AVTRON

LOAD BANKS

60 HERTZ BUYER'S GUIDE

誥鑫企業有限公司
ARITH COMPANY LTD.
地 址： 台北市復興北路427巷30號
電 話： (02)2717-5038
傳 真： (02)2717-5039
e-mail: taipei@arith.com.tw
網 址： http://www.arith.com.tw

ISO 9001 CERTIFIED

www.load-bank.com

Avtron Loadbank, Inc.

Since 1953, Avtron has been a leader in the design and manufacture of high quality and reliable products intended for very demanding industrial applications. Avtron's products include:

- Resistive and Reactive Load Banks
- Industrial Resistors
- Aircraft Electrical Test Systems
- Digital Instrumentation Systems
- Digital Control Systems

Avtron is 100% committed to maintaining the high standards that you have every right to expect – in Design, Manufacturing, and Product Support.

Decades of extensive experience provide Avtron with capabilities for satisfying any load bank design requirement.

Quality System Certified to ISO 9001

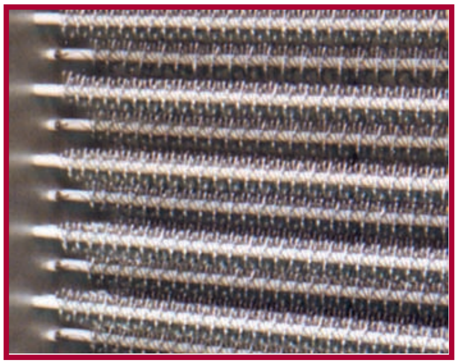
Avtron's Quality System is certified to meet ISO 9001 standards. This means that Avtron products consistently meet the highest quality standards.

Meet NFPA Requirements

The National Fire Protection Association (NFPA) has issued testing standards for emergency and standby power systems including NFPA 70, NFPA 99, and NFPA 110. These standards provide guidelines for installation acceptance of power systems, periodic testing and maintenance, and specific testing requirements of systems used to support health care facilities. All these standards require partial or full load testing of backup power systems using loading equipment. Avtron load banks provide the necessary loading capabilities for testing emergency and standby power equipment to meet NFPA requirements.

Avtron Load Banks

Load Banks are devices designed to provide electrical loads for testing power sources such as generators and Uninterruptible Power Supplies (UPS). Load banks are also used to reduce "wet stacking" problems in diesel engines of backup generating systems.



Avtron's Helidyne™ elements are fully supported and operate at low temperatures for longer life.

Most Avtron resistive load banks feature Helidyne™ resistive elements. These Avtron designed and manufactured elements are made of a corrosion resistant chromium alloy and are fully supported across their entire length on stainless steel support rods with segmented ceramic insulators. Elements are carefully selected to operate at low temperatures to provide extended, reliable performance, eliminating the need for a "cool down" period after load bank operation.

Applications

Load banks can be used in a wide variety of applications, such as:

- Factory testing of engine generator sets
- To reduce "wet stacking" problems
- Periodic exercising of stand-by engine generator sets
- UPS system testing
- Battery system testing
- Ground power testing
- Load optimization in prime power applications
- Factory testing of turbines

Avtron manufactures both the load banks and the auxiliary equipment necessary to handle these and other applications. Contact your Avtron sales representative for complete support in choosing the best load bank system for your requirements.

Improve Reliability of Generator Set

Industry trade organizations and manufacturers both agree that a well planned preventive maintenance program is vital to the reliable operation of a standby generator. Load Banks are an essential part of such a program. Load Banks provide a practical means to test the system without interruption to the critical loads.

The primary cause of diesel engine failure is "wet-stacking" ("wet" unburned fuel accumulating in the engine "stack"). It is caused by under-loading of the generator. Diesel engines that are lightly loaded, or allowed to idle for long periods, never reach their recommended operating temperature. Over time, unburned fuel coats the combustion chamber, reducing engine rating, efficiency, and life span. A preventive maintenance plan that includes load testing of a diesel generator set, will reduce the harmful effects of "wet-stacking" and increase engine life.

Advantages of Aluminized Steel Construction

Load Banks convert electrical energy into heat. The majority of this heat is dissipated away from the device by the cooling fan. However, the enclosure itself absorbs a portion of the generated heat. As such, these products must be constructed out of a material that can withstand this thermal environment. Avtron Load Bank enclosures are constructed from Aluminized Steel, which offers superior heat and corrosion protection over the more commonly used Galvanized Steel.

Standard Models

Note: *Models shown are available in international 50/60 Hertz voltages and custom DC designs. For details see 50 Hertz Buyer's Guide or Canadian Buyer's Guide.*

TYPE	MODEL	CAPACITY	MIN. LOAD STEP RESOLUTION	LOAD VOLTAGE	BLOWER VOLTAGE	APPROX. DIMENSIONS (inches)	APPROX. WEIGHT (pounds)
Portable, Resistive, Indoor with Integral Control Panel	K490	10 KW	0.25 KW	120 VAC; 120/240 VAC; 1Ø	120 VAC; 1Ø	18"L, 13"W, 11"H	35
	Liberty	25-75 KW	0.5 KW or 1 KW	120/240 VAC; 1Ø, 240 VAC; 1Ø	120 VAC; 1Ø	23"L, 13"W, 24"H	75
		55 KW	5 KW	240/480 VAC; 3Ø			
	Freedom	100 KW/93.75 KW	5 KW	240/480 VAC; 3Ø	120 VAC; 1Ø	25"L, 16"W, 29"H	105
	Millennium	200 KW	5 KW	240/480 VAC; 3Ø	120 VAC; 1Ø; 1HP	47"L, 34"W, 52"H	600
		250 KW			208-230/460 VAC; 3Ø; 3 HP	56"L, 34"W, 52"H	650
		400 KW					800
	Patriot	500 or 700 KW	5 KW	240/480 VAC; 3Ø	208-230/460 VAC; 3Ø; 5 HP	61"L, 34"W, 75"H	1,200
DC Portables	K492	150 Amps DC	1 Amp	26/52 VDC	26/52 VDC or 120 VAC; 1Ø	18"L, 13"W, 11"H	35
	K576	500 Amps DC	2.5 Amps	52 VDC	120 VAC; 1Ø; 0.25 HP	28"L, 24"W, 27"H	160
	K571	1000 Amps DC	5 Amps	28 or 52 VDC	120 VAC; 1Ø; 0.5 HP	28"L, 23"W, 63"H	295
Trailer-Mntd, Outdoor, Resistive	K580	750 - 1250 KW	5 or 50 KW	240/480 VAC; 3Ø	208-230/460 VAC; 3Ø; 5 HP	208"L, 93"W, 84"H	4,000*
	LTV	1500 - 2000 KW	5 or 50 KW	480 VAC; 3Ø	480 VAC; 3Ø	188"L, 93"W, 118"H	6,000*
		2500 - 3000 KW				208"L, 93"W, 118"H	7,500*
Skid Mntd, Outdoor, Res./Reac.	LPS	2000 KW; 1500 KVAR or 1500 KW; 1125 KVAR	50 KW; 37.5 KVAR or 5 KW; 3.75 KVAR	480 VAC; 3Ø	480 VAC; 3Ø	255"L, 76"W, 109"H	13,000
Radiator/ Duct Mount	K711/K711A	10 to 1000 KW	as required	208 VAC; 240 VAC; 480 VAC; 3Ø	N/A	customer defined	–
Permanently Installed, Resistive with Remote Control Panel Outdoor Rated	Spirit	50 to 150 KW	5 KW	208 VAC; 3Ø, 240 VAC; 3Ø, 240/480 VAC; 3Ø, 480 VAC; 3Ø	208/230/460 VAC; 3Ø; 60 Hz; 1HP	48"L, 27"W, 35"H	500
	K675A	200 to 500 KW	5 KW	240/480 VAC; 480 VAC; 3Ø	230/460 VAC; 460 VAC, 3Ø; 2 or 5 HP	61"L, 47"W, 52"H	800 - 1,000
	K875A	750 KW	5 or 50 KW	240/480 VAC; 3Ø, 480 VAC; 3Ø	(1) 10 HP; 460 VAC	40"L, 59"W, 138"H	1,500
		1000 KW					2,000
		1500 KW	5 or 50 KW	480 VAC; 3Ø	(2) 10 HP; 460 VAC	80"L, 59"W, 156"H	3,000
		2000 KW					4,000
		2500 KW	50 KW	480 VAC; 3Ø	(3) 10 HP; 460 VAC	120"L, 59"W, 156"H	5,000
		3000 KW					6,000
	K875A-MV	750 - 1000 KW 1500 - 2000 KW	5 or 50 KW	5 kV AC, 5 - 15 kV AC; 3Ø	(1) 10 HP; 460 VAC (2) 10 HP; 460 VAC	165"L, 60"W, 148"H 230"L, 60"W, 148"H	10,000 14,000
	K922A	3000 - 6000 KW per module	250, 500, or 1000 KW	5 kV AC; 3Ø, 5 - 15 kV AC; 3Ø	(4) to (8) 10 HP; 460 VAC	187"L, 102"W, 192"H (typical 4500 KW unit)	13,000 - 17,000
Permanently Installed, Reactive	K841	150 to 375 KVAR	3.75 KVAR	480 VAC; 3Ø, 240/480 VAC; 3Ø	120 VAC; 1Ø	54"L, 52"W, 92"H	4,500
	K841B	375 to 1875 KVAR	3.75 or 37.5 KVAR	480 VAC; 3Ø, 240/480 VAC; 3Ø	120 VAC; 1Ø	116"L, 66"W, 80"H 144"L, 66"W, 80"H	6,000 - 10,000
Containerized Resistive and Reactive	LCV	3000 KW/2250 KVAR 4000 KW/3000 KVAR 5000 KW/3750 KVAR	25 KW/18.75 KVAR	480 VAC; 3Ø	460 VAC; 3Ø; 10 HP x 3 or 6	240"L, 96"W, 108"H	29,000 - 37,000

Control Power: Typical power required for control circuit operation is 120 VAC, 1Ø, 60 Hz. If 120 VAC, 1Ø, 60 Hz is not available, a single phase control power transformer can be provided.

Blower Power: Blower power is typically provided by an outside source. Selected load banks are available with blower power derived from the power source under test.

Digital Metering: Avtron Advanced Digital Monitoring System (ADMS) is provided as a standard feature for most Avtron Portable Load Banks, and as an option for many other models. The multi-function digital power meter provides digital display of voltage, current, frequency, and power measurements. Includes Communicator EXT™ Data Logging Software.

Note: *Other models with different KW/KVAR and Voltage ratings are available on request. Specifications are subject to change without notice.*

* *Includes trailer.*

Permanent Load Banks

Avtron's permanently installed resistive load banks are ruggedly constructed units typically rated between 50 KW and 3000 KW.

Designed for outdoor operation, these units feature highly reliable Avtron Helidyne™ load elements. These elements are mounted in enclosures equipped with screened and louvered intake and exhaust openings to protect against debris, and are cooled by heavy duty blowers.

These units are provided with a gasketed and heated enclosure to protect contactors and other components from condensation related problems.

Remote control panels are provided with each unit, ready for 19" rack mounting, or installed in a NEMA-type wall-mount enclosure.

Horizontal airflow, resistive load bank from 50 KW to 150 KW (model Spirit).

Horizontal airflow, resistive load bank from 200 KW to 500 KW (model K675A).

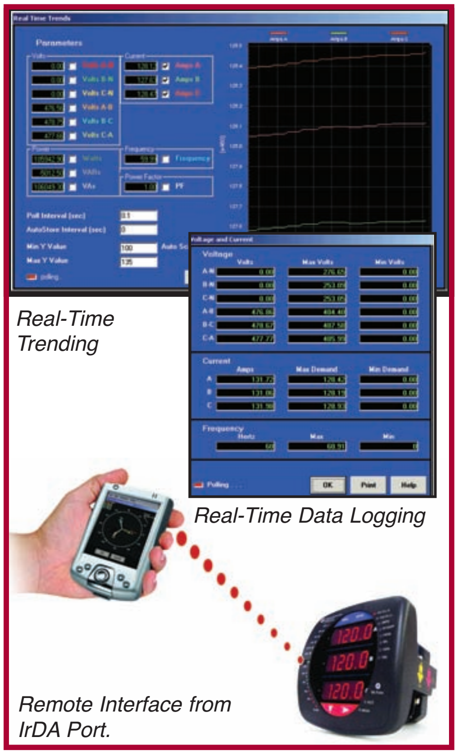
Space saving high capacity vertical airflow load bank. Model K875A 2500-3000 KW (left) and Model K875A 1500-2000 KW (above). (Model K875A 750-1000 KW not shown.)

Advanced Digital Monitoring System

The Avtron Advanced Digital Monitoring System (ADMS™) is a Multi-Function Digital Power Meter that provides 3-line digital display of Voltage, Current, Frequency, and Power Measurements. Unlike conventional meters, the large 0.56" extra-bright LED's allow the user to clearly monitor the meter display under any condition 24/7. The meter faceplate features an optical IrDA port for data transfer and comes complete with an IrDA/USB adapter for "plug and play" convenience. Meter parameters are captured from the IrDA port and can be downloaded to your PC or PDA. The Communicator EXT™ software provides Real-Time Monitoring and Data Acquisition from your laptop PC, allowing the user to display meter parameters in Real-Time Trending or Real-Time Data Logging format. Data can automatically be recorded and saved to your computer which can be easily imported into a Windows™ spreadsheet.

This rugged metering system is designed to save both time and money. It virtually eliminates the need to manually record load bank values during a load test.

The ADMS™ meter is provided as a standard feature on most portable load banks and as an option for many other models.



Portable Load Banks

Avtron's complete line of portable resistive load banks range (in size) from 10 KW to 700 KW. For larger ratings, Avtron can provide trailer mounted models to satisfy most load testing requirements at remote sites.

Built to resist vibration encountered during transportation, Avtron portable load banks are lightweight, compact, reliable, and save money because they last long.

These Avtron units feature durable Helidyne™ resistive elements cooled by high volume blower assemblies and integral operator control panels. Switches on the control panel actuate contactors to safely isolate the operator from high voltage circuits. Control power can be derived from the power source under test, or from an external

The Millennium load bank (400 KW) is compact and is easily transported.

120 VAC source (line cord provided). The ADMS™ digital metering system is standard on units rated 25 KW or higher.

Avtron's portable load banks are constructed using heavy gauge aluminized

The Patriot load bank (700 KW) is equipped with lockable casters for easy repositioning.

steel for years of reliable service. These units are fitted with casters or rubber shock mount feet for easy movement from one test site to another using common pickup trucks or vans.

Hand Carried Portable Load Banks

Avtron produces three small hand carried portable load banks. The model K490 is an AC load bank designed for indoor use that provides up to 10 KW load at 120 or 240 VAC, single phase. Due to its small size, the K490 is easily transported to any job site.

The Liberty load bank is an ultra-compact unit designed for single or three phase loading from 25 KW to 75 KW. It is lightweight enough to be easily moved into position, and rugged enough to stand up to years of reliable service in all kinds of shop and field environments.

For DC loading in a hand carried package, Avtron offers the model K492. This unit provides up to 150 amps loading

capacity for testing UPS and other DC power sources at either 26 or 52 Volts DC. This unit does not require special tools.

The Liberty load bank (above, shown with case) and the K490 load bank (left) are popular and easy to use.

These units are "the load banks of choice" as they provide the right mix of transportability, ease of use, and reliable Avtron construction.

High Capacity, Ultra Compact, Portable Load Bank

The Avtron Freedom Load Bank is rated at 100 KW at 480 VAC, 3-Phase, 60 Hz and 93.75 KW at 240 VAC, 3-Phase, 60 Hz. The ADMS digital metering system is standard. Designed for continuous operation, this load bank gives users the freedom of a high capacity load in a lightweight, compact package. Weighing only 105 pounds, this load bank is less than half the weight and size of traditional load banks of similar capacity. Built for indoor operation, the Freedom load bank is ideal for field testing Uninterruptible Power Supplies (UPS) and small AC generators.

The Freedom load bank (100 KW) is ultra compact and lightweight.

Reactive Load Banks

Avtron inductive/reactive load banks (KVAR) are typically used in combination with resistive load banks (KW) to test a generator or power source at 0.8 power factor (lagging). The reactive load bank should be sized at 75% of the resistive load bank KW rating to achieve a 0.8 power factor. The resistive and reactive load banks are connected and operated in parallel.

Models such as the K841 and K841B range from 50 - 1875 KVAR. They are designed for indoor or outdoor permanent installations and come complete with remote operator control panels (19" rack mount or NEMA enclosed).

Avtron's inductive/reactive load banks feature non-saturating single phase and three phase iron core load reactors.

Large capacity reactive load bank (model K841B) available from 375 KVAR to 1875 KVAR.

Installed 375 KVAR units (model K841) can be used individually or in parallel depending on load requirements.

High capacity skid mounted resistive/ reactive load bank (model LPS) available from 1875 - 2500 KVA.

Trailer Mounted Load Banks

Avtron offers trailer packages for high power mobile testing at multiple sites. Resistive, reactive, or DC models are available. Options include cable reels, cable storage box, and load cable.

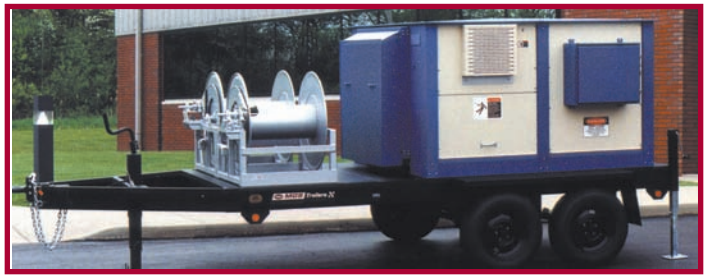
High capacity 2000 KW trailer package with optional cable reels (model LTV).

Custom 1250 KW trailer package with all stainless steel construction (model K580).

Remote Hand Held Controller

The Avtron Remote Hand Held Controller is standard on most High Capacity Load Banks (LCV and LPS). The controller is also available as an option on the LTV and K580 Trailer Mounted Load Banks.

This rugged, compact, and lightweight controller is designed for easy operation. All of the load bank controls are activated by pressing the membrane style keypad. The load bank functions are shown on a backlit LCD display. A hard wired E-Stop push button is also provided in the controller. Communication between the controller and the load bank PLC is via a 200' cable with an MS style connector.



Standard 1250 KW trailer package with optional cable reels (model K580).

Large trailer package with resistive/reactive load bank (model LCV) and step-down transformer.

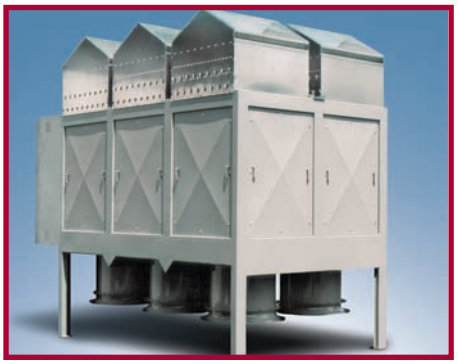
Medium Voltage Load Banks

Avtron is a leading manufacturer of true medium voltage load banks.

These units operate at the actual output voltage of medium voltage generators and therefore do not require large step-down transformers.

A typical module is rated 4 to 6 megawatts and multiple modules are used when tens or hundreds of megawatts are required. Voltages from 5 to 15 kV are standard. Other voltages are also available as custom designs.

Also available are conventional load bank and step-down transformer designs (model K875A-MV) mounted on a common structural skid.



Cost effective skid mounted medium voltage load bank system, available from 750 - 2000 KW (model K875A-MV, above).

Model K922A (left) is one of several medium voltage modules used by a large turbine manufacturer for production testing.

Radiator and Duct Mounted Load Banks

The Avtron model K711 and K711A load banks are designed for radiator or duct mounting on diesel engine generator sets. The load bank is permanently mounted to the front of the engine generator and sized to match the width and height of the radiator core or exhaust duct opening. The load bank utilizes the engine cooling air rather than an internal cooling fan found on conventional load banks. A top and bottom mounting flange, or removable duct adapter flanges are supplied for mounting and ease of installation.

The load banks are typically sized at 50-60% of the generator KW rating and used to periodically test the generator or to supplement the real generator load to minimize the effects of diesel engine "wet-stacking".

Capacities range from 10-1000 KW at voltages of 208, 240, or 480 Volts AC, 3-Phase, 60 Hz.

Radiator and duct mounted load bank from 10-1000 KW (model K711).

Avtron Neutral Grounding Resistors

Avtron Neutral Grounding Resistors are designed to provide added safety to industrial distribution systems by limiting ground fault current to reasonable levels. In a typical solidly grounded four wire system, the neutral is tied directly to earth ground. This can cause high ground fault current (typically 10,000 to 20,000 amps) and excessive damage to transformers, generators, motors, wiring, and associated equipment. Inserting an Avtron Neutral Grounding Resistor between neutral and ground limits fault current to a safe level (typically 25 to 400 amps) while still allowing sufficient current flow to operate fault clearing relays. Limiting fault current also reduces the problem of transient overvoltages (up to six times normal voltage) which can occur during arcing type ground faults.

Internal bushings/connection points eliminate the need for elevating stands or towers to raise live roof bushings above personnel. Current transformer (to monitor fault current) are available as an option.

Neutral Grounding Resistor rated 4160/2400 volts, 400 amps, 10 seconds.

Power Information

KW - kilowatts
KVA - kilo volt-amperes
pf - power factor
KVAR - kilo volt-amperes reactive

$$KW = KVA \times pf$$

$$KVA = \frac{KW}{pf}$$

$$pf = \frac{KW}{KVA}$$

$$KVAR = \sqrt{KVA^2 - KW^2}$$

The KW rating of the engine-generator set is dependent on the horsepower rating of the prime mover and the electrical rating of the generator.

The KVA rating of the generator is dependent on the current rating of the generator.

Ordering

When ordering or requesting pricing on Avtron load banks, the following information is helpful:

1. Resistive, Reactive, or DC
2. Applied Voltage(s) and Frequency
3. Portable or Permanent Mounting
4. Capacity
5. Load Step Resolution
6. Internal and/or External Control Power
7. Blower Voltage Requirements
8. Indoor or Outdoor Service
9. Core Dimensions and Air Flow (K711 Duct Mount only)

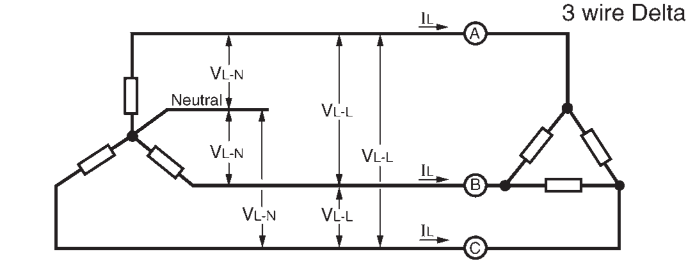
For a prompt quotation, please provide a complete specification via FAX: (1) 216-573-5953, PHONE: (1) 216-573-7600, or E-MAIL: LBsales@avtron.com.

Load Bank Connections

Most Avtron load banks are three-wire delta designs. Four wire wye power systems can be easily connected to the standard Avtron load bank by connecting phases A, B, and C to their respective input terminals. The standard Avtron load bank is a balanced 3-phase load, so the generator's neutral wire is not required.

When rating load bank capacities for special applications, refer to the wiring diagrams below:

CONNECTION DIAGRAM

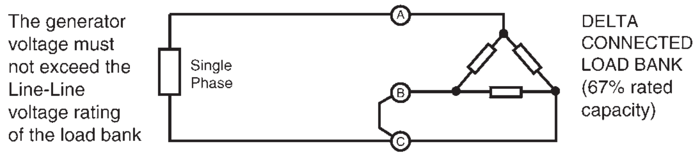


$V_{L\text{-}L} = V_{L\text{-}N} \times \sqrt{3}$

$I_L = \dfrac{KW \times 577}{V_{L\text{-}L}}$

$V_{L\text{-}L}$ = Voltage measured Line to Line
$V_{L\text{-}N}$ = Voltage measured Line to Neutral
I_L = Current in Amps

CONNECTION DIAGRAM
Single Phase Generator to Three Phase Load Bank



Voltage Derating

Load banks are designed to provide a specific capacity at a rated voltage. They cannot be operated at a voltage higher than their rating without risking damage to the load bank. However, the load bank can be operated at lower voltages.

Load bank derating is calculated as follows:

$$\frac{\text{Applied Voltage}^2}{\text{Rated Voltage}^2} = D$$

$$D \times \text{Rated Capacity} = \text{Reduced Rating}$$

Example:
Question: Can a 500 KW 480 VAC load bank fully load test a generator rated at 300 KW, 380 VAC?

$$\frac{380^2}{480^2} = \frac{144{,}400}{230{,}400} = .6267$$

.6267 x 500 KW = 313 KW
Load Bank Capacity

Answer: Yes, the load bank in this example provides 313KW load at 380V which is higher than the 300KW required

AVTRON LOADBANK, INC.
6255 HALLE DRIVE, CLEVELAND, OH, U.S.A. 441
E-MAIL: LBsales@avtron.com • www.load-bank.com

ARITH
誥鑫企業有限公司
ARITH COMPANY LTD.
地 址：台北市復興北路427巷30號
電 話：(02)2717-5038
傳 真：(02)2717-5039
e-mail: taipei@arith.com.tw
網 址：http://www.arith.com.tw