HOFFMANN TECHNICS AG
ROTATING ELECTRICAL MACHINES
SWITZERLAND

2026

POWER GENERATION · OIL & GAS · INDUSTRIAL ENERGY

SYNCHRONOUS GENERATORS

& INTEGRATED TURBO-GENERATOR SYSTEMS

Technology, product platforms, API shaft-train integration, project execution, testing and lifecycle services.

ENGINEERED-TO-ORDER SYNCHRONOUS GENERATOR

Brushless excitation · MV terminal systems · API train integration

1-70	0.4-15	2-20
MVA PLATFORM RANGE	KV RATED VOLTAGE	POLES · 50/60 HZ

ENGINEERED IN SWITZERLAND

IEC 60034 · API 546 · API 670 · API 684 · API 686 · API 613 · API 671

CATALOGUE NAVIGATION

From generator platform to operating lifecycle

A structured technical catalogue covering machine design, electrical systems, shaft-train interfaces, manufacturing quality, testing and lifecycle support.

01 **Company & Platform** 03
Engineering capability, applications and product portfolio

02 **Generator Technology** 06
Electromagnetic, insulation, mechanical and cooling systems

03 **Excitation & Grid Interface** 11
AVR, performance, protection and terminal systems

04 **Rotordynamics & Train Integration** 15
Shaft-train analysis, gear, coupling and alignment

05 **Platform Configurations** 20
Capability envelope and configurable generator platforms

06 **Quality & Testing** 25
Materials, ITP/QCP, FAT and manufacturing dossier

07 **Project Execution & Services** 28
Engineering deliverables, schedule and lifecycle support

08 **Specification Guide** 31
Compliance framework and enquiry checklist

A catalogue for technical evaluation and supplier prequalification - not merely product promotion.

01 · COMPANY & PLATFORM

Engineering depth behind every machine

Hoffmann Technics generators are engineered to order around the prime mover, grid, operating profile, site conditions and complete shaft-train behaviour.

Integrated engineering scope

- Electromagnetic, thermal and ventilation design
- Rotor, shaft, bearing and structural engineering
- Lateral and torsional rotordynamic coordination
- Excitation, protection and grid-interface studies
- Mechanical, electrical and package-interface drawings

Controlled manufacturing execution

- Qualified material and component supply chain
- Coil manufacture, insulation and VPI process control
- Rotor machining, assembly and balancing
- Inspection to approved ITP/QCP and witness points
- Factory acceptance testing and final documentation

> **Engineered around the application - verified against the contractual guarantees.**
> Each project is governed by a defined design basis, completed data sheets, interface control, calculation reports, an approved inspection and test plan, and a traceable final manufacturing record book.

ISO 9001
QUALITY MANAGEMENT ALIGNMENT

ITP / QCP
PROJECT-SPECIFIC INSPECTION CONTROL

Witnessed
FAT AND THIRD-PARTY INSPECTION AVAILABLE

Lifecycle
SERVICE, DIAGNOSTICS AND UPGRADES

Hoffmann Technics AG is a Swiss engineering and manufacturing company specialising in synchronous generators and integrated generator packages for power generation, oil and gas, industrial energy and grid-support applications. Our execution model combines application engineering, controlled manufacturing, project quality management, factory testing and lifecycle support.

Machines are configured for direct-coupled, gear-driven or engine-driven duty and can be adapted to the requirements of turbine, engine, gearbox and plant-system suppliers. Applicable IEC, API, ISO, IEEE and customer specifications are converted into a project-specific compliance matrix before design release.

01 · COMPANY & PLATFORM

Application map

Generator platforms are adapted to the driver, operating regime, electrical network, environmental severity and maintenance philosophy.

HTG 2 / HTG 4

Gas turbines

Direct-coupled 2-pole or gear-driven 4-pole machines for open-cycle, combined-cycle and mechanical-drive derived packages.

HTG 2 / HTG 4

Steam turbines

Base-load and cyclic industrial turbo-generators with cylindrical or solid salient rotor options.

HTE

Reciprocating engines

Multi-pole salient machines with torsional tuning for firing-order excitation and flywheel effects.

HTG / HTE

Industrial self-generation

Steel, chemical, cement, mining, pulp and paper, water and desalination plants.

HTG / HTE

Renewable thermal

Biomass, waste-to-energy, geothermal and district-heating CHP applications.

All platforms

Grid support

Synchronous-condenser operation for reactive-power support, voltage regulation and short-circuit strength.

Hazardous and severe environments: pressurised or non-sparking executions, enhanced filtration, tropicalisation, corrosion protection, seismic qualification and project-specific material selection are available.

01 · COMPANY & PLATFORM

Generator platform portfolio

Three engineered platforms cover high-speed, medium-speed and low-speed synchronous generation duties up to 75 MW. Final ratings are confirmed by project-specific design.

Series	Rotor architecture	Poles / speed	Indicative output	Common voltage range	Excitation
HTG 2	Cylindrical forged turbo rotor	2 poles · 3,000 / 3,600 rpm	10-75 MW	6.3-15.75 kV	Brushless or static
HTG 4	Cylindrical or solid salient-pole rotor	4 poles · 1,500 / 1,800 rpm	5-60 MW	3.3-15.75 kV	Brushless or static
HTE	Laminated salient-pole rotor	6-24+ poles · 300-1,200 rpm	1-35 MW	0.4-13.8 kV	Brushless

0.80-0.90
STANDARD POWER FACTOR RANGE; OTHER VALUES ON REQUEST

S1
CONTINUOUS-DUTY DESIGN BASIS

F / B
CLASS F INSULATION / CLASS B TEMPERATURE RISE

IP23-IP55
ENCLOSURE OPTIONS BY APPLICATION

Selection drivers

- Prime-mover speed, torque spectrum and operating profile
- Rated MW/MVA, power factor and reactive capability
- Grid-code response, short-circuit level and fault duty
- Cooling medium, acoustic requirement and site environment
- Shaft-line arrangement, bearing system and foundation

Project customisation

- Common IEC and ANSI system voltages and terminal arrangements
- Brushless or static excitation and AVR redundancy
- Sleeve or rolling-element bearings and lubrication systems
- Air, air-to-air or air-to-water cooling systems
- Monitoring, protection, base frame and package interfaces

Capability ranges are indicative. Rated output, voltage, current, inertia, short-circuit characteristics, efficiency and dimensions are defined only after application-specific design verification.

02 · GENERATOR TECHNOLOGY

Rotor architecture matched to duty

Rotor selection governs power density, transient behaviour, damper performance, maintenance profile and shaft-train response.

Rotor type	Typical speed/poles	Construction	Engineering advantage	Typical driver
Cylindrical turbo rotor	2-pole; also selected 4-pole designs	Single forged body with field winding in machined slots	High power density; balanced high-speed geometry	Steam turbines and direct-coupled gas turbines
Solid salient-pole rotor	4-pole at 1,500/1,800 rpm	Integral or shrunk solid poles; robust damper behaviour	Excellent for cyclic gear-driven duty and disturbed grids	Industrial gas and steam turbines
Laminated salient-pole rotor	6-20 poles and above	Laminated poles with amortisseur cage	Flexible speed matching and pulsation control	Engines, small hydro and low-speed drives

Damper design

Solid pole faces or dedicated amortisseur systems are tuned for unbalance, hunting and torsional excitation.

Mechanical integrity

Rotating elements are designed for starting, overspeed and sudden short-circuit duties.

Parameter control

Air gap, slots and damper geometry tune SCR, reactances and fault-current behaviour.

Feature	Cylindrical (turbo) rotor	Solid salient-pole rotor	Laminated salient-pole rotor
Typical speed / poles	2-pole (3,000 / 3,600 rpm); also 4-pole	4-pole (1,500 / 1,800 rpm)	6 – 20 poles and more (≤ 1,200 rpm)
Construction	Single forging; field winding in milled slots, retained by wedges	Poles forged integrally with (or shrunk onto) the shaft body	Stacked pole laminations, dove-tail or T-tail fixed to shaft or spider
Damper system	Slot wedges and rotor body act as damper	Solid pole faces give strong inherent damper action – excellent for gear-driven, cyclic duty and disturbed grids	Copper/brass amortisseur bars in the pole faces, connected by end segments
Saliency (Xq / Xd)	≈ 1.0	≈ 0.6 – 0.75	≈ 0.55 – 0.7
Typical drivers	Steam turbines, high-speed gas turbines	Gear-driven gas turbines, industrial steam turbines	Reciprocating engines, small hydro
Hoffmann Technics series	HTG 2 (and HTG 4 cylindrical)	HTG 4	HTE

02 · GENERATOR TECHNOLOGY

Electromagnetic design - predictable performance from first principles

Every winding, slot, air gap and magnetic section is optimised as part of one coupled electrical-thermal-mechanical design.

Stator core & winding

- Low-loss electrical steel with controlled stacking pressure
- Form-wound double-layer lap winding; Roebel bars where current demands
- Short-pitch and phase-belt distribution to suppress low-order harmonics
- Conductive slot coating and stress grading for MV field control
- Six winding ends available for differential and neutral schemes

Rotor field & damper

- Hard-drawn copper field coils with positive mechanical support
- Class F insulation with Class H rotor option
- Damper system coordinated with negative-sequence and transient duty
- Air-gap selection balances SCR, excitation demand and machine size
- Subtransient reactance tuned to the plant fault-level window

QUALITY	**Winding distribution + magnetic utilisation + AVR response**	PERFORMANCE	**Air gap + leakage + damper geometry**

Guaranteed output: project data sheets declare saturated and unsaturated reactances, resistances, time constants, losses, efficiency, excitation values and short-circuit characteristics.

02 · GENERATOR TECHNOLOGY

Insulation systems built for thermal margin and long life

Mica-based insulation, controlled stress grading and documented impregnation provide the electrical and environmental integrity expected of MV generation equipment.

Thermal class	Limit temperature	Permissible rise at 40 °C	Typical application
Class B	130 °C	80 K	Adopted utilisation limit for long-life operation
Class F	155 °C	105 K	Standard stator insulation build
Class H	180 °C	125 K	Rotor option or added thermal reserve

Single-coil VPI

Each mica-taped coil is impregnated and cured individually before insertion. Repair-friendly and individually testable.

Global VPI

Complete wound stator is impregnated in one controlled vacuum-pressure cycle for monolithic environmental integrity.

Resin-rich

Pre-impregnated mica tapes are hot-pressed bar by bar where a repairable bar philosophy is preferred.

One full thermal class of reserve

Standard practice uses Class F stator insulation - and Class F or H rotor insulation - while limiting temperature rise to Class B.

02 · GENERATOR TECHNOLOGY

Mechanical design & bearing systems

The rotor, bearings, frame and interfaces are designed together to maintain alignment, vibration margin and maintainability throughout the operating cycle.

Rotor & shaft

- Single-piece CrNiMo quenched-and-tempered forging
- Integral or shrink-fitted coupling flange options
- Balancing to ISO 21940-11 and API residual-unbalance limits
- Overspeed capability to 120% of rated speed
- Short-circuit torque transmitted safely through frame and foundation

Hydrodynamic bearings

- Spherically seated split sleeve or pad bearings
- Babbitted replaceable liners with anti-rotation and axial securing
- Geometry selected to suppress oil whirl and oil whip
- Both bearings electrically insulated; drive-end earthing device
- Liner replacement without removing coupling hub or major ductwork

Lubrication

Common ISO VG 46 pressure system or self-contained arrangement on smaller frames

Monitoring

Duplex bearing-metal Pt100, X-Y shaft probes, phase reference and housing seismic sensors

Maintainability

Access for inspection and routine replacement without dismantling adjacent equipment

02 · GENERATOR TECHNOLOGY

Cooling, ventilation and enclosure options

Cooling architecture is selected from output, site air quality, water availability, acoustic limits, footprint, maintainability and lifecycle cost.

Cooling code	Arrangement	Typical application	Primary benefit
IC 01 / IC 11	Open-circuit ventilation with shaft-mounted or separate fans	Indoor plants with clean or adequately filtered air	Simple, compact and economical
IC 611 (CACA)	Closed internal air circuit with air-to-air heat exchanger	Dusty, corrosive or outdoor sites without cooling water	Sealed internal circuit and robust site protection
IC 81W (CACW)	Closed internal air circuit with air-to-water heat exchanger	High-output or low-noise sites with reliable cooling water	Compact heat rejection and low acoustic emission

Thermal verification

- Coupled ventilation and thermal-network calculations
- Heat-rejection balance at rated and maximum operating points
- Winding, core, bearing, air, oil and water temperature mapping
- Cooler fouling margin and coolant-condition review
- Factory heat-run or agreed thermal verification

Environmental adaptation

- IP23 to IP55 enclosure options to IEC 60034-5
- Enhanced filtration and differential-pressure monitoring
- Tropicalisation, anti-condensation and corrosion protection
- Double-tube or leak-detected water coolers where required
- Outdoor, acoustic and hazardous-area adaptations by scope

Cooling-system selection is verified against site ambient, coolant quality, fouling allowance and guaranteed output.

03 · EXCITATION & GRID INTERFACE

Brushless excitation and digital voltage regulation

A shaft-mounted PMG and main exciter create an independent excitation source with minimal maintenance and stable response during network disturbances.

No brushes · short-time field forcing · black-start compatible · optional redundant control channels and PSS

Control modes

Automatic voltage regulation, manual field-current regulation, PF and VAr control, reactive droop and line-drop compensation.

Limiters

Over- and under-excitation, stator-current and V/Hz limiting coordinated with the protection and capability study.

Stability

Optional power-system stabilizer, event recording, redundant channels, hardwired and fieldbus interfaces.

Static excitation option: available where maximum ceiling voltage, negative forcing and fastest de-excitation are required.

03 · EXCITATION & GRID INTERFACE

Performance, efficiency and reactive capability

The project data sheet converts design intent into guaranteed electrical quantities, characteristic curves and an operating envelope that can be verified by calculation and factory testing.

Parameter	Meaning	Engineering use
Xd / Xq	Synchronous direct- and quadrature-axis reactances	Steady-state stability, excitation demand and capability diagram
Xd' / Xd"	Transient and subtransient reactances	Fault-current contribution, breaker duty and protection settings
X2 / X0	Negative- and zero-sequence reactances	Unbalance and earth-fault studies
SCR	Short-circuit ratio	Voltage stiffness, stability margin and excitation demand
Td' / Td" / Tdo'	Open- and short-circuit time constants	Fault-current decrement and AVR / protection studies

Standard curve set

- Open-circuit and short-circuit saturation curves
- V-curves or capability diagram at specified conditions
- Reactive capability including under-excitation limits
- Efficiency versus load and power factor
- Voltage-regulation, transient and fault-current data

Efficiency commitment

- Efficiency determined by an agreed IEC 60034-2-1 test method
- Loss segregation documented by component and operating point
- Bearing, ventilation and excitation losses included as specified
- Guaranteed values corrected to agreed reference conditions

Guaranteed data include rated current, power factor, efficiency, excitation values, saturated and unsaturated reactances, resistances, time constants, losses and short-circuit characteristics. Values are project-specific and are not inferred from catalogue ratings.

03 · EXCITATION & GRID INTERFACE

Protection, instrumentation & condition monitoring

Generator data, instrument transformers and field sensors are coordinated so the plant protection and monitoring systems receive complete, verifiable inputs.

ANSI	Function	Generator-side basis
87G	Generator differential	Matched line- and neutral-side CT sets
64G / 59N	Stator earth fault	High-resistance neutral earthing and neutral displacement
40	Loss of excitation	Capability diagram and Xd / X'd
46	Negative sequence	Continuous I2 and $I2^2t$ withstand
24	Overfluxing	Core design and AVR V/Hz limiter
49	Stator thermal	Embedded slot RTDs and thermal model
21 / 51V	Impedance / voltage-restraint	Reactances and decrement curves
27 / 59 / 81	Voltage / frequency	IEC operating zones

Machinery protection

X-Y proximity probes at each radial bearing, one-per-revolution phase reference and bearing-housing seismic sensors.

Temperature system

Duplex bearing-metal Pt100 plus stator-slot, core, cooling-air and optional water RTDs.

Advanced monitoring

Optional partial-discharge couplers, air-gap flux probes, rotating-diode monitoring and baseline signatures.

03 · EXCITATION & GRID INTERFACE

Integrated terminal and neutral systems

The generator electrical interface can be supplied as a coordinated package incorporating phase terminals, neutral terminals, instrument transformers, surge protection, earthing and monitoring interfaces.

Configurable terminal-system capability

- Three-phase copper or aluminium busbars with six winding ends where required
- Cable, segregated-phase bus or isolated-phase bus interfaces
- Common system voltages from low voltage to 15.75 kV
- CT and VT ratios, burdens and accuracy classes by protection study
- Surge arresters and capacitors where required by insulation coordination
- Neutral grounding resistor, grounding transformer or solid neutral options

Main terminal box

- Phase-segregated or common-phase arrangement
- Cable lugs, busbar or busduct interface
- Short-time current and dielectric duty verified

Neutral terminal box

- All three neutral ends accessible where specified
- Differential-protection CT accommodation
- Neutral grounding and displacement-voltage interface

Protection interfaces

- CT / VT marshalling and secondary segregation
- Surge protection and earthing coordination
- Customer protection, metering and synchronising data

Final insulation level, cable quantity, phase spacing, busduct loads, CT/VT data, neutral-earthing duty, enclosure rating and terminal orientation are confirmed against the plant single-line diagram and protection philosophy.

04 · ROTORDYNAMICS & TRAIN INTEGRATION

Rotordynamic assurance from machine to foundation

The analytical model is not limited to the rotor. Bearing coefficients, housing stiffness, base-frame flexibility and foundation dynamics are included in the design basis.

Lateral analysis

- Undamped critical-speed map
- Damped unbalance-response analysis
- Stability / damped-eigenvalue analysis
- Minimum and maximum bearing clearances and oil temperatures
- Correlation by unbalanced-rotor response test

Torsional coordination

- Detailed mass-elastic shaft model
- Equivalent shaft and coupling torsional stiffness
- Polar and transverse inertias with component centres of gravity
- Campbell assessment against electrical and gear-mesh orders
- Participation in complete-train torsional study

INPUTS
Shaft geometry · material · bearings · frame · foundation

→

MODEL
Rotor + supports + coupled equipment

→

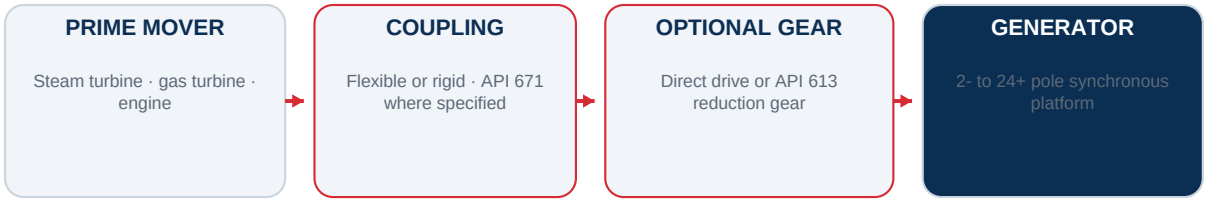
VERIFICATION
Shop test correlation + operating margins

Deliverables: shaft section model, eight-coefficient bearing data, frame stiffness, foundation requirements, critical-speed maps, response plots, stability report and test correlation.

04 · ROTORDYNAMICS & TRAIN INTEGRATION

Shaft-train interface management

Mechanical and electrical interfaces are frozen through controlled drawings, dynamic data and responsibility matrices - not left to field adjustment.



Integrated lateral, torsional, alignment and thermal-growth engineering across the complete shaft train

Geometry control

- Flange, spigot and bolt-circle definition
- DBSE, shaft-end and coupling dimensions
- Mounting, jacking and lifting interfaces
- Rotation, axial location and centreline data

Thermal growth

- Cold-to-hot shaft-centreline movement
- Axial expansion and thrust-reference definition
- Bearing pedestal and casing growth
- Piping and busduct movement allowances

Alignment basis

- Cold offsets including thermal growth
- Bearing reactions and shaft lift
- Permitted movement and soft-foot limits
- Field alignment and final verification criteria

Interface responsibilities are documented for civil works, foundation loads, lubrication, cooling-water piping, cable or busduct, protection, control, earthing, instrumentation, base frame, preservation and commissioning.

04 · ROTORDYNAMICS & TRAIN INTEGRATION

API 613 special-purpose gear units

For gear-driven turbo-generator packages, Hoffmann Technics can define and coordinate the reduction gear as a controlled adjacent-equipment package or interface-managed scope.

Item	Representative capability
Architecture	Single-stage, double-helical, parallel-shaft speed reducer
Reference duty	29,000 kW; 7,734 rpm input / 1,500 rpm output
Service factor	API 613 gear service factor 1.30
Gearing	Case-carburised and ground; representative 18CrNiMo7-6, ≥58 HRC
Lubrication	Common external ISO VG 46 system, 10 µm filtration
Monitoring	Bearing-metal RTDs, X-Y shaft probes, phase reference, accelerometers
Acceptance	4-hour full-speed run, 110% and momentary 120% speed excursions
Design life	At least 120,000 equivalent operating hours

Engineering scope

- Three-load-level rotordynamic analyses
- Coupled generator + gear low-speed rotor analysis where quill-connected
- Gear mesh stiffness and torsional data
- Base-frame and foundation dynamic requirements
- Oil P&ID, nozzle loads and delivery-limit drawings

Maintainability & quality

- Service-area and crane-clearance layout
- Serialised traceability of gears, shafts, bearings and housings
- Material, heat-treatment, NDT and hardness records
- ITP/ATP covering components, assembly, performance and sound

04 · ROTORDYNAMICS & TRAIN INTEGRATION

API 671 flexible couplings and quill-shaft systems

Coupling selection is treated as a dynamic design activity - not a catalogue diameter selection.

Design item	Catalogue position
Type	Dry, non-lubricated metallic flexible-element coupling
Design duty	Steady-state, cyclic and maximum transient torque simultaneously with misalignment and thermal movement
Minimum service factor	1.50 for flexible element / quill; coupling-to-shaft juncture verified at 1.75
Angular capability	Representative minimum 0.375°
Parallel offset	Representative minimum 7.5 mm
Axial displacement	Representative minimum ±4.3 mm
Spacer frequency	≥2.0× max operating speed, or ≥1.5× with rigorous actual-geometry analysis
Declared data	Masses, inertia, stiffness, critical speed, torque capability, direction and cross-section

Dynamic validation

- Torsional, axial, radial and angular stiffness tests where specified
- Natural-frequency and lateral-critical-speed verification
- Component balancing and assembly repeatability checks
- Moment simulator for driver shop test

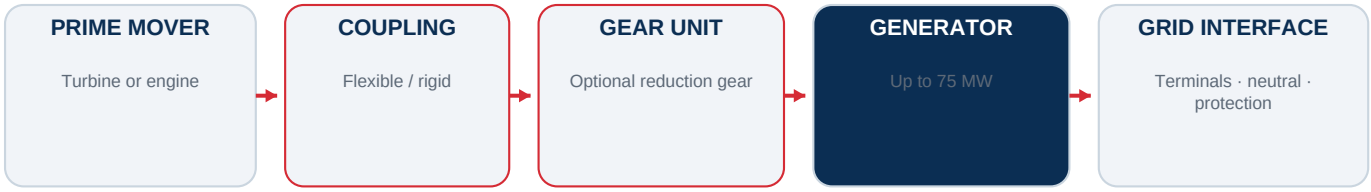
Interface management

- Turbine and generator hub/juncture drawings
- DBSE and thermal-growth allowance
- Flange geometry and fitted-bolt definition
- Final stiffness coordinated with train torsional study

04 · ROTORDYNAMICS & TRAIN INTEGRATION

Integrated generator-package capability

A single technical baseline can link the prime mover, coupling, optional gear unit, generator, excitation, terminal systems, lubrication, monitoring and civil interfaces.



One controlled interface register across mechanical, electrical, dynamic and project disciplines

Mechanical

- Torque and transient duty
- Flanges, bearings and base frame
- Alignment and thermal growth

Electrical

- Voltage, current and terminal system
- Excitation, CT/VT and neutral earthing
- Protection and synchronising data

Dynamic

- Lateral and torsional analysis
- Stability and unbalance response
- Test correlation and acceptance limits

Project

- Drawings and calculations
- ITP/QCP, schedule and manufacturing dossier
- Site services and commissioning support

One design basis. One controlled document list. One traceable route from enquiry to commissioned operation.

Package scope is modular: generator-only supply, generator with excitation and terminal systems, or a coordinated train package including coupling, gear and common auxiliaries.

05 · PLATFORM CONFIGURATIONS

Engineered generator capability up to 75 MW

A configurable platform approach allows the machine architecture to be matched to the driver, rated speed, voltage, grid duty, environment and lifecycle philosophy.

0.4-15.75 kV
COMMON SYSTEM VOLTAGE RANGE

300-3,600 rpm
TYPICAL RATED-SPEED RANGE

2-24+ poles
ROTOR CONFIGURATIONS

50 / 60 Hz
STANDARD SYSTEM FREQUENCIES

Typical applications

- Gas- and steam-turbine power generation
- Reciprocating-engine generation and CHP
- Industrial self-generation and captive power
- Renewable thermal and waste-to-energy plants
- Synchronous-condenser and grid-support duty

Configuration principles

- Electrical performance defined by the plant study
- Mechanical design coordinated with the complete shaft train
- Cooling and enclosure adapted to the actual site
- Monitoring and protection selected by criticality
- Testing and documentation agreed before design freeze

Indicative technical data. Binding values are defined in project-specific proposals and contract documents.

05 · PLATFORM CONFIGURATIONS

Configurable platform data

The table summarises the normal engineering envelope. Final ratings, dimensions, inertia, efficiency and short-circuit characteristics are issued only in the project data sheet.

Item	HTG 2 - high speed	HTG 4 - medium speed	HTE - low / medium speed
Typical rotor	Cylindrical forged rotor	Cylindrical or solid salient-pole rotor	Laminated salient-pole rotor
Typical poles / speed	2 poles · 3,000 / 3,600 rpm	4 poles · 1,500 / 1,800 rpm	6-24+ poles · 300-1,200 rpm
Indicative output	10-75 MW	5-60 MW	1-35 MW
Common voltage range	6.3-15.75 kV	3.3-15.75 kV	0.4-13.8 kV
Cooling options	IC 01, IC 611, IC 81W	IC 01, IC 611, IC 81W	IC 01, IC 611, IC 81W
Bearings	Hydrodynamic sleeve bearings	Sleeve or rolling-element bearings	Sleeve or rolling-element bearings
Excitation	Brushless or static	Brushless or static	Brushless
Mounting	Horizontal; pedestal or common base	Horizontal; pedestal or common base	Horizontal or vertical by application
Typical drivers	Steam turbine, direct-coupled gas turbine	Industrial turbine, gear-driven turbine	Engine, small hydro, low-speed process drive

Electrical options

- Power factor and reactive range selected to grid requirements
- Six winding ends, differential CTs and neutral-earthing systems
- Brushless or static excitation with redundant AVR options
- Surge protection, synchronising and plant-control interfaces

Mechanical options

- Direct drive, flexible coupling, gear drive or quill interface
- Separate pedestal, common base or package-mounted arrangement
- Oil-ring, forced-lubricated or self-contained bearing systems

The capability envelope is not a standard product-selection chart. It is an engineering starting point for a project-specific generator design.

05 · PLATFORM CONFIGURATIONS

Electrical performance and grid-interface deliverables

Every generator definition includes the electrical quantities required for plant studies, protection coordination, synchronising, grid-code assessment and shaft-train design.

Deliverable	Project-specific content
Ratings and limits	MW / MVA, voltage, current, frequency, power factor, service factor, ambient and coolant conditions
Reactances and time constants	Xd, Xq, Xd', Xd'', X2, X0, SCR, open- and short-circuit time constants
Fault and unbalance duty	Short-circuit decrement, negative-sequence capability, earth-fault data and thermal withstand
Excitation and reactive capability	No-load and rated field data, ceiling capability, limiter settings and capability diagram
Efficiency and losses	Guaranteed efficiency, component losses, reference conditions, test method and tolerance
Grid-interface data	Synchronising limits, voltage and frequency operating ranges, V/Hz capability and AVR functions
Protection inputs	CT/VT requirements, differential scheme, RTD map, vibration channels and trip/alarm philosophy

Curves

- Saturation curves
- V-curves / capability diagram
- Efficiency and loss curves
- Fault-current decrement curves

Thermal data

- Heating and cooling constants
- RTD locations and alarm limits
- Cooler duty and heat rejection
- Ambient and coolant corrections

Dynamic data

- Inertia and torsional model
- Critical-speed and stability data
- Bearing coefficients
- Unbalance-response acceptance

Guarantees are stated in completed project data sheets and the contract. Catalogue values are indicative and are not used as acceptance criteria.

05 · PLATFORM CONFIGURATIONS

Environmental and site design envelope

Generator platforms can be adapted for altitude, temperature, humidity, dust, salinity, seismic loading, corrosive atmospheres and project-specific hazardous-area requirements.

Site parameter	Design approach
Ambient and coolant temperature	Output and temperature rise verified at the declared maximum operating conditions
Altitude	Cooling and dielectric capability corrected to the specified site elevation
Humidity and condensation	Anti-condensation heaters, tropicalisation and space-heater control philosophy
Dust, sand and salt	Filtration, pressure monitoring, sealed cooling circuits and corrosion-protection systems
Seismic loading	Frame, cooler, terminal box and accessory qualification to project response spectra
Hazardous area	IEC 60079 / ATEX / IECEx or NEC classification applied only when specified and technically feasible
Outdoor exposure	IP enclosure, paint system, drainage, sunshade, acoustic and weather protection

Generator adaptation

- Enhanced filtration and differential-pressure monitoring
- Winding, terminal and instrumentation tropicalisation
- Thermal capability versus air or water-coolant condition
- Corrosion-resistant materials, fasteners and coatings
- Seismic restraint and foundation-input definition

Adjacent-equipment adaptation

- Cooler, oil-system and terminal-enclosure qualification
- Flexible connections for thermal and seismic movement
- Low-temperature oil, heaters and start-up provisions
- Outdoor cable, instrument and junction-box protection
- Project-specific preservation and storage procedures

Environmental capability is verified at the complete-machine and package level. A site condition is not accepted by catalogue declaration alone.

05 · PLATFORM CONFIGURATIONS

Monitoring and protection architecture

Instrumentation is selected according to machine size, bearing type, package criticality and the plant protection philosophy so that every required alarm, trip and diagnostic input is traceable.

Generator instrumentation

- X-Y proximity probes for sleeve bearings
- Bearing-housing seismic sensors where required
- One-per-revolution phase reference / keyphasor
- Duplex bearing-metal and stator-winding Pt100 RTDs
- Cooling-air, water and oil temperature monitoring

MPS / DCS

integrated plant interface

Electrical protection inputs

- Generator differential and stator earth fault
- Loss of excitation and reverse / under power
- Negative sequence and overfluxing
- Voltage, frequency and synchronising supervision
- Rotor-earth-fault and diode monitoring where applicable

Condition-monitoring options

- Continuous vibration, orbit and shaft-position monitoring
- Partial-discharge couplers and baseline signatures
- Air-gap flux and rotating-diode monitoring
- Oil-quality, particle and water-content monitoring
- Trend, diagnostic and preventive-maintenance support

System integration

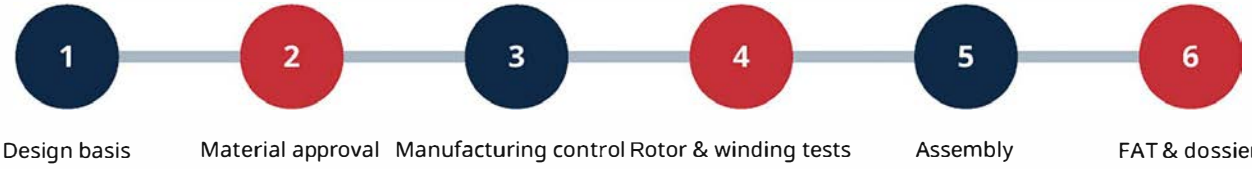
- Alarm and trip set-point schedule
- Marshalling, cable and junction-box architecture
- Redundant signal paths for critical channels
- Modbus, IEC 61850 or hardwired plant interfaces by scope
- Commissioning records and baseline-condition report

The final sensor schedule is coordinated with the plant protection system, machinery protection system, DCS, vibration standard and bearing arrangement.

06 · QUALITY & TESTING

Materials, forging quality and traceability

Material selection is backed by controlled melt route, heat treatment, non-destructive examination, mechanical testing and serialised traceability.



Traceability from specification through final data book

Generator rotor forging

- Low-alloy CrNiMo quenched-and-tempered steel
- VOD-refined and bottom-poured melt route
- Preliminary and final UT to EN 10228-3
- Stress relieving before final machining
- Residual stress verified ≤60 N/mm²
- Tangential tensile and triple-Charpy sampling
- Magnetic verification to EN 60404-4

Gear and shaft materials

- Case-hardening grades such as 18CrNiMo7-6
- Q&T shaft grades such as 42CrMo4
- Cleanliness, grain-size and hardenability control
- 100% UT on rough-machined forging surfaces
- Hardness and mechanical-property verification
- Traceability to heat and heat-treatment lot

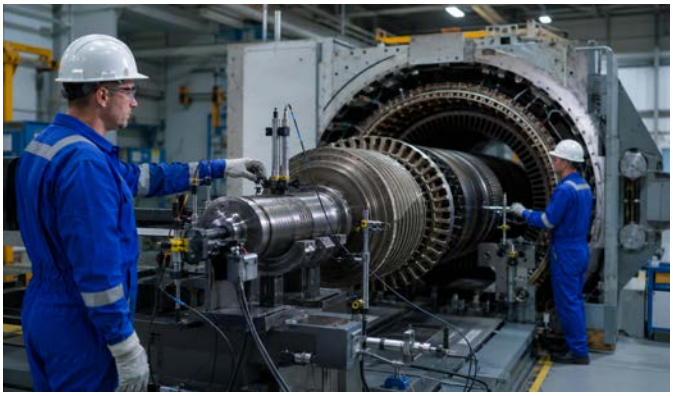
Project data book: material certificates, heat-treatment records, welding/NDT reports, balancing reports, instrument certificates and final inspection records.

06 · QUALITY & TESTING

Factory acceptance testing - evidence against every guarantee

The generator is assembled and tested with contract instrumentation and accessories. Customer and third-party witness points are incorporated into the approved inspection and test plan.

Test / verification	Category	Typical reference
Winding resistance, insulation resistance and polarisation index	Routine	IEC 60034-1 / project specification
High-voltage dielectric withstand	Routine	IEC 60034-1
Open-circuit and short-circuit saturation tests	Routine / type	IEC 60034-4-1
Losses and efficiency determination	Type / special	IEC 60034-2-1
Heat run / temperature-rise verification	Type / special	IEC 60034-1 / IEC 60034-3
Overspeed and mechanical run	Routine / type	IEC 60034-1 / API 546 when applicable
Vibration, shaft runout and bearing performance	Routine	IEC 60034-14 / ISO 20816 applicable part
Unbalance-response / rotordynamic correlation	Special	API 684 / project specification
Excitation, AVR, limiter and protection functional tests	Routine / special	Approved functional test procedure
Partial-discharge, surge or additional diagnostic tests	Optional	Project specification



Test execution and records

- Calibrated instrumentation and traceable test equipment
- Approved procedures and acceptance criteria before test
- Customer / third-party witness and hold points
- Test deviations controlled through formal concession process
- Signed test reports, calibration certificates and raw data
- Final FAT release linked to the manufacturing dossier

Package tests for gear units, couplings, lubrication systems and terminal equipment are included only when those items are within the contractual scope.

06 · QUALITY & TESTING

Inspection architecture and manufacturing dossier

Quality control is planned before manufacture and closed only when every hold point, inspection record and guarantee has objective evidence.

QCP / ITP content

- Approved design and material release points
- Sub-vendor control and source inspection
- Winding, rotor, bearing and frame manufacturing controls
- NDT, dimensional, electrical and balance inspections
- Assembly and instrumentation checks
- FAT witness and final release

Final manufacturing record book

- Approved drawings and data sheets
- Material and heat-treatment certificates
- Welding and NDT records
- Balancing and overspeed reports
- Instrument calibration and setting lists
- Electrical and mechanical test reports
- Deviation closure and punch-list status

DESIGN BOOK

CALCULATION BOOK

QUALITY BOOK

TEST BOOK

INSTALLATION & O&M

Traceable, reviewable and suitable for long-term plant asset records.

07 · PROJECT EXECUTION & SERVICES

Engineering deliverables and submittal control

A controlled Vendor Print Index and Schedule aligns technical approvals with procurement, manufacturing, inspection and site readiness.

Design

- Basis of design
- Completed data sheets
- Calculation book
- Capability and characteristic curves
- 3D model and general arrangement

Mechanical

- Cross-sections and component drawings
- Shaft, flange and coupling interfaces
- Mass, inertia and COG data
- Nozzle loads and piping limits
- Alignment and thermal-growth tables

Electrical

- Terminal and neutral diagrams
- CT/VT and protection data
- Cable schedules and connection tables
- Instrument list and wiring
- Load list and auxiliaries

Execution

- ITP/QCP and inspection procedures
- Manufacturing schedule
- Packing and preservation
- Erection and commissioning manuals
- Final data books and editable native files

Document handling: approval submittals, maintained drawing list, native electronic files, progress reporting and final as-built documentation are defined project by project.

07 · PROJECT EXECUTION & SERVICES

Project execution lifecycle

Disciplined technical gates keep interfaces, guarantees and manufacturing decisions aligned from enquiry to commissioning.

1

Requirement capture

Data sheets · standards · interfaces

2

Concept freeze

Platform · cooling · excitation · train

3

Design approval

Calculations · drawings · analyses

4

Manufacturing release

ITP/QCP · materials · sub-vendors

5

Inspection & FAT

Hold points · witness · guarantee tests

6

Delivery & site

Preservation · installation · commissioning

Coordination disciplines

- Customer and package-designer review meetings
- Interface-register ownership and technical queries
- Bi-weekly or agreed progress reporting
- Change control and deviation management

Optional site services

- Supervision of erection and alignment
- Site electrical checks and oil-system acceptance
- First excitation and synchronisation support
- Operator and maintenance training with certification

07 · PROJECT EXECUTION & SERVICES

Lifecycle services, spares and maintainability

The equipment is designed around the driver inspection cycle, with accessible routine-service components and a documented long-term support strategy.

COMMISSIONING

Start-up spares, tools, field support

OPERATION

Diagnostics, trending, inspections

MAJOR OVERHAUL

Rotor, winding, bearing and exciter service

LIFE EXTENSION

Rewind, uprate, retrofit and monitoring upgrades

Supply packages

- Commissioning spare-parts package
- Two-year operating spare-parts package
- Special hand tools and rotor-removal devices
- Recommended consumables and preservation materials

Service capability

- Field inspection and diagnostic support
- Insulation, vibration and partial-discharge assessment
- Bearing, exciter and rotor service
- Rewind, repair, retrofit and performance upgrade

120,000
EOH DESIGN CAPABILITY

Filters & oil
ROUTINE CONSUMABLES

Accessible
SERVICE COMPONENTS

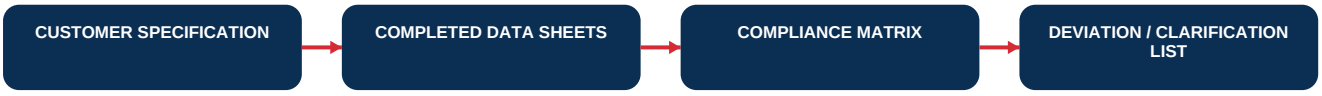
12 months
REFERENCE WARRANTY BASIS

08 · SPECIFICATION GUIDE

Compliance framework for demanding projects

Applicable standards are selected by machine type, rating, industry, site and contractual scope. A project-specific compliance matrix controls precedence, deviations and evidence of conformity.

Framework	Application in generator projects
IEC 60034-1:2026	Rating, performance, duty, temperature rise, dielectric tests and general requirements
IEC 60034-2-1:2024	Standard methods for determining losses and efficiency from tests
IEC 60034-3:2020	Specific requirements for turbine-driven synchronous generators of 10 MVA and above
IEC 60034-4-1:2018	Determination of electrically excited synchronous-machine quantities from tests
IEC 60034-5 / -6 / -7 / -9 / -11 / -14 / -15	IP protection, cooling, mounting, noise, thermal protection, vibration and impulse withstand
API 546	Brushless synchronous machines 500 kVA and larger for petroleum and process-industry service
API 670 / API 684	Machinery protection systems and rotordynamic analysis / balancing guidance
API 613 / API 671 / API 686	Special-purpose gear units, couplings, installation and alignment interfaces
ISO 20816 / ISO 21940	Machine-vibration evaluation and rotor-balancing quality
ISO 9001 / EN 10204 / EN 10228	Quality management, material certification and forging NDT
IEC 60079 / ATEX / IECEx / NEC	Hazardous-area requirements when specified and applicable
IEEE 115 / ANSI C50 series	Alternative test and performance frameworks when contractually specified



Order of precedence: contract and customer specifications, completed project data sheets, the agreed standards and then supplier documents. Any conflict is resolved through the formal clarification and deviation process.

08 · SPECIFICATION GUIDE

Enquiry checklist and customer contact

Electrical and operating data

- Rated MW / MVA, power factor, voltage, frequency and duty
- Load profile, service factor and required overload capability
- Grid connection, short-circuit level and reactive requirements
- Excitation / AVR architecture and grid-code functions
- Required curves, tests and guaranteed performance
- Ambient, altitude, humidity and cooling-medium data

Mechanical and package data

- Driver type, rated speed and torque spectrum
- Direct, flexible, gear-driven or quill-shaft arrangement
- Flange geometry, DBSE, rotation and axial reference
- Bearing, lubrication and foundation philosophy
- Cooling, enclosure, acoustic and seismic requirements
- Instrumentation, protection and site-service scope

HOFFMANN TECHNICS AG
ROTATING ELECTRICAL MACHINES
SWITZERLAND

Technical proposals engineered around your project.

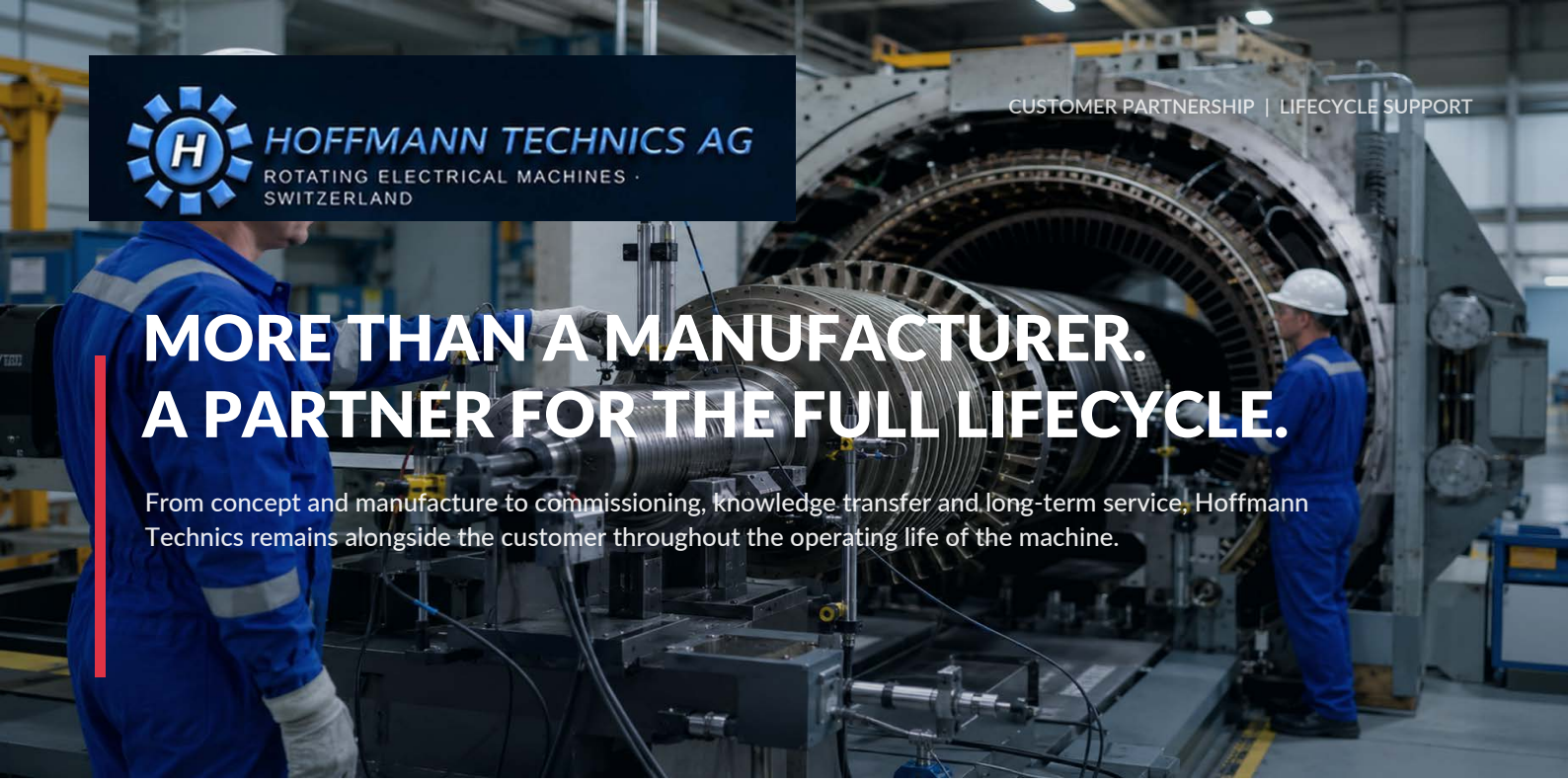
Generator selection, retrofit studies, package interfaces, testing programmes and lifecycle support.

support@hoffmann-tech.ch

+41 71 223 26 87

HOFFMANN TECHNICS AG · ROTATING ELECTRICAL MACHINES · SWITZERLAND · www.hoffmann-tech.ch

All catalogue data are indicative and subject to change. Binding values are stated only in project-specific proposals, approved data sheets and contract documents.



HOFFMANN TECHNICS AG
ROTATING ELECTRICAL MACHINES · SWITZERLAND

MORE THAN A MANUFACTURER. A PARTNER FOR THE FULL LIFECYCLE.

From concept and manufacture to commissioning, knowledge transfer and long-term service, Hoffmann Technics remains alongside the customer throughout the operating life of the machine.

Your investment includes more than equipment.

Selecting a Hoffmann Technics generator establishes a long-term engineering relationship - not a one-time purchase. We combine application-specific design, controlled project execution and continuing lifecycle support so that the machine, the plant interface and the customer's operating team remain aligned from the first technical discussion through years of service.

APPLICATION ENGINEERING

Machine selection, electrical and mechanical optimisation, grid interface, cooling, protection and complete shaft-train coordination.

TECHNOLOGY TRANSFER

Structured transfer of design intent, operating philosophy, documentation and practical know-how to the customer's engineering and maintenance teams.

COMMISSIONING & START-UP

Installation review, alignment support, pre-commissioning checks, first energisation assistance, performance verification and handover.

CONTINUING CUSTOMER SERVICE

A defined technical contact throughout the equipment lifecycle, with responsive engineering support for operational questions and plant changes.

DIAGNOSTICS, SPARES & FIELD SERVICE

Condition assessment, troubleshooting, inspection planning, recommended spares, specialist site intervention and documented corrective actions.

UPGRADES & LIFE EXTENSION

Rewinds, excitation and protection upgrades, cooling improvements, rerating studies, modernisation and obsolescence management.

ONE MACHINE. ONE TECHNICAL BASELINE. ONE PARTNER.

Engineering continuity | Knowledge transfer | Lifecycle support | Long-term asset value

ENGINEERED IN SWITZERLAND