



# SATURN-HV

## Medium-Voltage Load Bank

### Description

The **Saturn-HV** is a self-contained load bank to 15KV utilizing the Simplex Saturn Load Module with on-board dry-type power transformer. It is a free-standing, semi-portable skidded unit consisting of three principle sections:

1. High voltage section consisting of main input power terminals, high voltage: 480V 3-phase power transformer, low voltage output terminals, low voltage fuses and outputs to load cell
2. 480V, low voltage resistive load section consisting of one 1400-3000KW forced-air cooled load cell
3. Control Section

All control circuits and control power supplies are powered internally. The Saturn-HV requires connection of a 3-phase feeder only.

Load circuits and cooling fan operate at 480V; control circuits operate at 120V.

Input disconnects, fuses, lightning arrestors and potheads available as options.

### Construction

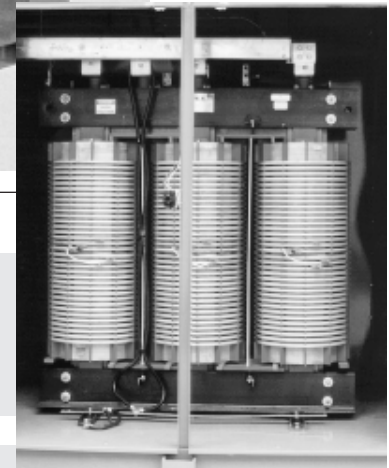
All panels for access to serviceable components are hinged doors with stainless steel hinges and lockable latches. All exterior fasteners are stainless steel.

The load bank enclosure is double wall constructed for a cool exterior and thermal isolation of the load elements. Cooling airflow through the enclosure is vertical with cold air intake at the bottom and hot air exhaust out the top. Intake and exhaust openings are screened. Exhaust is straight up with no flow to any side. Exhaust flow is directed through rain and snow shedding louvers.

**Dimensions:** 74"W x 140"H x 233"D

**Enclosure:** NEMA3R control section; NEMA3R power section

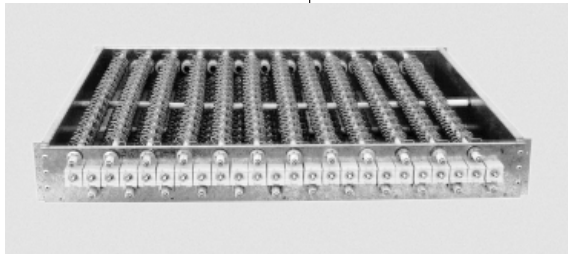
**Shipping Weight:** Approx. 15,850 lbs.



<b>CAPACITY:</b>	1400-3000 KW, 1.0 power factor
<b>VOLTAGE:</b>	To 15 KV AC, 3-phase (typical: 2400V, 3300V, 4160V, 13,200V, 13,800V) Load circuits operate at 480V via main power transformer
<b>FREQUENCY:</b>	50, 60 Hertz
<b>LOAD STEPS:</b>	50 KW resolution
<b>DUTY CYCLE:</b>	Continuous
<b>TEMPERATURE RATING:</b>	120°F maximum air intake temperature 120°F maximum ambient temperature Exhaust rise: 150°F (note: as airflow is not laminar, exhaust air temperatures are not equal at all points at the plane of air exhaust. Some parcels of air may reach approximately 575°F before mixing)
<b>AIRFLOW REQUIREMENTS:</b>	1400-1800 KW, 40,000 CFM 1800-2000 KW, 50,000 CFM 2500-3000 KW, 60,000 CFM
<b>ALTITUDE:</b>	6000'
<b>FAN/CONTROL POWER:</b>	Internal via high voltage: 480 V, 3-phase transformer for fan power, 480:120 transformer for control circuits



### Powr-Web Resistive Load Element



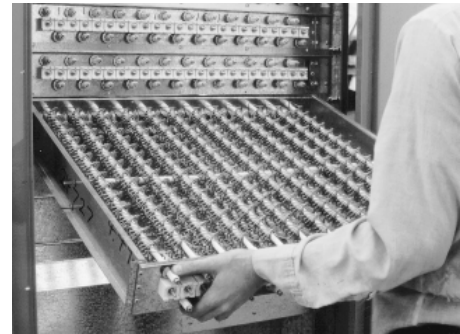
#### Description

The Simplex "Powr-Web" load resistor is used in the SATURN-HV. The "Powr-Web" is an advanced design, air-cooled power resistor specifically designed for application to load bank systems. The "Powr-Web" is conservatively operated at half the maximum temperature rating of the alloy and features a short-circuit-safe design based on continuous mechanical support of the resistor by high temperature, ceramic clad stainless steel rods.

The "Power Webs" are assembled into discrete trays which are assembled in a vertical "stack." Each tray in the "stack" is independently serviceable without disturbing adjacent trays.

#### Specifications

- Alloy: FeCrAl
- Maximum continuous temperature rating: 1920°F



- Maximum operating temperature as applied in Load Bank: 1080° F
- Cool down time from operating to ambient temperature is 10 seconds.

#### Construction

- Precision calibrated to specific ohmic value
- Welded lugs each end
- All load elements are continuously supported by vibration resistant, ceramic clad, stainless steel through-rods.

### Branch Circuit Fuse Protection



The load of a resistive load bank consists of a dense array of open, uninsulated power resistors mounted within a cooling air stream. Since the elements are electrically live, it is possible for a foreign object to penetrate the element array and create a short circuit of adjacent elements or a short to ground. Since the elements are densely packed, it is possible for a short circuit, once started, to rapidly propagate through the entire element array. As a load bank represents a relatively large amount of power concentrated within a relatively small volume, a self-propagating, cascading short circuit would have catastrophic results.

Simplex virtually eliminates the dangers of short circuit through the use of branch circuit fuse protection of the load elements. Per NEC 110-10, protective devices shall clear a fault without "extensive damage" to the circuit components. A Simplex Load Bank is divided into branch circuits of not more than 50 KW each.

Each branch circuit is then individually fused. In a load bank, a developing short circuit can be current limited, initially, by the unaffected portion of the shorted load element. Closely scheduled branch circuit fuse protection as applied by Simplex can sense a low level developing fault, clear the fault and isolate the failed elements before propagation occurs. Since the load of a load bank is fixed in value and is either full-on or full-off, any excursion from rated current represents a fault. For this reason, Simplex Load Banks utilize closely scheduled, very fast acting, single-element fuses. In order to permit the application of a load bank to high capacity systems having a high available short circuit current, Simplex utilizes current limiting fuses which have the maximum U.L. interrupting rating of 200,000 amperes. This rating affords compliance with NEC sections 110-9 and 230-98 in today's large capacity systems and meets the requirements of future system expansion.

**Main Terminals:** High voltage input terminals, silver-plated copper bus bar

**Transformer:**

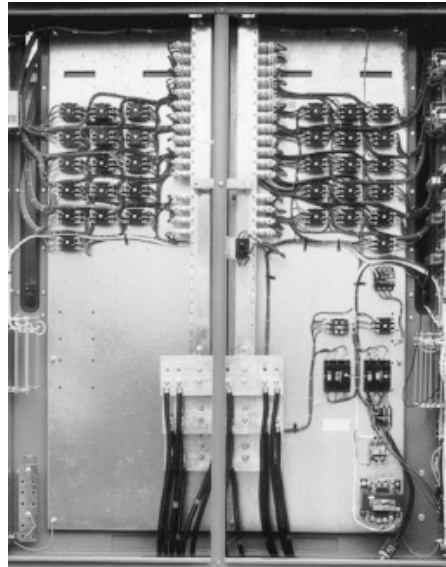
- Dry type transformer
- 1400-3000KVA, continuous duty
- High voltage delta, 3-wire primary
- 480 volt wye, 4-wire secondary with grounded neutral
- 220°C insulation
- 150°C rise

**Insulation Level:**

System Voltage	BIL
2.5KV	20KV
5.0KV	30KV
8.7KV	45KV
15KV	60KV

Overtemperature switch embedded in coils

**Output Circuits:** Secondary of transformer connected to output fuse circuit



## Principle Systems and Components

### Load Elements

Simplex "Powr-Web" open wire, helically wound, chromium alloy, thermally derated to 60%, 5% tolerance, 2% balance .995 p.f. Element wire mechanically supported over entire length such that if a wire should break, the broken wire segments will not short to adjacent conductors or to ground.

Load elements are individually serviceable and replaceable in the field without major disassembly of the load bank. The load elements are installed in slide-out, removable trays such that any element is easily accessed without disturbing any other elements.

All materials used in the mounting and installation of the load elements are suitable for the temperatures encountered, both in normal operation and under fault conditions.

Materials in direct contact with the element wire are ceramic, other materials which structurally support the load elements and/or which form the hot air duct within which the elements are mounted are steel, stainless steel or aluminum. Plastics and glass reinforced plastic materials and flammable materials are not acceptable materials of construction for installation, support and mounting of load elements or in the construction of the load bank hot air duct.

### Load Control

Branch circuit contactors, each 50KW step. Contactors have enclosed silver surfaced contacts, 120V coils; electrically operated and electrically held.

### Element Circuit Protection

Branch circuit fuses, each 50KW branch circuit, 200KAIC, current limiting type

### Power Wiring

150°C insulated; color coded and numbered

### Control Wiring

105°C, color coded and/or numbered

### Power Connection

Plated bus bar within an oversize NEMA3R, terminal junction box.

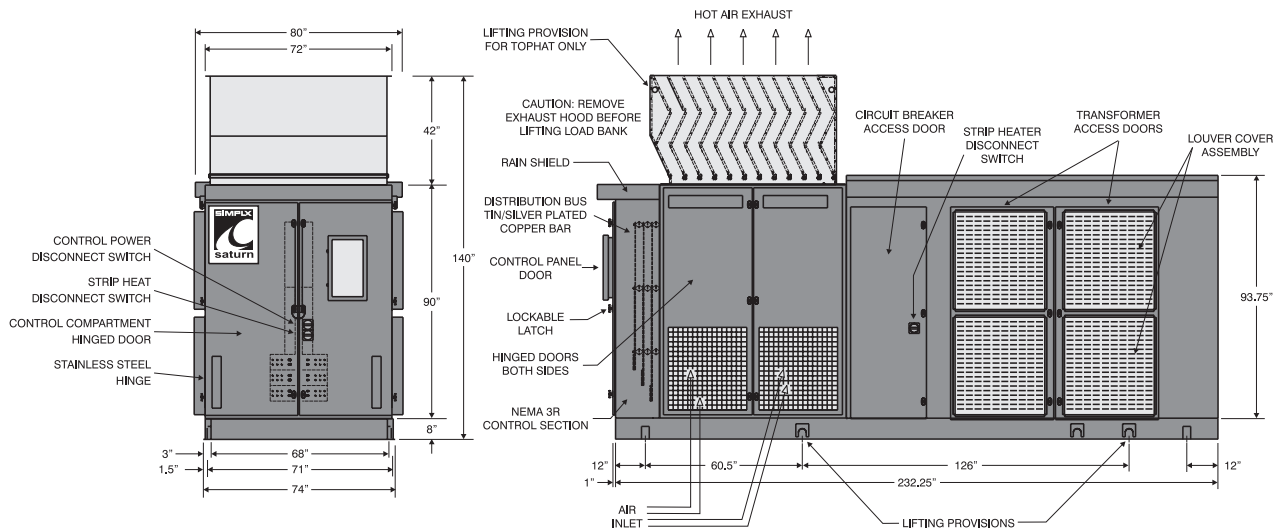
### Cooling

Forced air, vertical airflow, top exhaust. 20/30 HP, 3-phase, TEFC motor driving cast aluminum fan blade. Circuit breaker combination motor starter.

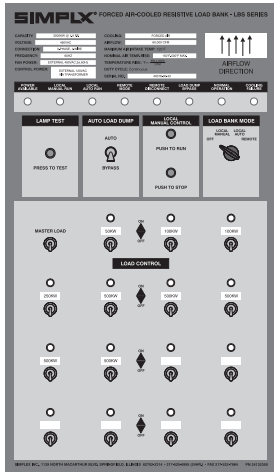
### System Protection

Fan failure, high exhaust temperature, high intake temperature; transformer overtemperature; lockout and alarm.

### Dimensions and Key Features



### Load Bank Control



Operating controls are located on a Local and a Remote Control Panel. The Control Panels contain printed circuit boards with 24VDC components. DC control power is supplied to the printed circuit boards by a 24VDC power supply located in the Load Bank. Common serviceable components include Control Fuses, Power Supply Fuses, and Load Step Fuses. Lamps on the control panels indicate the Load Bank operating status.

The Local Control Panel contains the following components:

1. Power Available, Local Manual Run, Local Auto Run, Remote Mode, Remote Disconnect, Load Dump Bypass, Normal Operation, and Cooling Failure indicator lamps
2. Lamp Test pushbutton
3. Load Dump Bypass switch
4. Local Manual Control pushbuttons
5. Load Bank Mode switch
6. Master Load and load step switches

The Remote Control Panel contains the following components:

1. Power Available, Remote Manual Run, Remote Auto Run, Local Mode, Remote Disconnect, Load Dump Bypass, Normal

Operation, and Cooling Failure indicator lamps

3. Lamp Test pushbutton
4. Load Dump Bypass switch
5. Local Manual Control pushbuttons
6. Load Bank Mode switch
7. Master Load and load step switches

The Load Bank control system also includes: malfunction detection and automatic disconnect system, remote load dump circuit for remote dry contacts (close to run) to trip Load Bank off line, and auxiliary dry contacts to indicate normal operation or system failure

#### Options:

- Input disconnect switch, 5KV or 15KV class
- Input fuses
- Lightning arrestors
- 5KV or 15KV potheads
- Low voltage (480V secondary) disconnect switch
- Automatic load regulating features
- Automatic regenerative power control features
- Analog or digital instrumentation