Load Banks for Data Centers

avtronpower.com

AVTRON
POWER SOLUTIONS

THE DATA CENTER POWER CHALLENGE

In today's data centers, uptime is assumed. Tier requirements, strict service level agreements (SLAs), and growing regulatory oversight mean power infrastructure must perform exactly as designed — not just on day one, but throughout the facility's lifecycle. Any weakness, however small, can translate directly into risk.

At the same time, power architectures are becoming more complex. Higher rack densities, modular expansion, distributed UPS systems, and multiple generator configurations increase interdependency across electrical and mechanical systems. As complexity rises, so does the potential for hidden failure modes.

The greatest risk lies in infrastructure that has never been tested under real operating conditions. Systems that appear healthy at no-load or partial load can behave very differently when pushed to full capacity:

- Generators that start reliably, but cannot sustain rated load
- UPS systems that pass functional tests, yet fail under real electrical stress
- Battery systems with undetected degradation
- Cooling systems unable to support true IT load conditions
- Power and cooling systems interacting unpredictably once fully loaded

Commissioning and testing without realistic load only tells part of the story. True data center resilience is proven when power and cooling systems are validated together, under controlled, full-load conditions — before uptime is put at risk.

LOAD BANKS FOR DATA CENTERS

To reduce risks, data centers turn to Avtron load banks — the industry's trusted solution for applying safe, controlled, and fully realistic electrical loads during commissioning. Avtron's selection of air and liquid-cooled load banks replicate the exact conditions your power and cooling systems will face once IT equipment is installed. By placing the entire infrastructure under genuine full-load stress, Avtron load banks expose hidden weaknesses early, validate system performance, and prove that the facility is truly ready for live operation.

LOAD BANK APPLICATIONS

GENERATOR TESTING

Load banks safely simulate real electrical demand to test backup generators under full-load conditions. This confirms that generators can start, carry critical loads, and perform reliably during a power outage—without risking live IT equipment.

ELECTRICAL SIGN-OFF

Electrical sign-off and validation confirm that all power systems have been installed, tested, and configured to operate as designed. Through inspections and functional testing, this process verifies safety, redundancy, and compliance—ensuring the data center's electrical infrastructure is ready to support critical operations from day one.

COOLING VALIDATION

Cooling validation verifies that a data center's cooling systems perform as designed under expected operating conditions. Through testing and measurement, it confirms proper airflow, temperature control, and redundancy—ensuring critical IT equipment remains within safe thermal limits at all times.

UPS TESTING

UPS testing ensures uninterrupted power protection by verifying that uninterruptible power supply systems operate correctly during normal conditions and power disturbances. Through controlled testing, it confirms battery performance, load-handling capacity, and seamless transfer—helping protect critical IT equipment from power interruptions.

POWER VALIDATION

As utilities struggle to meet growing demand, data centers increasingly rely on medium- and high-voltage power sources such as gas turbines, reciprocating engines, and renewable generation. Through controlled load bank testing, these generators are validated for performance, load-handling capability, and stability—ensuring dependable power delivery to critical infrastructure regardless of grid limitations.

DATA CENTER COMMISSIONING LEVELS

The standard commissioning levels (L1–L5) guide a data center from basic equipment checks to full, integrated performance under realistic conditions. Load banks are essential throughout because they safely simulate the electrical demand of a live facility, allowing teams to verify UPS systems, generators, and power pathways long before actual IT load arrives. Without load banks, it's impossible to prove true resilience or validate that the power infrastructure will perform reliably when the data center goes live.

LEVEL	NAME	DESCRIPTION	LOAD BANK UTILIZATION
L1	Factory Acceptance Test	Factory Acceptance Testing (FAT) performed at the manufacturer before equipment ships.	Yes - Load banks may be used for proving performance of back-up power and cooling infrastructure at manufacturers factories.
L2	Site Acceptance	Site Acceptance / Installation Verification to ensure equipment is installed correctly and ready for power.	Minimal or none — primarily visual and installation checks.
L3	Pre-Functional Testing	Pre-functional Testing / Startup of individual systems (UPS, generators, switchgear).	Moderate — load banks used to test UPS, batteries, and generator startup performance.
L4	Functional Testing	Functional Performance Testing of systems working individually but under controlled load.	High — load banks simulate IT load to validate electrical and mechanical system operation.
L5	Integrated System Test (IST)	Integrated Systems Testing (IST) validating full end-to-end operation under realistic scenarios.	Very High — full-facility load simulation, redundancy testing, and failover proofing.

LOAD BANKS ARE USED IN DATA CENTERS FOR:

- *COMMISSIONING*
- *ROUTINE POWER TESTING AND MAINTENANCE*
- *EXPANSION*

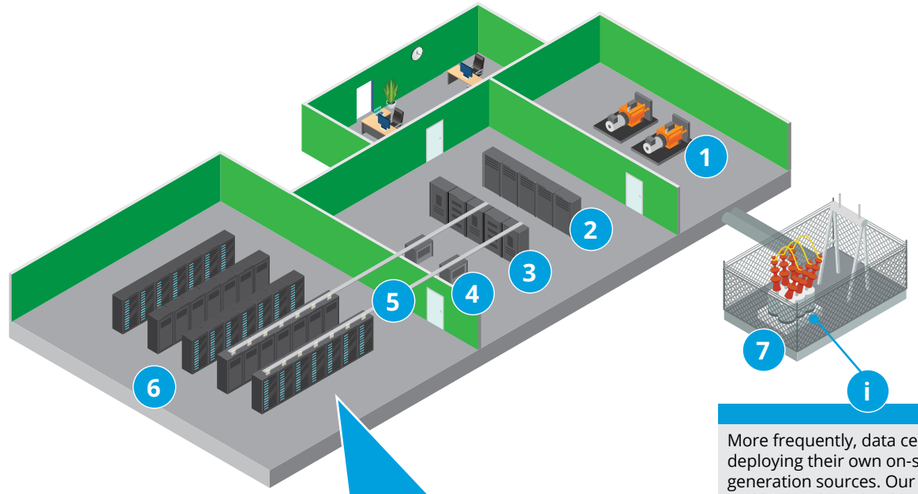
AIR COOLED LOAD BANKS IN DATA CENTERS

Air-cooled load banks are essential tools for traditional air-cooled data centers, providing a safe and controlled way to replicate real IT electrical and thermal loads. By converting electrical power into heat through resistive elements, they allow operators to test facility readiness before servers are installed—ensuring the data hall's airflow, cooling capacity, and environmental stability meet design intentions.

They are used across multiple validation applications, including commissioning and routine testing of generators, UPS systems, PDUs, power panels, and busways. By applying adjustable, realistic load profiles, air-cooled load banks help confirm that the electrical infrastructure delivers stable, reliable performance under real-world conditions. This proactive testing identifies issues early, strengthens resilience, and ensures the data center can support continuous, uninterrupted operation.

	WHAT IS THE LOAD BANK TESTING	WHAT TYPE OF LOAD BANK IS USED	WHAT DOES THE LOAD BANK DO?
1	Backup Generators	Resistive Reactive Permanent	• Apply resistive and reactive load to fully exercise generator output • Test voltage regulation, frequency stability, and transient response • Validate alternator, cooling, and fuel system performance • Confirm correct controls operation and load-sharing behaviour
2	Uninterruptible Power Systems (UPS)	Resistive Permanent	• Apply controlled load to test UPS capacity and battery runtime • Verify inverter performance and transfer-mode operation • Test battery discharge, recharge cycles, and overall health • Validate monitoring accuracy, alarms, and system efficiency
3	Power Distribution Units (PDUs)	Resistive Portable	• Apply staged loads to confirm circuit capacity and breaker operation • Validate voltage stability and phase balancing • Check the accuracy of onboard metering (V, A, kW, temp) • Ensure safe operation under realistic IT-simulated loads
4	Power Panels	Resistive Portable	• Test circuits under defined load to verify capacity and protection • Validate breaker coordination and trip settings • Confirm phase balancing and voltage performance • Assess thermal behaviour during continuous load
5	Bus Ways	Resistive Portable	• Apply distributed load to verify thermal and electrical performance • Confirm integrity of joints, tap-offs, and mechanical connections • Test voltage drop and phase balancing along the busway • Ensure reliability under full and partial load conditions
6	Heating, Ventilation and Air Conditioning Systems (HVAC)	Resistive Portable	• Simulate IT heat load to test HVAC cooling capacity • Validate airflow distribution, temperature control, and humidity stability • Confirm CRAC/CRAH system performance across load levels • Test redundancy, staging, and environmental control responses
7	Substation	Medium/High Voltage	• Apply controlled MV/HV load to verify transformer capacity • Validate protection and coordination (breakers, relays, switchgear) • Test voltage regulation and system response under load • Confirm overall reliability and safety prior to energizing downstream systems

TYPICAL AIR COOLED DATA CENTER ARRANGEMENT



i

More frequently, data centers are deploying their own on-site power generation sources. Our medium- and high-voltage load banks are used to commission and maintain these systems, ensuring reliable performance.

DATA HALL COMMISSIONING

i

Avtron portable load banks from the 2000 and 3000 SERIES range are commonly used during data center hall commissioning. The heat generated by the load bank replicates the thermal output of server racks before they are installed. This process ensures that both the electrical infrastructure and the HVAC system are capable of handling peak operational loads.

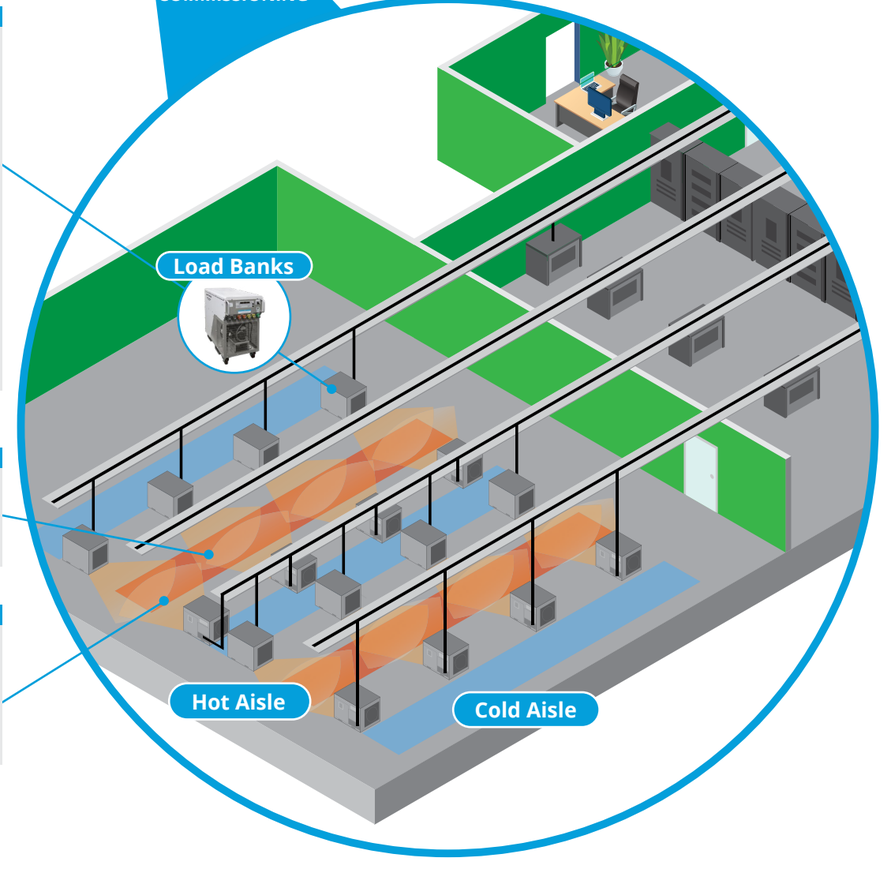
The diagram illustrates how the load bank's heat is directed into the hot aisles and how power is drawn from the bus bars to validate their performance as well.

i

Some data centers use temporary hot-aisle containment during load bank commissioning to better simulate real operations.

i

Our load banks are used for zone-level commissioning rather than individual rack-level testing, enabling faster and more efficient deployment—especially in large-scale data centers.



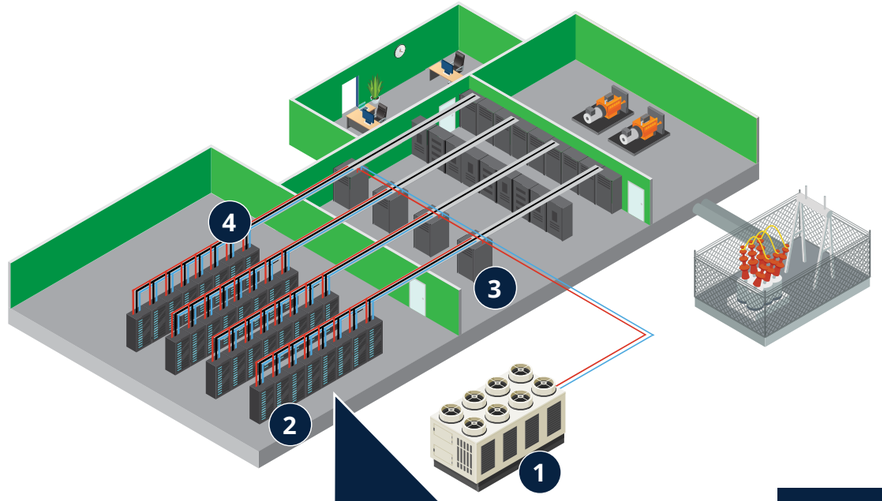
LIQUID COOLED LOAD BANKS IN DATA CENTERS

Liquid-cooled load banks are purpose-built for modern high-density data centers that use direct-to-chip or liquid-assisted cooling. By absorbing electrical load and transferring heat directly into a coolant loop, they safely replicate the thermal and hydraulic behavior of advanced servers without requiring live IT hardware. This enables operators to verify coolant flow rates, temperature differentials, pump performance, and heat-exchange capacity long before production systems arrive—ensuring the liquid-cooling environment is fully ready for deployment.

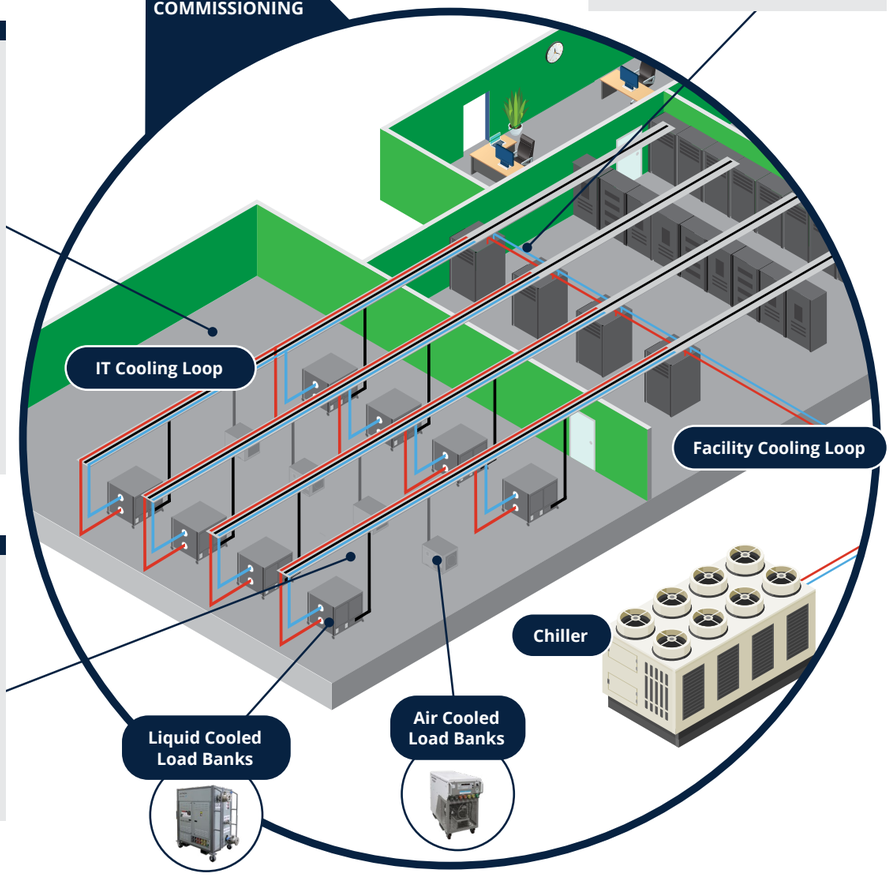
These load banks support multiple validation applications across the critical infrastructure, including testing chillers, CDUs, manifolds, and liquid-cooled rack systems. By applying controlled, adjustable heat loads, liquid-cooled load banks help confirm the stability, redundancy, and responsiveness of the entire cooling and electrical ecosystem under real-world conditions. This comprehensive testing uncovers issues early, strengthens reliability, and gives operators confidence that their high-density AI and HPC deployments will run safely and efficiently from day one.

	WHAT ARE THE LOAD BANKS TESTING?	SUITED LOAD BANK TYPE	WHAT DO THE LOAD BANKS DO?
1	Chiller Validation	Liquid Cooled Portable	• Simulate IT heat load • Validate cooling capacity, staging & redundancy • Verify system control, stability, and heat rejection
2	Server Simulation	Liquid Cooled Portable	• Replicate real server thermal output at high density • Test coolant flow, ΔT, and pressure under dynamic workloads • Validate liquid-cooling loop performance before deploying IT hardware
3	Coolant Distribution Units (CDU's)	Liquid Cooled Portable	• Apply controlled heat load to verify CDU heat-exchange capacity • Test pump performance, flow stability, and redundancy modes • Validate sensors, alarms, controls, and facility interface behavior
4	Manifold & Busway Validation	Liquid Cooled Portable	• Confirm proper coolant distribution and branch balancing • Verify manifold/busway connections, quick-disconnects & leak integrity • Test flow behavior, pressure drops, and isolation valve operation

TYPICAL LIQUID COOLED DATA CENTER ARRANGEMENT



DATA HALL COMMISSIONING



i

Load banks can be used for testing both primary and facility cooling loops.

i

Avtron liquid-cooled load banks are used during data center commissioning to simulate the full load heat and flow characteristics of liquid-cooled servers. By pushing thermal load into the cooling loop, they verify that the electrical system, pipework, pumps, and chillers can support full design capacity. Without this testing, there's no way to confirm performance under real operational stress, increasing the risk of costly failures once the facility goes live.

The diagram shows how load banks may be arranged during commissioning to simulate multiple server rack characteristics.

i

During Level 5 (IST) commissioning, both air-cooled and liquid-cooled load banks are often deployed to fully validate a facility's electrical and thermal performance. Avtron's SIGMA control platform enables seamless operation of both load bank types within a single hybrid network, supporting custom test scripts, detailed data capture, and faster, more repeatable commissioning cycles.

WHY AVTRON FOR DATA CENTERS?

Avtron is the trusted load bank partner for data centers where uptime is non-negotiable. With decades of experience supporting mission-critical power systems, Avtron designs and delivers load bank solutions built specifically for data center commissioning, testing, and long-term resilience. From scalable liquid and air-cooled technologies to advanced control, data capture, and global service support, Avtron helps operators prove performance, reduce risk, and protect availability at every stage of the facility lifecycle.

Standard & Custom Solutions: Whether you need pre-engineered load banks for fast deployment or fully bespoke systems for complex white-space, mechanical, or electrical test environments—we deliver exactly what your data center requires.

Global Manufacturing: With seven manufacturing hubs, we ensure consistent quality, rapid lead times, and compliance with the certifications data centers demand—wherever your facility is located.

Intelligent SIGMA Control: SIGMA enables precise, repeatable, and fully automated commissioning and IST workflows. Advanced data logging and seamless network integration give operators total visibility across every test asset onsite.

Built to Last: Our load banks are built to thrive in demanding data center conditions, minimizing maintenance windows and lowering total cost of ownership over the equipment's entire life cycle.

70+ Years of Expertise: We've solved every load testing challenge—from hyperscale commissioning to colocation redundancy validation—backed by deep global project experience.

Versatile Range: Air-cooled, liquid-cooled, resistive, reactive, portable, rack-mount, rooftop, and containerized systems—whatever your power architecture demands, we have the right solution.

Trusted by Industry Leaders: The top hyperscalers, colos, and enterprise operators rely on our technology because they require one thing above all else: absolute reliability.

SIGMA & RXMS CONTROL

SIGMA Control

SIGMA control is designed for the realities of modern data centers. It enables fast, accurate setup of load testing systems, reducing commissioning time while ensuring repeatable, reliable results.

SIGMA can network up to 250 air and liquid-cooled load banks, making it ideal for large-scale, hybrid testing across generators, UPS, and integrated systems. Both wired and wireless connectivity options provide flexibility for live environments and phased commissioning.

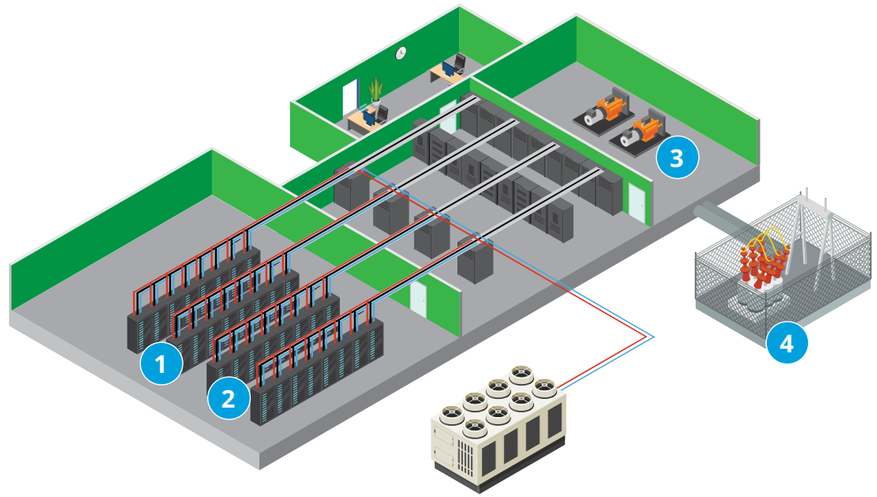
Comprehensive data capture and reporting deliver clear test records for compliance, handover, and ongoing operational assurance. SIGMA supports PC-based or hand-held control, allowing engineers to work efficiently on the plant floor or from a central location.

RXMS Control

Avtron load banks enhanced with RxMS technology deliver precise, automated validation of data center power systems. Integrated data acquisition and commissioning automation enable repeatable load profiles and high-resolution performance insights across generators, UPS systems, switchgear, and cooling equipment.

Automated sequencing and synchronized data capture generate detailed reports that reveal issues traditional testing can miss. Scalable for new builds, expansions, and ongoing reliability checks, Avtron + RxMS provides consistent, data-driven proof of power system performance in mission-critical environments.

KEY LOAD BANK MODELS FOR DATA CENTERS



1

MODEL NAME: LC20
TYPE: LIQUID COOLED | RESISTIVE | PORTABLE
CAPACITY: 500KW @ 480V or 415V
DESIGNED FOR: LIQUID COOLED DATA HALL COMMISSIONING

2

MODEL NAME: 2775
TYPE: AIR COOLED | RESISTIVE | PORTABLE
CAPACITY: 265KW @ 480V
DESIGNED FOR: AIR COOLED DATA HALL COMMISSIONING

3

MODEL NAME: 8400
TYPE: AIR COOLED | RESISTIVE & REACTIVE | CONTAINER
CAPACITY: UP TO 6250KVA @ 0.8PF
DESIGNED FOR: POWER SYSTEM COMMISSIONING & MAINTENANCE

4

MODEL NAME: 9100
TYPE: AIR COOLED | RESISTIVE | MEDIUM VOLTAGE
CAPACITY: UP TO 7000kW (4160V - 13.8kV)
DESIGNED FOR: MEDIUM VOLTAGE COMMISSIONING & MAINTENANCE

AVTRON
POWER SOLUTIONS

www.avtronpower.com

Avtron Power Solutions
6255 Halle Drive
Cleveland, OH 44125, USA
Tel: 216 573 7600

Cliffe Road, Easton-on-the-Hill
Stamford PE9 3NP, United Kingdom
Tel: +44 (0) 1780 480033

customercare@avtronpower.com

Publication 5246 Rev -