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Design Requirements

The equipment listed within the scope of supply is designed according to the following requirements:

Codes and Standards

Equipment	Code or standard
Base frames	Welding: EN 287 / EN 288 or Asme IV. Design: BSK-1994 (corresponding to ISO 2394-1986).
Bolts and nuts	DIN
Control cubicles	IEC/EN 60439 part1, IEC/EN 60529, IEC/EN 60947 part 2, 3 and 4-1
Couplings	API 671 with E & C
Enclosures	BSK-1994 (corresponding to ISO 2394-1986).
Pressure vessels, filters and coolers	ASME Section VIII (excl. U-stamp). Also TEMA C in applicable parts (coolers).
Flanges	Dimensions: DIN (core engine) or ANSI (package). Design: PED or ANSI B16.5
Instruments	Measuring in SI-units except pressure [bar]
Noise generating equipment	Noise emissions: ISO 3746-1995 and ANSI S 12.36
Other electrical equipment	Applicable IEC/EN-code
Pipe coupling threads	ISO 228:1-1994 and SMS 2165
Pipes	Dimensions: DIN (core engine) and ANSI (package installation). Design: PED. ANSI/ASME B31.3 for fuel piping.
Pumps	DIN and/or ISO
Vibration measured equipment	ISO 10816-4, 1998
Vibration monitoring	API 670 with E & C
Drawings	ISO 5457-1980
Structural steel	IBC-2006 with exception for use of European standards
Cable joints of MM-type	IEC EN 50262
Balancing	ISO 1940-1 and ISO 11342-1998
Gas detection system	IEC/EN 60079-1:2004 Explosion group IIC (zone 1)
Gas fuel system	SIEMENS design
Liquid fuel system	Swedish standard.
Lube Oil Unit	API 614 With E&C
Electric generator	IEC/ EN60034-1
Gear and couplings	AGMA 421.06 & API 613 with E & C
Fire extinguishing equipment	NFPA 12 with Exceptions and Comments
CO2 bottles	European Directive 1999/36/EC
Motor control center	IEC/EN 60439 part1, IEC/EN 60529, IEC/EN 60947 part 2, 3 and 4-1
Control system	IEC/EN 61000-6-4:2007, IEC/EN 61000-6-2:2005, IEC/EN 60068 part 2, IEC/EN 60439-1, IEC/EN 60950, IEC/EN 61010-1
Frequency converters	IEC/EN 60204 part 1, IEC/EN 60529, IEC/EN 61800 part 3.
Electrical installation	The electrical installation fulfill the requirements in: Low-voltage electrical installations IEC 60364-series, HD 384, HD 60364-series. Safety of machinery IEC 60204-1 Low-voltage directive 2006/95/EC

Equipment	Code or standard
Control cables	IEC/EN 60227, IEC/EN 60228, IEC/EN 60331, IEC/EN 60332, IEC/EN 60502, IEC/EN 60811
Power cables	IEC/EN 60227, IEC/EN 60228, IEC/EN 60331, IEC/EN 60332, IEC/EN 60502-1
Factory tests	Balancing of rotors: ISO 1940-1 and ISO 11342-1998
Customer documentation	Drawings: ISO5457-1980, Designation system: KKS (Kraftwerk Kennzeichnen System)

Life Cycle Assessment

A life cycle assessment study (LCA) according to ISO 14040-43 is available. It contains quantifications of the resource depletion, generation of waste and emissions to the environment caused by the manufacturing, use and disposal of the product.

Project Specific Requirements

- Minimum outdoor temperature: 18 °C
- Maximum outdoor temperature: 43 °C
- The auxiliary voltage is 415 VAC
- The altitude of the installation is below 1000 meters
- Outdoor installation
- Installation made for Seismic zone 2 (IBC 2006)
- Design for maximum wind speed of 45 m/s (according to IBC 2006)
- The equipment is suitable for areas classified as safe. The electrical material in the gas turbine room is however classified for zone 1.
- Design for sound pressure level 85 dB(A) any point, near field, with exclusions. See separate document for guarantees
- Onshore installation less than 5km from coastline
- Surface treatment: Outdoor, Corrosivity category C5-M very high (off-shore) according to ISO 12944-2:1998 and according to NORSOK M-501, coating system no. 1. The internal equipment is treated for corrosivity category C2. Generator is treated for corrosivity category C3. Galvanised carbon steel according to ISO 1461:1999 (corresponding to C3).
- KKS tag number system. The components are identified in a hierarchial system according to the functional placement in the plant.
- Electrical frequency 50 Hz
- Enhanced instrumentation included on tripping signals. (excluding vibration).

Scope of Supply

Gas turbine equipment

Gas turbine engine

- Insulation of the Gas Turbine and selected piping (incl. exhaust casing) for personnel safety, heat and noise reduction.
- Compressor inlet casing and inlet bellmouth casing.
- Thrust bearing #1 combined with radial journal bearing #1 (tilting pad types, directed mineral oil lubrication) located in the inlet bellmouth casing.
- 2-stage gas generator turbine discs with blades, bolted to the compressor rotor.
- 11 stage axial flow compressor with two variable guide vane rings (AC servo motor driven), electron beam welded compressor rotor, inner stator casing with vane carriers forming air flow path, horizontally split outer casing.
- Central casing containing radial journal bearing #2 (directed mineral oil lubrication).
- 2 top-mounted bleed valves (pneumatically actuated) for air bleed during start-up and shutdown.
- Ignition system including one removable high energy spark plug (igniting the start-up burner).
- An annular third generation DLE combustion chamber with internal thermal barrier coating.
- Two optical flame detectors. One indicating the flame at start-up burner at ignition and during operation used as main flame detector. The other detector indicates cross ignition at start-up and during operation used as main flame detector.
- Combustion chamber primary zone by-pass arrangement with 5 motor operated valves (AC servo motor driven), for emission control at part load.
- 18 Dry Low Emission burners (dual fuel).
- Liquid fuel manifold and primary and main Gaseous fuel manifolds connected to the 18 fuel injectors.
- Quick couplings (mechanical). Converting adapter from Siemens core engine standard flange to auxiliary mating flange. For 24h gas generator exchange.
- Quick couplings (electrical). For 24h gas generator exchange.
- 2 stage power turbine, 6500rpm constant speed. Discs bolted to the shaft. Rotating direction is anti-clockwise looking counter flow.
- Power turbine exhaust diffuser.
- Drain valves (manually operated) from power turbine casing and exhaust casing.
- Tilting pad radial journal bearing #3 (directed mineral oil lubrication) located in the power turbine diffuser casing.
- One tilting pad thrust bearing combined with one tilting radial journal bearing #4 (directed mineral oil lubrication) located in the power turbine diffuser casing.
- Turbine intermediate piece.
- Flexible coupling and spark-proof coupling guard.
- Instruments with trip-function have the following configuration: 2oo3 for axial displacement (GG & PT), inlet and outlet pressure, exhaust gas temperature, rotating speed (GG & PT) and bearing vibration supervision (bearing number 1 to 4, accelerometer type). Flame detection with 1oo2.

Combustion air inlet system

- Air intake bug screen.
- Air inlet hoods.
- Single side static filter system with 2 filter stages. Droplet separators as weather protection, disposable pre filters (class F7 acc. EN 779) and disposable high efficiency filters (class H10 acc. EN 1822). Service platform and ladder. Filter house in carbon steel.
- Hoist for filter replacement in carbon steel, hand operated.
- Inlet silencer. Carbon steel casing and rods in AISI 304.
- Inlet plenum in AISI 304.

Exhaust gas system

- ~~Vertical~~ exhaust system including bellows, ~~transition, silencer~~, insulation and support. ~~Exhaust height 11,0m~~. Internal structure in EN 1.7335, outside cladding in aluzink and splitters in AISI 321.

Base frame for gas turbine

- Pendulum supports, spring loaded supports, fix point support and side support for the gas generator and power turbine, down to the main base frame.
- Fixed (stiff) 3 point mounts.
- Gas turbine and generator.
- External stairs and platforms gas turbine.

Enclosure for gas turbine

- Enclosure provided for weather and sound protection equipped with ventilation. Equipped with two maintenance openings, one on each long side of the enclosure. Walkways to be used inside enclosure provided, to be stored outside enclosure. They shall be installed during service. Enclosure equipped with main lighting and emergency lighting system.
- Enclosure for the Gas turbine in carbon steel.
- Ignition gas cabinet (carbon steel), including 2x100% Propane bottles, isolation valve, pressure reducing valve and cabinet heater. Instrumentation acc. to attached P&ID. Stainless steel material for gas wetted parts except for Propane bottles, bottle connections and bottle hoses. All components inside the cabinet are approved for hazardous area acc. to classification plan.

Ventilation for gas turbine enclosure

- The GT compartment ventilation is integrated in the combustion filter house and shares filter with the GT. The ventilation air is taken between the first and second stage of filters.
- The ventilation is of overpressure type and fully redundant. It has two fans and normally operating at 2x50%. Each fan has the capacity to run at 1x100% and in case of failure an automatic switch-over is made.

Gas detection system

- 3 gas detectors located in the ventilation outlet from the GT room. The detectors are connected to the GT-control system via transducer cards. Each gas detector has an alarm and an engine shutdown level.

Gas fuel system

- Internal gas fuel unit with simplex Y-type strainer, shut off valves and control valves. Connection for N2-purging located at strainer, for maintenance purpose. Double block and bleed valves for safe fuel shut off. The unit is located inside the gas turbine enclosure close to fuel manifolds.
- Flow meter dummy for performance test meter.
- Gas turbine package gas piping in stainless steel 316L. Strainer and gas wetted valves upstream strainer in carbon steel. Gas wetted valves downstream strainer in stainless steel 316/316L.
- Manual isolation valve and automatic isolation valve located outside gas turbine enclosure.
- Gas fuel piping 10 % radiographic testing.

Liquid fuel system

- Liquid fuel system consisting of isolation shut off valve, fuel tank, high pressure fuel pumps (internal gear type), shut off valves, pressure relief valves, particle filter, tank heater for start up, floating valve and piping. The fuel tank is ventilated to atmosphere. Tank & piping material in AISI 316L. Instrumentation according to attached P&ID. The liquid fuel unit is located outside the turbine enclosure.
- 2x100% last chance particle filter with differential pressure indication for manual changeover. If needed the filter will be equipped with insulation & heat tracing.
- Single lift skid with weather protection roof for liquid fuel auxiliary equipment.

Ignition system

- Ignition gas panel with shut off and vent valves for gas distribution to burner #6. Main gas fuel or Propane used as ignition gas. Gas wetted parts in stainless steel.

Starting system

- Static frequency converter (SFC), electric asynchronous motor for gas turbine start and barring, transmission shaft with flexible coupling and overrunning clutch.

Lube oil system for gas turbine

- Lubricating oil system designed for mineral oil ISO VG46 (fulfilling SIEMENS material specification 812109). The lube oil system components are located on top of the oil tank.
- One electrical heater to ensure oil temperature at start-up and during stand still. 3x70% AC-driven main oil pumps (centrifugal type). The pumps are normally utilised to 2x50% but the SFCs and motors are designed for the increasing flow when a single pump is in operation. The combined high pressure/scavenge pumps supplies high pressure oil to bearing #2 and ensures the draining of the bearing. A static frequency converter drives each pump. DC back-up is provided on each pump by the 440V battery feed to the SFCs. 2x100% lubricating oil filter with dP-transmitter and manual switch-over. 1x100% AC-driven oil system ventilation fan to evacuate air from the tank during start-up. When the system is in operation the air is evacuated by an ejector. Oil ventilation filter with filter casing in stainless steel. Lube oil unit in carbon steel. Piping in stainless steel.
- Water cooled lube oil cooler, plate heat exchanger type. Plates in stainless steel 316L. Cooling media water/anti-freeze or fresh water. **Standby lube oil cooler additionally fitted with change over scheme**
- External ladder and platform oil cooler.
- Lube oil cooler pipes, length (meters) 2x5. (Piping between Lube Oil Coolers and Lube Oil System)

Cooling and sealing air system

- Water cooled seal air cooler of tube heat exchanger type for the supply of cooled high pressure sealing air to bearing #2. Cooling media water/anti-freeze.

Purge air system

- Water cooled purge air cooler of tube heat exchanger type. Cooling media water/anti-freeze.
- Design according to ASME excluding U-stamp.
- Purge air ventilation, outlet located above the GT enclosure roof. Note: For indoor installation the outlet must be extended outside the main building.
- Shut off and vent valves (pneumatic operated). Internal piping between the compressor tapping and the gas fuel system. Stainless steel materials 316/316L for parts in contact with the purge air.

Instrument air for gas turbine

- Stainless steel tubing inside GT package to on-skid instrument air consumers. Manual isolation valve and last chance coalescer filtration included.

Washing and cleaning system

- Compressor cleaning nozzles.
- Compressor washing unit for offline washing.
- Mobility wheel kit for the washing unit.
- Counter flange terminal point.

Electric generator equipment

Electric generator (ABB make)

- Four pole (salient) three phase synchronous generator with the following equipment:
 - Brushless AC- exciter with rotating rectifier and PMG for excitation power supply
 - Insulation stator and exciter, class F, Insulation main rotor, class H, with a temperature rise at gas turbine rated output and power factor 0,8 within class B absolute according to ' 16.3.4 of IEC 34-1 within the ambient temperature range.
 - Temperature monitoring by RTD and vibration monitoring by accelerometers.
 - Line and neutral side termination point for MV terminal enclosure.
 - Anti condensation heater in the main machine, exciter and MV terminal box.
 - Separate junction boxes for instruments, excitation and heaters.
 - Rated Current, Max FLC (Full load Current) and short circuit current, peak 100kA.
- Generator type AMS 1250SE.
 - Frequency / speed / voltage: 50 Hz / 1500 RPM / 11 kV.
 - Rated Power 40000 kVA at 35°C cooling water temperature and PF 0,8.
 - Generator cooling: IC8 A1W7 (TEWAC).
 - Four top mounted cooler elements (2+2) and heat exchangers with single tube material.

- Ingress protection class: IP54.

Excitation and voltage regulator system

- Excitation and redundant automatic voltage regulator (AVR) system with the following functions.
 - Built in DC-chopper for regulation of field current
 - Power factor control, Reactive power factor control
 - Excitation current limiter with cooling air bias
 - Stator current limiter with cooling air bias and
 - Under excitation limiter.

Line and neutral cubicle

- Terminal box for line and neutral side MV equipment. Phase conductors of solid copper bars. Connection of generator to the grid is performed via undrilled Cu bus bars at the lower end of enclosure suitable for cable or bus duct connection.

Technical data:

- Rated Voltage: 11kV
- Rated Current: Max FLC (Full load Current)
- Rated frequency: 50Hz
- Highest system voltage: 12kV
- Rated insulation level, 1 min: 28kV
- Impulse Withstand Voltage, (Full Wave 1,2/50 microseconds): 75kV
- Short circuit current, 1s:50kA
- Short circuit current, peak: 125kA
- Degree of protection: IP54

The enclosure accommodates the following equipment:

- Voltage transformers on the line side (3 nos. single phase units, connected YN).
- Generator stator terminals (6 nos or 12 nos. depending on the current).
- Generator star point.
- Current transformers on the neutral side. (3 nos., 3 secondaries, 1A /phase).
- Excitation rectifier and AVR module with transducers for electrical quantities.
- Mobile earthing tool for maintenance work.
- Lightning/surge arrestors on the line side. (3 nos. single phase units, connected YN).
- Surge capacitors. (3 nos., single phase units, connected in YN).
- Neutral point resistor, 10A, 10s.

Synchronizing equipment

- Automatic and manual (semiautomatic) synchronising system for the Generator Circuit Breaker (GCB). The system is provided with a "Synchronising by-pass" switch for breaker closing against a "dead bus".

Relay protection

- The unit is equipped with a multifunction generator protection from Siemens SIPROTEC 4 family and is of the type 7UM62x. The protection system is divided into two sub system, sub1 and sub2, each of the protections having the same protection functions included. The basic functions are as follows:
 - Inverse time over current protection, 51V.
 - Negative sequence protection, 46.
 - Differential protection, 87G.
 - Under excitation protection, 40.
 - Reverse power protection, 32R.
 - Under voltage protection, 27.
 - Overvoltage protection, 59.
 - 95%- stator earth fault protection, 59N.
 - Voltage transformer circuit supervision, 60FL.
 - Stator overload protection, 49 (realized in GT Control System).
 - Rotating diode failure protection, 58 (realized in the voltage regulator).
 - Watchdog for continuous monitoring of the program sequences.
 - Communication interface with Profibus DP.

- Block differential protection, 87GT
- Rotor earth fault protection, 64R

Gear and couplings

- Speed reduction gear from 6500rpm to 1500rpm, double helical design. High speed side flexible coupling, low speed side internal quill shaft with stiff flange coupling. Design according to AGMA. Instrumentation according to separate P&ID.
- External stairs and platforms at gear box and electrical generator.

Base frame for electric generator

- Base frame for the electric generator. This frame is bolted together with the speed reduction gear and the gas turbine base frame and will form a common three point supported unit.

Noise and weather protection for electrical generator

- Noise reduction and weather protection walls and roof for the Electric Generator. Material in carbon steel.

Enclosure for gear

- Enclosure over the gear system.

Lube oil for electric generator

- Lube oil unit for generator is common with gas turbine lube oil.

Train auxiliary equipment

- Selected piping insulated for personnel safety and heat reduction. Instrumentation pipes, instrument valves and fittings in 316L stainless steel.

Water cooled cooling system

- Terminal points are flanges on coolers.

Instrument air for train auxiliary**Foundation for train auxiliary systems**

- Outline drawing of the foundation with static and dynamic loads will be presented. Anchor bolts for auxiliary equipment (such as stairs, platforms, coolers, fuel systems etc.) are included in the delivery.
- Customer responsible for embedded steel plates.

Fire detection and extinguishing system

- Fire panel located in package control panel providing status of fire detection and extinguishing system.
- Status panels on gas turbine enclosure long sides reachable at entrance doors, including 2 status lights, 1 warning light flashing red, 1 manual release button and lockable release inhibit switch.
- 6 IR flame detectors, 6 heat detectors located in the GT room.
- 2 electrical and 2 pneumatic sirens in the GT room.
- 4 smoke detectors in control room, 2 smoke detectors in battery room at control room.
- 1 electrical siren.
- 1 portable fire extinguisher.
- Fire extinguishing CO2 system with extended discharge.
- 1x100% discharge system.
- CO2 cylinders into separate container. Pipework, valves and nozzles to feed CO2 to the protected rooms.
- Pipes in galvanized carbon steel. Nozzles in brass material.
- Container in carbon steel.

Electrical and control equipment

Electrical and control modules

- The electrical and control module is a freestanding building containing the systems for the gas turbine set.
- Air conditioning unit (1x100%), Heater and ventilation for electrical and control module.
- Separate battery module.
- Air conditioning unit (1x100%), heater and ventilation for UPS battery module.

Motor control center

- The motor control center supplies all electrical consumers within the scope of supply.
- Single incomer.

Control system

- Control system for automatic start-up, operation and shut-down. A micro processor based control, supervision and protection system with a PC based operator station. The system is designed for highest possible operator friendliness with color process graphics, log and alarm/event displays, printer for lists and hardcopies from the screen. The system has various openings to external computer systems. The system program is in US English language.
- The unit protection system is built up around a fail safe controller, AS400-F, proven according to IEC 61508. All trip signals works with the principle of fail safe, i.e. signal loss generates a turbine trip. The fail safe principle is also valid for alarms. The system operates with 24VDC.
- Operators station: PC based (Windows XP) operators interface, Simatic WinCC with necessary software to operate the GT in all operation modes. Rack type computer with redundant Hot-Swap, RAID controllers.
- The PC based operators interface consists of: Rack mounted turbine HMI with cubicle mounted 19 inch screen, keyboard, mouse and laser colour printer.
- The operator station performs, apart from providing normal operators dialogue: Trending and storing of process parameters, Self diagnostics and displays of system and individual board status, Start counter, Operating hours and Equivalent operating hours counters.
- Main process controller Simatic AS400 The main Simatic controller contains system and application programs to perform both open and closed loop control in order to run the gas turbine set, the programs are battery backed-up for approx. two months. The main tasks of the AS400 controller are: Analogue and Binary I/O handling, Sequencer for start and stop, Gas turbine set supervision and monitoring, Frequency/load control, Gas generator speed and temperature control.
- Data Logging. All process signals including alarms and events are transferred to a database (DC - Data Collector) for long term storage. Stored data can be used for fault finding, verification and optimization. The database is located in the gas turbine operator station and is available via the product CMS Base Package. The stored data may be sent to SIT for viewing and analysis.
- PCS7 license for control system programming included in a separate engineering station.
- Control of all SIT gas turbines from all SIT operator stations.
- Operator station server with the possibility to connect to operator station clients.
- Operator station client

Electrical emergency system

- The Motor Drive System – with UMD and UPS supplies all the electrical motors within the scope of supply with power.
- Single incomer
- The system consists of UPS (Uninterrupted Power Supply) and UMD (Uninterrupted Motor Drive). The system provides uninterrupted AC power to the AC motor driven lube oil pumps, the oil ventilation fan(s) and the I&C (Instrument & Control system) of the turbine package. The system is configured with static frequency converters (SFC) with dual power feed from both mains and back-up battery power.
- The system is a self-contained freestanding panel arrangement containing:
 - One AC power distribution board with MCCB breakers supplying the frequency converters and the battery charger.
 - One DC power distribution board with MCCB breakers supplying the frequency converters.
 - Static frequency converters for the lube oil pumps and the oil ventilation fan.

- UPS unit(s) (static frequency converter, sine filter and transformer) with manual bypass to mains.
- MCB distribution board for I&C equipment fed from UPS.
- battery charger 440VDC; PLC based emergency back-up operation system.
- Valve regulated 440 VDC Pb Gel Battery (including temperature compensated charging voltage) with switches for service of each battery pack. Capacity for a complete 10h emergency cool down cycle and one hour autonomy time for the UPS system. Eurobat classification: High Integrity, design life 10 years.
- UMD cabinet incl standard lube oil unit, UPS, ingress protection IP21.
- One UPS distribution board with MCBs for supply of the I&C equipment. The UPS can be by-passed during maintenance.

Frequency converters

Condition monitoring system

- Condition monitoring system (CMS) main objectives are: collecting, monitoring and analyzing historical data of process and control system values from the Bas Turbine process. A Software License Agreement (SLA) must be signed by the End Customer before the installation at site. The base module includes software (for trends, alarm & event and reporting tools), hardware (remote access connection (Internet/ISDN), computer with monitor including storage capacity for approximately 5 years data), service (customer configuration, installation, commissioning). The CMS-computer shall be placed within 5m range from a common Terminal Net used by all Operator Stations and the Remote access connection. 2 years annual maintenance fee for the base module included for software updates.

Electrical installation

- Electrical installation on base frame and skids with onshore cable.
- Cable ladder in Stainless steel.
- Basic Electrical material for electrical installation at site.

Project execution

Project management

General services

- Product certification. A classification plan of the installation according to the International and European standard IEC/EN 60079-10 as well as a Risk Analysis which is the base for the Certificate of Conformance according to the machinery directive, are available.
- Warranty period 12 months (operation) or 18 months (from Ex-work), whichever comes first. Details and conditions found in commercial T&C.

Factory services

Packing and delivery

- Rental of lifting tools for on/off loading. The Tools are property of the SIEMENS and shall be returned. Transport cost at the return to be paid by the customer.
- 30 weeks rental period for lifting tools.
- Packaging for sea transport.
- Weight control and gravity check included.
- Delivery acc. to INCOTERMS 2000 as defined in commercial T&C.
- Drying system for transport of turbine.
- Drying system for transport of control module.

Factory assembly

Factory inspections

- Quality control according to standard Inspection Plan.

Factory tests

- Balancing and overspeed testing of Gas Generator and Power Turbine rotor.
- Electric generator standard test performed at the sub-supplier's workshop.
- Gear standard test at the sub-supplier's workshop.
- Mechanical running test of the gas generator and power turbine. Total running time of 2,5 hours.
- Stationary testing including system tests of the assembled enclosure equipment, with contract auxiliary systems and contract control equipment.

Installation and commissioning services

Site installation

- Site installation is offered on a daily rate basis.

Commissioning and site tests

- The pre-commissioning (stationary test) is offered separately on a daily-rate basis.
- Test of completion offered separately on a daily-rate basis.

Operation and maintenance services

Customer documentation

- The Documentation is divided into five blocks 1, 2, 3, 4 (Operation and Maintenance) and 5 (Quality Documentation). All documentation, with the exception of block 5 is delivered on CD/DVD-ROM. The application uses a standard HTML web-browser and Acrobat Reader.
- Manufacturing record book. The compiled documentation that shall be used to support inspection and the periodical survey of equipment as to meet the regulatory requirements. Number of copies: 2
- Block 1 is an introduction to the Operation & Maintenance documentation structure and comprises key information on how to recognize and find the appropriate documents and how to understand the typical symbols used.
 - 1 Documentation overview
- Block 2 serves as the instruction for operation of the gas turbine package and as well as handling the unit in emergencies. The System Descriptions and the System (P&I) Diagrams form an appropriate level of information for understanding the basic systems design and operation. This block also contains instructions for scheduled preventive maintenance.
 - 2A Operation Instruction, including control system operator interface
 - 2B Fault Procedures
 - 2C System Descriptions
 - 2D Process & Instrument Diagrams (P&ID)
 - 2E Setting list, Electrical load list, Aggregate list and Instrument list
 - 2F Maintenance Documentation
- Technical Documentation (Block 3) contains detailed technical information, mainly intended for the maintenance personnel.
 - 3A Installation Documentation
 - 3B Building Documentation
 - 3C Electrical Documentation
 - 3D Control Documentation
- The Component Documentation (Block 4) mainly consists of Technical Documentation and a limited part of Operation and Maintenance Documentation.
 - 4A Control Components
 - 4B Electrical Components
 - 4C Mechanical Components

- The Manufacturing Record Book (Block 5) includes inspection plans and different types of certificates for the electrical and mechanical equipment.
 - Test and inspection documentation.
- Language: English
- Number of paper copies of binder for block 1, 2 and 3: 2
- Number of paper copies of binder for block 4: 2
- Number of electronic copies for block 1, 2, 3 and 4: 4
- Combined binder sets for two gas turbines.

Customer training

- Customer training is required in order to have a safe and reliable operation. Both basic training as well as special training courses (for electrical/instrument, mechanical and operators) are available.
- Basic training course, all categories, max 18 participants, 5 days at site.
- Category training course, electrical and instrument technicians, max 6 participants, 4 days at site.
- Category training course, mechanical technicians, max 6 participants, 2 days at site.
- Category training course, Operators, max 6 participants, 3 days at site.

Maintenance tools

- Standard hand tools are not included in the scope.
- Maintenance tools for site maintenance of gas turbine.
- Electric generator and gear adjusting tools.

Spare parts

- Spare parts for 2 years of operation:
- Spare parts for commissioning and start-up (electrical and mechanical).

→ As per list enclosed and received along with the Gas Turbine Generator

Main Exclusions

- Pipes to water cooled coolers. Terminal point at flanges
- Site cables for power between local control room and base frame.
- Site cables for signal between local control room and base frame.
- All civil works including foundations.
- Auxiliary power.
- Cooling media (Temper or other anti-freeze media).
- Drain from terminal point.
- Earthing network external to gas turbine train.
- Embedded steel plates.
- External support structures for air intake and exhaust gas systems excluded.
- Fuel.
- Generator circuit breaker.
- Grease.
- Instrument air.
- Lubrication oil.
- Compressor anti-surge/performance controller.
- Main power cabling between the electric generator and the generator breaker (step-up transformer).
- Nitrogen bottles.
- Nitrogen.
- Trial run.
- Valves, instrumentation and piping if not specifically listed in scope of supply (drawing only to show control philosophy and required instrumentation).
- Washing detergent.
- Water.
- Witness points.
- Supervision of erection (Offered on Daily Rates)
- Commissioning (Offered on Daily Rates)