Scope of Supply

Project name
Generic Fast Track SGT-800

Site

Turbine type
SGT-800 54MW Power Generation

This scope of supply is valid for three (3) item of Siemens Industrial Turbomachinery AB's model SGT-800 54MW gas turbine 50 Hz for power generation, designed for continuous base load operating mode.

The SGT-800 is a high performance industrial gas turbine suitable for a variety of applications including simple cycle, combined heat and power and combined cycle power plant. In order to ensure reliability in the SGT-800, its design philosophy has been based upon simplicity, robustness and the use of proven technology. Modularization, few parts, long component life and easy inspection ensure high availability and low maintenance costs.

Please feel free to contact us regarding your requirements.

Note:

The SGT-800 Generic Fast Track unit is a pre-configured product with a fixed scope of supply as specified in this document. In order to offer this product with shortest possible delivery time, manufacturing of the unit may be in progress and therefore any changes to the design and assembly will impact on delivery time and price.

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1 Design Requirements

1.1 Design Basis

- Minimum outdoor temperature: -15 ºC.
- Maximum outdoor temperature: 55 ºC
- Minimum lifting temperature: -15 ºC
- Minimum transport temperature: -15 ºC
- Altitude: <1000 meters above sea level.
- Package location: Outdoor.
- Seismic loads according to IBC.
  Acceleration short period, Ss, up to and including 1.5g.
  Acceleration long period, S1, up to and including 0.625g.
- Wind speed: 45 m/s according to IBC.
  Non-hazardous area.
- Near field sound pressure level: 85 dB (A).
- Electrical utility frequency: 50 Hz.
- Auxiliary voltage: 400 VAC.

1.2 General Specifications

- KKS designation system.
- Welded thermowells for gas fuel system and 1/2" NPT threaded for other auxiliaries.
- Electrical and control panels in light grey, RAL 7035.
- Warranty as defined in Commercial terms and conditions.
- Air cooled coolers for all equipment.
- Surface treatment for indoor equipment according to ISO12944-2:1998, category C3 medium.
- Surface treatment for outdoor equipment according to ISO 12944-2:1998, category C4 high. Enclosure internal equipment according to category C2. Galvanized carbon steel according to ISO 1461:1999.
- Surface treatment for electric generator according to ISO 12944-2:1998, category C5-I.
- Enclosure exterior surface in pebble grey, RAL 7032, top coat color.
- A life cycle assessment 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.

1.3 Codes and Standards

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

Equipment	Code or standard
Base frames	EN 1993 Eurocode
Bolts and nuts	ASME standards
Control cubicles	EN 60439 (corresponding to IEC 60439)
Couplings	API 671 with comments
Enclosures	EN 1993 Eurocode
Pressure vessels, filters and coolers	ASME VIII excluding U-stamp.
Flanges	ANSI B16.5 on package piping and interconnecting piping.
Units	SI-units. Exception: pressure (bar).
Noise generating equipment	ISO 11204 and ISO 10494
Other electrical equipment	EN 60204 (corresponding to IEC 60204)
Pipe coupling threads	NPT and/or ISO threads
Pipes	EN 13480 with dimensional standards according to ASME B31.3
Pumps	DIN and ISO standards.
Vibration measured equipment	ISO 10816-4
Vibration monitoring	API 670 with comments
Drawings	ISO 5457
Structural steel	EN 1993 Eurocode with additional compliance with IBC 2009.
Cable joints of M-type	EN 50262
Balancing	ISO 1940-1 and ISO 11342
Air intake filter	First stage filters: EN 779:2012. Second stage filter: EN 1822:2009.
Gas fuel system	ISO 21789

Equipment	Code or standard
Liquid fuel system	ISO 21789
Lube Oil Unit	EN 60034 (corresponding to IEC 60034) and API 614, with exceptions and clarifications.
Electric generator surface treatment	ISO 12944-2:1998 "Paints and varnishes. Corrosion protection of steel structures by protective paint systems."
Main gear and couplings	AGMA 6011-I03
Speed reduction gear	Design according to AGMA 421
Gas detection system	IEC/EN 60079-1:2004 Explosion group IIC (zone 1)
Fire extinguishing equipment	NFPA 12 with exceptions and clarifications.
CO2 bottles	European Directive 1999/36/EC
Motor control center	EN 60439 (corresponding to IEC 60439)
Control system	EN 60439 (corresponding to IEC 60439)
Frequency converters	EN 60204 (corresponding to IEC 60204)
Electrical installation	EN 60204 (corresponding to IEC 60204)
Control cables	EN 60204 (corresponding to IEC 60204)
Power cables	EN 60204 (corresponding to IEC 60204)
Factory tests	ISO 3977-8
Customer documentation	ISO5457-1999 with designation system: KKS. Documents' structuring principles based on IEC 81346: "Classification and designation of documents for plants, systems and equipment".

1.4 Abbreviations

The following abbreviations may be used:

AN Air natural

CEMS Continuous emission monitoring system

CMS Condition monitoring system

DC Data collector

DCS Distributed control system

DLE Dry low emission

EPA Efficient particulate air filter (E10–E12)

GG Gas generator

HMI Human machine interface

HART Highway addressable remote transducer

HRSG Heat recovery steam generator

I&C Instrument and control system

LV Low voltage

MCC Motor control center

MCCB Molded case circuit breaker

ONAN Oil natural air natural

P&ID Process and instrument diagrams

PT Power turbine

RTD Resistance temperature device

SFC Static frequency converter

SIL Safety integrity level

UCP Unit control panel

UMD Uninterruptable motor drive

UPS Uninterruptible power supply

2 Equipment and Services

2.1 Gas turbine equipment

2.1.1 Gas turbine engine

Single shaft industrial type gas turbine with modular design. Vertically split compressor casing for ease of maintenance.

- Compressor inlet casing and inlet bellmouth casing.
- All bearings of tilting pad type with directed mineral oil lubrication.
- Thrust bearing #1 combined with radial journal bearing #1, located in inlet bellmouth casing. Radial journal bearing #2, located in the turbine exhaust diffuser casing.
- Two pneumatically actuated bleed valves for air bleed during startup and shutdown.
- Ignition system including one removable high energy spark plug for startup burner.
- Annular combustion chamber with internal thermal barrier coating.
- Two optical flame detectors. One indicating the flame at startup burner at ignition and one indicating cross ignition at startup. During operation both are used as main flame detector.
- 30 DLE burners of third generation for dual fuel.
- Five fuel manifolds. Two for liquid fuel operation: pilot and main. Four for gas fuel operation: two pilots, one central and one main.
- Manually operated drain valves at compressor inlet plenum and bleed cavities and at combustion chamber and exhaust casings.
- Turbine exhaust casing and exhaust diffuser.
- Online combustor pulsation monitoring system with three dynamic pressure transducers that continuously measure the combustor dynamic pressure.
- Insulation of gas turbine and exhaust casing for personnel safety and heat & noise attenuation.
- Dehumidifier unit for use in non-hazardous area. For engine dry out during extended shut down periods.
- 12 x 1.5 mm instrument tubing in 316L stainless steel with double ferrule couplings for core engine.
- Instruments with trip function during operation have the following configuration:
  - 2oo3 for gas turbine inlet & outlet pressure, axial displacement, exhaust gas temperature. 2oo3 for rotating speed.
  - 1oo2 for flame detection.

2.1.2 Combustion air inlet system

Air inlet system including weather protection, filters and silencer.

- Filter house with service platform and ladder.
- Single side pulse clean filter system with two filter stages, class F7 pulse filters as first stage and static class E10 disposable high efficiency filters as second stage.
- Droplet separator as weather protection.
- Support structure for filter house.
- Hand operated hoist for filter replacement.
- Air intake prepared for future chiller coil installation (chiller coils not included).
- Low pressure drop inlet silencer with baffles in 316L stainless steel.
- Inlet plenum with inspection window.

2.1.3 Exhaust gas system

- Insulated axial exhaust diffuser with support.
- Stack height: 18 m above ground.
- Prepared for installation of diverter valve (diverter valve not included).
- Exhaust stack including bellows, transition piece and silencer with internal insulation.
- Material:
  - Stack outer structure in painted carbon steel.
  - The inner liner and splitters in AISI409 stainless steel.

2.1.4 Base frame for gas turbine

Welded I-beam base frame for the gas turbine driver unit.

- Pendulum, fix point and flex support between gas turbine and base frame.
- Multipoint support between base frame and foundation.

2.1.5 Gas turbine enclosure

Enclosure for weather and noise protection equipped with ventilation, main & emergency lighting and external stairs & walkways. The enclosure is an integral part of the machine safety concept and considered as machine equipment designed to accommodate gas turbine unit with auxiliaries.

- Left side maintenance opening, looking from exhaust towards inlet. Internal walkways. Including over pressure damper.
- Maintenance overhead crane with a capacity of eight tonnes.

2.1.6 Ventilation for gas turbine enclosure

Ventilation system taking air from a non-hazardous area.

- 2 x 100% AC driven fans creating atmospheric under pressure in gas turbine enclosure. The fan unit is placed outside the enclosure.
- One-stage disposable barrier type air filter, class G4.
- Ducts in carbon steel.
- Inlet and outlet are equipped with:
  - silencers
  - weather louvers
  - shut off dampers.

2.1.7 Gas fuel system

Unit located inside gas turbine enclosure close to fuel manifolds. Nitrogen purging connection for maintenance.

- Simplex Y-type strainer with mesh size 200 (74 µm).
- Dual quick shut off valves with intermediate bleed valve.
- Control valves.
  - Motor operated for pilot and main gas.
  - Pneumatically operated for central gas.
- Total gas mass flow meter of coriolis type.
- Gas piping and valves, downstream strainer, in 316/316L stainless steel.
- Minimum 5% radiographic testing of gas fuel piping circumferential welds.
- Gas fuel ventilation to atmosphere located above gas turbine enclosure roof.

2.1.8 Liquid fuel system

High pressure liquid fuel unit.

- Isolation shut off valve.
- 2 x 100% particle filter with possibility to switch filter during operation. Filter element with 10 µm, β = 75 separation degree.
- Service fuel tank in 316L stainless steel with floating level control valve and heater.
- Variable speed drive motors and high pressure pumps of internal gear type for main and pilot line.
- Dual quick shut off valves and drain valve for main and pilot line respectively.
- Pressure relief valves.
- 316L stainless steel piping downstream the filter.
- Single lift skid with weather protection roof and extra sun protection. The skid is placed separately outside of gas turbine enclosure.
- Insulation and heat tracing of piping.
- Ventilation line from tank to atmosphere.

2.1.9 Ignition system

- Ignition gas panel with shut off and ventilation valves for gas distribution to burner #26. Main gas fuel or propane used as ignition gas. Gas wetted parts in 316/316L stainless steel.
- Ignition gas cabinet in carbon steel, including 2 x 100% propane bottles, isolation valve, pressure reducing valve and cabinet heater. Instrumentation according to attached process and instrument diagrams. 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 according to classification plan.

2.1.10 Starting system

Combined low voltage starting and barring motor.

- Variable speed drive squirrel cage induction motor of four pole design with hydro dynamic bearings.
- Supply voltage: 690 VAC.
- SSS-type overrunning clutch for connection of electric start/barring motor to main gearbox.

2.1.11 Lubricating oil system

System common for driver and driven equipment, located inside gas turbine enclosure with its components on top of tank. Designed for mineral oil fulfilling ISO VG46.

- Three AC driven main pumps of centrifugal type, two in operation and one in standby mode. Fully automatic and bumpless switch over to standby pump. Cooling down can be made safely with a single pump in operation.
- Jacking oil pump.
- Electrical pump and fan motors, fed via frequency converters. DC backup provided on all pumps by a 440V battery to the frequency converters. In case of failure in AC distribution, switch over to DC feeding is made automatically and without interruption.
- One top mounted electrical heater to ensure oil temperature during startup and stand still.
- 2 x 100% oil filter with possibility to switch filter during operation. Filter element with 10 µm, β = 200 separation degree in multi-layer metal meshed glass fiber.
- 2 x 100% oil mist fans with filter casing in stainless steel.
- Piping downstream filter in 316L stainless steel.
- Filter housing designed according to ASME VIII.
- Fin fan type lubrication oil cooler, ladder and platform.
  - Cooler redundancy (n+1).
- Interconnecting piping according to GA drawing.

2.1.12 Cooling and sealing air system

Cooling and sealing air for gas turbine including pipes and valves.

2.1.13 Purge air system

Pressurized purge air is extracted from gas turbine compressor for purging gas fuel nozzles of burners during liquid fuel operation.

- 1 x 100% cooler capacity.
- Purge air ventilation outlet to atmosphere, located above gas turbine enclosure roof.
- Pneumatically operated shut off and ventilation valves. Purge air wetted parts in 316/316L stainless steel.

2.1.14 Washing and cleaning system

Permanently installed nozzles located upstream of gas turbine compressor. Nozzles are connected to a washing unit via high pressure hose and filter.

- Compressor washing unit for offline washing. Locally operated.
- Stationary washing unit. Locally operated.

2.2 Electric generator equipment

2.2.1 Electric generator

Four-pole synchronous AC generator of salient pole rotor type. Brushless excitation system with rotating rectifier and PMG for excitation power supply. Lubrication oil is supplied by the gas turbine package common system. For further information refer to generator technical specification.

- 11 kV, 50 Hz and 1500 RPM.
- Power factor 0.8.
- Generator cooling IC6 A1 A6, TEAAC.

- Anti-condensation heater in main machine, exciter and medium voltage terminal box.
- Separate junction boxes for instruments, excitation and heaters.
- Ingress protection class: IP54.
- Cooling air and stator winding temperature supervised by RTD:s.
- Three vibration detectors of accelerometer type at each bearing.

2.2.2 Automatic voltage regulator

Automatic voltage regulator integrated in the gas turbine package control system. Voltage, power factor, reactive power and manual control modes with automatic and bumpless changeover. Built in DC-chopper for field current control.

- Dual channel.
- Excitation current limiter with cooling air bias.
- Stator current limiter with cooling air bias.
- Under and over excitation limiters.
- Operator interface via package HMI.
- Power system stabilizer with project settings integrated in automatic voltage regulator. Required data provided by client. Site tuning and evaluation to meet grid requirements is not included.

2.2.3 Line and neutral cubicle

Terminal box for line and neutral side of generator. Air insulated phase conductors of solid copper bar design. Connection of generator to the grid is performed via undrilled copper bus bars inside terminal box, suitable for cable or bus duct connection.

- Short circuit current 50 kA/1s with 125 kA peak.
- Three YN connected single phase voltage transformers on generator line side.
- Three line side current transformers, 1A per phase on secondary side.
- Lightning arrestors on line side, three phase-neutral and three phase-phase.
- Neutral point resistor, 10 A, 10 s.
- Connection of MV cables or bus duct at bottom of terminal box.
- AC Unit for AVR (Automatic Voltage Regulator) compartment.

2.2.4 Synchronizing equipment

Automatic and manual mode synchronization system including dead bus breaker closure by-pass switch for the generator circuit breaker.

- Synchronizing of two external breakers.

2.2.5 Relay protection

Redundant digital multifunctional relay protection with internal hardware and software watch dog. Communication and time synchronization with gas turbine controller by PROFIBUS DP.

- [51V] Inverse time over current protection.
- [46] Negative sequence protection.
- [87G] Differential protection.
- [40] Under excitation protection.
- [32R] Reverse power protection.
- [27] Under voltage protection.
- [59] Overvoltage protection.
- [59N] 95% stator earth fault protection.
- [60FL] Voltage transformer circuit supervision.
- [49] Stator overload protection, realized in gas turbine control system.
- [58] Rotating diode failure protection, realized in the voltage regulator.
- [78] Out of step.

2.2.6 Main gear and couplings

Parallel shaft gear of double helical design. White metal journal bearings with bearing temperature and vibration measurement.

- String torsional and lateral analysis.
- High speed quill shaft between gas turbine and speed reduction gear.
- Low speed quill shaft between speed reduction gear and electric generator.
- 2oo3 vibration transducers of accelerometer type at high speed casing side and one at low speed casing side.

2.3 Auxiliaries

2.3.1 Instrument air

Instrument air tubing in 316L stainless steel for the gas turbine package air consumers.

2.3.2 Foundation

Outline drawing of foundation with static and dynamic loads.

- Anchor bolts and embedded steel plates.

2.3.3 Gas detection system

Enclosure provided with gas detection system to detect gas fuel leakages.

- Infrared type gas detectors. Each gas detector has an alarm and an engine shutdown level.
- Signal evaluation according to 2oo3.
- Six gas detectors are located in clusters of three in enclosure ventilation outlet.

2.3.4 Fire detection and extinguishing system

Fire panel with matrix type status display located in UCP. Extinguishing media including manifolds and valves in freestanding container. Interconnecting piping between container and enclosure.

- Status & warning lights placed on gas turbine enclosure long sides indicating: CO2 release blocked, pre-alarm and alarm/CO2 release. Lights and manual release buttons at entrance doors.
- Ten IR flame detectors and six heat detectors located in gas turbine enclosure.
- One electrical and one pneumatic siren in gas turbine enclosure.
- Dual shot discharge CO2 extinguishing system in gas turbine enclosure.
  - Extinguishing capacity: 1 x 100% discharge.
  - Discharge delay: 30 seconds.
- Extinguishing nozzles in brass material.

2.4 Electrical and control equipment

2.4.1 LER and Battery module

Freestanding LER including lighting, HVAC and external stairs & platforms. All electrical and control panels are located in the pre-wired and workshop tested LER. Batteries in freestanding container including lighting and HVAC.

- 4x33% AC units, heater and overpressure ventilation in LER.
- 2 x 100% HVAC in battery container.

2.4.2 Motor control center

MCC including LV distribution of IEC 60439 form 4b and withdrawable unit design supplying all consumers, except starting system. Distribution panel design with cable entries at bottom and front doors with lockable handles. Incoming MCCB with front panel multi-function display indicating mains parameters U, I, f and power factor.

- Single incomer.
- Ingress protection: IP30.

2.4.3 Instrumentation

Instrumentation for gas turbine skid is fully assembled, piped and wired. Instruments and junction boxes located outdoor have at least IP65 ingress protection. Transmitters are of two-wire 4-20 mA 24 VDC type including HART protocol for pressure transmitters. In general no gauges are used; package is intended for remote operation. Pressure instruments crucial for man and machine safety has 316L stainless steel shut-off valves. Instrument tubing in 316L stainless steel with double ferrule couplings for auxiliaries. Further information on instrumentation according to attached P&IDs.

- 2oo3 voting for all instruments with trip function during operation. Due to physical restrictions flame detectors are 1oo2.

2.4.4 Control system

Gas turbine package control system based on Siemens Simatic with PC based HMI for

monitoring, control and safety with separate IEC 61508 SIL proven safety controller. Designed for operator friendliness with color process graphics, log and alarm/event displays.

- Automatic startup, operation and shutdown of gas turbine and its auxiliaries.
- Application software in controllers are battery backed-up for two months.
- Safety system signals are failsafe and operates with 24VDC.
- System programs in English.
- PC based operator station of industrial rack mounted type with redundant hot-swap RAID controllers and a 19" panel mounted HMI with keyboard & mouse.
  - One additional operator station, including 24" HMI for placement in customer's premises.
  - One month trending capacity for analogue signals.
  - One color laser printer.
- Internal time synchronization with GPS clock between systems supplied within scope of supply. No time synchronization of external systems included.
- Operator HMI language: English.
- Vibration monitoring system including key phasors and axial position.
- Separate overspeed protection and monitoring system
- Redundant CPUs, profibus and power supplies.
- Hardwired signal interface to/from waste heat recovery unit control system for start/stop of gas turbine.
- PCS7 engineering license for control system programming included in operator station.
- OPC communication with external control system.

2.4.5 UPS and motor drives

UPS with MCB distribution board supplying uninterrupted power to instrument & control system. Automatic and bumpless switch over between mains and back-up battery by static frequency converter. UPS can be by-passed during maintenance.

- 440 VDC sealed, valve regulated, lead acid battery. Capacity for ten hour emergency cooldown including one hour supply to instrument and control system. Ten years design life.

Panel mounted uninterruptible motor drive system for motor driven lubricating oil pumps and lubricating oil mist fans. SFC controlled variable speed drive motors with dual feed from mains and UPS battery.

- AC and DC power distribution boards with MCCBs.
- Lubricating oil emergency PLC used for pump control during UPS powered cooldown.
- Ingress protection: IP21.
- UMD transformer for indoor installation.
  - Ingress protection: IP21.

2.4.6 Frequency converters

- Starter motor SFC of six-pulse type, located in a freestanding panel.
  - Ingress protection: IP21.
- Liquid fuel SFC with ingress protection IP21, located in a freestanding panel.

2.4.7 Electrical installation

Complete on-package electrical installation including main & emergency lighting, cabling with metal glands to junction boxes/remote I/O and single-phase & three-phase wall outlets. Power and instrument cables are routed on separate ladders with 90° intersections.

- Industrial standard cables of halogen free, low smoke and fire classified type.
- Cable ladder in galvanized carbon steel.
- Maximum cable length between package and electrical & control panels (m): 150

2.4.8 Remote connection

Remote connection, enabling online communication between gas turbine control

system and Siemens' support center. Connection requires internet connection, provided by customer.

2.5 Factory services

2.5.1 Packing and delivery

Delivery according to Incoterms 2010 as defined in Commercial terms and conditions.

- Rental of lifting tools for transport and installation. The tools are property of Siemens and shall be returned.
- Rental period for lifting tools 60 weeks from Ex-Works Finspong.
- Packaging for sea transport.
- Dryer for gas turbine during transport and storage.
- Dryer for control module during transport and storage.
- Suitable for storage up to six months

2.5.2 Factory assembly

Mechanical and electrical assembly and control system installation in workshop.

2.5.3 Factory tests

Balancing and over-speed testing of gas turbine rotor.

- Electric generator routine test at the subcontractor’s workshop.
- Gear box standard test at the subcontractor’s workshop.
- Turbine controller software FAT with shop PLC including logics, sequences, alarm & trip-list and HMI.
- Unit workshop stationary test with contract auxiliaries and UCP. During the stationary test settings and adjustments are verified and flushing of systems carried out. Test includes function test of lubrication oil system.

2.5.4 Factory inspections

Quality control according to standard inspection plan.

2.6 Installation and Commissioning services

2.6.1 Site installation

- Site installation offered on a daily rate basis.

2.6.2 Commissioning and site tests

Commissioning includes engineers to advice or perform stationary and rotating commissioning.

- Stationary and rotating commissioning offered separately on a daily-rate basis.

2.7 Operation and maintenance

2.7.1 Customer documentation

- Design phase documentation will be delivered during the project engineering phase.
  - Including drawings, layouts, P&ID's, system descriptions, lists, quality plans, electrical and control documentation.
- Final documentation
  - Operation & Maintenance (O&M) documentation will be delivered in the As Designed and As Built delivery.
  - Including O&M instructions, fault procedures, system descriptions, P&ID's, lists, drawings, layouts, sub vendor documentation, electrical and control documentation.
  - Documentation language is English.
  - Manufacturing record book including manufacturing and test reports, commissioning report and certificates.
  - Number of Manufacturing record book copies: 1
- Documentation in the design phase will be delivered according to Siemens Supplier Document Register List (SDRL).
- Electronic files (PDF) are uploaded on Siemens sharepoint server according to document SDRL/CDL Processes, W980041E.

- Operation and Maintenance Documentation will be delivered according to Siemens scope, described in document Customer Documentation, W980025E.
- The As Designed delivery (ExW + 16 weeks) is delivered in electronic format (3 DVD).
- The As Built delivery (PAC + 14 weeks) is delivered in electronic format (3 DVD).

2.7.2 Maintenance tools

Sets of special tools for the gas turbine package maintenance excluding normal hand tools, as listed below.

- Core engine A inspection.
- Generator earthing tool for maintenance work.

2.7.3 Spare parts

- Commissioning spare parts. Unused parts kept by Siemens.

3 Terminal Points

For data at the terminal points, please refer to attached document.

4 Exclusions

Siemens Industrial Turbomachinery AB does not accept any responsibility for items outside this scope of supply. Equipment, works and services not listed in scope of supply are the purchaser's responsibility. Where design of the installation is to be provided by the purchaser, Siemens requests the opportunity to review and comment against the general arrangement. It is particularly important for safe and proper operation to ensure that the duct-work systems are compatible with the gas turbine.

The main exclusions from this scope of supply are:

- Power system stabilizer site tuning and evaluation to meet grid requirements.
- Interconnecting instrument, control and power cable between package and electrical & control panels.
- SIL analysis.
- Workshop test of combustion air inlet filter, ventilation and exhaust systems.
- Technical field advisory for site installation. Required for validity of warranty and guarantees.
- All civil works including foundations.
- Technical field advisory for site installation and commissioning. Required for validity of warranty and guarantees
- Counter flanges at terminal points.
- Drain from terminal points.
- Earthing network.
- Lightning protection.
- Instrument air compressor
- External lighting.
- External fuel systems.
- Fire detection and extinguishing for electric generator.
- Generator circuit breaker.
- Main power cabling from electric generator.
- Mechanical running test.
- Training.
- Trial run.
- Chiller coil.
- Exhaust diverter valve.
- Sound and emission tests.
- Following consumables and utilities:
  - Auxiliary power.
  - Fuel.
  - Lubricating oil.
  - Nitrogen.
  - Washing detergent.
  - Water.
  - Grease.
  - Instrument air.
- Anything not specifically listed in the Scope of supply.