1. Generator Load Bank

Provide a fan-cooled resistive load bank for permanent, on-site installation as a component of the power generation system. The load bank is to be primarily used to absorb any regenerative power feeding back into the generator and to supplement the plant load if the plant load drops below an unacceptable level. The normal mode of load bank operation shall be in automatic mode, installed complete with all ancillary devises to monitor the generator load condition.
Except as otherwise indicated, the load bank and ancillary components shall be of types, sizes, characteristics, and ratings indicated, which comply with the manufacturer's standard design, materials, components and construction, in accordance with published product information, and as required for complete installation.

Manufacturers

Subject to compliance with requirements, the load bank shall be SEPHCO type or approved equivalent.

2. Sequencing and Scheduling

(a) Schedule delivery of load bank equipment, which permits ready building ingress for large equipment components to their designated installation spaces.
(b) Co-ordinate the size and location of concrete equipment pads.
(c) Co-ordinate with other electrical work including location of raceway entries and fittings, and cabling/wiring work, as necessary to interface installation of load bank with other work.

3. Load Bank Rating

(a) Capacity	: XXXkW
(b) Power Factor	: 1.0
(c) Load Steps	: XXX kW resolution
(d) Voltage	: XXXV 3 phase Delta
(e) Frequency	: XX Hz
(f) Ambient Temperature	: 5° to 45° C
(g) Duty Cycle	: Continuous
(h) Control Voltage	: XXXV

4. Load Bank Design

The load bank shall be completely self contained, free standing unit, incorporating all resistive elements, load contactors for each load group, individual load group circuit breakers, load bank protection devises, main load bus, auxiliary terminals, fan cooling systems, malfunction detection system, unit controller and IP55 type control enclosure.

5. Enclosure

(a) The load bank control enclosure shall be constructed from zinc coated steel with a minimum metal thickness of 2mm, have fully opening hinged doors to provide full and clear access to all resistor connections and switch gear, and fitted with lift-off type hinges and tool operated chrome plated locks. The enclosure shall have a full gutter surround, fitted with a neoprene rubber, wire reinforced automotive type gasket. Structural steelwork such as load bank mounting chassis and resistor supports shall be hot dipped galvanized. General paint treatment of the load bank shall be two-pack Acrylic primer, finished with a minimum of two coats of two-pack white Acrylic.

(b) Cooling airflow through the resistor chamber shall be vertical discharge, with cold air intake at the bottom and hot air exhaust at the top. Temperature rise of the control and the load bank resistor compartment shall not exceed 20° C above ambient temperature. The cool air intake at the base of the load bank and at the exhaust exit shall be fully protected by screens having 12 x 12 mm maximum openings.

(c)

The load bank resistor chamber and materials including resistors, shall be able to withstand direct rain and meet IP65 conditions. Gravity dampers shall not be relied upon to meet the IP65 conditions. Load bank construction such as body panels and doors shall be zinc coated steel. Load bank chassis and framework shall be steel, hot dipped galvanized after construction. All external securing devises such as screws, nuts and bolts shall be of #316 stainless steel. The load bank paint finish shall be two-pack polyurethane primer finished with two coats of two-pack polyurethane marine grade enamel.

(d) The load bank shall include forklift channels and lifting eyes. Lifting of the load bank using chains or slings shall not distort or damage the load bank.

6. Load Resistors

(a) The load resistors shall be totally immersion proof type IP65, impervious to heavy rain, ice, and snow build-up. The resistors shall be fully sealed SEPHCO SDL Incoloy sheath, stainless steel finned type, mineral insulated and tested to 2.5 kV. Resistor to resistor contact or to adjacent metal parts shall not impede the performance or cause failure to the resistor. Resistor values shall be accurate to 2.5% of rated value and shall not reduce in value by more than 2.5% at full operating temperature.

(b) Each resistor shall be fixed to the control enclosure by a brass bulkhead fitting sealed by gasket. Resistors shall be fully supported along their length by galvanized steel grids. Each resistor shall be adequately grounded and removable without dismantling adjacent resistors. Wire type resistors, ceramic supports, plastics, glass reinforced plastic materials, shall not be used in the resistor design.

(c) Resistor terminals shall be fully accessible and segregated from the switchgear. Each resistor shall be easily removable and withdrawn from the rear of the load bank, accessible by removable panels.

(d) Resistor design and rating shall ensure a life span of ten years under normal operating conditions.

7. Short Circuit Protection

(a) Each resistor shall be grounded to the main control enclosure.
Each load group shall be protected by a three-pole circuit breaker. Fuses shall not be used.
(b) Contactors for each load group shall be sized to match the breaker capacity and rated for 50° C operation.
(c) Wiring to resistors shall be by flexible multi-stranded copper cable rated to 150° C. Heavy bus connections shall not be used to terminate the resistors.
(d) Main terminal studs shall be provided directly onto the copper bus. Connections be provided for multiple incoming cables per bus, as recommended by the load bank manufacturer.
(e) Cooling system shall be by fans directly driven by 940 RPM max, IP55 rated motors. Each fan motor shall be protected by a thermal overload and circuit breaker in the load bank enclosure.
(f) Each cooling fan shall have monitoring and trip devises, such as an airflow switch and high limit re-settable thermostat connected to the load bank's control interlock system.
(g) Cooling fans shall be connected to the load bank auxiliary terminals for connections to a dedicated 3 phase circuit from the mains power source, to facilitate a five-minute fan run-on cool-down period after the load bank shutdown.
(h) The load control circuits and fan motor circuits shall operate from an external 240V power source.

8. Load Bank Control

(a) The load bank shall include an automatic unit controller, which provides the following functions.
(b) Monitoring of the load bank fan interlock systems, such as thermostats, airflow switches and fan motor thermal overload devises.
(c) Automatic monitoring of the generator line voltage and load current from external C.T's.
(d) Cooling fan automatic start-up.
(e) Cooling fan automatic shutdown.
(f) Automatic load response and variable switching of the load bank load stages to suit the required operating current of the generator or absorb any regenerative power.
(g) Automatic load dump signaled from a remote source, initiating a fan cool-down period.
(h) Variable load adjustment from 0%-100% of generator rating.
(i) Auxiliary contacts for field use to indicate load bank "Operating Normally" and "Load Bank Failure".

9. Load Bank Control Operation

(a) The load bank shall be equipped with an automatic control processor, which will activate upon closure of the remote enable/disable signal.
(b) In automatic mode, the load bank control system is to be on-line and the power source monitoring system be continuously operative whenever the power source runs. The load bank shall provide a component of the total load and shall be automatically variable to respond to dynamic load demands upon the power source or compensate for any regenerative power feeding back into the generator/s.
(c) The automatic control processor shall feature EEPROM memory for system back-up of operation parameters during any momentary power loss. Operating parameters such as generator rating, C.T. ratio, time delays and percentage load setting shall be stored in the EEPROM memory. Adjustment to the percentage load setting shall be accessible at any time.
(d) The controller shall calculate the exact load required to supplement and maintain the correct loading onto the power source, corresponding to the controller's setting or apply loads to compensate for any regenerative load condition. The controller shall actuate one or a combination of load steps from the load bank to precisely stabilise the engine-generator. The switching operation of load shall be non-linear, so as to provide smooth operation, whilst minimising load contactor switching. The controller shall include solid state contactor drives for fast reliable operation of the load bank contactors. The controller shall instantly remove loads should a sudden increase in power source load occurs or threaten an engine generator overload.
(e) Upon recovery of the power source load and condition, the controller shall shed loads from the load bank and automatically run the cooling fan/s for a period of five minutes.

10. Delivery, Storage and Handling

(a) Deliver load bank to site for receipt by installing contractor.
(b) Inspect delivered load bank, at site together with installing contractor, to ensure that there is no damage to the unit.
(c) Any equipment found damaged at time of inspection, shall be removed by Vendor from site and replaced with new.
(d) Deliver load bank and components properly packaged and mounted on pallets or skids to facilitate handling by installing contractor. Utilize factory fabricated type containers or wrapping for load bank to protect unit from damage.
(e) If storage is required, store units in original packaging and protect from weather.
(f) Handle load bank carefully to prevent physical damage to equipment and components. Remove packaging, including opening of crates and containers at site, avoiding any actions which would damage the equipment, prior to inspection of equipment with installing contractor.

11. Field Quality Control

(a) Prior to energising of circuitry check all accessible connections to manufacturer's torque tightening specifications.

(b) Prior to energising of load bank, check with earth resistance tester phase-to-phase and phase-to-earth insulation resistance levels to ensure requirements are fulfilled.

(c) Prior to energizing of the load bank, check for electrical continuity of circuits, and for short circuits.

12. Adjusting and Cleaning

(a) Adjust operating mechanisms for free mechanical movement.

(b) Touch-up scratched or marred surfaces to match original finishes.

13. Earthing

Provide equipment earthing connections bus for load bank. Tighten connections to comply with tightening torque to relevant standards to ensure permanent and effective earth.

14. Demonstration

After wire and cable hook-ups, energize load bank and demonstrate operation in accordance with requirements. Where necessary, correct malfunction units, and then reset to demonstrate compliance.