

500kVA Generator Datasheet PDF - Complete Technical Specifications and Download Guide

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Introduction

The 500kVA generator stands as a cornerstone of large-scale power generation infrastructure, delivering substantial electrical output for major industrial facilities, critical institutions, and large commercial operations. This comprehensive datasheet provides complete technical specifications, performance characteristics, engineering data, and application guidance for 500kVA diesel generator sets, serving as the authoritative reference for consulting engineers, facility managers, and power system designers.

Delivering 400kW of prime power at 0.8 power factor, the 500kVA generator addresses the demanding requirements of large hospitals, manufacturing plants, data centers, commercial complexes, and infrastructure projects. These substantial power generation units represent a significant investment and require careful engineering consideration for installation, operation, and maintenance. The 500kVA capacity provides true facility-scale power capability, enabling support for complete building operations rather than just critical loads.

Modern 500kVA generators incorporate advanced technologies including emissions-compliant engines with sophisticated fuel injection and after-treatment systems, high-efficiency alternators with advanced voltage regulation, intelligent control systems with remote monitoring capabilities, and comprehensive protection systems. These technological advancements enable compliance with stringent environmental regulations while delivering exceptional performance, reliability, and fuel efficiency across diverse operating conditions and applications.

Technical Specifications

Engine Specifications

Parameter	Specification
Prime Power Output	500 kVA / 400 kW
Standby Power Output	550 kVA / 440 kW
Rated Voltage	400V / 230V (3-phase)
Rated Frequency	50 Hz
Rated Current (Prime)	721.7 A
Power Factor	0.8 (lagging)
Engine Type	4-cycle, Turbocharged Intercooled Diesel
Number of Cylinders	6, 8, or 12
Displacement	12.0L - 18.0L
Bore x Stroke	Varies by manufacturer
Compression Ratio	14.5:1 - 16.5:1
Aspiration	Turbocharged with air-to-air charge cooling
Governor Type	Electronic
Governor Class	ISO 8528-5 Class G3

Fuel System Specifications

Parameter	Specification
Fuel Consumption (100% Load)	100-118 L/hr
Fuel Consumption (75% Load)	78-90 L/hr
Fuel Consumption (50% Load)	56-65 L/hr
Fuel Type	ASTM D975 No. 2-D Diesel
Fuel Tank Capacity (Base)	600-800 L
Fuel Tank Capacity (Optional)	Up to 2500 L
Fuel Injection System	Common rail high-pressure injection
Fuel Filter Type	Multi-stage with water separator and hand primer

Electrical Specifications

Parameter	Specification
Alternator Type	Brushless, self-excited, self-regulated
Insulation Class	H
Protection Class	IP23 (standard) / IP44 (optional)
Voltage Regulation	$\pm 0.5\%$ (steady state)
Frequency Regulation	$\pm 0.25\%$ (isochronous)
THD (Total Harmonic Distortion)	$< 4\%$
Transient Response (Load Step)	Recovers to $\pm 10\%$ within 2 seconds
Starting Capability	75% of rated kVA in one step
Alternator Cooling	Self-ventilated with external fan

Physical Specifications

Parameter	Specification
Length (Canopy)	3800-4500 mm
Width (Canopy)	1500-1800 mm
Height (Canopy)	1900-2300 mm
Dry Weight (Canopy)	4800-6500 kg
Operating Weight	5500-7500 kg
Sound Level at 1m (Canopy)	72-80 dB(A)
Sound Level at 7m (Canopy)	62-70 dB(A)
Cooling System	Radiator with belt-driven fan
Coolant Capacity	45-70 L

Environmental Specifications

Parameter Specification
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Operating Temperature Range -25°C to +50°C
Storage Temperature Range -40°C to +65°C
Altitude Capability Up to 1000m (standard), derate above
Humidity Up to 95% non-condensing
Emissions Compliance EU Stage V / EPA Tier 4 Final

Performance Curves Description

Load-Fuel Consumption Curve

The fuel consumption characteristics of a 500kVA generator demonstrate the substantial fuel requirements for large power generation. At 25% load (125 kVA), consumption ranges from 38-45 liters per hour, representing approximately 35-40% of full-load consumption. This relatively high percentage reflects the overhead of engine friction, auxiliary systems, and minimum fuel consumption required to maintain engine operation.

As load increases to 50% (250 kVA), fuel consumption rises to approximately 56-65 L/hr. The optimal operating efficiency range lies between 60-85% load, where the generator achieves minimum specific fuel consumption. At 75% load (375 kVA), consumption reaches 78-90 L/hr, representing efficient operation. Full-load operation at 500 kVA requires 100-118 L/hr depending on engine calibration, ambient conditions, and fuel quality.

Modern electronic engines with common rail fuel injection demonstrate improved fuel efficiency across the operating range compared to mechanical injection systems. However, extended operation below 30% load should be avoided to prevent wet stacking and reduced engine efficiency. For applications with highly variable loads, consider multiple smaller generators or load management strategies.

Temperature Derating Curve

High ambient temperatures significantly impact the output capability of 500kVA generators. Standard ratings apply at reference temperatures of 25°C or 40°C. Above 40°C, derating of 1.5-2.5% per 5°C increment typically applies. At 50°C ambient, expect output limited to 92-96% of rated capacity.

The derating mechanism involves multiple factors including reduced air density affecting combustion, reduced charge air cooler effectiveness, decreased radiator cooling capacity, and increased alternator temperature rise. Large generators with higher power density may experience more pronounced temperature derating. For installations in hot climates, consider oversizing the generator or specifying enhanced cooling systems.

Altitude Derating Curve

High altitude operation presents challenges for 500kVA generators due to reduced air density affecting both combustion and cooling. Standard ratings apply up to 1000 meters elevation. Above this threshold, derating of 3-4% per 500 meters applies. At 2000 meters, output drops to approximately 86-91% of rated capacity. At 3000 meters, expect 75-83% of the sea-level rating.

Turbocharged engines with charge air cooling perform better at altitude than naturally aspirated units. However, both engine combustion and cooling system performance are affected. For high-altitude installations, consult with the manufacturer for specific derating factors and potential cooling system upgrades.

Load Step Response Curve

The load step response characteristics of a 500kVA generator demonstrate excellent transient performance due to the substantial rotating mass and advanced control systems. These units can typically accept 75% of rated load (375 kVA) in a single step while maintaining voltage deviation within $\pm 10\%$ and frequency deviation within $\pm 7\%$.

Recovery to steady-state voltage typically occurs within 1.5-2.5 seconds, with frequency recovery within 2-3.5 seconds. The response characteristics benefit from the higher inertia of larger rotating components. For applications with large motor starting requirements, the substantial capacity provides excellent motor starting capability with reduced need for reduced voltage starting methods.

Compatible Applications

Large Hospitals and Healthcare Complexes

500kVA generators provide comprehensive backup power for large hospitals, medical centers, and healthcare complexes. These units support life-safety systems, surgical suites, critical care areas, diagnostic imaging, laboratory services, pharmaceutical refrigeration, and complete facility operations. Healthcare applications require compliance with specific regulatory standards for backup power reliability, testing, and automatic transfer.

Industrial Manufacturing Facilities

Large manufacturing plants, process industries, and production facilities rely on 500kVA generators for production equipment, process controls, compressed air systems, material handling, environmental controls, and facility operations. The substantial capacity supports critical production processes and enables true facility-wide backup power rather than partial coverage.

Data Centers and IT Infrastructure

Medium to large data centers, enterprise IT facilities, and colocation centers depend on 500kVA generators for primary backup power. These applications require clean, reliable power with fast response times, automatic synchronization with UPS systems, and provisions for N+1 redundancy. Generator reliability directly impacts uptime guarantees and service level agreements.

Large Commercial Complexes

Major office buildings, shopping centers, hotels, entertainment venues, and mixed-use developments utilize 500kVA generators for complete facility backup power. The substantial capacity enables support for HVAC systems, elevators, lighting, security systems, IT infrastructure, and all normal facility operations during utility outages.

Universities and Educational Institutions

Large university campuses, research facilities, and educational institutions require 500kVA generators for academic buildings, laboratories, dormitories, dining facilities, sports complexes, and safety systems. Multiple generators may be paralleled for campus-wide power systems with redundancy.

Utility and Infrastructure

Power plants, substations, pumping stations, water treatment facilities, and telecommunications central offices use 500kVA generators for critical infrastructure support. These applications often require extended fuel storage, remote monitoring, and automatic starting for unmanned operation.

Download PDF Section

Official Datasheet Downloads

Comprehensive technical datasheets for 500kVA generators are available from authorized manufacturer websites and distributor portals. These detailed PDF documents contain complete specifications, performance curves, dimensional drawings, electrical diagrams, installation requirements, and maintenance procedures. Documentation is essential for specification, installation, commissioning, and ongoing maintenance.

Documentation Package Components

A complete 500kVA generator documentation set includes:

- Detailed technical specification sheet with all parameters
- Performance curves (fuel consumption, derating, transient response)
- Dimensional drawings with connection points and clearances
- Electrical schematics and wiring diagrams
- Control panel layout and operation manual
- Foundation design requirements and drawings
- Fuel system installation guidelines
- Ventilation and exhaust system specifications
- Vibration isolation and mounting details
- Maintenance schedule and detailed procedures
- Parts catalog with component specifications
- Installation and commissioning checklists
- Warranty terms and registration documentation

Technical Support and Training

Manufacturer technical support provides:

- Application engineering and system design assistance
- Detailed sizing calculations and load analysis
- Installation supervision and commissioning support

- Troubleshooting and diagnostic assistance
- Spare parts identification and expedited supply
- Operator and technician training programs
- Software updates and configuration support
- Technical bulletins and service updates

Frequently Asked Questions

1. What is the fuel consumption of a 500kVA generator?

A 500kVA generator consumes approximately 100-118 liters per hour at full load (500 kVA / 400 kW). At 75% load, consumption drops to 78-90 L/hr. At 50% load, expect 56-65 L/hr. Actual consumption depends on engine technology, load characteristics, and ambient conditions.

2. What size electrical cable do I need for a 500kVA generator?

For a 500kVA generator with rated current of 721.7A at 400V, typical cable requirements include multiple parallel conductors per phase such as 3x240mm² or 4x185mm² copper cables. Exact sizing depends on installation method, ambient temperature, cable routing, and voltage drop requirements. Consult a qualified electrical engineer for detailed cable sizing.

3. How many buildings can a 500kVA generator power?

A 500kVA generator delivering 400 kW can power a large commercial building or multiple smaller buildings depending on load density and usage patterns. For typical office buildings with 50-100 W/m² power density, a 500kVA unit could support 4000-8000 m² of floor space. Detailed load analysis is necessary for accurate sizing.

4. What foundation does a 500kVA generator need?

A 500kVA generator requires a substantial reinforced concrete foundation with dimensions approximately 150-200% of the generator footprint, thickness of 300-400mm, and mass 1.5-2 times the generator weight. The foundation should be isolated from building structures, include vibration isolation, and provide adequate support for the significant static and dynamic loads.

5. How often should a 500kVA generator be serviced?

Service intervals typically include daily inspections, weekly test runs, monthly battery checks, quarterly filter inspections, semi-annual comprehensive inspections, and annual major service including all fluids and filters. Major services at 2000-3000 hours include valve adjustments and injector testing. Follow manufacturer-specific maintenance schedules.

6. What is the lifespan of a 500kVA diesel generator?

With proper maintenance, a 500kVA generator can achieve 30,000-40,000 operating hours before major overhaul. In standby applications with limited running hours, service life typically ranges from 25-35 years. Maintenance quality, operating conditions, and proper loading practices significantly impact generator longevity.

7. Can a 500kVA generator be paralleled?

Yes, 500kVA generators can be paralleled with identical or different capacity units when equipped with appropriate synchronizing controls, switchgear, and protection systems. Paralleling enables capacity expansion, load sharing, and redundancy. Multiple units can operate in parallel to meet larger load requirements or provide N+1 redundancy.

8. What emissions after-treatment does a 500kVA generator have?

Stage V / Tier 4 Final compliant 500kVA generators typically include diesel oxidation catalysts (DOC), diesel particulate filters (DPF), and selective catalytic reduction (SCR) with DEF (diesel exhaust fluid) injection. These systems require maintenance and monitoring to ensure continued emissions compliance and proper operation.

9. What transfer switch rating do I need for a 500kVA generator?

For a 500kVA generator with 721.7A rated current, an 800A or 1000A automatic transfer switch is typically required. The ATS should be rated for the application class (emergency, legally required, optional standby) and comply with relevant standards such as IEC 60947-6-1 or UL 1008.

10. How much fuel storage do I need for a 500kVA generator?

At full-load consumption of approximately 110 L/hr, a 5000-liter fuel tank provides approximately 45 hours of operation. Required storage depends on utility reliability, fuel delivery availability, regulatory requirements, and operational requirements. Many facilities install bulk storage tanks for extended operation capability.

11. What is the difference between prime and standby rated 500kVA generators?

Prime-rated 500kVA generators can operate continuously at variable loads with unlimited hours per year, accepting 10% overload for limited periods. Standby-rated units provide maximum output for limited hours (typically <200 hours/year) during utility outages with no overload capability. Prime-rated units are built more robustly for extended operation.

12. How do I size a generator for UPS loads?

UPS loads require careful generator sizing due to harmonic currents and potential step load applications. Generally, size the generator at 1.5-2 times the UPS rating for static UPS systems with input filters, or 2-3 times for systems without harmonic mitigation. Consult with UPS and generator manufacturers for specific recommendations.

13. What type of enclosure do I need for a 500kVA generator?

Enclosure options include weather-protective for outdoor installation, sound-attenuated for noise-sensitive locations, and containerized for mobile or rapid deployment applications. Enclosure selection depends on installation location, environmental conditions, noise regulations, and security requirements. Many installations require walk-in enclosures for maintenance access.

14. How long does it take to install a 500kVA generator?

Complete installation of a 500kVA generator including foundation, electrical connections, fuel system, exhaust system, and commissioning typically requires 4-8 weeks depending on site conditions, permitting, and complexity. Factory-built enclosures and pre-engineered packages can reduce installation time. Planning should begin months in advance of required operation date.

15. What testing is required for a 500kVA standby generator?

Standby generators require regular testing per applicable standards and codes. NFPA 110 requires weekly inspections, monthly load bank tests, and annual comprehensive testing. Healthcare facilities have specific testing requirements per CMS regulations. Transfer switch testing, battery testing, and fuel system testing are also required components of a comprehensive testing program.

Related Downloads

Engine Technical Documentation

- Cummins QSK19-G5 Engine Specifications
- Perkins 4006-23TAG3A Technical Manual
- Volvo Penta TAD1652GE Engine Datasheet
- MTU Series 2000 Engine Manual
- Mitsubishi S12R-PTA Engine Specifications

Alternator Documentation

- Stamford UCI274G Alternator Datasheet
- Leroy Somer LSA50.2 Technical Manual
- Mecc Alte ECO49-1LN/4 Specifications
- Marathon Electric 574 Datasheet
- Siemens 1FC6 Series Technical Data

Control System Manuals

- Deep Sea Electronics DSE8660 MKII Controller
- ComAp IntelliGen-NT-CB Paralleling System
- Woodward easYgen-3500XT Operation Manual
- Deif AGC-4 Automatic Genset Controller
- Smartgen HGM9510 Controller Manual

Installation Standards and Guidelines

- ISO 8528-9:2017 Generator Installation
- BS 7671 IET Wiring Regulations 18th Edition
- NFPA 110 Emergency and Standby Power Systems
- IEC 60364 Electrical Installations
- Local Building and Fire Regulations

Application Engineering Guides

- Generator Sizing for HVAC Applications
- UPS Compatibility and Sizing Guide
- Paralleling Switchgear Design Guidelines
- Fuel System Design and Installation
- Ventilation and Cooling Design Manual

- Seismic and Wind Restraint Specifications
- Sound Attenuation Design Guidelines

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