

**AVTRON MODEL K711
LOAD BANK
Part Number K711D36027**

600 kW @ 480 VAC, 3-Phase, 60 Hz
50, 50, 100, 100, 100, 100, and 100 kW
CFM REQUIRED: 61152

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AVTRON MODEL K711A LOAD BANK

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APPENDIX - Avtron Load Bank Troubleshooting Guide

SUPPLEMENTAL INFORMATION

Avtron Bulletin 202	Installation Notes - Engine Generator Duct Type Load Banks
Avtron Bulletin 203	Sample Calculations Engine Generator Duct Type Load Banks

DRAWINGS

SB2196	Outline Drawing Enclosure, Wall Mount
SB2287	Outline Drawing, Load Bank
D36028	Load Bank Schematic/Interconnection Diagram

AVTRON MODEL K711
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SECTION I

SAFETY CONSIDERATIONS

Throughout this manual, you will find **WARNING** and **CAUTION** statements. Personal injury or death may occur to an operator using or repairing the equipment if a **WARNING** statement is ignored. Damage to the equipment and potentially hazardous conditions for personnel may occur if a **CAUTION** statement is ignored.

Each Avtron unit is safety checked for opens and shorts, and the insulation is high potential tested to ensure safe operation. All fuses, safety interlocks, and related safety equipment have been proven reliable as part of the testing procedure of each unit.

As part of your safety program, an initial inspection after receiving the unit(s) and periodic preventive maintenance and safety inspections should be conducted to ensure the reliability and safety built into your Avtron equipment.

The Model K711 Load Bank is an industrial test unit designed to be used indoors safely. The unit will be installed in an enclosure. However, because the function of the Load Bank is the dissipation of electrical energy, there are inherent dangers to operators and equipment. These dangers are outlined in this section.

Electrical energy is transformed into heat by the resistors. This heat must be removed from the Load Bank by the customer-supplied cooling fans/blowers. If there is any restriction or stoppage of airflow, the Load Bank will overheat and may start a fire. It is recommended that:

1. The operator should read the manual before using the Load Bank.
2. Run an approved ground wire from the Load Bank ground lug(s) to the generator frame. Run an approved ground wire from the generator frame to a good earth ground. Size ground wire in accordance with National Electrical Code and any local codes.
3. Do not bypass the exhaust over-temperature switch to prevent nuisance tripping.
4. Replace any burned out bulbs on the control panel. Each lamp is an indication that a system is active or has failed and is important to the operation of the Load Bank and safety of the operator.
5. Maintenance personnel must always exercise caution when the access panels or intake screens are removed. Personal injury from electrical shock may result if all sources of power

- are not disconnected before servicing. Maintenance work must be done only by qualified personnel.
6. The Load Bank must be used in a cool, well ventilated area as described in the INSTALLATION section of this manual. Do not allow exhaust air to recirculate through the Load Bank. This causes a constant rise in cooling air temperature and may cause the Load Bank to overheat.
 7. Venting the heated air from the exhaust toward overhead cables, sprinkler systems, or into a room with insufficient volume or "Make-Up" air is a definite hazard. The Load Banks should be used in a cool, well ventilated area. This Load Bank is specifically designed for use within an enclosure.
 8. After running a load test, residual heat may be removed from the Load Bank and downstream duct work by allowing the fans to operate for a few minutes after load is removed. This procedure is not required for maintaining Load Bank integrity, but it may guard operating personnel from possible burn injuries.
 9. The operator should avoid coming in contact with the resistor elements or surrounding covers during and for some time after operation. These portions of the Load Bank become quite hot and may result in a serious burn should contact be made with them.
 10. Do not allow objects to enter or block the air intake or exhaust of the Load Bank. A blockage can cause Load Bank overheating. If an object enters the screens, it will cause damage to the resistor elements, possibly shorting them and causing shock and/or fire hazards.
 11. Operators must not operate the Load Bank with the access panels or screens removed. To do so exposes the operator and other persons to possible personal injury from electrical shock.
 12. Emergency Shutdown Procedure
 - A. In an emergency, turn off the MASTER LOAD switch, then the generator. The MASTER LOAD switch will allow disconnection of all load steps.
 - B. The power ON/OFF switch will disconnect all load steps. The Generator Emergency "OFF" switch should be located near the load system.
 13. An approved electrical fire extinguisher should be on hand at all times.
 14. It is the responsibility of the customer to take diligent care in installing the Load Bank. The National Electrical Code (NEC), sound local electrical and safety codes, and the Occupational Safety and Health Act (OSHA) should be followed when installing the equipment to reduce hazards to persons and property.
 15. Read and heed all **WARNING** and **CAUTION** statements in the manual.

SECTION II

DESCRIPTION

The Avtron Model K711D36027 Load Bank is a duct mount style unit designed to provide a balanced resistive load of unity power factor, at a specified 3-phase voltage. The total load capability of the K711 Load Bank is 600 kW at 480 VAC, 3-phase, 60 Hz. Load steps are 50, 50, 100, 100, 100, 100, and 100 kW. Using the toggle switches on the control panel, any combination of the available load steps may be selected to achieve a desired load.

An integral 480:120 volt control transformer is installed to provide 120 VAC, single phase, 60 Hz control power.

A generator exerciser/controller is built into the Load Bank. This controller consists of a programmable weekly timer, which will initiate a generator start signal. After an adjustable time delay period, the Load Bank will apply load blocks of 100, 150, 150, and 200 kW sequentially. After an adjustable exercise period, the load steps will be removed, based upon adjustable timed settings.

The control panel contains a POWER ON-OFF switch with a POWER ON light, an OVER TEMP light, a MASTER LOAD ON-OFF switch, a MODE SELECT MANUAL/AUTOMATIC switch, an AUTO ON light, a clock, and individual KW LOAD STEP switches. All load step switches are the toggle type with metal levers. The control panel also contains a FUSE for protection of the control circuit. A Digital Metering Package is also included which monitors Volts, Amps, Frequency, and kilowatts.

The control panel is supplied mounted in a remote wall mount enclosure. Refer to SB2196 for dimensional information.

The Load Bank is sized for a core size of 104” high by 98” wide. Refer to SB2203 for dimensional information.

CAUTION

Never exceed the rated voltage as this will cause the Load Bank to overheat.

Do not apply DC voltages as the contactors do not have arc blowout magnets.

SECTION III INSTALLATION

INSTALLATION CHECKOUT PROCEDURE - TO BE DONE PRIOR TO OPERATION

This Installation Checkout Procedure is intended to be used upon initial receipt of equipment and following any relocation of a permanent mounted Load Bank. These procedures apply to Load Banks in general and may include steps not relevant to the specific unit being installed. Disregard those procedures which do not apply.

WARNING

THE FOLLOWING TESTS ARE TO BE ACCOMPLISHED BY A QUALIFIED ELECTRICIAN OR TECHNICIAN USING EXTREME CAUTION AS POTENTIALLY LETHAL VOLTAGES AND DANGEROUS ROTATING COMPONENTS ARE PRESENT. IF ASSISTANCE IS REQUIRED, AVTRON CAN PROVIDE START UP SERVICE AT A NOMINAL CHARGE. AVTRON ALSO WILL PROVIDE TELEPHONE ASSISTANCE IF REQUIRED BY CALLING (216) 641-8310.

1. Verify the Load Bank placement meets the installation requirements found in the INSTALLATION section of the instruction manual:
 - A. Check the clearance from both intake and exhaust to any obstruction.
 - B. If the location has a prevailing wind, make the wind aid in the cooling of the resistor elements.
 - C. Duct exhaust air outdoors via a customer-supplied exhaust hood which, along with intake losses, creates no more than 0.25" total system static pressure (pressure drop).
2. Check the mechanical integrity of all customer-supplied interconnection wiring:
 - A. Check lugs that they are properly crimped.
 - B. Check terminations that they are properly torqued.
3. Utilize system schematics to ohm out customer-supplied interconnection control wiring and safety circuits:

- A. If control wiring is all the same color, ohm out each individual wire to confirm proper labeling and placement.

CAUTION

Control wiring must be a minimum of 14 AWG for wire runs under 50 feet. Consult Avtron factory for wire sizing when wire run exceeds 50 feet.

- B. Confirm the correct wire gauge has been used for interconnection wiring. Control wiring should be a minimum of 14 AWG for control panel to Load Bank lengths of 50 feet or less. For lengths of greater than 50 feet, consult the factory.
4. Energize the source of control power only:

Check the control voltage and confirm it is within 10% of the required voltage.

WARNING

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

5. Verify the proper relays energize with each individual load switch.
- A. Turn on each load step individually and observe that each relay or relays pulls in without chatter or hesitation.
 - B. Turn off the master load switch. Turn on all the load steps. Turn the master load on and observe the pull in of all the contactors. If chatter or hesitation is observed, locate the cause of the voltage drop causing the problem.

This checkout procedure is intended to be a guide to Load Bank installations in general. Special installation considerations not addressed herein may be necessary due to installation site or environment. Any questions or concerns regarding Load Bank installation should be directed to Avtron Field Service at (216) 641-8310.

LOCATION

The Load Bank must be used in a cool, well ventilated area. It must be installed where cool air is continually available and where hot exhaust air will not be recirculated through the Load Bank. The Load Bank must not be operated in a closed space.

The exhaust air may exceed 300°F above ambient under full load conditions. The unit must not be installed near any equipment, wiring, or plumbing which may be damaged by high air temperatures or which may constitute a fire hazard.

AIRFLOW CONSIDERATIONS

Even with an ample supply of cooling air, the Load Bank may overheat if it is not properly installed. There are two types of airflow problems that should be avoided:

1. Recirculating Airflow - If the hot, exhausted air is permitted to recirculate through the Load Bank, it will reach such a high temperature and low density that it will no longer cool the elements. A Load Bank should not be installed so close to any surface as to reflect the exhausted air back to the air intake.
2. Restriction of Cooling Air - Any obstruction located within five (5) feet of the inlet and twelve (12) feet of the exhaust hood (duct) will restrict the Load Bank's airflow. Airflow is also restricted when two or more Load Banks have air inlets positioned close to each other. This competition for cooling air causes a low pressure area, restricting adequate airflow.
3. The Load Banks are designed to tolerate up to 0.25" water gage additional system airflow resistance. This includes air intake resistance (building make up air pressure) and resistance due to exhaust duct/louvers/screen.
4. If exhaust duct exits through motorized louvers, the design must be interlocked to assure full open prior to operation. Consideration must also be given for louver design and actuator to prevent heat problems.

Consult the factory if strong prevailing winds exist.

CONTROL CONNECTIONS

The control panel is supplied mounted in a 19-inch rack-type enclosure. Connect terminals of the control panel to terminals of the Load Bank as shown on the schematic/interconnection diagram D36028.

Control power is derived from an externally supplied 480V, 3-phase, 60 Hz power source connected to the Load Bank terminal block TB1 terminals 19 and 20 as shown on schematic D36028.

LOAD CONNECTIONS

Load connections are made to the main line power distribution bus bars. (Refer to Outline Drawing SB2203.) The connections are marked A, B, and C. Cables to the Load Bank should be of adequate size to handle maximum rated load according to the National Electrical Code and any local codes.

The ampacities of these load connections are shown on the Load Bank schematic diagram, D36028.

GROUNDING

A permanent ground conductor must be connected to the Load Bank enclosure by an individual ground wire to prevent a potential above ground on the enclosure. This ground conductor should be run with the load power conductors to provide the lowest impedance fault path. The ground stud must be connected to both the power source frame and to a good earth ground. The ground conductor should be sized per the National Electrical Code Section 250-95, if not superseded by local codes.

SECTION IV OPERATION

CAUTION

Never exceed the rated voltage as this will cause the Load Bank to overheat, resulting in damage to equipment.

Do not apply DC voltages as the contactors do not have arc blowout magnets.

DO NOT allow objects to enter or block screens.

MANUAL OPERATION

1. Place all switches on the control panel to the OFF position. Place MODE SELECT MANUAL/AUTOMATIC operation toggle switch to MANUAL position.
2. Verify that all electrical connections (Control, Load, and Grounding) to the Load Bank have been completed as described in the INSTALLATION section.

CAUTION

DO NOT operate the Load Bank over the rated voltage as this will cause catastrophic failure in the Load Bank.

3. Place the control power ON/OFF switch to the ON position. The POWER ON light will be energized, indicating control power is present.
4. Start the generator under test.

5. The resistive loading is selected by toggle switches, using any one or combination of the toggle switches to make up a given load.
6. By placing the MASTER LOAD switch to the ON position, the preselected load will be applied to the power source.
7. Any available load step can be added or removed as required while the MASTER LOAD switch is closed (ON).
8. To remove the load, open the MASTER LOAD switch by placing it in the OFF position.

MANUAL SHUTDOWN PROCEDURES

1. Place the MASTER LOAD switch to the OFF position.
2. Place the control power ON/OFF switch to the OFF position, and other switches on the control panel should be turned OFF.
3. Shut down the power source/sources.
4. Disconnect the Load Bank from the power source(s).

AUTOMATIC OPERATION

1. Place all switches on the control panel to the OFF position. Place MODE SELECT MANUAL/AUTOMATIC operation toggle switch to the AUTOMATIC position.
2. Verify that all electrical connections (Control, Load, and Grounding) to the Load Bank have been completed as described in the INSTALLATION section.
3. Place the control power ON/OFF switch to the ON position. The control power light will be energized, indicating control power is present. The AUTO ON light will also be energized.
4. When the programmed test cycle begins, a generator start signal will bring the engine generator on-line. The Load Bank will add load steps in increments of 100, 150, 150, and 200 kW. After the programmed exercise period has expired, the load steps will be removed. An adjustable generator cooldown period will allow the generator to operate in a no-load condition. Refer to schematic D36028 for field adjustable functions and settings.

EXERCISER/CONTROLLER THEORY OF OPERATION

The automatic exerciser/controller circuitry within the Load Bank allows for the generator to be exercised on a programmable, weekly basis.

A programmable weekly timer (K216) is installed on control panel D36083. During a programmed test cycle, a contact closure from K214 at TB1(17-18) will start the engine generator. K214 is a “delay-off” relay which, at the end of the programmed exercise cycle, (controlled by K215), will allow the engine generator to cool down, under a no load condition. When the proper temperature is sensed, K51 will energize. K51 will initiate the adjustable “delay-on” relays K202, K204, K206, and K208. These relays control adjustable “delay-off” relays K203, K205, K207, and K209, which in turn control pilot relays K210, K211, K212, and K213. Each pilot relay controls a portion of the Load Bank load. Based on the time delay settings of the adjustable relays, a wide range of exercise control is available. Reference schematic D36028 for sample control scheme.

SECTION V

MAINTENANCE

To provide long equipment life and to reduce the chance of electric shock, fires, and personal injury, good maintenance procedures must be used. Before servicing, review the SAFETY CONSIDERATIONS section of this manual.

The following examples of scheduled maintenance procedures are not intended to be all-inclusive, but must be accomplished to maintain the equipment in a good, safe condition. All maintenance work must be performed only by qualified personnel.

WARNING

Personal injury from electrical shock or from the moving fan blade may result if ALL sources of power are not disconnected. Refer to the SAFETY CONSIDERATIONS section of this manual.

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

DAILY

1. Remove any restrictions to the airflow through the Load Bank.
2. Check the screens to make sure that no objects have blocked or entered the openings. If freezing conditions exist (below 32°F or 0°C) and freezing rain, sleet, or snow block the exhaust hood/duct/louver, the following special precautions must be taken. Clear area around exhaust opening.
3. Verify that the airflow is in the proper direction.
4. Assure that there is no recirculation of the exhaust air through the Load Bank.

THREE MONTHS

1. Remove the access panels and screens, and inspect the load resistors for mechanical breakdown which is demonstrated by excessive sagging of the elements. Replace worn resistor elements with new resistor elements as required.
2. Inspect for broken ceramic insulators. Replace any broken or cracked insulator with a new ceramic insulator.
3. Inspect for loose hardware or loose connections. Tighten where required.
4. Inspect all connections for oxidation or corrosion. Clean the connection or replace the hardware where required.
5. Inspect all magnetic contactors to make sure that the contacts are not severely pitted or corroded. The contacts must move freely and be properly seated.
6. Clean all dirt and debris out of the Load Bank. This can be accomplished by blowing the inside of the units with clean, dry compressed air (not to exceed 40 PSI). Eye protection should be worn when cleaning the Load Bank with compressed air.
7. Inspect all the wiring for any sign of insulation failure.
8. Replace all access panels and screens. Tighten all the fastening hardware securely.
9. Check the indicator lamps on the control panel.

ANNUALLY

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

SECTION VI

REPLACEMENT PARTS LIST

INTRODUCTION

The parts list in this section contains the description, quantity required, and Avtron part numbers for each listed part. The list also includes, where appropriate, the manufacturer's name and part number, as well as schematic reference designators to facilitate parts identification.

NOTE

Every effort has been made to ensure the accuracy of this information. However, changes are sometimes necessary and revisions to the parts list may be made at any time without notice.

REFERENCE DESIGNATORS

Service personnel may use this parts list along with the Avtron system schematics to identify and order replaceable parts. The reference designators were carefully selected and matched to those on the schematic diagrams and equipment to simplify the troubleshooting and repair process.

NOTE

When ordering replacement parts, be certain to state the part's description, Avtron part number, and the schematic reference designator number if one is available. Also include the model and serial number of the equipment.

Replacement Parts List

Avtron Load Bank • Part Number K711D36027

SCHEMATIC REFERENCE	DESCRIPTION	MANUFACTURER and PART NO.	AVTRON P/N	QTY/UNIT
	AVTRON MODEL K711 LOAD BANK		K711- D36027	
	.SCHEMATIC/INTCON DIAGRAM		D36028	REF
	.INSULATOR		411141	1728
	.INSULATOR		411145	72
	.RESISTANCE ELEMENT		606337	72
K1, 2, 3A-7A, 3B-7B	.RELAY		B14796	12
F1-6, 7A-21A, 7B-21B	.FUSE, 80A, 600V1	LITTELFUSE JLLS-80	324420	36
XF1-6, 7A-21A, 7B-21B	.FUSEBLOCK	BUSSMANN T60100-3C	324967	12
	.CERAMIC		411181	144
	.CERAMIC		411182	288
S60	.TEMPERATURE SWITCH	EMERSON ELECTRIC 60T-13 203546	360379	1
CT2, 3	.CURRENT TRANSFORMER, 800:5	INSTRUMENT TRANSFORMERS 7RBT801	370908	2
	.CONTROL ENCLOSURE ASSEMBLY		D36083	1
	..SCHEMATIC/INTCON DIAGRAM		D36028	REF
S50	..SWITCH, TOGGLE	CARLINGSWITCH 2GL54-73	360591	1
S1-7, 20, 21	..SWITCH, TOGGLE	CARLINGSWITCH 2GK51-73	360589	9
F101	..FUSE, 600V, 10A	LITTELFUSE KLKR-10	324128	1
XF101	..FUSEHOLDER	BUSSMANN HPF-WT	325022	1
DS21	..LIGHT, INDICATOR, RED	DIALIGHT 556-3105-304	329714	1
DS20, 50	..LIGHT, INDICATOR, GREEN	DIALIGHT 556-3205-304	329715	2
K99	..RELAY	POTTER & BRUMFIELD T92S7A22120	350525	1
M1	..METER	MULTITEK M801-MD4-VE	336992	1
K216	..CLOCK, WEEKLY TIMER	OMRON ELECTRONICS H5S-B	369270	1
T1	.CONTROL TRANSFORMER	HEVI-DUTY ELECTRIC E500	370984	1
K215	.RELAY	OMRON ELECTRONICS H3CA	369269	1
K203, 205, 207, 209, 214	.TIMER, DELAY ON BREAK	SYRELEC SA 88-865-305	369262	5
XK215	.SOCKET, RELAY	OMRON ELECTRONICS P2CF-11	358656	1

Replacement Parts List

Avtron Load Bank • Part Number K711D36027

SCHEMATIC REFERENCE	DESCRIPTION	MANUFACTURER and PART NO.	AVTRON P/N	QTY/ UNIT
XF102-107	.FUSEBLOCK	BUSSMANN BM6033SQ	324615	2
XF102,103	.FUSE, 3A, 600V	LITTELFUSE KLDR-3	324453	2
F104-106	.FUSE, 1A, 600V	LITTELFUSE KLDR-1	324449	3
K202,204,206, 208	.RELAY, TIME DELAY	CROUZET 88-865-215	351981	4
XK51,201,210- 213	.SOCKET, RELAY	POTTER & BRUMFIELD 27E893	358280	6
K51,201, 210-213	.RELAY	POTTER & BRUMFIELD KUP14A15	351060	6
XK51,201, 210-213	.RETAINER, RELAY	POTTER & BRUMFIELD 20C318	467550	6
F107	.FUSE, 10 AMPS, 600V	LITTELFUSE KLKR-10	324128	1