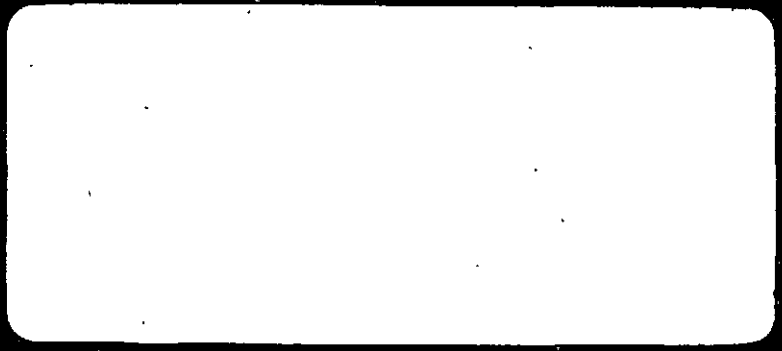
INSTRUCTION MANUAL

MODEL: K711C
200KW, 480V, 3P, 60H
PARTS #: 71872



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AVTRON MODEL K711
LOAD BANK, RESISTIVE, DUCT MOUNT
Serial Number 825 and Above

CJN 93430

Cleveland, Ohio

October 5, 1996

PROPRIETARY NOTE

This document contains information PROPRIETARY to Avtron Manufacturing, Inc., is furnished solely to provide information sufficient for instruction, operation, maintenance, evaluation, and testing of the equipment herein disclosed, is not to be used for manufacturing or procurement and is not to be disclosed to anyone other than persons in the Division, or the Company, or the Government, as the case may be, responsible for action relating to this document without the express written permission of Avtron Manufacturing, Inc.

WARRANTY

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

Feb. 1995

AVTRON MODEL K711C
LOAD BANK, RESISTIVE, DUCT MOUNT

January 2, 1997

AVTRON MODEL K711C
LOAD BANK, RESISTIVE, DUCT MOUNT
Part Number K711C-72-92-480-H

CJN 93430

Load Bank Ratings:

Total KW 200 KW

Operating Voltage (Volts, Phase, Frequency, Amps) 480VAC 3 Phase, 60 Hz., 240.6 Amps.

Minimum airflow required for full load operation 39,744 CFM

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BULLETINS

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203	Sample Calculations, Engine Generator, Duct Type Load Banks

PHZ/kv
1/2/97

DERIVATION OF K711C LOAD BANK PART NUMBER AND CALCULATIONS FOR AMPS AND AIRFLOW REQUIREMENTS

The K711C part number identifies the size and electrical characteristics which apply to a given unit. An explanation of how K711C part numbers are configured and how to decipher them follows:

K711C part numbers take the form K711C-YY-XX-VVV-C where:

YY = Height in Inches
XX = Width in Inches
VVV = Voltage (208, 240, 480, or 600V)
C = Load Steps (Quantity of load step precedes identifier if more than 1.)

LOAD STEP IDENTIFIER

A =	5 KW
B =	10 KW
C =	15 KW
D =	20 KW
E =	25 KW
F =	50 KW
G =	100 KW
H =	200 KW
J =	400 KW

EXAMPLE: K711C-40-36-208-3FG

DESCRIPTION - CORE SIZE 40"H x 36"W Rated 208V, 3-Phase, Bulk Load of 250 KW

To calculate the minimum airflow requirement:

MINIMUM CFM REQ'D = CORE DIMENSIONS (W" x H") x 6

To calculate Amperage: $\text{Amps} = \frac{\text{KW} \times 577}{\text{L-L Volts}}$

ESD PRECAUTIONARY GUIDELINES

C A U T I O N

Certain circuit card assemblies and their components, typically integrated circuits, may be damaged by seemingly undetectable electrostatic discharge (ESD). Care must be exercised during handling/repair of these items. Use electrostatic discharge precautionary procedures.

The following guidelines are not necessarily all inclusive but rather serve as reminders for good shop practices for the handling/ repair of ESD sensitive circuit card assemblies and devices.

- Store ESD sensitive items in their original containers. These items are often marked with the symbol shown at the top of this page.
- Put on a grounded wrist strap before handling any ESD sensitive item.
- Clear work area of Styrofoam^{R}*, plastic, and vinyl items such as coffee cups.
- Handle ESD items by the body, never the open edge connectors.
- Never slide ESD sensitive items over any surface.
- Transport ESD sensitive items in a static shielding container to a static-free work station.
- If a static-free work station is not available, ground the transport container before removing or inserting an ESD item.
- Electric tools used during repair should be grounded. For example, use only anti-static type solder suckers and grounded tip soldering irons. Discharge non-electric tools before use.
- Pack ESD items in static shielding containers before shipping them to Avtron for repair.

*Styrofoam^{R} is a registered trademark of Dow Chemical.

AVTRON MODEL K711C
LOAD BANK, RESISTIVE, DUCT MOUNT

SECTION I

SAFETY CONSIDERATIONS

Throughout this manual, you will find **WARNING** and **CAUTION** statements. Personal injury to an operator using or repairing the equipment may occur 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 insure 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 insure the reliability and safety built into your Avtron equipment.

The Model K711C Load Bank is an industrial test unit designed to be used indoors safely. However, because of the nature of the Load Bank function (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 cooling blower. If there is any restriction or stoppage of airflow, the Load Bank may overheat and may even start a fire. It is recommended that:

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

2. Run an approved ground wire from the Load Bank ground lug, located inside the load connection area to the generator frame. Run an approved ground wire from the generator frame to a good earth ground.

3. If your unit is equipped with an airflow safety or temperature switch, do not bypass the airflow safety or temperature switch to prevent nuisance tripping. The switches drop out load if insufficient air is reaching the load elements.

4. When installing the Load Bank, do not drill into side flanges. Use only top and bottom flanges as mounting locations. Compliance with this instruction helps guard against damage to internal wiring.

5. If the unit is to be installed within existing duct work, leave enough access area to easily remove access covers on each side of the Load Bank. Special consideration should be given to mounting surface material due to hot air exhaust.

6. Maintenance personnel must always exercise caution when the access panels 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.

7. Adequate airflow in cubic ft./min. (CFM) must be maintained at all times. (Refer to the DESCRIPTION section for minimum value of required airflow.) Failure to maintain this airflow evenly across the resistor elements may result in element burnout.

8. If duct work is vented through a screened exhaust or louvered exhaust, insure that the louvers (if motorized) are fully open when using the Load Bank. If exhausting through a screened opening, check screen periodically for any blockage.

9. After running a load test, residual heat may be removed from the Load Bank and downstream duct work by allowing the blower to operate for a few minutes after load is removed. This procedure is not required for Load Bank integrity, but it may guard operating personnel from possible burn injuries.

10. The operator should avoid coming in contact with the resistor elements or surrounding covers during and for some time after operation. These portions of the Load Bank become quite hot and may result in a serious burn should contact be made with them.

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

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

13. 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.

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

SECTION II

DESCRIPTION AND SPECIFICATIONS

The Avtron Model K711C is designed to be used as a duct- or radiator-mounted Load Bank providing custom tailored mounting and installation. The K711C provides a bulk resistive load rated as indicated on the Table of Contents. Minimum airflow required to cool the elements operating at full load is as indicated on the Table of Contents and must be maintained to ensure safe operation of the Load Bank.

****

C A U T I O N

To prevent load element burnout, adequate airflow must be maintained over the entire load element area at all times voltage is applied. Insufficient air for even a few seconds will cause element burnout. This unit must have uniform airflow over the entire outlet area. If there are dead spots, damage to the elements may result.

****

CONTROL PANEL

The K711C Load Bank is provided without a control panel. Load application and safety circuitry are the responsibility of the customer.

Interconnection wiring should conform to the National Electrical Code and any local codes.

LOUVERS (OPTIONAL)

The exhaust of the Load Bank may be protected by either a stationary or motorized louver assembly.

The motorized version includes a limit switch which prevents the application of load steps if the louvers are not fully open.

SECTION III

INSTALLATION

This Load Bank is designed for direct installation in a ventilation duct or on the exhaust end of a radiator. Use standard 1/4 inch hardware to mount the Load Bank to the duct or radiator. Do not extend the hardware into the Load Bank more than a maximum of 1/2 inch to insure adequate clearance between element terminations and mounting hardware. Bulletin 202 shows the proper positioning of the Load Bank in the air duct.

****

C A U T I O N

To prevent load element burnout, adequate airflow must be maintained over the entire load element area at all times voltage is applied. Insufficient air for even a few seconds will cause element burnout. This unit must have uniform airflow over the entire outlet area. If there are dead spots, damage to the elements may result.

****

In general, the protection provided external to the Load Bank is determined by the local codes. Since the Load Bank is generally part of an existing electrical installation, it must be protected by a fused disconnect or circuit breaker meeting all local codes.

Before making any electrical connections, the maximum phase current for the Load Bank should be determined. This may be done using the following formula.

$$I_{PHASE}(MAX) = \frac{KW \times 577}{V \text{ (Line-to-Line)}}$$

****

C A U T I O N

When installing the Load Bank, do not drill into side flanges. Use only top and bottom flanges as mounting locations. Compliance with this instruction helps guard against damage to internal wiring.

****

The electrical connections necessary for proper operation of the Load Bank are as follows:

1. Connect the load power source as indicated on the Schematic/ Interconnection Diagram.

2. A ground connection must be made to the Load Bank (GND terminal) to prevent injury to personnel. This may be accomplished by a ground wire connected directly to the Load Bank ground stud provided in the control box. This ground wire should be connected to the frame of the generator under test. The generator frame should be grounded to a good earth ground.

INSTALLATION CHECKOUT PROCEDURE - TO BE DONE PRIOR TO OPERATION

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

****

W A R N I N G

THE FOLLOWING TESTS ARE TO BE ACCOMPLISHED BY A QUALIFIED ELECTRICIAN OR TECHNICIAN USING EXTREME CAUTION AS POTENTIALLY LETHAL VOLTAGES AND DANGEROUS ROTATING COMPONENTS ARE PRESENT. IF ASSISTANCE IS REQUIRED, AVTRON CAN PROVIDE START UP SERVICE AT A NOMINAL CHARGE. AVTRON ALSO WILL PROVIDE TELEPHONE ASSISTANCE IF REQUIRED BY CALLING (216) 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. If the Load Bank is elevated, a plate under the Load Bank will be needed to block hot exhaust from returning to the intake.

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 wiring and safety circuits.

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.

SECTION IV

OPERATION

****

C A U T I O N

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

DO NOT apply DC voltages to the Load Bank.

To prevent load element burnout, adequate airflow must be maintained over entire load element area at all times voltage is applied. Insufficient air for even a few seconds will cause element burnout.

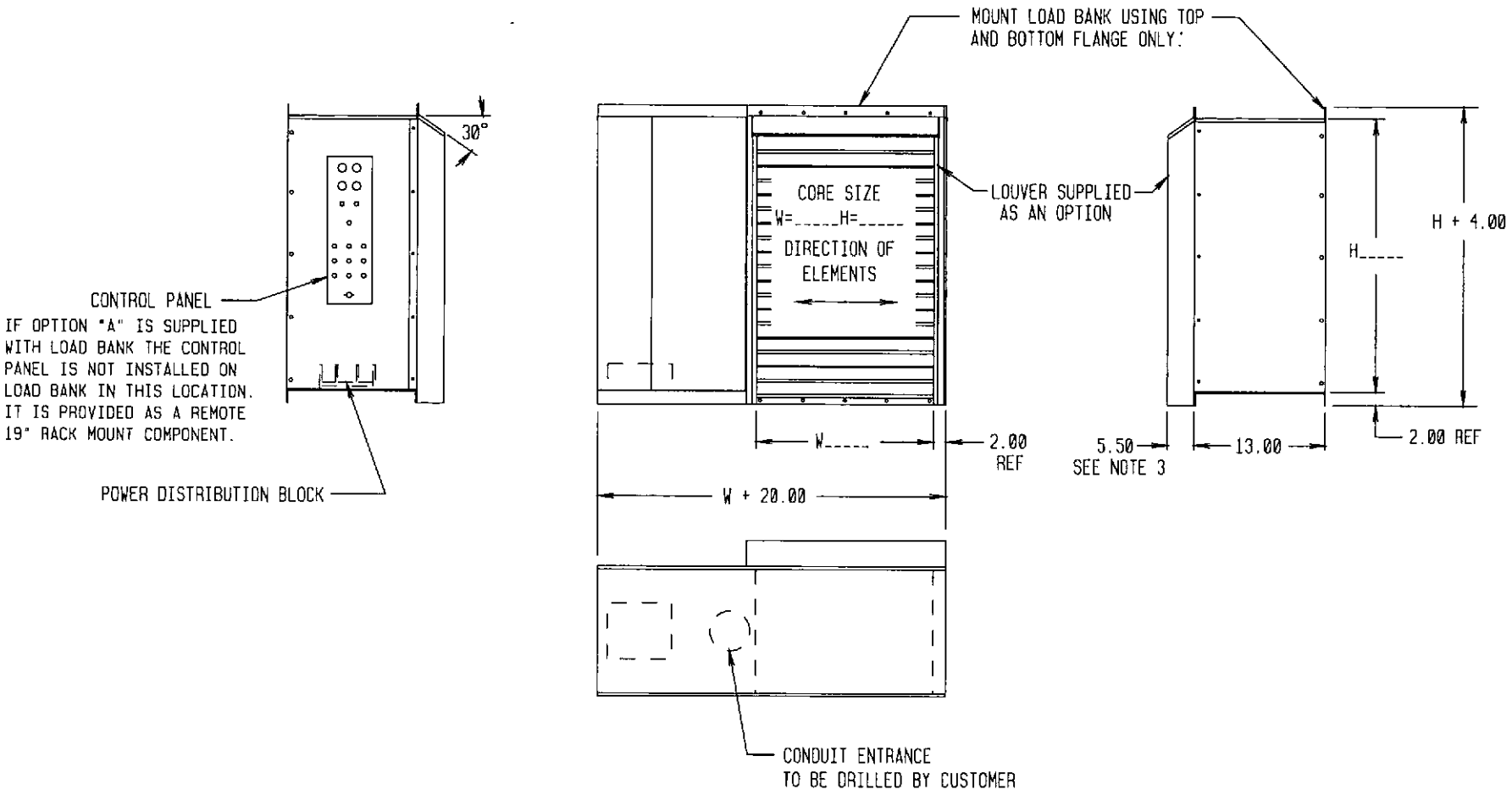
****

The K711C Load Bank is designed to supply a bulk load. No controls are incorporated into the unit. When the rated voltage is applied to the unit, the total KW load as listed in the Table of Contents will be applied. It is the customer's responsibility to interlock the overtemperature contact supplied to remove the applied voltage during an overtemperature or insufficient airflow condition.

DRAWINGS

PROPRIETARY NOTE

The wiring diagrams and schematics which follow contain information PROPRIETARY to Avtron Manufacturing, Inc., are furnished solely to provide information sufficient for instruction, operation, maintenance, evaluation, and testing of the equipment herein disclosed, are not to be used for manufacturing or procurement and are not to be disclosed to anyone other than persons in the Division, or the Company, or the Government, as the case may be, responsible for action relating to this document without the express written permission of Avtron Manufacturing, Inc.



3 - K711 LOAD BANKS, WITH OUTDOOR UL OPTION. USE A HOOD IN PLACE OF LOUVER. THE HOOD DEPTH WILL CHANGE THE 5.50 DIMENSION TO "H" OR THE SAME AS THE HEIGHT OF THE CORE.

2 - ALL DIMENSIONS ARE APPROX.

1 - WEIGHT:

NOTES:

FOR APPLICATION ENGINEERING USAGE ONLY

CHG. NO.	LOC LET.	CHANGE	CHG'D	CHK'D
C		REV PER ECN AB525 D.LOREK	7/25/95	BOHRER
B		REV PER ECN ZIVKOVIC	6/1/94	BOHRER
A		REVISED PER ECN	ZMECEK 7/27/92	DAN BOHRER

DRAWN E.JAMIOL	DATE 5/13/92	AYTRON MANUFACTURING, INC. INDEPENDENCE, OHIO
CHECKED		LOAD BANK K711
APPROVED D.BOHRER	SCALE NONE	

DRAWING NUMBER SB2203

OUTLINE DRAWING

REVISIONS				
ECN NO.	REV	DESCRIPTION	DATE	APPROVED

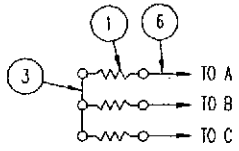
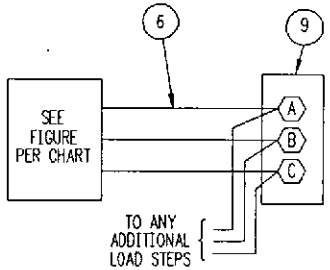


FIGURE #1



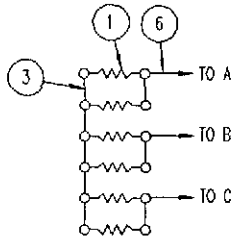


FIGURE #2

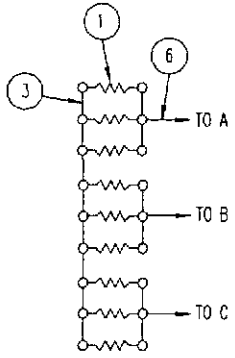


FIGURE #3

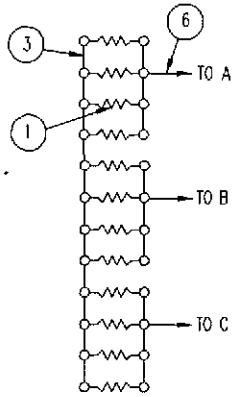


FIGURE #4

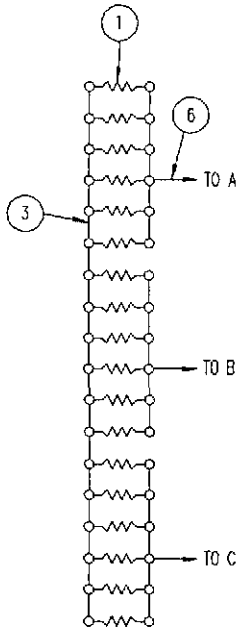


FIGURE #5

LOAD STEP CONFIGURATION GUIDE

EXAMPLE PART NO:

K711C-26-30-480-A2BC

THIS DEFINES THE LOAD STEP CONFIGURATION AS

A = 1 LOAD STEP OF 5KW
2B = 2 LOAD STEPS OF 10KW
C = 1 LOAD STEP OF 15KW

— PER KEY BELOW

APPLY THE ABOVE EXAMPLE TO ACTUAL PART NO. OF MODEL K711C LOAD BANK. REFER TO MATERIAL TABULATION AND THE APPLICABLE LOAD STEP DIAGRAM FIGURE.

KEY	
LETTER	LOAD STEPS
A	5KW
B	10KW
C	15KW
D	20KW
E	25KW
F	50KW
G	100KW
H	200KW
J	400KW

THIS IS REFERENCE INFORMATION, PARTS AND TOTAL QUANTITIES ARE SPECIFIED ON THE MFG TOP ASSEMBLY DRAWING.

SEE POWER DISTRIBUTION BLOCK CHART																												9	POWER DISTR BLOCK
NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	8	RESISTOR
x1	FIG.#2	x1	FIG.#4	x1	FIG.#5	x1	FIG.#1	x1	FIG.#2	x1	FIG.#3	x1	FIG.#1	x1	FIG.#2	x1	FIG. #3	x1	FIG.#1	x1	FIG.#2	x1	FIG.#1	x1	FIG.#2	x1	FIG.#1	7	LOAD STEP DIAGRAM
AR	390323	AR	390323	AR	390323	AR	390322	AR	390322	AR	390322	AR	390321	AR	390321	AR	390321	AR	390735	AR	390735	AR	390736	AR	390736	AR	390736	6	WIRE (BLACK)
																												5	
																												4	
8	602050	20	602050	32	602050	2	602050	8	602050	14	602050	2	602050	8	602050	14	602050	2	602050	8	602050	2	602050	8	602050	2	602050	3	BUS LINK
																												2	
6	606337	12	606344	18	606068	3	606337	6	606344	9	606068	3	606338	6	606346	9	606078	3	606342	6	606069	3	606346	6	606350	3	606350	1	RESISTOR
QTY P/N 50KW STEP W >39		QTY P/N 50KW STEP 27<W<39		QTY P/N 50KW STEP W <27		QTY P/N 25KW STEP W >39		QTY P/N 25KW STEP 27<W<39		QTY P/N 25KW STEP W <27		QTY P/N 20KW STEP W >35		QTY P/N 20KW STEP 27<W<35		QTY P/N 20KW STEP W <27		QTY P/N 15KW STEP W >33		QTY P/N 15KW STEP W <33		QTY P/N 10KW STEP W >27		QTY P/N 10KW STEP W <27		QTY P/N 5KW STEP		ITEM NO.	DESCRIPTION

POWER DISTRIBUTION BLOCK

(REF: CHART 3 ON TOP ASSY)

TOTAL (Y) USED. AS INDICATED IN TOP ASSEMBLY (Y COLUMN)	(ITEM 26) POWER DISTRIBUTION BLOCK	QTY
1 THRU 5	364948	1
6 THRU 11	364973	1
12 THRU 29	364979	3

CONFIGURATION AND QUANTITY OF LOAD STEPS ARE DEFINED BY PART NUMBER CODE.

100KW STEP – USE 50KW COLUMN x 2
200KW STEP – USE 50KW COLUMN x 4
400KW STEP – USE 50KW COLUMN x 8

5 – ITEM 3 MAY BE REPLACED BY #6 AWG JUMPER WIRE (PN 390323).

4 – EACH COLUMN DEFINES MATERIAL REQUIRED FOR ONE LOAD STEP.

3 –

2 –

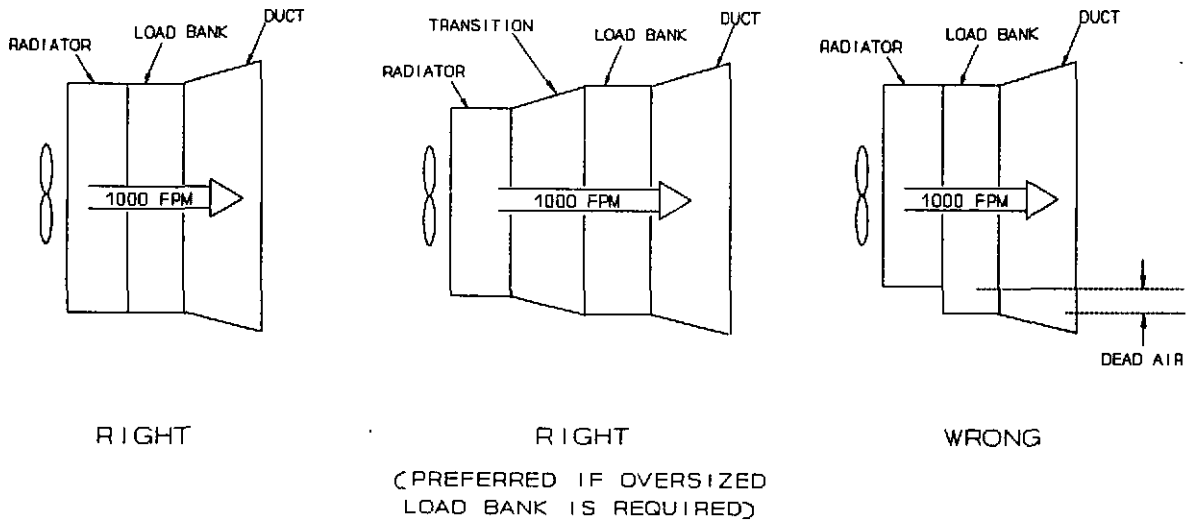
1 –

UNLESS OTHERWISE SPECIFIED THE ABOVE NOTES APPLY

		UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES	DRAWN ARMAGOST	DATE 12/11/96	AVTRON MANUFACTURING INC 7500 E.PLEASANT VALLEY ROAD INDEPENDENCE, OH 44131-5529	
		TOLERANCES: ANGLES±1° DECIMALS .XX± .XXX±	CHECKED ARMAGOST	12/11/96	SCHEMATIC/WIRING DIAGRAM 480V	IMF ☒ PSF ☐
		FINISH	ENG APVD ARMAGOST	12/11/96		
		PAINT PER PS	APVD PROD C.ZIMMERMAN	12/12/96		
K711C	K711C	PLATE PER			SIZE C CAGE NO. 01014 DWG. NO. C23449	REV
NEXT ASSY	USED ON	COAT PER PS				
APPLICATION		ANODIZED PER			SCALE NONE MODEL K711C	SHEET 1 OF 1
		OTHER				

Since the load banks absorb 100% of their rating as soon as voltage is applied regardless of air flow, it is necessary to install them properly to prevent damage or malfunctions. Outlined below are some practices which should be followed.

1. AIR FLOW - The air flow through all sections of the load bank should be at least 800 ft/min. and preferably 1000 ft/min. or greater. The air flow should not be blocked from some sections of the load bank or the load bank installed so there are areas of "dead" air. See Bulletin 203 for method of air flow computation.



RIGHT

RIGHT
(PREFERRED IF OVERSIZED LOAD BANK IS REQUIRED)

WRONG

2. THERMAL PROTECTORS - When thermal protectors are included as a part of the unit, the load bank should always be installed with the thermal protector at the top.

RIGHT

WRONG

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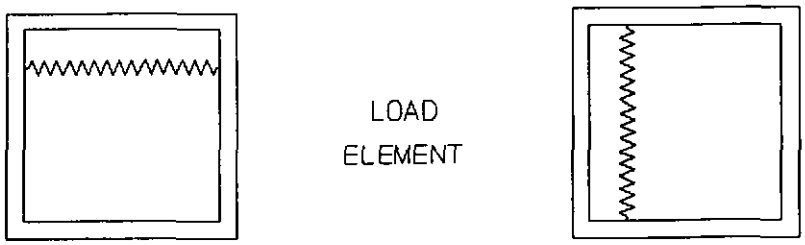

3. ELEMENT POSITION - The elements are designed for horizontal installation to prevent sagging or movement that would cause damage. The load bank should be installed with the elements horizontal, as shown above.

4. RATED CURRENT AND FUSING - When installing the load bank, it is necessary to provide the proper size wire and, if fuses are required, they must be selected so they are compatible with the load steps and voltage applied to the unit. The current drawn by the load bank may be computed from the formula:

$$I = \frac{KW \times 577}{\text{Voltage (Line-to-Line)}}$$

For example, a 100 KW load bank will draw 120 amperes at 480 volts and 240 amperes at 240 volts. For the low voltage installation, the fuse rating and wire size must have twice the current capacity of the high voltage installation. Load banks can be installed with a load connected as a single step or multiple small steps, and the fuses and wire size should be selected accordingly.

5. PARTIAL DUCT INSTALLATIONS - There may be installations where only a small amount of load is required relative to the generator rating and duct size. Avtron recommends that a load bank be selected which is large enough to match the size of the engine air duct. If this is not feasible, a smaller load bank can be used which will only fill a part of the duct. Under these circumstances, it is the installer's responsibility to insure that sufficient air passes through the load bank for proper cooling.

I. AIRFLOW CALCULATIONS

Load Banks are designed to operate with air passing over the load elements at a rate of approximately 1,000 ft./min. (5.08 meters/sec.). They will withstand higher air velocity without any problems as far as the Load Bank is concerned; however, the pressure drop across the Load Bank will increase. Therefore, this must be considered when selecting a Load Bank. When the air velocity is a great deal less than 1,000 ft./min., the load elements will operate at a higher temperature, which results in shorter life. At very low air velocity, the elements will overheat and be destroyed.

Outlined below are simple methods of computing air velocity, pressure drop, and temperature rise for the Avtron K711 series duct type Load Banks.

A. AIR VELOCITY COMPUTATIONS

When selecting a duct type Load Bank, the engine radiator parameters such as size and airflow are known. The Load Bank frame with dimensions closest to the effective dimensions of the radiator should be considered. For a given engine configuration, the airflow in cubic feet per minute or liters per second is supplied by the engine manufacturer. The velocity is calculated by using the effective area of the Load Bank and the engine airflow.

$$\text{Velocity (Ft. per Min.)} = \frac{\text{Engine Airflow (cu. ft./min.) x 144}}{\text{Load Bank Width (in) Load Bank Height (in)}}$$

$$\text{Velocity (meters/sec.)} = \frac{\text{Engine Airflow (Liters/Sec.) x 10}}{\text{Load Bank Width (cm) Load Bank Height (cm)}}$$

B. PRESSURE DROP

The Avtron K711 series of Load Banks are designed to be compatible with typical radiator sizes and airflows. One important criterion in application of the Load Banks is the air pressure drop through the Load Bank. The engine generator sets are usually designed with sufficient fan capacity to provide a head of .5 in. H_2O (12.7mm H_2O) after the air has passed through the radiator. The Load Banks are designed to minimize the cooling air pressure drop. Typically, the louver type Load Banks have a pressure drop of about .2 in. H_2O (5.08mm H_2O) and the duct types have a drop of about .1 in. H_2O (2.54mm H_2O) at minimum rated airflow.

C. AIR TEMPERATURE RISE

In some installations, the allowable exhaust air temperature from the overall engine generator and Load Bank combination must be limited to a specific value. The temperature rise information on the engine generator combination can be supplied by the manufacturer. The air temperature rise through the Load Bank can be calculated from the following formula:

$$\text{Temp Rise (° F)} \quad \frac{\text{Load Bank KW x 3200}}{\text{CFM}}$$

$$\text{Temp Rise (° C)} \quad \frac{\text{Load Bank KW x 570}}{\text{Liters/Sec.}}$$

Depending on the installation, the cooling system exhaust air temperature rise may be compiled using the Load Bank temperature rise derived from the above calculation and adding it to the other system temperature rises.

II. ELECTRICAL CALCULATIONS

A. RATING

The Load Bank power ratings are based on the highest rated operating voltage. Each load step consists of two elements, each rated at 138 volts connected in wye. When connected in the series configuration, the Load Bank may be used on 480 V or 380 V, 3 Phase. With 480 volts applied to the terminals, 138 volts is applied to each element. When connected in parallel configuration, the Load Bank may be used on 240 V or 208 V, 3 Phase systems. With 240 V, 3 Phase applied to the terminals, 138 volts is applied to each element. The load absorbed by the Load Bank at other than rated voltage can be computed from the formula:

$$\text{Absorbed KW} = \frac{\text{Rated KW x (Applied Voltage)}^2}{(\text{RATED VOLTAGE})^2}$$

For example, a 100 KW Load Bank connected for 240 volts with 208 volts applied will absorb 75 KW.

$$\text{Absorbed KW} = \frac{100 \times (208)^2}{(240)^2}$$

B. CURRENT CALCULATIONS

To determine the wire size and fuse ratings for a given installation, it is necessary to determine the line current. This can be readily determined from the formula:

$$\text{Phase Current} = \frac{\text{Absorbed KW x 577}}{\text{Applied Voltage (Line-to-Line)}}$$

For example, a 100 KW load with 480 volts applied will draw 120 amperes per phase.

$$\text{Phase Current} = \frac{100 \times 577}{480}$$

C. REACTIVE LOAD CALCULATIONS

When engine generator sets are operated with Resistive (KW) load, they are being tested at unity (1.0) Power Factor. Some load tests require operation at lower power factors, usually .8 PF. To perform these tests requires a load with both Resistive (KW) and Reactive (KVAR) capability. The Resistive and Reactive parts of the total load add vectorially, not directly. For example, to load a 100 KW generator at .8 Power Factor requires a Resistive load with a capacity of 100 KW and a Reactive load of 75 KVAR. The total load (Resistive and Reactive) on the generator is expressed as Volt-Amperes (KVA) and is the product of current times voltage. Using the above example of 100 KW Resistive load and 75 KVAR Reactive load, the total load (KVA) on the generator is 125 KVA.

When the generator set rating is expressed in terms of Resistive load at a certain power factor (100 KW at .8 PF), the total load (KVA) and Reactive load (KVAR) can be calculated as outlined below.

$$\text{Total Load (KVA)} = \frac{\text{Resistive Load (KW)}}{\text{Power Factor}}$$

$$\text{KVA} = \frac{100}{.8} = 125$$

Reactive Load $= \sqrt{(KVA)^2 - (KW)^2}$

$\sqrt{(125)^2 - (100)^2}$

$\sqrt{15625 - 10000}$

$\sqrt{5625} = 75$ KVAR

Warranty

Warranty and Duration

For a period of one year after installation, or fifteen (15) months from date of shipment from our plant, whichever is shorter, Avtron warrants the equipment, except as hereinafter provided, to be free from harmful defects in material and workmanship. Notwithstanding any other term or provision in this Warranty, the warranty provided herein shall terminate unless buyer notifies Avtron, in writing, of a breach hereof within the warranty period; any claims not made within such period are waived by Buyer. The warranty provided herein applies only if Buyer complies with all the other terms and provisions of this Warranty.

Uses of Equipment

The warranty provided herein applies only if the equipment has been used in a normal and proper manner under recommended conditions. Notwithstanding any advice or assistance given to the Buyer by Avtron or its suppliers concerning the equipment or its use, Avtron makes no express or implied warranties or representations, except as herein expressly provided, with respect to the equipment or its use, and Avtron shall not be liable in contract, warranty or tort (including, without limitation, for negligence or strict liability) as a result of such advice or assistance. In addition, unless otherwise agreed in writing signed by a duly authorized representative of Avtron, no equipment covered by this warranty is intended to be used in connection with any nuclear facility or activity, and if so used, Avtron disclaims any and all liability for any damage resulting therefrom.

Notification of Breach

When claiming a breach of this Warranty, Buyer must promptly (within 10 days from the date of the discovery of the defect) notify Avtron in writing.

Equipment Disposition

Upon notification of a claimed breach of this Warranty, Avtron, at its discretion, will either authorize the return of the defective equipment or part thereof (transportation costs to be prepaid by Buyer) or provide a suitable replacement or authorize the Buyer in writing to effect repairs at Avtron's expense. In the event that the equipment returned as authorized is found to be defective and Avtron elects to repair or replace said equipment, Avtron will pay the transportation costs associated with the return of said equipment to Buyer. Avtron shall not however be liable for any customs, tariffs, duties or taxes incurred in shipping equipment pursuant to this Warranty. These shall be the responsibility of the Buyer.

Option of Avtron to Repair or Replace Equipment or to Issue Credit

Avtron's sole obligation under this Warranty shall be, at the option of Avtron, to replace or repair any defective equipment or part thereof or to issue a credit with respect to the defective equipment equal to the purchase price thereof less depreciation.

Equipment Excluded From Warranty

The warranty provided herein specifically excludes equipment and components that Avtron purchases and resells as part of a system, product or spare part order. The warranties provided to Avtron by the manufacturers of the foregoing equipment and components will, to the extent possible, be passed on to the Buyer. Copies of such warranties, if on file at Avton, will be made available for inspection upon the request of Buyer. Equipment such as, but not limited to, computers, CRTs, operator interface modules, monitors, etc., normally have a short warranty period and should be covered by a continuous service contract generally available from the original manufacturer at a reasonable cost. Consumable items including, but not limited to, lamps, filters, fuses and motor brushes are excluded from all warranties. Other items or components may be excluded from this warranty if so noted in the governing purchase order or contract.

Resale or Lease of Equipment

In the event that the Buyer resells or leases equipment purchased from Avtron, the Buyer shall obtain the signed written agreement of the purchaser or lessee thereof that Avtron's only liability with respect to said equipment is as set forth in this Warranty. In the event that the Buyer fails to obtain such a signed written agreement, the Buyer agrees to indemnify Avtron against any claims, demands, judgments, suits, costs, liabilities and expenses (including reasonable attorney's fees) incurred by Avtron as a result of such failure.

Unauthorized Repairs

Unless otherwise agreed in writing signed by a duly authorized representative of Avtron, if the Buyer has repairs or modifications made to equipment covered by this Warranty by a person other than an authorized Avtron service representative, Avtron shall not be liable for any expenses incurred in connection therewith and the warranty provided herein shall automatically be terminated.

Governing Law; Saving Clause

This Warranty is part of the terms and conditions of the sale of the equipment covered hereunder and shall be governed by and enforced in accordance with the laws of the State of Ohio. Any provision hereof which is prohibited or unenforceable in any jurisdiction shall, as to such jurisdiction, be ineffective to the extent of such prohibition or unenforceability without invalidating the remaining provisions hereof or affecting the validity or enforceability of such provision in any other jurisdiction.

Limitation of Liability

IN NO EVENT SHALL AVTRON BE LIABLE IN CONTRACT, IN TORT OR OTHERWISE FOR SPECIAL, INCIDENTAL, CONSEQUENTIAL OR PUNITIVE DAMAGES (INCLUDING, BUT NOT LIMITED TO, LOSS OF PROFITS OR REVENUES, LOSS OF USE OF THE EQUIPMENT OR ANY DAMAGE TO ASSOCIATED EQUIPMENT, DAMAGE OR INJURY TO PERSONS OR PROPERTY, COST OF CAPITAL, COST OF SUBSTITUTE OR TEMPORARY EQUIPMENT, DOWNTIME OR CLAIMS OF CUSTOMERS) ARISING OUT OF OR AS A RESULT OF BREACH OF WARRANTY, DEFECT IN MATERIAL OR WORKMANSHIP OR ANY OTHER OBLIGATION OF AVTRON HEREUNDER.

Disclaimer of All Other Warranties

THIS WARRANTY COMPRISES AVTRON'S SOLE AND ENTIRE WARRANTY OBLIGATION TO BUYER, ITS CUSTOMERS AND ASSIGNS IN CONNECTION WITH EQUIPMENT SOLD, ASSIGNED, LEASED OR OTHERWISE DEALT WITH BY AVTRON. ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, WARRANTIES OF MERCHANTABILITY AND FITNESS, ARE EXPRESSLY EXCLUDED.

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