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About Our Company

About Mitsubishi Hitachi Power Systems, Ltd.

Mitsubishi Hitachi Power Systems, Ltd. (MHPS), a joint venture company formed in February 2014, integrated the thermal power generation divisions of Mitsubishi Heavy Industries, Ltd. and Hitachi, Ltd. MHPS, headquartered in Yokohama, Japan, ranks among the world’s leading suppliers of equipment and services to the power generation market backed by 100 billion yen and approximately 20,000 employees worldwide.

As the company maximizes synergies and expands globally, MHPS has fortified three core areas: technology, comprehensive engineering, and aftermarket services. Through the development of the world’s most efficient power generation and related equipment, MHPS continues to meet the expectations of its customers and contributes to the future of a sustainable society. For more information, please visit www.mhps.com.

PW Power Systems LLC

PW Power Systems LLC (PWPS) is a group company of Mitsubishi Hitachi Power Systems, Ltd. PWPS has leveraged the advanced technology of Pratt & Whitney® proven aircraft engines and uniquely applied it to complex power system solutions to become a leader in power generation.

PW Power Systems has more than 2,000 industrial gas turbines installed in over 50 countries worldwide and prides itself on being superior in the gas turbine repair and overhaul sector. The PWPS gas turbine engine portfolio offers competitive, efficient, and flexible products that generate 30 to 140 MW of power.

PW Power Systems is committed to providing high-quality solutions for the distributed energy market that increase energy productivity and reliability and deliver operational savings for its customers.
FT4000® SWIFTPAC® Gas Turbine Package

The FT4000® SWIFTPAC® gas turbine package is available in both single- and twin-engine configurations which offer greater than 41 percent simple-cycle efficiency and a nominal 60-70 or 120-140 MW of power. The modular design is built utilizing over 55 years of aero-derivative design and packaging experience.
Utilizing the core technology derived from the proven Pratt & Whitney® PW4000™ turbofan engine, the all-new SWIFTPAC® gas turbine packages are designed to provide reliable peaking and base load power with a relatively compact footprint. This is accomplished by coupling either one or two FT4000® engines to one electric generator. The modular design includes proven features of the successful FT8® SWIFTPAC® and MOBILEPAC® gas turbine package designs.

Features
- One (1) aero-derivative engine (60-70 MW) or two (2) aero-derivative engines (120-140 MW)
- Single or dual engine configuration
- Modular design
- Maximum factory assembly
- Optimized shipping sizes
- Proven industrial components
- Integrated ancillary systems
- Prefabricated field piping
- Standard option packages

Benefits
- Reduced transportation time and cost
- Limited on-site inventory
- Minimal installation time
- Efficient commissioning
- Low installed cost/high overall value
- Operating flexibility
- High part load efficiency
- 10-minute start-up time
- Quick engine changeout
- Design flexibility to meet customer needs

Performance
- 140 MW nominal output in twin-engine configuration
- Wet compression for improved performance above ISO conditions
- Highest power output by any aero-derivative gas turbine package
- Single or dual engine operation
- 50 or 60 Hz performance with no penalty
- >41% thermal efficiency without external cooling
FT4000® SWIFTPAC® Gas Turbine Package
Scope of Supply

GT Enclosure Assembly
One (1) per aero-derivative engine
• Gas generator
• Power turbine
• Exhaust diffuser and collector box
• Diaphragm-type coupling
• Engine base
• Structural base frame with drip pan
• Acoustic/weather enclosure
• Combustion air inlet plenum
• Engine removal system
• Fuel control module
• Ignition system
• Synthetic lube oil system
• Hydraulic start system
• Hydraulic control oil system
• Bleed air system
• Buffer air system
• Ventilation air system
• Offline water wash system
• Vent and drain system
• Fire protection system

Electric Generator Assembly
One (1) per package
• Open-ventilated, air-cooled generator
• Brushless excitation system
• Lineside cubicle
• Neutral cubicle
• Rotor ground detection system
• Acoustic/weather enclosure
• Inlet and exhaust cooling air silencers
• Generator instrumentation

Control Panels
• Turbine control cabinets
• Gas turbine digital control system
• Vibration monitoring system
• Multifunction protection relays
• Fire protection cabinet

Major Field Assemblies
• Inlet filter houses, two-stage
• Combustion and ventilation air inlet silencers
• Ventilation air exhaust silencer
• Prefabricated field piping

Auxiliary Skid Assemblies
• Mineral-oil lubricating oil skid
• Gas fuel filter skids
• Liquid fuel boost pump skids
• Water injection boost pump skids
• Battery skid
• Fire suppression skids
• Water wash pump cart

Options
• Evaporative cooler system
• Inlet fogging system
• Wet compression system
• Modular exhaust stacks
• Reduced far-field noise
• 15 kV generator breaker
• Auxiliary transformer
• Fire suppression: electric generator enclosure, power control enclosure, and gas turbine enclosure

Available Services
• Permitting support
• Balance of Plant (BOP) engineering and procurement
• Installation technical support
• Construction management and labor
• Operation and maintenance

FT4000® SWIFTPAC® Combined-cycle Plants
Features
• All the advantages of an aero-derivative prime mover
• High availability
• High reliability
• Excellent full and part load efficiency
• Reduced installation times
• State-of-the-art plant-distributed control systems
• Available with air-cooled condenser
• Can be configured for cogeneration
• Available on turnkey basis
FT8® MOBILEPAC® Gas Turbine Package

30 MW of Mobile Power

The FT8® MOBILEPAC® gas turbine package requires a small footprint utilizing a 72 by 53 foot area*. Very little advanced site preparation is required, and no foundation or concrete pad is necessary for installation of the unit. The unit is transportable by land, sea, or air and modularly packaged for quick, worldwide delivery and installation.

*Compact footprint installed in parallel or in-line. This footprint allows equipment access and necessary clearance.
FT8® MOBILEPAC® Gas Turbine Package: Dual Fuel, Water Injection

Scope of Supply

**Power Trailer**

Gas Turbine Package
- Gas generator (GG8-3 core engine)
- Power turbine
- Diffuser
- Collector box
- Exhaust transition
- Fabricated gas turbine base and mount assembly
- Power turbine and generator coupling connection
- Hydraulic starting motor
- Ignition system
- Off-line compressor internal water wash system
- Lube oil system
- Fuel supply system
- Buffered air system
- Water injection NOx control system
- Gas turbine enclosure with three point jacking and leveling system
- Two-stage inlet air filter with weather protection
- Inlet silencing
- Exhaust stack
- Quick-disconnect electrical interface

**Generator Package**
- Open-ventilated, air-cooled synchronous generator or equivalent
- Brushless exciter assembly
- Stator heaters
- Neutral ground transformer/resistor
- Current transformers
- Stator RTDs
- Vibration probes
- Bearing drain RTDs
- Bearing metal RTDs
- Hot and cold air RTDs
- Rotor ground detection
- Generator lube oil system
- Enclosure
- Quick-disconnect electrical interface

**Control Trailer**

Control Enclosure with HVAC
- Operator control cabinet
- Monitoring cabinet
- Instrument cabinet
- Unit control cabinet
- Generator protective relay panel
- Motor control center
- Master terminal cabinet
- Rack-mounted, sealed, lead acid cell batteries
- Battery chargers
- Switchgear module 15 kV class
- CTG auxiliary transformer
- FM-200 fire suppression

**Hydraulic Starting Package**

Field Installation Hardware
- Interconnecting piping and hoses (CO2, fuel)
- Interconnecting, quick-disconnect electrical cables for power and signal
- Access stairs and platforms for power trailer and control trailer
- Piping interfaces
- Special maintenance tools

**Options**
- Equipment erection
- Equipment demolition
- Balance of Plant (BOP) design, supply, and install
- Freight
Owner’s Responsibilities

Project and Site Development
- Adequate title and interest, permanent facility permits, construction permits, and licensing
- Equipment mounting and mounting hardware
- Provisions of local communication facilities
- Temporary construction staging and secure inventory area
- Access roads, interior roads, and parking areas
- Site prep, leveling, and compaction to meet at least 191,521 Pa (4,000 lbs. per square foot) compressive strength
- Transmission system

Engineering and Construction
- Site engineering
- Site organization during construction
- Emissions and acoustic testing
- Workers’ compensation, employer liability, and any other local insurance required
- All supervision and craft labor for complete off-loading
- Required test prior to start-up
- Construction equipment, tools, and aids
- Phasing and synchronizing the generator to purchaser’s system

Other Responsibilities
- Site survey and plot plan
- Excavation for foundations, pipes, roads, cabling, and grounding grid
- Site leveling
- Backfill
- Finish grading
- Surface drainage including any collection pond
- Oily water separator
- Sanitary waste disposal
- Plant lighting
- Plant fire protection systems, hydrants, panels, and extinguishers
- Interpersonal communication system
- Site fencing and gates
- Construction water
- Builder’s all risk insurance

Interface Requirements and Responsibilities
- Electrical ground grid interconnecting grounding pads are provided by PWPS on each trailer and auxiliary skid
- Vent and drain maximum flow on oily waste drain is 35 GPM for water wash; total waste water per wash is 300 gal.
- High-voltage power
- Control system interface and grid signals
- Alternate electrical power supply 255 kW
The MOBILEPAC® gas turbine package is one of the industry leaders in providing state-of-the-art technology. After many successful years of operation, the MOBILEPAC® gas turbine package utilizes the FT8® engine and offers 30 MW of movable power. Utilizing the proven SWIFTPAC® gas turbine package technology, this package is designed to provide quick, reliable power and is especially useful in emergency situations.

The MOBILEPAC® gas turbine package design includes two trailers. The first trailer contains the gas turbine, electric generator, exhaust collector, diffuser, and engine lube oil system. The second trailer carries the 15 kV switchgear, control system, operation panel, protective relays, batteries and charger, motor control center, and the hydraulic start package. A pre-commissioned MOBILEPAC® gas turbine package can be driven to a site and begin generating power in nine days or less.

Benefits
- Ready for emergency power in nine days or less after arrival on-site
- Environmentally compatible
- Dual fuel/dual frequency
- Optional black start capability
- Flexible trailer siting
- Highway compatible
- Three-point support and structural rigidity to maintain generator alignment
- Remote operation

Product Facts

<table>
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<tr>
<th>Parameter</th>
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<td>Output (kW)</td>
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<tr>
<td>Base engine</td>
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<td>Weight</td>
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</table>
FT8® SWIFTPAC® Gas Turbine Package

The FT8® SWIFTPAC® gas turbine power plant provides quick, reliable power with installation in less than 30 days.
FT8® SWIFTPAC® Gas Turbine Package
Scope of Supply

Gas Turbine Package
- Two (2) aero-derivative engines (30 MW each)
- Gas generator (GG8-3 core engine)
- Power turbine
- Diffuser
- Collector box
- Exhaust transition
- Fabricated gas turbine base and mount assembly
- Coupling connecting power turbine and generator
- Hydraulic starting motor
- Ignition system
- Off-line compressor, internal water wash system
- Lube oil system
- Fuel supply system
- Buffered air system
- Water injection NOx control system
- Gas turbine enclosure
- Two-stage inlet air filter with weather protection
- Inlet silencing
- Exhaust stack
- Quick-disconnect electrical interface

Generator Package
- Open-ventilated, air-cooled, double-ended, synchronous generator or equivalent
- Brushless exciter assembly
- Stator heaters
- Neutral ground transformer/resistor
- Current transformers
- Stator RTDs
- Vibration probes
- Bearing drain RTDs
- Bearing metal RTDs
- Hot and cold air RTDs
- Rotor ground detection
- Generator lube oil system
- Enclosure
- Quick-disconnect electrical interface

Hydraulic Starting Package

Field Installation Hardware
- Interconnecting piping and hoses
- Interconnecting, quick-disconnect electrical cables for power and signal
- Foundation embedded material
- Special maintenance tools

Control Enclosure with HVAC
- Operator control cabinet
- Monitoring cabinet
- Instrument cabinet
- Unit control cabinet
- Generator protective relay panel
- Motor control center
- Master terminal cabinet
- Rack-mounted, sealed, lead, acid cell batteries
- Battery chargers
- Switchgear module, 15 kV class
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- Adequate title and interest, permanent facility permits, construction permits, and licensing
- Equipment mounting and mounting hardware
- Provision of local communications facility
- Temporary construction staging and secure inventory area
- Access roads, interior roads, and parking areas
- Site prep, leveling, and compaction

Engineering and Construction
- Site engineering
- Site organization during construction
- Emissions and acoustic testing
- Workers’ compensation, employer liability, and any other local insurance required
- All supervision and craft labor for complete off-loading, inventory, inventory control, storage, erection, installation, checkout, testing, and start-up of all non-PWPS supplied equipment and material
- Consumable material for erection work
- Required test prior to start-up
- Construction equipment, tools, and aids
- Phasing and synchronizing the generator to purchasers system

Other Responsibilities
- Site survey and plot plan
- Excavation for foundations, pipes, roads, cabling, and grounding grid
- Site leveling
- Backfill
- Finish grading
- Surface drainage including any collection pond
- Oily water separator
- Sanitary waste disposal
- Plant lighting
- Plant fire protection systems, hydrants, panels, and extinguishers
- Interpersonal communication system
- Site fencing and gates
- Construction water
- Builder’s all risk insurance

Interface Requirements and Responsibilities
- Electrical ground grid interconnecting grounding pads are provided by PWPS on each trailer and auxiliary skid
- Vent and drain maximum flow on oily waste drain is 35 GPM for water wash; total waste water per wash is 300 gal.
- High-voltage power
- Control system interface and grid signals
- Alternate electrical power supply 255 kW per power island, 380 V, 50 Hz, 3-phase for lighting, heating, and intermittent auxiliaries
The FT8® SWIFTPAC® gas turbine package offers 30 or 60 MW of power. Utilizing proven FT8® technology derived from a Pratt & Whitney® JT8D™ gas generator, the SWIFTPAC® power plant is designed to provide quick, reliable power.

The package design includes an enclosed driver assembly incorporating the gas generator, power turbine, exhaust collector box, inlet plenum, and lube system. These factory assembled modules allow the FT8® SWIFTPAC® power plant to generate power less than 30 days after arriving on site.

**FT8® SWIFTPAC® Gas Turbine Package**

**Installation Labor Costs – Typical U.S. Site**

- Tech Advisers
- General Operators
- Electricians
- Millwrights
- Pipe Fitters
- Riggers

Conventional SWIFTPAC® Power Plant
Benefits
• Best-in-class part load efficiency
• Reduced site setup time
• Lower site cost
• Less expensive shipping
• Reduced field flushing
• Minimal field wiring terminations utilizing quick-disconnect cables
• Prefabricated piping needs no field welding
• Condensed site labor
• Standard and repeatable manufacturing process
• Standard and repeatable installation process
• Pre-assembled and tested
• Reduced field inventory
• Ease of engine checkout and maintenance
• Operating flexibility
• Ease of transportation and relocation

Enhancements
• Factory-assembled modules
• Integrated lube oil system
• Factory-tested, quick-disconnect cables
• Prefabricated field piping
• Factory-flushed lube oil systems
• Combined gas turbine and exhaust enclosure
• Factory checkout
• Simple, flat foundation with minimal embedments
• Compact layout