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POWER PROVING LOAD BANKS

INSTALLATION AND OPERATION MANUAL

MODEL No.: VPS100-LBR-PLC

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TYPICAL NAMEPLATE DETAILS



DESCRIPTION: PORTABLE TEST LOAD BANK

CONTROL TYPE: PLC TOUCH SCREEN WITH FAN & POWER CHANGEOVER SWITCHES

IP RATING: IP54 (CONTROL PANEL DOOR CLOSED)

IP44 (CONTROL PANEL DOOR OPEN)

SECTION 1

INSTALLATION AND HANDLING

SYSTEM INSTALLATION

TRANSPORTATION & LIFTING

This load bank is fitted with two (2) top mounted lifting points. Lifting by suitably rated chains or slings from these two points is recommended. The unit can also be lifted using a forklift with the base of the load bank housing supported on the fork tines or by using the optional fork lift base (if installed).

When tying down for transport, care should be taken so as there is no undue strain on the load bank enclosure. Always use the tie down points on the roll frame to secure the load bank. Soft packing or spacers must be used under ropes or slings when slung over the main body of the unit.

OPERATING LOCATION

- Place the load bank in position at least one metre from any wall or adjacent equipment.
- Operating location must be in a clean dirt free area, any debris, paper etc. must be cleared and removed before commencing testing.
- Ensure the unit is on level ground and that it is well supported over the entire base area
- Vertical discharge, fan cooled load banks must not have any overhung roofs or awnings placed over the units which may restrict the air discharge or deflect the airflow
- If acoustic attenuation barriers are to be fitted around the load bank, a minimum of one metre clearance must be maintained around the unit.

ENVIRONMENTAL & SAFETY PRECAUTIONS

- It is imperative that this load bank is only operated by personnel trained in the use of this unit, familiar with safety requirements and fully conversant with this operating manual.
- Before connection of cables, during maintenance or fault finding, make sure incoming power supply to the load bank is isolated from the generating set or other power source.
- Check to make sure all compartment doors are closed and locked. Panels or terminal covers fitted with screw type locking must be securely fixed in place.

BE AWARE OF, AND UNDERSTAND ALL RELEVANT SIGNS AND WARNING LABELS AFFIXED TO THIS UNIT BEFORE OPERATING



CAUTION SIGN
BE AWARE OF POTENTIAL
RISKS TO EQUIPMENT OR
PERSONS



ELECTRICAL RISK
ELECTRIC SHOCK RISK. THIS WORK
SHOULD ONLY BE PERFORMED BY
QUALIFIED PERSONNEL

CABLE INSTALLATION

- Connection of the load bank must be by qualified technicians in strict conformance with the relevant local electrical standards.
- This load bank is fitted with main busbars / terminals for connection load power cables rated at minimum 150 amps.
- Ensure cables used for connection of the generating set or other supply have a specified current rating adequate to meet the expected test load current
- Flexible, double insulated cables with a voltage rating over 600 volts AC are the preferred cable type for operation with this unit.
- It is strongly recommended not to use hard drawn copper cables (fixed wiring cables) with this unit in a temporary installation.

INITIAL START UP OPERATION

- All circuit breakers in this unit are shipped in the “OFF” position Leave breakers in this position until completion of megger test.



ENSURE THAT ALL CIRCUIT BREAKERS ARE OFF AND ALL FUSE HOLDERS ARE OPEN WITH FUSE CARTRIDGES REMOVED BEFORE COMMENCING ANY MEGGER TEST OF THE LOAD ELEMENTS.

DELICATE ELECTRONIC EQUIPMENT IS INSTALLED IN THIS LOAD BANK. MEGGER TESTING OF THIS ELECTRONIC EQUIPMENT WILL RESULT IN SERIOUS DAMAGE

- Using a minimum 500 volt megger, carry out an insulation test of the load bank RESISTOR ELEMENTS ONLY for earth fault by connecting the test instrument to the individual phase connections for each load element (one at a time) and earth stud.
- With power supply isolated and megger test completed, switch all load circuit breakers and control breaker to the “ON” position. Close control component door and lock securely using the supplied key.
- Open the cover over the load bank connection terminals and connect power supply cables to the load bank. Close the cover over the terminal connections and secure with screws supplied.
- Check that the all control switches are in the “OFF” position
- Take special care to check that both the “COOLING FAN” and “CONTROL POWER” cam switches are also in the off position

CONTROL POWER SELECTION (*Optional*)

The load bank has two available power supply sources for the unit controls and cooling fan power supply

1. Internally sourced power supply that is connected to the main busbar inputs
2. External power supply from an alternative power source i.e. Mains Power via the external power inlet socket

Ensure that the correct supply voltage is always connected to both the control and cooling fan.



THE RECOMMENDED VOLTAGE FOR BOTH THE LOAD BANK CONTROLS AND COOLING FAN MOTOR IS 3 PHASE, 400v (+/- 10%), 50 Hz
OTHER VOLTAGES OR Hz RATINGS WILL CAUSE SEVERE DAMAGE TO LOAD BANK COMPONENTS

To select the required control/fan power supply use the “CONTROL POWER” cam switch.....

- For connection of the same power supply that is connected to the main busbar power connections, move the “CONTROL POWER” cam switch from “OFF” to the “INTERNAL” position
- For connection of the external auxiliary power supply connected via the power inlet socket, move the “CONTROL POWER” cam switch from “OFF” to the “EXTERNAL” position.
- After selecting the correct incoming power supply the load bank power (and external auxiliary supply if required) can be turned on to allow operation of the unit



CAUTION: CONTROL POWER SUPPLY VOLTAGE MUST BE BETWEEN 360-420 VOLTS AC OR DAMAGE TO THE UNIT WILL OCCUR

COOLING FAN ROTATION (*Optional*)

The rotation of the 3 phase cooling fan motor is dictated by the phase rotation of the connected power supply. A changeover cam switch on the control panel allows the changing of the phase rotation without disconnecting the main incoming supply . To check and/or change the fan rotation, use the following procedure.....

- Turn the large “COOLING FAN” cam switch from “OFF” position to “FWD” position
- Start cooling fan by turning the “FAN OVERRIDE” switch to “ON”. This will bypass the PLC control system and start the fan. The display will flash a message **Cooling Fan Override**
- Check air flow direction of the cooling fan.



COOLING FAN SHOULD DISCHARGE AIR THROUGH THE TOP OF THE UNIT IF RUNNING CORRECTLY

- If air flow and fan direction is incorrect.....
 - Return the smaller “FAN OVERRIDE” switch to the “OFF” position
 - Allow the cooling fan to come to a complete stop
 - Turn “COOLING FAN” cam switch to the “OFF” position and then to the “REV” position
 - Return the “FAN OVERRIDE” switch to the “ON” position to re-start the cooling fan motor.
 - Test operation of cooling fan and direction of air flow.
 - If airflow is now correct return the “FAN OVERRIDE” switch to the “OFF” position
- Unit is now ready for use and application of load steps as required

SYSTEM OVERVIEW

- Viking LBR-PLC series load banks are 100% resistive fan cooled, weather resistant units designed for use in well ventilated outdoor areas and maximum ambient temperatures of 35 degrees C. Use of the load bank in ambient temperatures above this may require some de-rating of the load bank capacity to compensate for the higher intake air temperature.
- LBR-PLC series load banks incorporate a colour touch screen PLC controller that automatically connects the correct load step combinations to give the required load
- Simply selection of the load required using the “LOAD STEP” function on the PLC provides the user with the versatility to increase or decrease load in large or small steps by pre-selecting the load that is wanted then using the “LOAD kW” soft key on the touch screen to connect this load to the equipment being tested.
- Operation of the load bank using the touch screen controller is simple and straightforward. Brief operating instructions are listed under the screen display with further details listed below
- All load steps have circuit breaker protection for short circuit or overload. These circuit breakers are typically located directly below or beside the applicable load step contactor (see layout and wiring diagrams)
- The cooling fan control system includes fan protection for overload and an interlock system preventing the load bank elements from energising in the event cooling fan failure or restricted air flow.
- The LBR-PLC control system includes an automatic cool down timer to maintain a constant air flow over the load elements after completion of a load cycle. The cool down timer is set at a non-adjustable time of 300 seconds (5 minutes) and the operation of the cool down cycle is indicated on the display via a flashing red warning message **“Cool Down Timer in Progress”** During the cool down cycle the power supply must be maintained until the fan has stopped.

“LOAD LOGIC” PLC TOUCH SCREEN CONTROLLER



ALTHOUGH THE TOUCH SCREEN PLC CONTROLLER INSTALLED ON THIS LOAD BANK IS DESIGNED FOR AN INDUSTRIAL ENVIRONMENT IT IS STILL A COMPLEX ELECTRONIC COMPONENT THAT REQUIRES CARE IN USE AND MAINTENANCE:

- **ALWAYS ENSURE THAT THE CORRECT POWERS SOURCE IS CONNECTED TO THE PLC AND LOAD BANK CONTROL SYSTEM. VOLTAGES HIGHER OR LOWER THAN THE RECOMMENDED WILL CAUSE DAMAGE.**
- **DO NOT USE EXCESSIVE PRESSURE ON THE TOUCH SCREEN, ONLY A LIGHT TOUCH WITH YOUR FINGER IS REQUIRED**
- **DO NOT EXPOSE THE DISPLAY PANEL TO HARSH OR CORROSIVE ENVIRONMENTS**
- **DO NOT USE THINNERS, OTHER SOLVENTS OR ABRASIVE CLEANING PRODUCTS TO CLEAN THE TOUCH SCREEN DISPLAY. A WIPE WITH A SOFT LINT FREE CLOTH IS USUALLY ALL THAT IS REQUIRED**

Basic control functions and operating methods for the PLC controller are listed below

- Power is connected to the PLC controller using the “PLC CONTROL” switch. When this is switched to “ON” the controller and the digital power meter will turn on. To enable operation of the load bank with the PLC the “ON” soft key in the lower right corner of the display must be first pressed. The display below this will then show “RUN”. The touch screen controller is now ready for use.

NOTE: ON UNITS FITTED WITH FAN REVERSING OR POWER SUPPLY SELECTION SWITCHES, THESE SWITCHES MUST BE IN EITHER OF THE OPERATING POSITIONS FOR THE PLC AND DIGITAL POWER METER TO OPERATE. IF EITHER SWITCH IS IN THE “OFF” POSITION BOTH CONTROLS WILL NOT TURN ON AND LIGHT UP

- The load bank is now ready for the operator to select the load increments that they need using the “LOAD STEP” soft keys on the display. Load steps are available in 5 kW, 10kW, 20kW & 40kW blocks i.e if the 20kW block is selected then the “UP” & “DOWN” soft key arrows will adjust the preselected load in 20kW steps
- After selecting the required load steps the operator can use the “ARROW “ soft keys ▲ or ▼ to increase or decrease the kW load in the small pre-select window by the selected step quantity. This load will not be connected to the equipment being tested until the “LOAD kW” soft key is pressed.

NOTE: THE COOLING FAN WILL START AUTOMATICALLY WHEN ANY LOAD IS CONNECTED USING THE “LOAD Kw” SOFT KEY

- The lower and smaller of the two digital display windows as described above is used by the operator to select the load he requires to switch on to the equipment being tested without actually connecting this load

- The larger display window indicates the actual kW load that is connected to the equipment being tested i.e. Display showing 40kW means that the equipment under test is carrying a 40kW load.
- At the completion of the load test, pressing the “LOAD DUMP” soft key on the display will disconnect all load from the equipment under test apart from the cooling fan (unless cooling fan and controls are running off a separate supply source) and start the cool down cycle timer. If a selected load is re-applied using the “LOAD kW” key then the cool down timer will stop and reset. Cool down sequence will commence again once this load is disconnected.
- **NOTE: THE COOL DOWN TIME OF 300 SECONDS IS PRE-SET IN THE CONTROLLER. THE POWER SOURCE FOR THE COOLING FAN AND CONTROLLER MUST BE MAINTAINED FOR THE DURATION OF THE COOL DOWN SEQUENCE.**



FAILURE TO RUN THE ENTIRE COOL DOWN SEQUENCE OF 300 SECONDS WILL CAUSE DAMAGE TO LOAD BANK RESISTOR ELEMENTS

EXAMPLE OF TYPICAL LOAD TEST USING THE “LOAD-LOGIC” CONTROLLER WHERE THE OPERATOR WANTS TO TEST A 60Kw GENERATING SET BY GRADUALLY INCREASING THE LOAD ON THE EQUIPMENT.

- After following the start procedure detailed above the operator uses the “LOAD STEP” soft key to select a load step of 10 kW.
- The operator then presses the ▲ arrow key once so that the small display window now indicates that 10 kW has been pre-selected.
- The next step is to press the “LOAD kW” soft key. This starts the cooling fan and connects a load of 10 kW to the generating set.
- Once the generator set is running steadily with the 10 kW load the operator again presses the ▲ arrow key once. The display in the small lower window now indicates 20 kW.
- Pressing the “LOAD kW” key again now connects an additional 10 kW of load to the generating set giving a total of 20 kW. This is displayed in the larger window as an actual load on the generating set of 20 kW.
- Repeating these steps again will add an extra 10 kW of load to the generator each time until the maximum required load of 60 kW is reached
- The operator can then either:
 - Reverse the loading by using the ▼ arrow key to decrease loading on the generating set in 10 kW steps again using the “LOAD kW” key

- Reverse the loading by using the ▼ arrow key to decrease loading on the generating set in some other step size i.e. 5 kW again using the “LOAD kW” key each time to connect the new load
- Use the “LOAD DUMP” soft key to disconnect all load from the generating set in one go and commence the cool down timer function

NOTE: THE kW DISPLAYED IN THE LARGER DISPLAY WINDOW IS A CALCULATED LOAD BASED ON THE LOAD STEPS SELECTED BY THE PLC. THE ACTUAL LOAD ON THE GENERATING SET MAY BE LESS THAN THIS DUE TO EITHER A TRIPPED LOAD BLOCK CIRCUIT BREAKER OR LOAD STEP ELEMENTS THAT HAVE FAILED.

THE ACTUAL kW LOAD ON THE GENERATING SET SHOULD ALWAYS BE CONFIRMED USING THE DIGITAL POWER METER INSTALLED ON THE LOAD BANK AS THIS MEASURES ACTUAL LOAD CURRENT VIA CURRENT TRANSFORMER INPUT ON THE INCOMING POWER CABLES

SECTION 2

MAJOR COMPONENT FAULT FINDING SERVICING AND REPLACEMENT



! CAUTION !

Before commencing any servicing, maintenance or fault finding ensure the following steps are completed:

- **Incoming power supply to the load bank is isolated from the power source and disconnected from the load bank terminals.**
- **Make a physical inspection to ensure that the power supply is disconnected from the load bank and any lock out tags are in place**
- **In addition make final checks of the relevant terminals and/or components with suitable test equipment to confirm that the power supply has been isolated or disconnected.**

Component type & Removal Procedure

The following components may require resetting, servicing or replacing during the normal operating life of this unit. For further information refer to the circuit diagram and/or the general arrangement diagram



ISOLATE POWER SUPPLY BEFORE COMMENCING ANY INSPECTION OR SERVICING OF THIS UNIT



ELECTRICAL MAINTENANCE ON THIS UNIT MUST BE PERFORMED BY A SUITABLY QUALIFIED ELECTRICAL TRADESMAN

Load & Control Circuit Breakers..... (CB- ??)

- Establish cause of the tripping. Megger test the load step circuit protected by the breaker. Megger from the load side of the contactor to check for load element earth/ground fault, **ALWAYS ENSURE THAT THE CIRCUIT BREAKER IS IN THE OFF POSITION BEFORE TESTING**
- After the fault is rectified, reset the load and/or control circuit breaker.

Power meter & control Fuses..... (F-??)

- Establish cause of the blown fuse cartridge. Visually inspect the digital power meter for any signs of damage or arcing.
- After the fault is rectified, reset the load and/or control circuit breaker.
- The Digital power meter contains no user serviceable parts. If the replacement fuse also blows, return the complete digital power meter unit to the manufacturer for inspection and repair.

Load Resistors..... (LE1 – LE??) (remove and replace)

- Isolate power supply to load bank
- Turn off main control circuit breakers (CB1 & CB2)
- Using a suitable multimeter set to 'Ohms' range, determine location of the faulty load element resistor by measuring and comparing phase to phase ohm readings on the faulty load step. An out of balance reading across the delta connected three phase resistor steps indicates a faulty element.
- To replace the faulty load element, open the load bank control compartment access door and remove the service access cover on the opposite side
NOTE: to access some load resistors near the top, the control panel front plate may also need to be removed from by undoing the securing screws.
- Disconnect wiring from faulty load resistor element and undo the locknut securing the element.
- Withdraw the faulty element through the load element compartment access opening (after removing the access panel).
- Replace the faulty element with a Viking genuine replacement unit of the same size, type and rating. Replacement procedure is the reverse of removal.

- Always ensure that replacement elements have a silicone seal applied on the connection end sealing plate before installation. Failure to do this will compromise the weather protection in the resistor connection enclosure



DO NOT REPLACE ANY LOAD RESISTOR WITH A DIFFERENT TYPE, MAKE OR SIZE.

Load Contactors.....MC1 – MC??

Failure of a contactor to close will result in one of the load steps either fully or partially not working. To replace the contactor:

- Turn off circuit breaker for the relevant load circuit contactor
- Disconnect load and control cables from the faulty unit
- Remove the faulty contactor and replace with a unit of the same type, brand and rating.

Over Temperature Thermostat.....TS-1

- The over temperature protection thermostat is located directly behind the control panel and will self-reset after a cool down period should a fault occur.
- Immediately after an over temperature fault occurs turn off all load steps and main load switch.
- Isolate supply to load bank
- Visually check the load bank for any fan problem restriction of cooling airflow or obstructed inlet or discharge openings.



In high ambient temperature conditions the over temperature thermostat may have the trip point increased by a maximum of 15 degrees C. Exceeding this could result in serious failure, injury or fire.

Control Circuit Breaker.....CB1

Provide protection for TX1 the control power transformer for load bank control circuits and components. If a breaker trips follow the following procedure

- Isolate the power supply to the load bank
- Inspect the transformer for any visible signs of damage or arcing
- Establish the cause of the circuit breaker trip
- Rectify the fault or replace the faulty component in the load bank control system
- Reset the circuit breaker and test

Fan Motor Thermal Overload.....TO-1

Establish cause of thermal overload trip. Some common causes are: loss of one or more phase supplies, internal motor winding fault, motor over current due to fan impeller damage etc.

- Isolate all power to the load bank
- Turn off control and motor protection circuit breakers

- Inspect all components as per above possible faults
- Reset motor overload trip
- Turn on circuit breakers and test

Touch Screen PLC

No user serviceable components form part of the main load bank PLC controller. The touch screen display and PLC controller is an integrated unit. If a fault occurs in either software or hardware of the controller the complete load bank must be returned to the manufacturer or authorised service agent for repair or replacement

- Isolate all power to the load bank
- Turn off control circuit breakers (CB1-CB2)
- Do not attempt to use the load bank if a fault is present in the PLC control unit, damage to other components may occur.
- Return the complete load bank for repair

Viking Digital power Meter.....EM-300A

This unit is sealed and cannot be repaired. To replace:

- Isolate all power to the load bank
- Turn off control circuit breakers (CB1)
- Disconnect voltage sensing by opening fuse holders F1 – F3
- Remove mounting clips from rear of unit
- Install new unit and replace clips
- Turn on control circuit breakers, close fuse holders and test. Follow EM-300A instructions in this manual for programming of new meter.

SECTION 3

GENERAL MAINTENANCE



Before commencing any servicing, maintenance or fault finding ensure the following steps are completed:

- **Incoming power supply to the load bank is isolated from the power source and disconnected from the load bank terminals.**
- **Make a physical inspection to ensure that the power supply is disconnected from the load bank and any lock out tags are in place**
- **In addition make final checks of the relevant terminals and/or components with suitable test equipment to ensure that the power supply has been isolated or disconnected.**

General Maintenance

In most cases, load banks require minimal maintenance other than regular cleaning and checks for component wear. Most component failures are covered by the fault finding section earlier in this manual.

This section covers the basic recommended procedures to maintain this equipment in a safe and reliable condition.



ELECTRICAL MAINTENANCE ON THIS UNIT MUST BE PERFORMED BY A SUITABLY QUALIFIED ELECTRICAL TRADESMAN

Load banks frequently operated outside, in extreme weather conditions or salt laden atmosphere require monthly inspections to ensure on-going reliability of the unit. Equipment used in less extreme conditions such as a workshop require inspection only every 3 months

- Check all external surfaces for dirt build-up and any obvious signs of corrosion. Clean and touch up paintwork in any damaged areas, which show signs of surface rust.
- Using the supplied key open the control panel door and switch off the control circuit breakers (CB1-CB2). Install lock out tags or breaker lockout device if local regulations require this.
- Undo the securing screws and remove the load resistor access panel . Inspect areas around the load element resistors for obvious signs of corrosion or build-up of dirt or other contaminants. Clean load element as required.
- Inspect fan chamber and cowling and check for any paper or debris, which may have entered into the fan compartment. Clean as required.
- Check all inlet grills for any blockage. Clean all surfaces including the fan impeller. If necessary, hose the unit down using a low pressure water source, making sure that the control compartment door is closed and sealed.



DO NOT USE CORROSIVE CLEANING AGENTS ON ANY AREA OR COMPONENTS OF THIS UNIT.

Electrical Maintenance

Load banks frequently operated outside, in extreme weather conditions or salt laden atmosphere require monthly inspections of electrical equipment to ensure on-going reliability of the unit. Units used in less extreme conditions such as a workshop require inspection only every 3 months.

Wiring and connections

- Check all wiring for loose connections and any sign of cable or terminal discolouration that may indicate a loose connection or “hot joint”. Re-terminate or replace any cable, terminal or components that may have been damaged.
- Insulation tests, using a 1000 volt megger, on load element resistors should be carried out on a regular basis. The frequency of these tests depends on the operating environment and usage, however a minimum of once per year is recommended.



TURN OFF ALL LOAD ELEMENT, CONTROL CIRCUIT BREAKERS AND ISOLATE ALL CONTROL FUSES BY REMOVING FUSE CARTRIDGES BEFORE COMMENCING ANY HIGH VOLTAGE MEGGER TESTING

- Connect the Megger ground test lead to the earth stud on the load bank frame.
 - Connect the second lead to one of the phase cables (L1, L2 or L3) on the output side of the load element contactor and test.
 - Insulation resistance readings should be approximately 10 megohms or higher.
- A lower resistance indicates a potential problem and the following additional tests should be performed;
 - Isolate the area of low resistance and check the resistor terminal area for dust or dirt, clean and re-test if necessary.
 - If necessary, remove the connection cables and copper links, then check each load bank element resistor for leakage to earth/ground.
 - Immediately remove and replace any faulty load element resistor

Low resistance to earth measurements can be caused by localised areas of low resistance around the load element seals. This can be prevalent in areas of sustained high humidity due to natural or man-made conditions. Local drying of this area and re-testing will confirm the condition of the load element resistor.

Cooling Fan Motor & Impeller

Regular inspection and maintenance should be carried out on the fan motor and impeller. The operating environment and amount of use are the principal factors in determining the frequency of this maintenance, however they should be performed a minimum of once per year and more frequently where high usage cycles or severe operating environments exist.

- Motor should be inspected and checked for dirt or contaminant built up in air intake and vent areas.
- Check for excessive movement in the motor shaft and / or any excessive bearing noise.

- Fan impellers should be checked for loose or damaged blades and the fan hub insert and retaining bolts checked for tightness
- Dismantling of the motor and inspection or replacement of the bearings should be performed every 8,000 – 10,000 running hours or every 5 years.

SECTION 4

Viking EM-300A Power Meter Programming and Operation

SECTION 5

Drawings & Component Specification

- 1. Electrical Component Layout Drawing**
- 2. Electrical Schematic – Sheet One**
- 3. Electrical Schematic – Sheet Two**
- 4. Component Data Sheets**