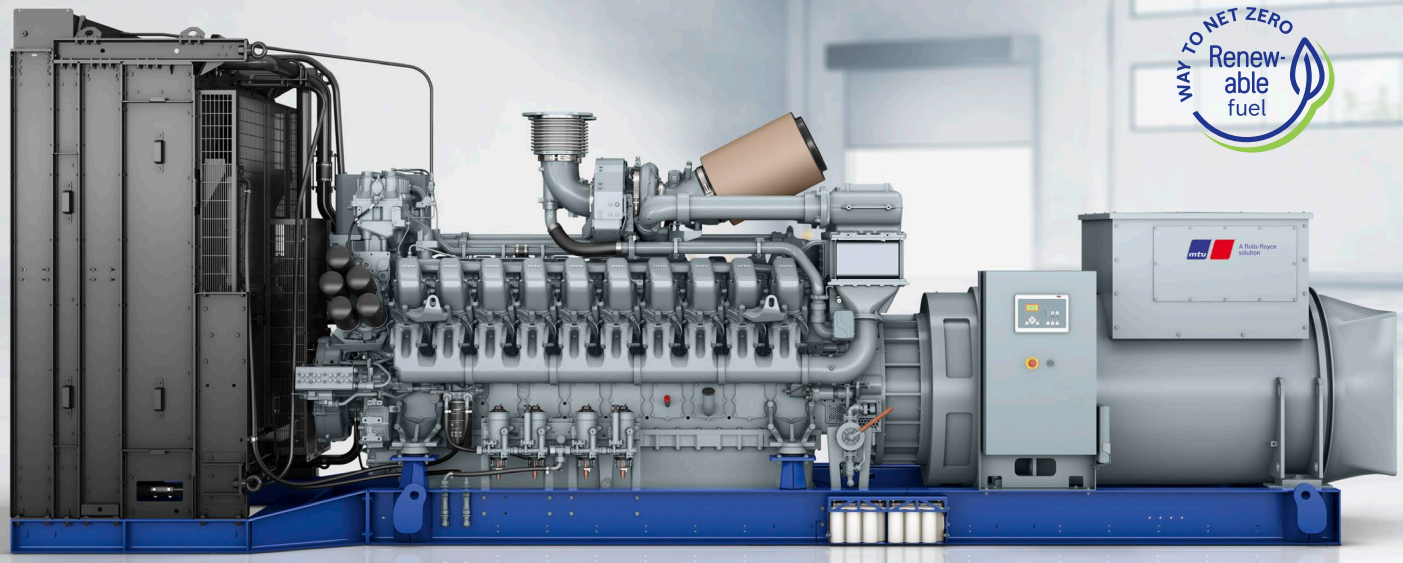


Power Generation

mtu Series 4000 diesel generator sets I 1,600–4,000 kVA I 50Hz

ENSURING A CONSTANT FLOW OF POWER – AND PEACE OF MIND

VDE-AR-N 4110 CERTIFIED GERMAN GRID CODE

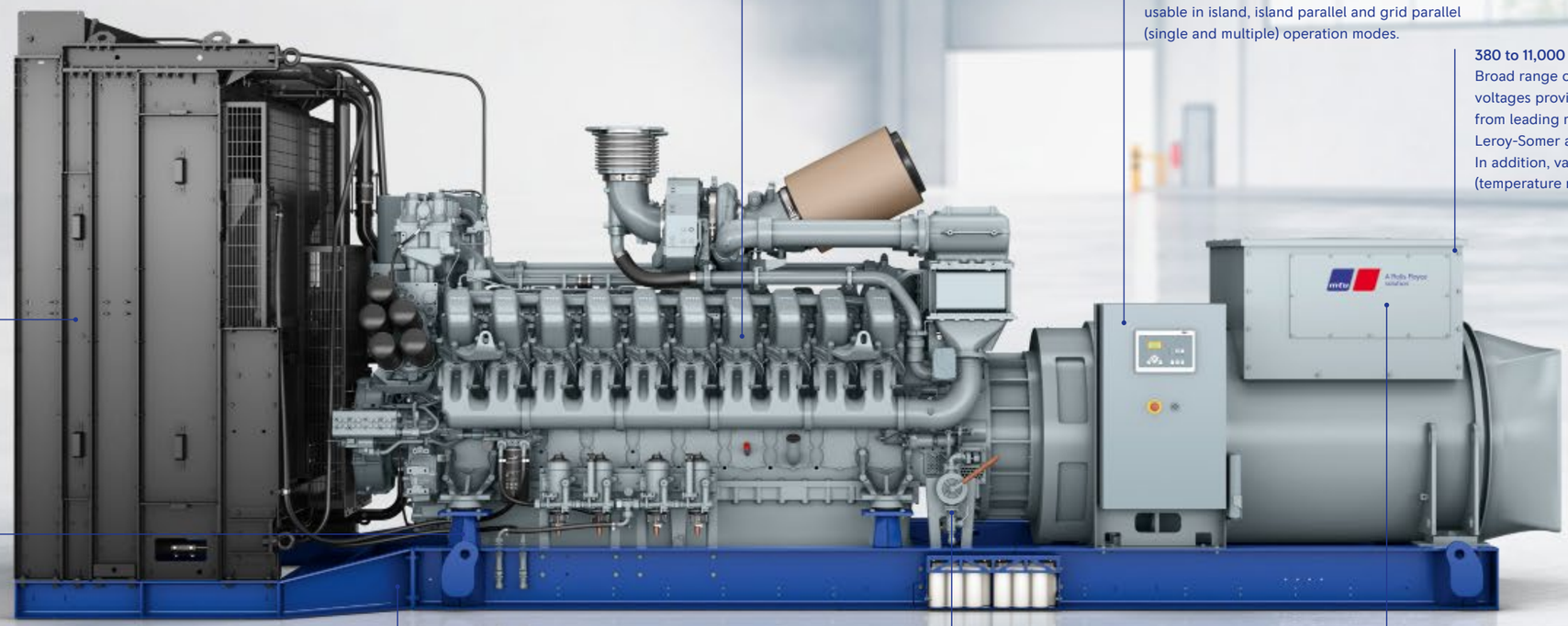
A Rolls-Royce solution

25 YEARS OF EXCELLENCE, FINE-TUNED

Our ***mtu*** Series 4000 engines have been a global success story for more than 25 years.

No matter how special your energy requirements are, ***mtu*** power generator systems will always give you the best independent power supply solution. Our generator sets meet the highest demands in terms of quality, performance and fuel efficiency. They ensure reliable power supply in the event of a grid failure – in hospitals, data centers, airports, healthcare, waste water treatment plants, industrial manufacturing plants, residential buildings, public facilities, decentralized power stations, microgrids, and hybrid power plants.

Our state-of-the-art generator sets are based on the legendary ***mtu*** engines with common rail fuel injection systems. Now in their fourth generation, they feature 12-, 16-, and 20-cylinder engine variants. The recently introduced 20-cylinder variant offers new, intelligently coordinated components, setting new standards for power and performance.



With 40° and 50°C cooling packages
The diesel generator set is adaptable to different ambient temperatures, allowing it to perform reliably and efficiently in various ambient conditions.

One standardized fuel connection interface
The unit has a fixed position for easy installation and simplified maintenance.

Up to 1,800 bar injection pressure
Thanks to state-of-the-art common rail injection system. Combined with the latest combustion technology, this equals superior fuel efficiency.

Two market leading controller brands
Available (Deif and Basler) in the standard scope, with simple integration if alternative controller brands are desired. Flexible product design, enabling controller cabinet to be mountable on either side of the generator set. Controllers are usable in island, island parallel and grid parallel (single and multiple) operation modes.

380 to 11,000 Volt
Broad range of low and medium voltages provided by generators from leading manufacturer Leroy-Somer and Marathon.
In addition, various sizing options (temperature rises) are available.

Fulfills G3 performance class
As defined in ISO 8528 for powering strategically critical loads or supplying a stable and accurate power supply. These diesel generator sets boast the highest load acceptance on the market thanks to state-of-the-art engine design, including optimal turbocharger arrangement and other key technologies.

85% load factor
For standby power – a value exceeding ISO standard, and raising the bar for power applications.

Three and four pole
And many customizable options are available for circuit breakers. Mounted on a base frame, the compact unit occupies less space and can be easily installed.

DECENTRALIZED ENERGY SUPPLY: ANYTIME, ANYWHERE

No matter how specific your energy supply requirements, our solutions always give you excellence that is fine-tuned to your exact needs.
mtu Series 4000 diesel generator sets have been doing just that for over 25 years already – for data centers, hospitals, airports, industrial plants, residential buildings, public facilities, decentralized power stations, microgrids, hybrid solutions and numerous other applications around the world.

Available in six different power ratings, including standby, prime and continuous, ***mtu*** Series 4000 diesel gensets cover the range from 1,600 to 4,000 kVA (50 Hz) and from 1,125 to 3,250 kWe (60 Hz). In addition to meeting highest quality, performance and fuel efficiency demands, they continue to define the benchmark for excellence with a variety of highly flexible, eco- and cost-efficient features, including low-voltage alternators, enhanced control panel options and more.

Reliable
Time between overhaul up to 48,000 hours

Flexible
Available for six different applications, from standby power to prime/peak and mission critical

Superior power
Providing the highest power density with industry-leading load factors and up to 4,000 kVA (50Hz) and 3,250 kWe

Highest power quality
Extremely fast ramp up, best load acceptance and transient behavior with minimal frequency and voltage deviations

Maximum resilience
High performance even under hot ambient conditions and in high altitude environments

Clean technology
A pioneer in developing environmentally friendly engines and reducing emissions.

Full lifecycle services
and a wide range of service products to minimize downtime and reduce lifecycle costs

Certified
For ISO 8528, CE/IEC, NFPA 110 and German Grid Code (VDE-AR-4110)

Approved
Designed and manufactured in ISO 9001:2008 and ISO 14001:2004 certified facilities in Germany

1 ***mtu*** 12V4000 DS1650
mtu 12V4000 DS1750
mtu 12V4000 DS2000

2 ***mtu*** 16V4000 DS2250
mtu 16V4000 DS2500

3 ***mtu*** 20V4000 DS2750
mtu 20V4000 DS3100
mtu 20V4000 DS3300

4 ***mtu*** 20V4000 DS3600
mtu 20V4000 DS4000

Optional equipment and finishing shown. Standard may vary.

INTELLIGENT TECHNOLOGY – STATE-OF-THE-ART

With the energy market constantly changing, we are continuously developing our Series 4000 generator sets. We've overhauled our third generation generator sets to incorporate new generator and paint designs, plus German Grid Code Certification. And our fourth generation generator sets feature modified components for increased performance. Other enhancements include:

- Increased power ratings for 12V, 16V and 20V cylinder configurations
- New Leroy Somer generators as standard
- Increased reliability with redundant starters for selected models
- Battery disconnection switch integrated into start system
- New battery charger
- Maintenance free batteries
- Improved fuel filter with water separator
- Standardized fuel connection interface
- Basler HD controller: ModBus TCP/IP with advanced programmabilities
- Additional controller cabinet (B-side) for power supply (preheating, anti condensation heating, battery charger), ready for German gride code VDE-AR-4110 interface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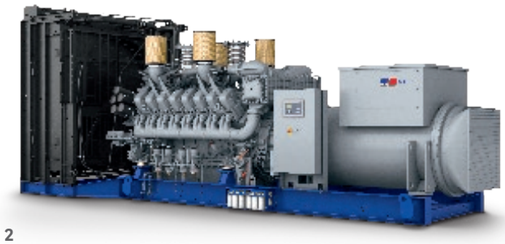
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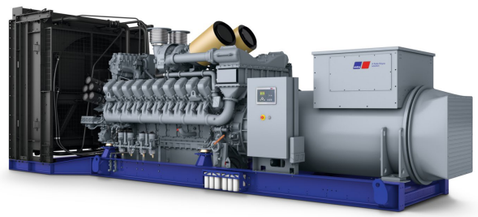
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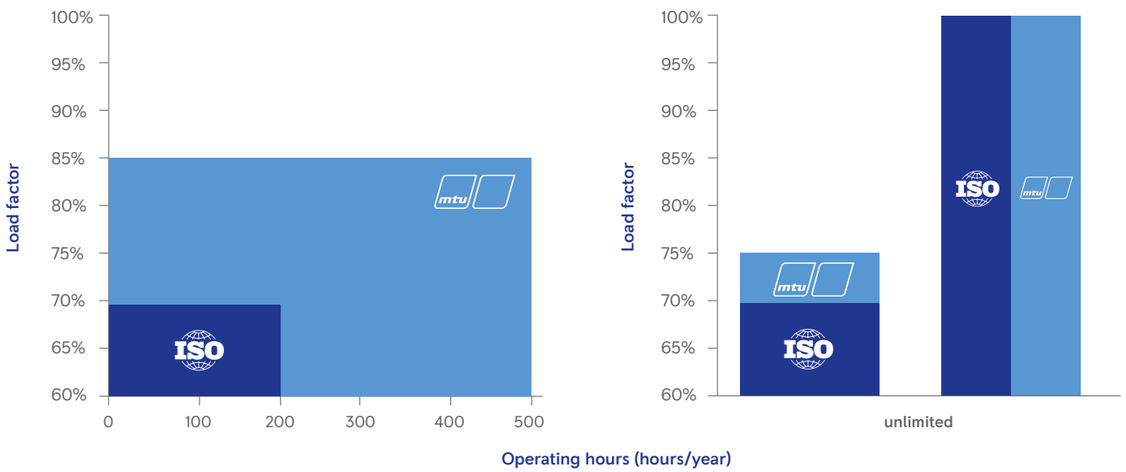
SUPERIOR POWER

The most important requirement of an emergency standby generator set: Full electrical power with industry-leading load factors available within a few seconds.

Mission-critical systems require fast-start capability and one-step load acceptance. That's why we have designed our systems to offer more available power within only a few seconds. We offer industry leading load factors up to 100% for data centers and up to 85% for standby applications. This exceeds the established industry norms such as ISO 8528-1 and allows even more operating hours for prime, emergency standby and data center applications. This way, we can deliver sophisticated power solutions with even more actual available power than other manufacturers with the same nominal power — regardless of the circumstances.

Comparing our load factors and operating hours to ISO 8528 requirements



mtu advantage: more available power

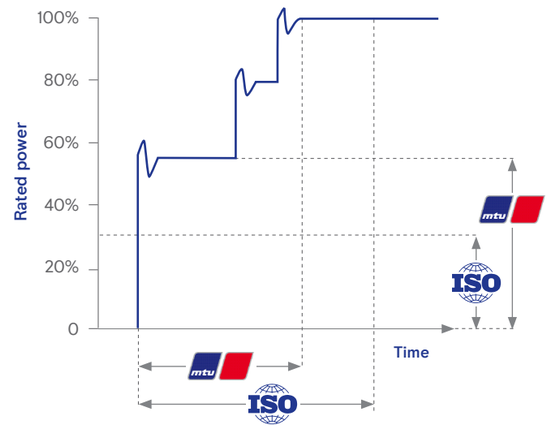
Higher load factors and more operating hours offer more available power than ISO-rated engines with the same nominal engine output.

HIGHEST POWER QUALITY

In case of an emergency, our ***mtu*** Series 4000 generator sets will provide their full electrical power within a few seconds – synchronized to the grid, to another power source or to other gensets in parallel. They are capable of accepting extremely high load steps without having significant frequency and voltage deviations and sacrificing the power quality. All ***mtu*** Series 4000 generator sets overachieve ISO 8528-5 performance class G2 and G3 and their respective performance and power quality requirements for dynamic loading application, removal and recovery time.
Even while keeping all performance limits for G3, ***mtu*** Series 4000 generator sets can accept more than 50% load in the first step and 100% block load acceptance according to NFPA 110 requirements is also possible.

- Extremely fast load acceptance
- Higher load steps possible for fast availability
- Minimal frequency and voltage deviations

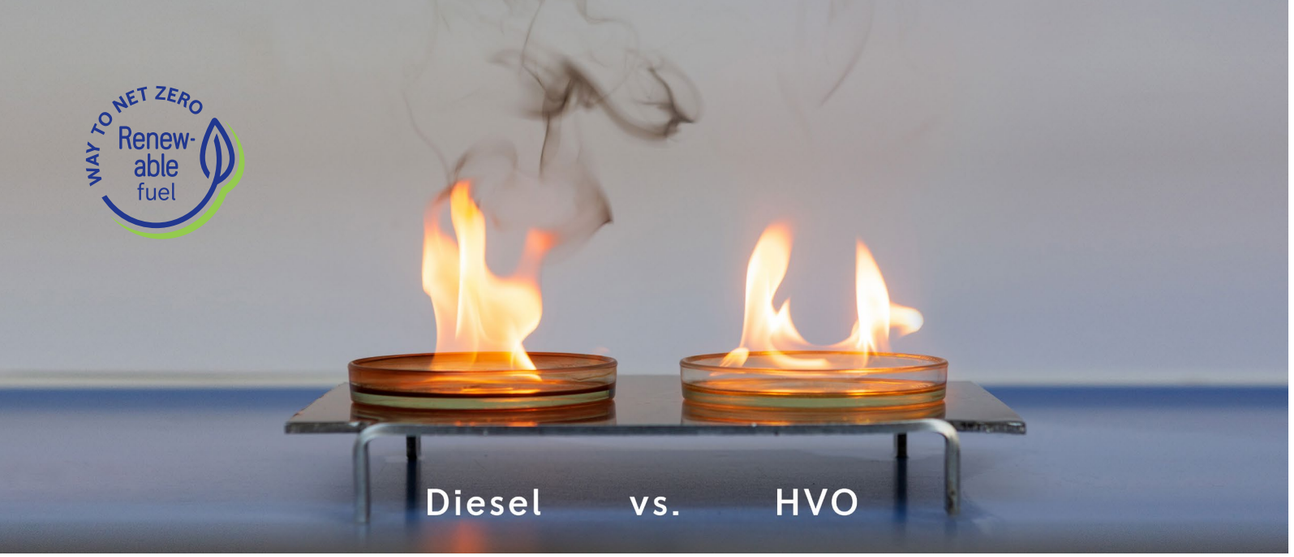
Illustrative *mtu* Series 4000 ramp-up curve



MAXIMUM RESILIENCE

Our ***mtu*** Series 4000 gensets operate trouble-free with the highest power quality even under extreme conditions. They have proven their resilience again and again in continuous operation and with full loads in the heat, cold, and dust, as well as with frequent load changes. In addition to their well-known longevity, their low-maintenance construction and long service intervals also ensure cost-effectiveness. They minimize expenses and downtime and ensure that all equipment is fully operational again in record time.

- Highly robust against derating
- Highest possible power output
- ESCM* tool-based power calculation



CLEAN TECHNOLOGY

Helping clients to achieve ambitious emissions targets requires solutions that are both innovative and individually adaptable. The ***mtu*** Series 4000 already addresses emissions reduction by meeting the highest standards in fuel efficiency. On top of that, there are two ways to optimize our systems to support your journey to net zero by adding exhaust gas after treatment and/or by enabling the use of renewable fuels.

Renewable and synthetic fuels

In addition to meeting highest standards in fuel efficiency, our ***mtu*** Series 4000 generator sets can now also be operated with synthetic fuels such as hydrotreated vegetable oil (HVO) and gas-to-liquid (GTL) in accordance with the EN15940 standard. Using renewable fuels such as HVO can lead to a reduction in CO_2 emissions of up to 90% depending on the fuel manufacturer. The use of these fuels has been successfully proven on the test bench and in the field. Fuels according to EN15940 are approved for all Series 4000 system configurations and emission calibrations.

Scan the QR-Code
& get the whitepaper

Exhaust gas after treatment

An exhaust gas after treatment (EGAT) system can help keep local emissions such as NOx-emissions or particulate matter to an absolute minimum. We support to fit EGAT solutions precisely to our generator sets while granting maximum power, best load acceptance, super-fast startup times and absolute resilience. We have a lot of experience in the design, project planning and commissioning of EGAT systems for large power generation projects (in the double-digit megawatt range).

Further benefits of renewable fuels (e.g. HVO)

- **Significant reduction of greenhouse gas emissions (CO_2) with HVO:** Improved ecological footprint & corporate image
- **Simple drop-in fuel:** no engine hard- or software adaptions necessary. Blends are possible.
- **No effect on service & maintenance intervals:** Standard warranty conditions apply.
- **Approved for S4000 generator sets:** all emission optimizations & power ratings
- **Reduction of harmful pollutants:** up to -80% particulate matter (PM) & up to -8% nitrous oxides (NO_x)
- **Same performances:** same maximum power, load acceptance and fuel consumption
- **Positive chemical properties:** higher cetane-number and better water seperation (hydrophobic)
- **Long storage capability:** High reliability under cold conditions and high oxidation stability (no FAME), depending on fuel supplier

UPGRADED FEATURES OF THE *mtu* SERIES 4000 GENERATOR SETS

Having just celebrated 25 years of excellence and performance, ***mtu*** Series 4000 diesel generator sets continue to define the benchmark for reliable backup, grid stability and prime power generation. How? With a variety of highly flexible, versatile and cost-efficient upgrades designed to precisely fulfill every individual need. Have a look!

1. Approved for HVO and GtL fuels

GtL (Gas-to-Liquid) and HVO (Hydrocreated Vegetable Oil) can be used as drop-in fuels instead of diesel. They offer better storage and lower emissions. Reduction of local emissions (espec PM & NOx). HVO offers up to 90% CO2 reduction.

2. Low-voltage alternators

High-efficiency premium Leroy Somer alternators for many power nodes, including low-voltage alternators for the upper power range from 3,300 – 4,000 kVA

3. Starting System

New standardized, fully redundant starting system fulfills even the highest availability requirements for mission critical applications

4. Control panel

Several upgrades to comply with the latest industry standards, including a configuration without a panel for more system integration and 3rd party controller flexibility

5. Circuit-breakers

New line of low-voltage, base frame-mounted, pre-wired and fully factory-tested circuit breakers up to 5,000 A

6. Radiators

Additional radiator features and general harmonization of standard radiator base frames (mechanical and electrical) simplify system integration planning

7. Base frame

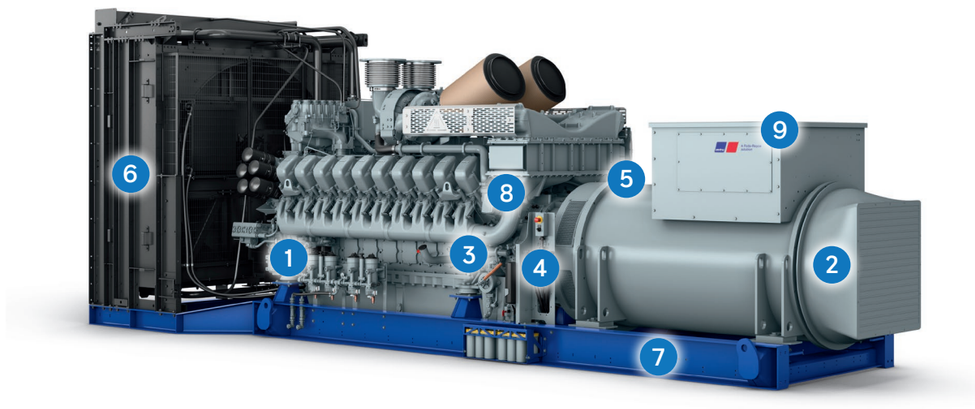
Improved base frame mounting options allow for easier installation on the genset foundation

8. *mtu* GO Connect Flexible

Top-notch digital connectivity device, including quick system data analysis, preventive and predictive maintenance features and for higher equipment availability and access to the ***mtu*** GO platform

9. Additional documentation

Updated documentation for customized system configurations (e.g. “winter package” for low ambient temperature conditions)

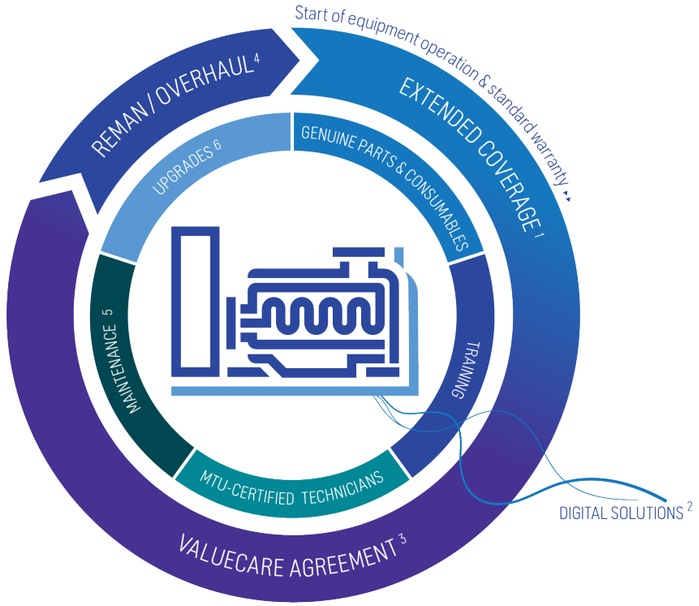


mtu VALUECARE AGREEMENTS

For maximum system performance, reliability and longevity, count on ValueCare, our full portfolio of service solutions. We're 100% committed to helping you get the most out of your equipment by providing:

- Maintenance, repair & overhaul – Rely on our trained experts to keep your equipment performing optimally.
- Annual check – Identify and address problems early with inspections and preventive maintenance recommendations.
- Technical documentation – Get the details you need for proper installation, commissioning, operation and maintenance.
- Training – Empower your operators and maintenance staff with classes taught by product experts.
- Commissioning – Ensure proper system installation, integration and optimization with expert support.
- Genuine parts – Protect and prolong equipment life with the only parts that are tested and approved specifically for your system.
- Consumables – Keep everything running smoothly with filters, oils and coolants that work in perfect harmony with your equipment.
- Remanufactured products – Cut costs and uphold quality with factory remanufactured parts, engines and systems.

1 Avoid the unexpected with added protection beyond the standard warranty.
2 Make better decisions faster with digitally-enhanced tools.
3 Maximize availability and optimize lifecycle costs with a ValueCare Agreement.
4 Improve system performance and extend equipment life with on-demand support.
5 Keep a good thing going with factory reman/overhaul solutions.



TEAMING UP FOR YOUR SUCCESS

Our support for your individual project

As a rule, every power generation project is different. Knowing this, we place great value on working closely with clients in planning and engineering the best possible solution for their individual requirements. Our commitment to teaming up to find optimal solutions covers every step of the lifecycle – from simulation to the client-specific solution, commissioning, digital aftersales, repowering and remanufacturing.

- Help with planning your new power generation solution
- Expertise to help you incorporate it into your application
- Detailed engine, system and component explanations
- Planning stage budget proposal and fixed implementation price
- Design and planning of peripheral systems
- Advice on service solutions
- Help with legal questions (e.g. German Renewable Energy Act levy, formaldehyde bonus)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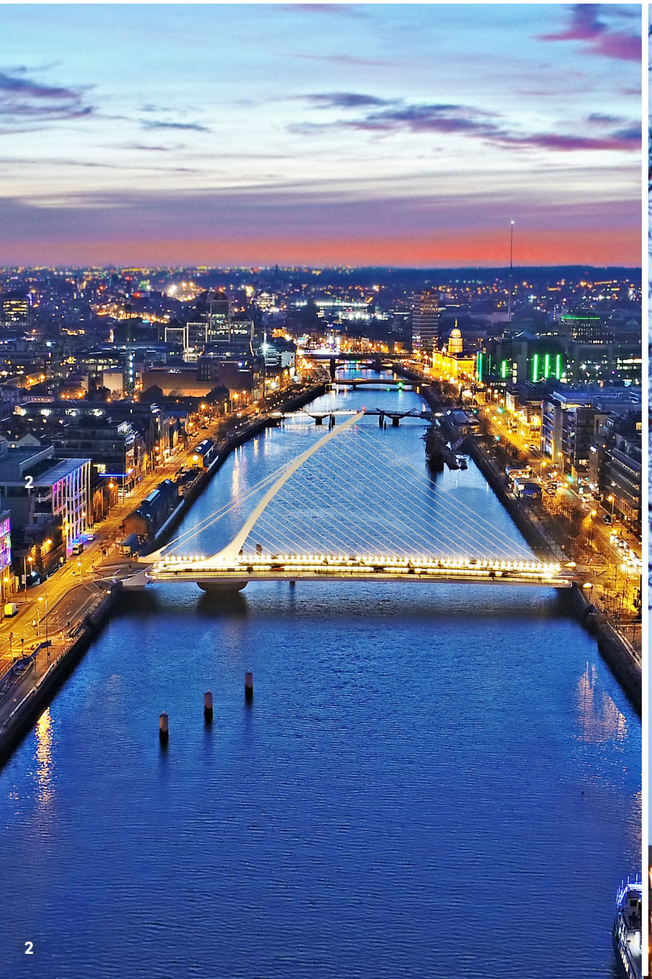
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REFERENCES

mtu Series 4000 engines are in service around the world, in data centers, hospitals, airports, farms and independent power stations, providing power for continuous, prime, peak, standby, and mission-critical applications.

Grid stability

Customer: Prime Energía
Locations: Pajonales, Los Condores, Combarbala, Llanos Blancos, San Javier, Chile
265 x ***mtu*** 16V 4000 DS
Power output: 475 MWel

The percentage of renewable energy in the Chilean power mix is expected to reach 60% by 2035. The 265 ***mtu*** gensets shared out across five plants are required to ensure grid stability with fast-response, cost-competitive backup power.

Standby power: Mission critical

Customer: EdgeConneX data center
Location: Amsterdam, Netherlands
23 x ***mtu*** 20V 4000 DS
Power output: 57 MWel

The gensets are based on 20-cylinder Series 4000 engines, each delivering an output of 2,480 kW, which in emergency situations can be operated continuously for up to 48 hours. The engines achieve full electrical output within 15 seconds of start-up and thus meet the customer's stringent project requirements.

Continuous power

Customer: Granjas Caroll de México
Location: Puebla, Mexico
4 x ***mtu*** 20V 4000 GS 1 x ***mtu*** 16V 4000 DS
Power output: 9.7 MWel

As part of one of Mexico's largest pork producers, the Granjas Carroll facility requires reliable, consistent energy with no fluctuation in voltage or frequency. Local providers could not guarantee that, so a completely independent off-grid solution was built using ***mtu*** gensets. The plant now produces enough electricity to handle all the plant's refrigeration and auxiliary needs. An extension for heat recovery and use of biogas is planned.

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1 **Prime Energia, Chile**
475 MWel, grid stability power

2 **Data Center, Dublin, Ireland**
30 MWel, up to 48 hours continuously

3 **Hospital, Berlin, Germany**
1,700 kVA, mission critical power

4000 DS. POWER RATINGS

Power output [1]	Standby/ Mission critical			Continuous / Prime / Grid stability	
	Standby power (3D)	Prime power for stationary emergency (3E)	Data center continuous power (3F)	Prime power (3B)	Grid stability power (3G)
50 Hz / 1500 rpm	kVA	kVA	kVA	kVA	kVA
12V4000 DS1650	1,780	1,600	1,600	1,600	1,600
12V4000 DS1750	1,880	1,700	1,700	1,700	1,700
12V4000 DS2000	2,080	1,880	1,880	1,880	1,880
12V4000 DS2250	2,300	2,100	2,100	---	---
16V4000 DS2250	2,330	2,160	2,160	2,160	2,160
16V4000 DS2500	2,610	2,360	2,360	2,360	2,360
16V4000 DS2750	2,850	2,600	2,600	---	---
20V4000 DS2750	2,800	2,640	2,640	2,640	2,640
20V4000 DS3100	3,200	2,910	2,910	2,910	2,910
20V4000 DS3300	3,410	3,110	3,110	3,110	3,110
20V4000 DS3600	3,730	---	3,390	3,390	---
20V4000 DS4000	4,000	3,630	3,630	---	---
Load	variable	variable	continuous	variable	continuous
Load factor	≤ 85%	≤ 85%	≤ 100%	≤ 75%	≤ 100%
10% overload (ICXN)	no	yes	yes	yes	yes
Max. operating hours (per year)	500h	500h	unlimited*	unlimited	1,000h, 500h with 100% load w/o interruption
Uptime compliant	Tier I & Tier II	Tier I & Tier II	Tier III & Tier IV	Tier I & Tier II	Tier I & Tier II

Available voltages	380V / 400V / 415V / 6300V / 6600V / 10,000V / 10,500V / 11,000V

1) Power outputs refer to standard scope of supply and may vary depending on generator voltage and ambient conditions.

2) On request

GERMAN GRID CODE CERTIFIED

In Germany, power generation systems connected to the public grid are required to meet guidelines set by BDEW (German Association of Energy & Water Industries). The ***mtu*** Series 4000 is the first generator set in its performance class to be certified by the VDE-AR-4110 according to code MSR2008. It complies with all the association's requirements for power grid operation.

VDE-AR-N 4110
CERTIFIED
GERMAN GRID CODE

Grid Code Compliance: Fluctuating renewable energy sources are supplying an increasing share of energy to the world's power grids. Against this backdrop, grid operators face the challenge to keep the grid stable and secure the supply of utility power. To deal with this, grid operators define standards in the form of so-called "Grid Codes" which all energy producers are obliged to follow.

One of the standards is represented by the German Grid Code VDE-AR-N 4110 (based on the European Network Code on Reguriements for Grid Connection of Generators NCRIG. It defines e.g. the requirements for generators regarding power quality, static as well as dynamic grid support or (re-) connection conditions for generators running in parallel with the grid.

All ***mtu*** S4000 generator sets are available with the VDE grid code certification and are therefore suitable for grid parallel operation for monthly test runs or to gain additional revenues through grid services such as frequency control reserve. With this certification, end users benefit through cost savings during the design, simulation, building and connecting phase of each energy project.

Power modules – 50/60Hz
Europe, Africa, Asia and Australia

Power output [1]	Standby power	Continuous power	Prime power
50 Hz / 1500 rpm	kVA	kVA	kVA
16V4000 DS2560	2,560	1,914	2,295
60 Hz / 1800 rpm	kWel	kWel	kWel
16V4000 DS2560	2,321	1,807	2,109

Subject to change. | 16120753 | Edition 01/21 | BMC 2021-07 | Printed in Germany on chlorine-free bleached paper.

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