

**White Paper**

**Radiator Mounted Load Banks**

## Radiator Mounted Load Banks

Radiator/Duct mounted load banks are a critical component of any backup power system. With available capacities from 50 to 1500 kW and a voltage range of 208 thru 600 VAC (three phase), the radiator mounted load bank is an ideal solution for supplemental generator set testing.

Available for mounting directly to the generator set radiator, existing duct work, outside of the generator set enclosure or on top of a sound attenuated package these load banks provide the flexibility needed to ensure correct power system testing.

Load bank specialist such as Avtron and Froment (brands of ASCO Power Technologies) can provide the equipment and expertise to meet almost any testing requirement.

### Radiator Mounted Load Banks

Radiator Mounted Load Banks are permanently installed to the radiator of an engine generator and utilize the cooling air from the engine fan to cool the resistive load elements. Since these load banks do not include any blower or blower controls they are a cost effective solution for supplemental loading. These load banks are commonly installed inside the engine generator's enclosure. They also can be provided for indoor, duct-mounted, or outdoor locations.

Radiator/Duct-mounted load banks are custom built for each application, matching the generator set's radiator core height and width. They are mounted directly to the generator set radiator and as stated above, utilize the engine fan for cooling.

The enclosure for the load bank and controls can be provided either for standard indoor mounting, or may include weather protective design with exhaust louver for outdoor installation. In the case of an outdoor design there will be an exhaust hood and additional gasketing, etc. for protection in an outdoor environment.

### Horizontal Mounted Load Banks

Horizontal Mounted Load Banks are radiator air cooled units designed for rooftop mounting on enclosed generator sets which have an air turning plenum to exhaust air vertically, through the roof. The Load Bank mounts over the air exhaust opening and is cooled by the radiator air outflow. These horizontal mount load banks are fully weatherproof and intended for outdoor installation and operation in all weather conditions. Given the rooftop mounting, remote operator controls are included as standard for installation in a user convenient location.

### Design Criteria

Radiator-style load banks are designed for supplemental loading and should be limited to between 50-70% of the generator set nameplate kW rating. This is typically an adequate load level to prevent wet stacking and maintain proper



**Horizontal Mounted Load Bank shown. (Photo courtesy of ASCO Power Technologies.)**



Photo courtesy of ASCO Power Technologies

loading on the generator set. A radiator load bank should not be designed for more than 70% of the nameplate kW without approval of the generator set manufacturer since the additional heat load could compromise the engine’s cooling system, particularly in high ambient temperature applications.

**CHART 1: Recommended Capacity for Radiator Mounted Load Banks**

Generator Rating (kW)	50% Radiator Mounted Load Bank (kW)	70% Radiator Mounted Load Bank (kW)	100% Permanent, Freestanding Load Bank (kW)
500	250	350	500
750	375	525	750
1000	500	700	1000
1250	625	875	1250
1500	750	1050	1500
2000	1000	1400	2000

Sizing a radiator load bank close to or at 100% of nameplate rating may require a deeper frame and will add significant external static pressure drop to the radiator cooling air, reducing the amount of cooling air through the radiator. This could affect the operating performance of the generator, engine and cooling system. The preferred solution for 100% load is to use a permanent mounted, free standing load bank. A free standing load bank has an integral cooling fan and therefore not subject to radiator mounted back pressure concerns. (See Chart 1, left).

## Back Pressure

Radiator load banks add to the air flow restriction of the engine cooling system and consideration must be given for overall operating conditions. The resistor load elements and support rods will increase the back pressure for the engine cooling fan and reduce the cooling air. Engineering calculations should be made to determine the air flow restriction and ensure that the resulting air flow through the radiator will provide adequate cooling for the engine. In high ambient areas this may require the use of oversized radiators with increased cooling capability on the generator set (or even prohibit the use of radiator load banks for the application).

The additional back pressure created by the radiator load bank can be estimated when the size of the radiator core and the volume of air (CFM) moving through the radiator are known. Radiator load banks designed for outdoor operation will further reduce the airflow due to the weather protective louver which is provided.

While the radiator load bank can provide an economical solution for generator set testing it does present some application issues which need to be understood. The addition of a radiator mounted load bank on the front of the engine cooling radiator does reduce the airflow through the radiator core. This reduction in cooling air flow will reduce the cooling capacity of the engine radiator cooling system and can reduce the ability of the engine generator set to carry its full load capacity under high ambient temperature conditions. Since the load bank elements are present and restricting the air flow even when the load bank is not being used this can reduce the engine generator capability.

In certain cases it may be necessary to increase the depth of the load bank frame to accommodate the load bank elements. This increased depth will also increase the back pressure created by the load bank and further restrict the cooling air flow.

## Manual Controls

The most common type of controls for radiator style load banks are manual toggle control. These controls are usually mounted directly on the side of the load bank enclosure. They can also be remotely mounted in a separate NEMA Type enclosure. The controls include over temperature protection



Photo courtesy of ASCO Power Technologies

to remove the load bank elements from the generator set in the event of a high temperature indication. The load step controls consist of a toggle switch for each load step and a master load control switch which will enable all selected load steps simultaneously.

The controls also include a standard “Remote Load Dump” circuit which can be interlocked with an external control (transfer switch) to remove all load bank elements in the event of a normal utility power failure. This circuit requires a normally closed contact which will open when the utility power fails and is commonly provided by a transfer switch auxiliary contact.

## Automatic Controls

These controls can be provided to monitor the building load, and automatically add and subtract load bank elements to maintain a minimum load on the generator set to help prevent wet stacking. These controls include a remote mounted current transformer to monitor the building load and a sensor which provide adjustable pickup and dropout set points as well as adjustable timing for the individual load steps. The standard automatic load controller provides five individual set points for automatic control of the load bank.

## Remote Interface

As Building Management Systems (BMS) become more sophisticated, the controls for radiator mounted load banks have also evolved. In today’s market, options are available for radiator mounted load banks to be controlled by BMS or Modbus. These options typically involve adding remote I/O, pilot relays or even a digital control platform to allow interface with BMS or other sophisticated master control systems.

## Mounting

Mounting provisions for radiator mounted load banks include a top and bottom horizontal flange which can be drilled to bolt the load bank to the engine generator set radiator shroud or housing. In most cases the radiator duct adapter flange will extend into the load bank frame. The load bank frame is commonly designed in two inch increments so the frame may be slightly larger than the radiator duct flange.

Over head lifting provisions are required so the load bank can be lined up and correctly mounted to genset radiator flange. These lifting provisions are commonly eye bolts or lifting eyes fabricated into the load bank frame.

## Diesel Particulate Filters

Passive diesel particulate filters (DPFs) rely on normal exhaust temperature to “regenerate”, or burn off, accumulated particulates/soot from within the filter. Diesel engines that are exercised with no load do not create sufficient exhaust temperature for regeneration and there is a danger that a DPF in the system will become totally blocked. A radiator load bank is an effective means of bringing the exhaust above the minimum regeneration temperature. Many of today’s load bank manufacturers have special designed load banks with extensive temperature sensing controls for emission compliance.

## Summary

Radiator/Duct mounted load banks offer a cost effective means for supplemental loading applications. Whether installed directly to a generator set radiator or on the outside of an enclosure, these load banks offer the most flexibility for critical power testing.

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