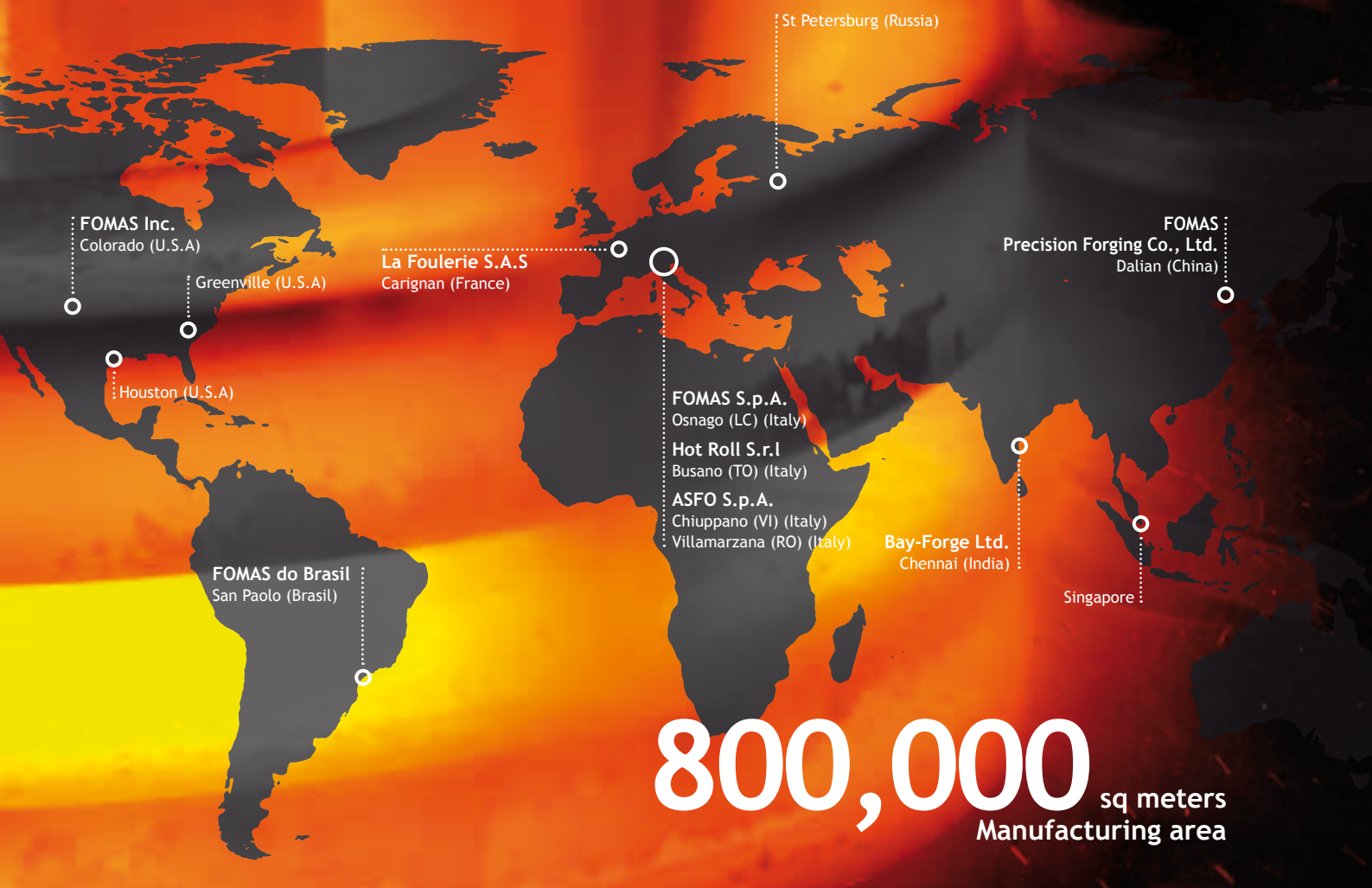
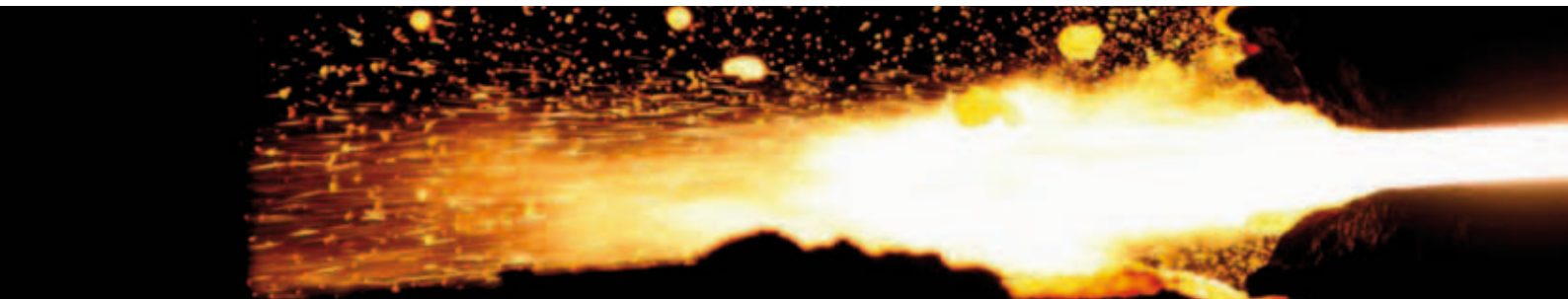


Since 1956 the reliable partner
of power generation equipment manufacturers

WORLDWIDE PRESENCE





OPEN DIE FORGINGS AND SEAMLESS ROLLED RINGS FOR POWER GENERATION

FOMAS Group manufactures open die forgings and seamless rolled rings, in any type of steel and non-ferrous alloys for the Power Generation:

- **Steam and Gas**
- **Hydroelectric**
- **Geothermal**
- **Nuclear**
- **Wind**

Our decades of experience in the manufacturing of power generation components have made us an essential partner to our clients.

We share know-how within the FOMAS Group, optimizing processes and materials, minimizing cost, and maximizing product quality.

Our added value is to provide **turnkey solutions**, from forging and ring rolling to the finished machined part.

Starting from a thorough analysis of the customer's design, then engineering the production of contour forgings close to net shape up to the finished part.

All the required machining processes such as milling, lathe-machining, drilling, sawing and others can be carried within our manufacturing units.

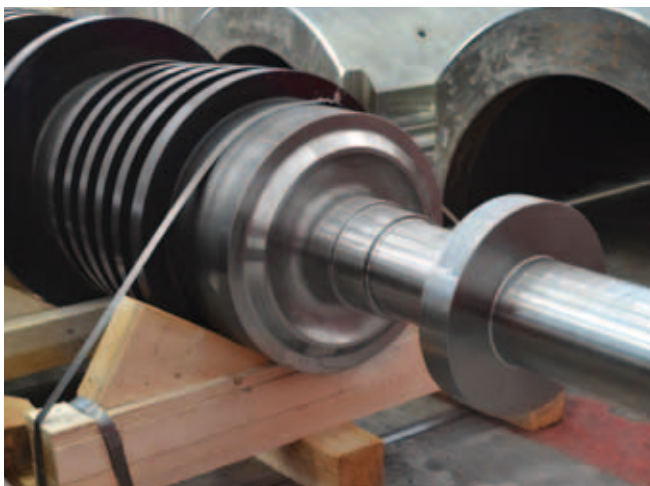
- **Cutting-edge technology**
- **Quality**
- **On time delivery**

Steam and Gas



FORGINGS

STEAM	GAS
<ul style="list-style-type: none">• Generators• HP/IP/LP Rotor (monoblock and welded design) shafts	<ul style="list-style-type: none">• All alloys and super alloys components• Forward compressor shafts• Compressor wheel stages• After compressor shafts• Distance pieces• Torque disk/tubes• Mid shafts• Turbine wheel stages• Spacers• After turbine shafts• Couplings



RINGS

STEAM	GAS
STEAM TURBINE <ul style="list-style-type: none">• Diaphragms• Guide Van Strips	GAS TURBINE <ul style="list-style-type: none">• 1st and 2nd stage casings• Heat Shields SHROUD RINGS <ul style="list-style-type: none">• Inner / Outer Shield• Discharge Support Rings• Inner and outer transition ducts• Half Rings



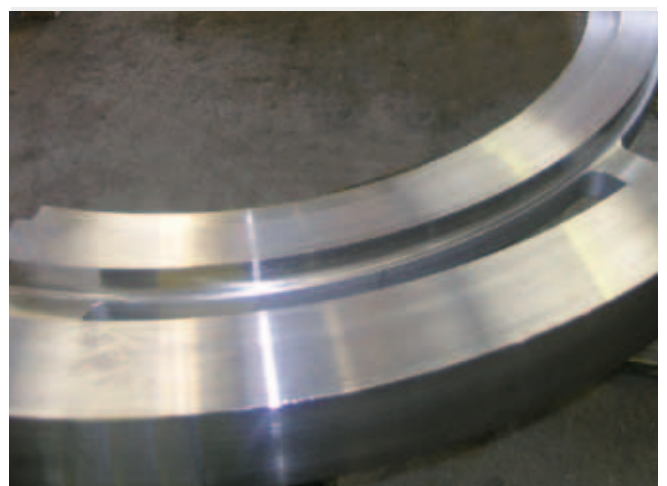
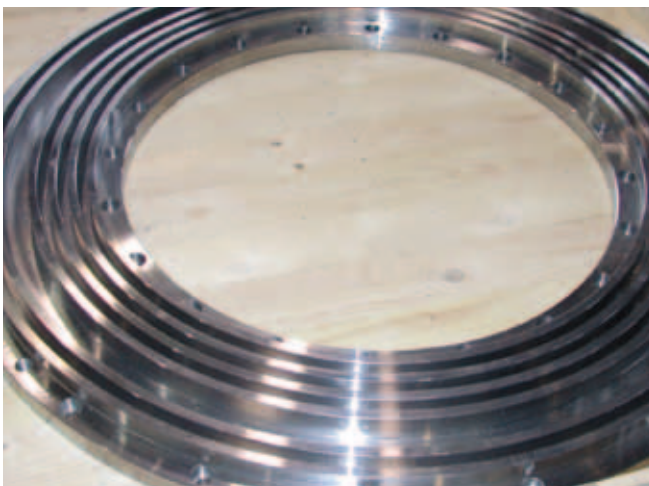


FORGINGS

- Single and double flanged hydro shafts
- Pelton runners up to 100 ton
- Generators shafts
- Bushing Rings
- Hydro casings
- Stay rings
- Upper and lower deck head covers
- Bottom Rings

RINGS

- Diaphragms
- Labyrinth Rings
- Francis and Pelton wheels
- Sealing rings



Geothermal



FORGINGS

- Bushing rings
- Triple phase stainless steel shafts

RINGS

- Crown Bands
- Labyrinths

LARDERELLO PROJECT, ITALY

FOMAS is a standard and preferred supplier of rotors for this geothermal power plant, in operation since 1913. The plant has now a total capacity of 810 MW.





Nuclear



FOMAS has successfully provided “High Integrity Open Die Forgings” to Nuclear Power Plants for the past 40 years.

In the early 70’s FOMAS delivered the first main inlet and outlet nozzles steel type ASME SA 508 Class 2 forgings to Breda Termomeccanica (first ever ASME N-Stamp in Europe) for the 850 MW BWR Caorso Power Station.

Among our recognitions, FOMAS remains the oldest and most experienced European supplier with uninterrupted ASME Material Organization qualification, backing up to the late 1970’s.



Today we supply forgings in accordance with:

ASME
RCCM
TÜV
KTA

ISO EN
BS
GOST
JAW
NNSA-HAF604



FORGINGS

- 1ST TO 4TH GENERATION PRIMARY/SECONDARY CIRCUIT FORGINGS
- EQUIPMENT FOR NUCLEAR WASTE MANAGEMENT
- NUCLEAR HOT FUSION - ITER PROJECT

TYPICAL COMPONENTS

- Steam Generator
 - Primary Heads
 - Main Tubesheets
 - Feedwater Nozzles
- Inlet - Outlet Super Heater Nozzles
- Manway nozzles
- Sever Accident Safety Valve nozzles Safe End
- Primary nozzle Dam Rings
- Core Support Components
- Primary Feedwater Pump Components
- Spray nozzle Transition Rings
- Boron Control System Motor Cases
- Low Pressure Steam Rotors





FORGINGS

- Main turbine shafts

RINGS

MULTIPLE WIND TURBINE ROLLED RING APPLICATIONS

MAIN GEARBOX

- Planetary gears
- Hollow shafts
- Ring gears

TOWER ASSEMBLY

- Structural flanges

BEARINGS

- Yaw slewing bearings
- Pitch slewing bearings

COUPLING

- Flanges



MATERIALS - Special steels, nickel and titanium alloys

Steel	Material Number	Uns-Designation	Din-identification	Alloy	Application
Austenitic Steels	-1,4302	S30400	X5CrNi18-10	F304	Nuclear, Oil&Gas
	-1,4306	S30403	X2CrNi19-11	F304 L	
	-	S30454	X5CrNi18-10	F304 LN	
	-1,4841	S31000	X15CrNi25-21	F310	
	-1,4401	S31600	X5CrNiMo17-12-2	F316	
	-1,4404	S31603	X2CrNiMo17-12-2	F316 L	
	-1,4406	S31653	X2CrNiMo17-11-2	F316 LN	
	-1,4541	S32100	X6CrNiTi18-10	F321	
	-1,4550	S34700	X6CrNiNb18-10	F347	
Super austenitic Steels	-1,4961	S34709	X8CrNiNb18-10	F347 H	Aerospace, Nuclear, Oil&Gas
	-1,4454	S21904	X2CrMnNiN20-9-7	F XM-11 / Nitronic 40	
	no	S20910	X3CrMnNiN22-5-12	F XM-19 / Nitronic 50	
	-1,4547	S31254	X1CrNiMoCuN20-18-7	F44	
Martensitic Steels	-1,4565	S34565	X2CrNiMnMoNbN25-18-5-4	F49	Oil&Gas
	-1,4413	S41500	X3CrNi13-4	F6NM	Oil&Gas, Process Equipment
	-1,4006	S41000	X12Cr13	F6 a	Oil&Gas, Process Equipment, Power Generation
	-1,4923	-	X22CrMoV12-1	-	Oil&Gas, Process Equipment
	-	-	X4CrNi16-4	Virgo 38	Oil&Gas, Process Equipment
	1,4939	-	X12CrNiMo12	Jethete M 152	Oil&Gas, Process Equipment, Power Generation
Martensitic Creep-resistant Steels	-	-	X14CrMoVNBn	Cost F	Power Generation, Gas Steam Turbine components
	-	-	X12CrMoWVNBn	Cost E	
	-	-	X13CrMoCoVNBnB	FB2	
	X10CrMoVNB9-1	K90901	X10CrMoVNB9-1	F91	Power Generation, Steam Valves, Pressure Vessel
	-	K92460	-	F92	
Stainless Precipit. Hardening Steels	-1,4545	-	-	15-5 PH	Aerospace, high-strength corrosion resistant components
	-1,4542	S17400	X5CrNiCuNb16-4-4	17-4 PH	
Duplex & Superduplex Stainless Steels	-1,4462	S31803	X2CrNiMoN22-5-3	F51	Oil&Gas, FPSO platforms
	-1,4410	S32750	X2CrNiMoN25-7-4	F53	Oil&Gas, Pumps, Valves
	-1,4501	S32760	X2CrNiMoCuWN25-7-4	F55	
	-1,4507	S32550	X2CrNiMo25-7-4	F61	
Superalloys		N08120	NiFeCr	HR120	Power generation, shrouds, diaphragms, heat shields, turbine stage
	2,4683	R30188	CoCr22NiW	Haynes 188 / Udimet 188	
	2,4733	N06230	NiCr22W14Mo	Haynes 230	
	2,4831 / 2,4856	N06625	NiCr22Mo9Nb	Inconel 625	Pressure Containers, Oil&Gas
	2,4642	N06690	NiCr29Fe	Inconel 690	
	2,4668	N06718	NiCr19Fe19Nb5Mo3	Inconel 718	Power Generation, Turbine components, Aviation, Oil&Gas, Nuclear
	2,4665		NiCr22Fe18Mo	Hastelloy X / Inconel HX	
	2,465	N07236	NiCo20Cr20MoTi	Nimonic 263	Power generation, shrouds, diaphragms, heat shields, turbine stage
				GTD333	
	1,4876	N08810	X10NiCrAlTi32-21	Incoloy 800H	Nuclear, Oil&Gas
Carbon & Low Alloys Steels	1,4944	no	no	A-286	Power Generation, Oil&Gas
				SA 105	Oil&Gas, General Industry
				SA 266	
				A 266 CL2	
				SA 350 LF2	
				SA 508 Grade 3 CL1 / CL2	
				A48 CP-APR	
				20 Mn 5	
				16 MnD 5	
				18 MnD 5	
				20 MnMoNi 55	
				A 694 F52	
				A 694 F60	
				A 694 F65	
				A 694 F70	
				A 707 Grade 3W	
				15NiCuMoNb5	
				SA 350 LF3	
				A 350 LF6	
	1,5421	K12822	20MnMo3-5	SA 336 F1	
	-1,7362	K41545	X11CrMo5	SA 336 F5	
		K11572	no	SA 336 F11	
	-1,7337	K11564	16CrMo4-4	SA 336 F12	
	no	K31545	no	SA 336 F21	
	1,738	K21590	10CrMo9-10	A 182 F22	
	no	K31835	12CrMoV9-10	A 182 F22V	
	-1,7214	no	30CrMo4	AISI 4130	
	1,7225	no	42CrMo4	AISI 4140	
				39NiCrMo3	
				A 470 CL8	
				A 522 Type1	
				20 NCD 12	
				15 Mo 3	

References

POWER GENERATION ROTATING COMPONENTS SIEMENS Reference List



EUROPEAN DESIGN

SGT5-4000F (former V94.3A), **SGT5-2000E** (former V94.2),
SGT6-2000E (former V84.2), **SGT6-4000F** (former V84.3A)

Main Components	Materials
Compr. Disks	26NiCrMoV14.5 (Super Clean)
Shafts	26NiCrMoV14.5
Torque Disks	26NiCrMoV11.5
Turbine Disks	X12CrMoWVNbN1011 (COST E)
Nuts / Rings	

FIRST PROTOTYPE SGT5-7000F

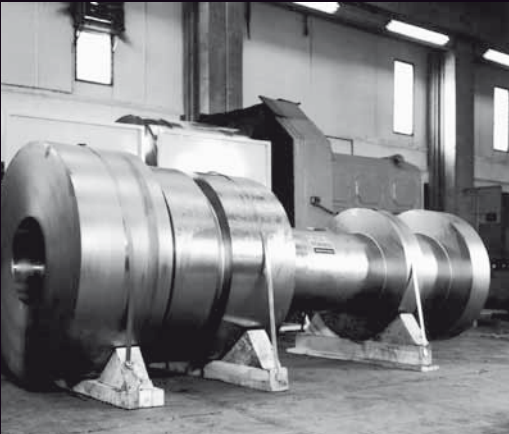
Main Components	Materials
Shafts	26NiCrMoV14.5 (SC)
Compr. Disks	26NiCrMoV11.5
Torque Disks	
Turbine Disks	
Nuts	

US DESIGN

SGT6-6000G (former W501G), **SGT6-5000F** (former W501F)
SGT6-3000E (former W501D5/D4)

Main Components	Materials
Shafts	30NiCrMoV15
Compr. Disks	30NiCrMoV12
Torque Disks	30NiCrMoV12Mod
Turbine Disks	26CrMoNiVNB8
Nuts	

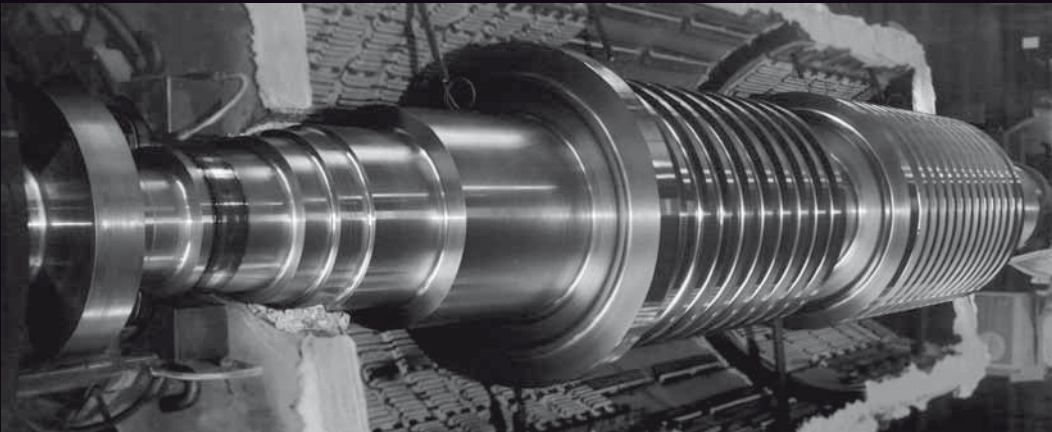
POWER GENERATION ROTATING COMPONENTS
GENERAL ELECTRIC Reference List



GAS TURBINES / ALL FRAMES	
9 H - 7 H - 9 E - 9FA - 9FB - 9 B - 7FA - 7 E - 7FB - 6 B - 6 C - 6FA - 5/2 E - 5M - 5C - 5D	
Main Components	Main Materials
Shafts	30NiCrMoV12
Compr. Disks	30NiCrMoV15
Turbine Disks	30CrMoV4.11
Spacers	12Cr Type M152



GENERATOR ROTORS **
Main Materials
30NiCrMoV15



STEAM TURBINES *
Main Materials
30CrMoV4.11mod
30NiCrMoV15

* HP's / IP's LP's Rotors max. gashed shipping weight of 80 t

** up to shipping weight of 90 t

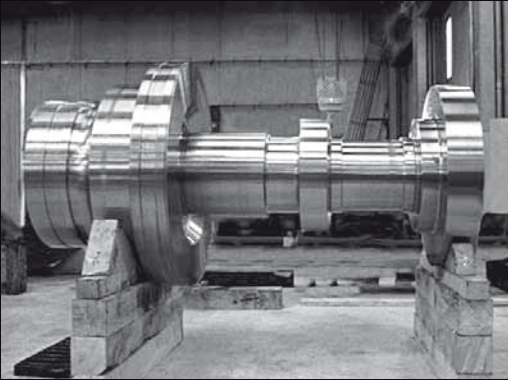
References

POWER GENERATION ROTATING COMPONENTS ALSTOM Reference List



* STEAM TURBINES

Materials	Weights
CrMoV and NiCrMoV	up to 40 t per forging



STEAM TURBINES **

Weights
up to 80 t per forging delivery
COST E
COST F
FB2

GAS TURBINES ALL FRAMES: GT11N2 - GT13E2 - GT24 - GT26

Materials	Weights
Alstom grades ref. CrMoV and NiCrMoV 12% Cr (X12CrNiMoV12)	up to 35 t per forging

* Polyblock LP's / IP's / HP's Rotors, Conventional ND 30/33/37/41, Polyblock Nuclear HP / LP's

** Material COST F (X14CrMoVNbN10) Polyblock IP's / HP's

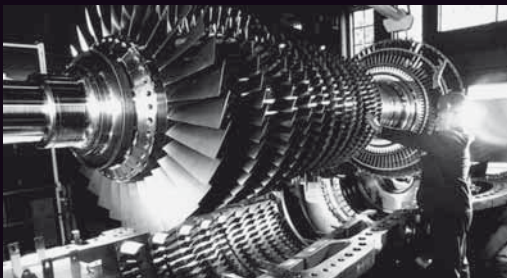
POWER GENERATION ROTATING COMPONENTS

Mechanical Drive Gas Turbines



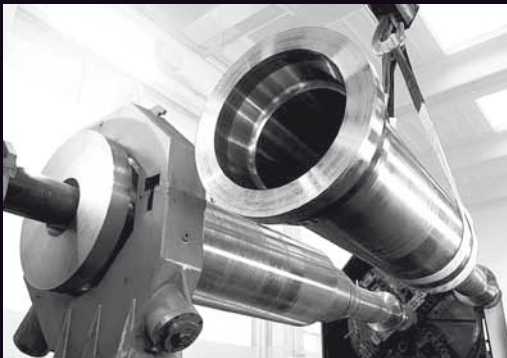
GENERAL ELECTRIC / PGT10, PGT25, LM2500

Main Components	Main Materials
Compr. Disks	30NiCrMoV12
Turbine Disks	30NiCrMoV15
Shafts	30CrMoV4.11
Spacers	12Cr Type M152
	A 286
	INCONEL 718



ALSTOM / GT8C2

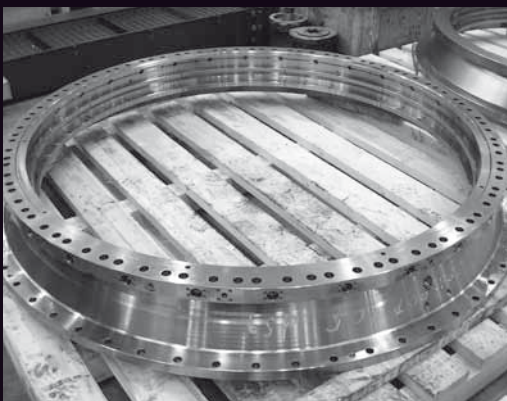
Main Components	Materials
Shafts	Alstom grades
Disks	CrMoV
	NiCrMoV



SIEMENS (WESTINGHOUSE) / W101, W191, W301

Main Components	Materials
Shafts	30NiCrMoV15
Compr. Disks	30NiCrMoV12
Torque Disks	30NiCrMoV12Mod
Turbine Disks	26CrMoNiVNb8
	DISCALOY (Ni base alloy)

POWER GENERATION STATORIC COMPONENTS



GENERAL ELECTRIC

Main Components	Materials
Heat Shield	Nimonic263
1st & 2st Turbine case	ASTM-A470-CL8
1st & 2st Diaphragm	
1st & 2st Shourds	Ni alloy
	Austenitc Steel
Centrifugal compressor components	



THE GROUP

Our mission is to fulfil customer requirements with unmatched quality and on time delivery.

Our 50 years experience enable us to provide the highest level of material and process knowledge on critical industrial applications.

The Group has over 1,300 employees all around the world. Working with us signifies entering a team which is focused on continuous evolution, a company that measures its success in the achievement of excellence at each and every step of function and process.

The Group is organised in two main business units, Forgings Division and Rings Division and its factories are located in Italy, France, India and China.

OUR GROWTH PATH

In order to comply with the most demanding customer requests, in 2007 the Group initiated an extensive **250 million euro investment** in new facilities, technology, and machinery and human capital around the world.

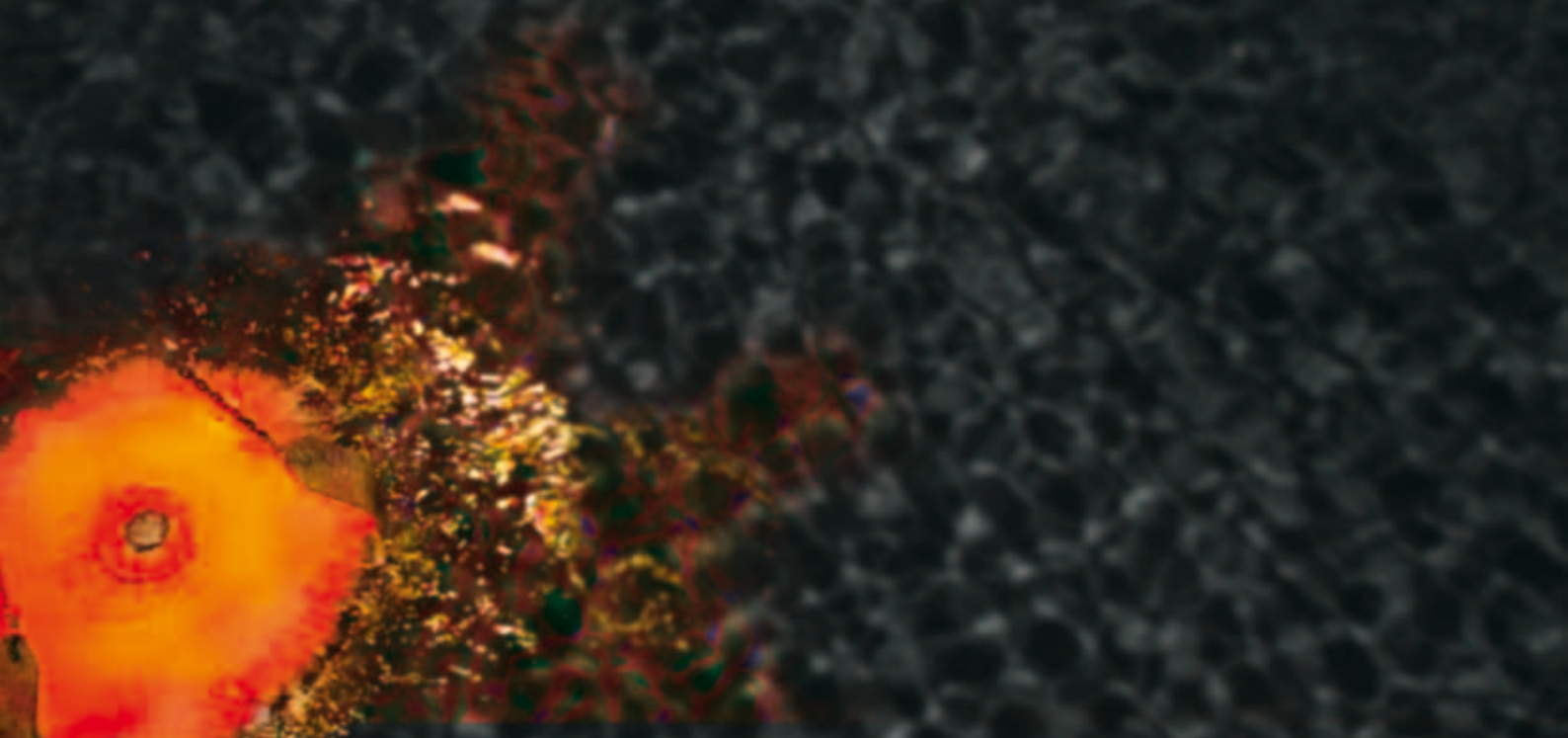
The “FOMAS 2012” project was launched to significantly increase the Group’s manufacturing capabilities and capacity.

While the world’s financial crisis hit, FOMAS continued to move forward with investments as planned: this major investment project was completed more than a year ahead of schedule.

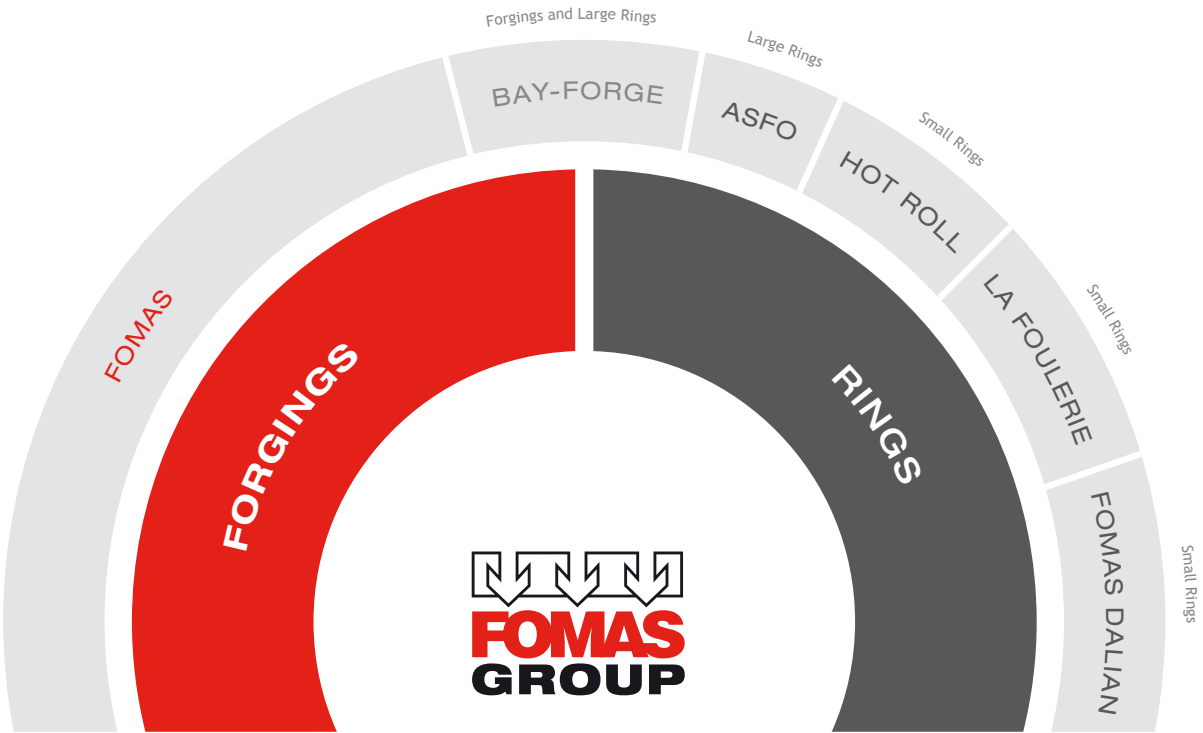
And we are still forging ahead with more upcoming investments.

1,320
employees





FOMAS GROUP STRUCTURE



average

180,000 tons

raw material purchased per year

POWER GENERATION

Steam
Gas
Hydro
Geothermal
Nuclear
Wind

OIL and GAS

Upstream
Downstream
Process Equipment

MOBILITY/TRANSPORTATION

Automotive
Industrial Vehicles
Aerospace
Railway
Ship Industry

CONSTRUCTION EQUIPMENT

Construction
Mining
Tunnelling

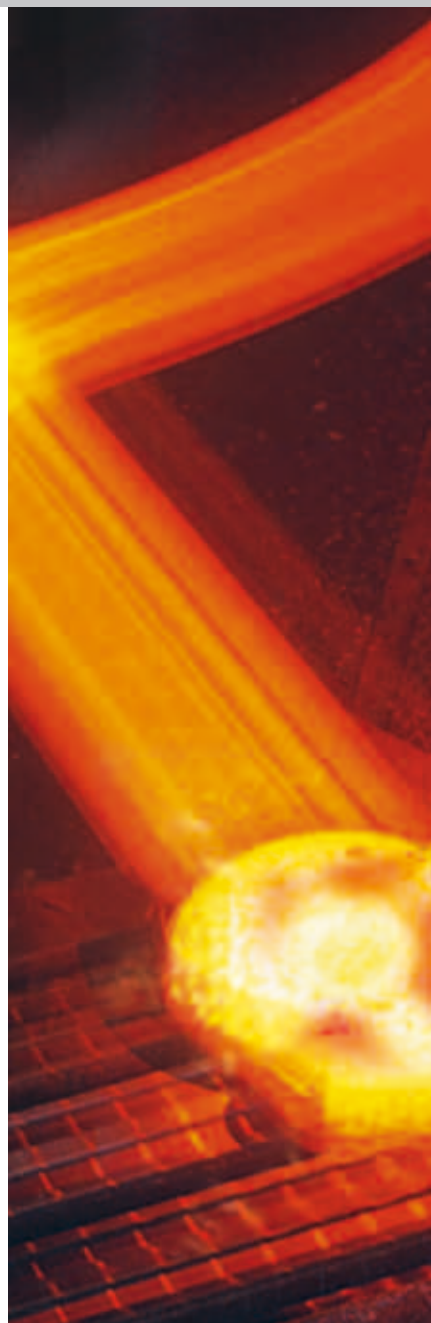
GENERAL INDUSTRY

Dies & Rolls
Agriculture
Chemical Process Equipment
Fluid Handling

GEARS TRANSMISSIONS & BEARINGS

Gear Boxes
Speed Reducers
Gear
Ultra Large Bearings

SPECIAL STEELS and ALLOYS





FORGINGS

Actual as forged weight and dimension limits

- max. diameter: 5,500 mm
- max. length: 18,000 mm
- max. ingot: 125 ton ESR
(equivalent to 170 tons conventional ingot)
- max. shipped weight: 100 ton

Six state of the art automatic UT stand both vertical and horizontal, produced on FOMAS design and qualified by the major turbine manufacturers. Titanium and Aluminium heat treatment production line equipped with electric drop furnace.

Presses

The forgings are processed in smaller or larger presses depending on the contours and size.

Our presses for open die forgings (all with integrated manipulators):

- 11,300 ton
- 6,000 ton
- n° 2 - 3,500 ton
- 2,000 ton

Electro Slag Remelting plant

- Three ESR stands
- New 125 ton ESR ingot equivalent to a conventional ingot of 170 ton.
- Pressurised ESR for top quality remelting of special steel & stainless steel under full inert gas atmosphere.

Horizontal spray-quench

- Differential heat treatment
- Fully control on drasticity
- Cooling zone control
- Time evolution of drasticity control
- Full rotor stability due to rotation
- Very uniform properties
- Plc controlled >> fully reproducible process (no variance)
- Full control on position/distance of nozzles
- Green process





RINGS

- max. ring diameter: 7,000 mm
- max ring height: 1,200 mm
- max ring weight: 15 ton
- max ingot weight: 40 ton

Rolling Mills

17 lines (axial/radial)

State of the art in-house heat treatment plants, with an automated mobile conveyor for loading/unloading operations. This means quick, consistent and optimized transfer time from furnace to tank. The Rings Division currently produces approximately 60,000 tons per year and has capacity to manufacture rings in the following range: 7,000 mm diameter, 1,200 mm in height and up to an approximate weight of 15 tons.





CERTIFICATIONS

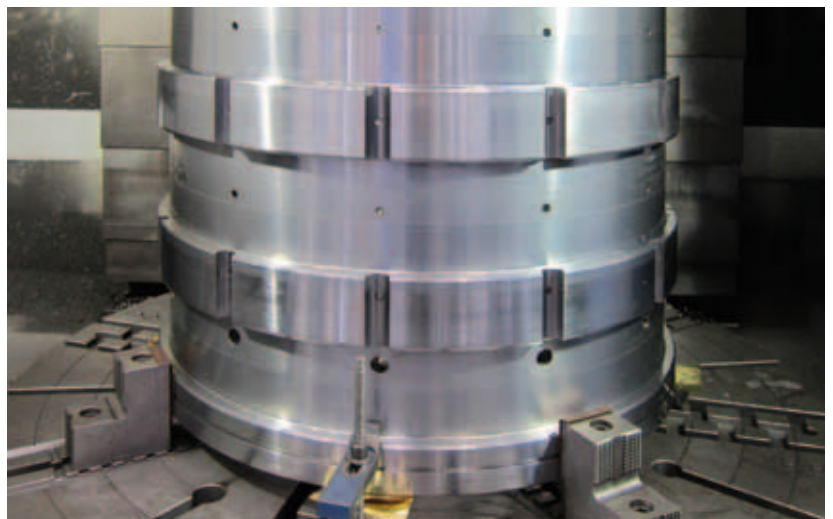
All the Group's Companies are certified with:

- ISO 9001
Det Norske Veritas (DNV)
- ISO 14001
Environmental Management (DNV)
- BS OHSAS 18001
Occupational Health and Safety (DNV)

Moreover each company is certified by the most prestigious institutes in specific sectors.



FOMAS Group's central research and development department aims to respond to customer needs. We often provide, on request co-design solutions. Our approach is to focus on safety, cost reduction, minimize end waste. Moreover we strive to sustain profitability providing the highest level of quality and safety throughout the entire manufacturing cycle and at the same time ensuring the least possible impact on the environment.







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