrations caused by the generator set 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, control power, anti-condensation heater power, etc.

COOLING FAILURE INDICATED

1. Over temperature sensor failure
2. Loss of genset exhaust
3. Air restriction (intake or exhaust)

TEST METERS DO NOT OPERATE PROPERLY

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

⚠ WARNING ⚠

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

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 Legend 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 Number are located on each drawing. A typical drawing legend and parts list is illustrated at right.

SIMPLEX™ SPRINGFIELD, ILLINOIS		
SCALE : ~	APPROVED BY :	DRAWN BY : AZM
DATE : 4/11/11		REVISED :
RESISTIVE LOAD BANK 250KW,480V,3Ø,60HZ	LBD-COS-250 POWER DISTRIBUTION	
W.O. #74356-11-43		DRAWING NUMBER 214189

ITEM	QTY.	PART #	DESIG.	DESCRIPTION
1	24	24328500 (24328530)	LR1-LR24	LOAD ELEMENTS,8333W@240V OPERATING AT 6259W@208V 60", INCOLLOY SHEATH
2	8	13027040	C1-C8	CONTACTOR 63A,600V,3POLE 120VAC COIL
3	1	14035500	CF1	FUSE 5A,600V,200KAIC
4	3	13906000	CF2-CF4	FUSE 0.5A,600V,200KAIC
5	24	14086000	F1-F24	FUSE 70A, 600V, 200KAIC
6	1	15012500	[CF1-CF3]	FUSEBLOCK 30A, 600V, 3 POLE
7	1	15010000	[CF4]	FUSEBLOCK 30A, 600V, 1 POLE
8	2	25672000	TB'C,CT' TB'CP1' TB'LD'	TERMINAL BLOCK 30A, 300V, 18 LINE
9	1	25663600	N	TERMINAL BLOCK 30A, 300V, 2 LINE
10	7	24827030	SR1-SR4 AMR,CPR OTR	GENERAL PURPOSE RELAY 10A,3PDT,240V 115VAC COIL
11	7	24882025	[ITEM-10]	RELAY BASE 3-POLE, SCREW TRM
12	1	24874005	VSR	VOLTAGE SENSING RELAY UPPER ADJ. 80-150V LOWER ADJ. 30-99%
13	1	25108000	R1	RESISTOR 5K OHM FIXED, 5W, 10%
14	1	25302000	S1	SWITCH DPDT,CENTER-OFF,TOGGLE
15	5	25301000	S2-S6	SWITCH DPDT,TOGGLE
16	1	24251500	L6	INDICATOR, RED 120V

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 sub-system

CPC - Pilot contactor-Contactor that must be energized before load is applied.

CPF - Control power fuse

CT - Current transformer-Transformer used in metering circuits

DC - Direct current

DHF - De-humidity control fuse

DHR - De-humidity control relay

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

GPM - Gallons per Minute

HCF - Humidity Control Fuse

HCR - Humidity Control Relay

HMD - Humidistat

HTR - Heater Strips

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

LBA - Load Bank Available Relay

LFR - Loss of Flow Relay

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

MF - Meter fuse

MLB - Main line bus

MOT - Motor

NEMA - National Electrical Manufacturer's Association

NSR - Normal Source Relay

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

OPR - Over Pressure Relay

OTR - Over Temperature Relay-Used in overtemperature failure system

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

PLC - Programmable Logic Controller

PT - Potential Transformer

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

PFM - Power factor meter

PS - Pressure switch-Normally closed switch used to detect fan failure

PSI - Pounds per square inch

PSR - Pump Start Relay

RML - Remote Master Load Relay

RR - Run relay

RS - Remote Load Step Relay

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

TB - Terminal block

TD-0 - Time Delay Timer-Delay on operate

TD-R - Time Delay Timer-Delay on release

TDR-0 - Time Delay Relay-Delay on operate

TDR-R - Time Delay Relay-Delay on release

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

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

UPS - Uninterruptable power source

V - Voltage

VO - Valve Operator

VOR - Valve Operator Relay

VSR - Voltage sensing relay

WFS - Water Flow Switch

WPS - Water Pressure Switch

WTS - Water Temperature Switch

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

$$\text{Average Current} = \frac{A_1 + A_2 + A_3}{3} = \frac{249+250+254}{3} = 251A$$

$$\text{Average Voltage} = \frac{V_{1-2} + V_{2-3} + V_{3-1}}{3} = \frac{481 + 479 + 483}{3} = 481V$$

$$\text{Kilowatts} = \frac{\text{Volts x Amps x } 1.732}{1000} = \frac{481 \text{ x } 251 \text{ x } 1.732}{1000} = 209.1KW$$

Single Phase

Current Reading: 150A Voltage Reading: 240V

$$\text{Kilowatts} = \frac{\text{Volts x Amps}}{1000} = \frac{150 \text{ x } 240}{1000} = 36.1KW$$

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	$\frac{\text{1.732 x Volts x Amps x PF*}}{1000}$	
		*Power Factor, expressed as decimal. (Resistive Load Bank PF is 1.0)	
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	$\frac{\text{1.732 x Volts x Amps x } \sqrt{1-PF^2}}{1000}$	

APPENDIX C - TORQUE VALUES

FAN BLADES		
FAN PART NO.	BOLT SIZE	TORQUE FT LBS // IN LBS
13820000	SET SCREW	11.7 // 140
13820500	SET SCREW	11.7 // 140
13821000	SET SCREW	8.3 // 100
13822000	1/4 — 20	7.5 // 90
13823000	1/4 — 20	7.5 // 90
13824000	1/4 — 20	7.5 // 90
13825100	1/4 — 20	7.5 // 90
13826000	1/4 — 20	7.5 // 90
13827500	5/16”	13 // 156
13827600	5/16”	13 // 156
13828000	3/8”	24 // 288

MOTORS, BRACKETS, BUS BAR CONNECTIONS		
BOLT/NUT SIZE	GRADE	TORQUE FT LBS // IN LBS
.250 (1/4-20)	Grade 5, dry	8 // 96
.250 (1/4-20)	Grade 2, dry	5.5 // 66
.312 (5/16)	Grade 5, dry	17 // 204
.312 (5/16)	Grade 2, dry	11 // 132
.375 (3/8)	Grade 5, dry	30 // 360
.375 (3/8)	Grade 2, dry	20 // 240
.437 (7/16)	Grade 5, dry	50 // 600
.437 (7/16)	Grade 2, dry	30 // 360
.500 (1/2)	Grade 5, dry	75 // 900
.500 (1/2)	Grade 2, dry	50 // 600
.562 (9/16) & up	Grade 5, dry	110 // 1320
.562 (9/16) & up	Grade 2, dry	70 // 840

CONTACTORS
See torque values on the front of the contactor.

ELEMENTS/TRAYS		
TERM/NUT SIZE		TORQUE INCH LBS
#6	Rod ends	4
#10	Element Conn.	20
1/4-20	High Voltage	Contact Simplex

MAIN LOAD BLOCKS- ALL SIZES		
CONNECTION	WIRE SIZE	TORQUE FT LBS // IN LBS
LOAD SIDE	4-14AWG	2.9 // 35
LINE SIDE	500MCM-4/0	31 // 375
	3/0-4/0	20 // 240
	2/0-6AWG	10 // 120
	8AWG	3.3 // 40

CIRCUIT BREAKERS		
STYLE	WIRE SIZE	TORQUE INCH LBS
Cutler-Hammer 1-Phase	14-10 AWG	20
	8 AWG	25
	6-4 AWG	27
	3-1/0 AWG	45
Merlin Gerin 3-Phase	14-1/0	50

APPENDIX C - TORQUE VALUES CONT'D

FUSEBLOCKS

MANUF. PART NO.	WIRE SIZE	TORQUE INCH LBS
BM6031SQ, BM6032SQ, BM6033SQ; 600V, 30A	10-18 AWG	20
T60060-2SR 600V, 60A	10-18 AWG	20
T60030-3CR, 600V, 30A T60060-3CR, 600V, 60A 60100-3CR, 600V, 100A	10-14 AWG	35
	8 AWG	40
	4-6 AWG	45
	2-3 AWG	50

MISCELLANEOUS-TERMINALS, METERS, SWITCHES, COILS, RELAYS, XFORMERS

CONNECTION SIZE	TORQUE INCH LBS
4	5
6	10
8	19
10	31
1/4-20"	66

TAPER-LOCK BUSHINGS

BUSHING NUMBER	TORQUE
1008, 1108	55 IN LBS
1210, 1215, 1310, 1610, 1615	15 FT LBS
2012	23 FT LBS
2517, 2525	36 FT LBS
3020, 3030	67 FT LBS
3535	83 FT LBS
4040	142 FT LBS
4545	204 FT LBS
5050	258 FT LBS
6050, 7060, 8065	652 FT LBS
10085, 12010	1142 FT LBS

CAM-LOK STUDS

THREADED STUD	MAXIMUM TORQUE
5/16" – 18	15 FT LBS
1/2" – 13	40 FT LBS

