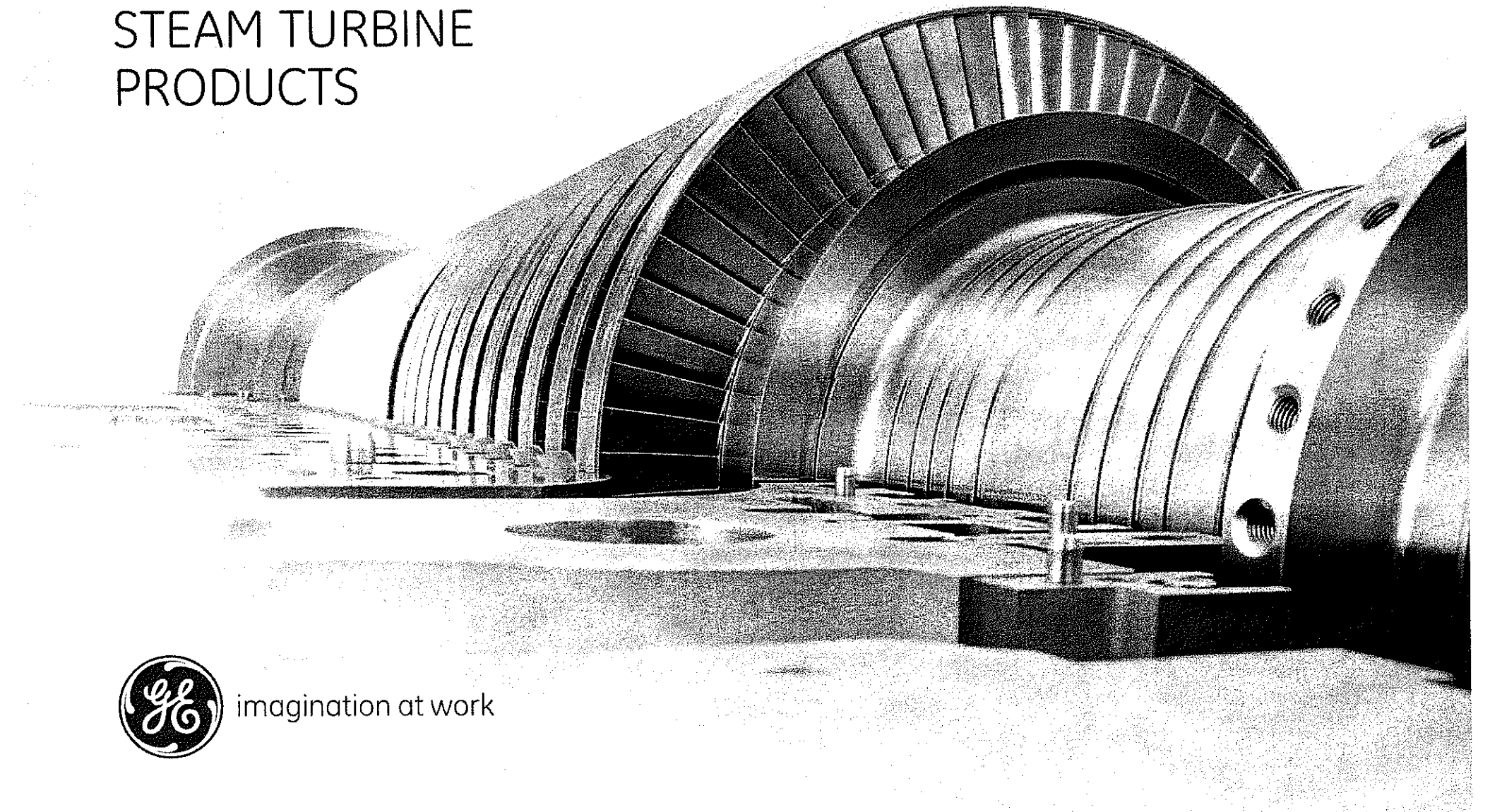
SNC000029

G.E. Steam Turbine

Product Brochure

GE Energy

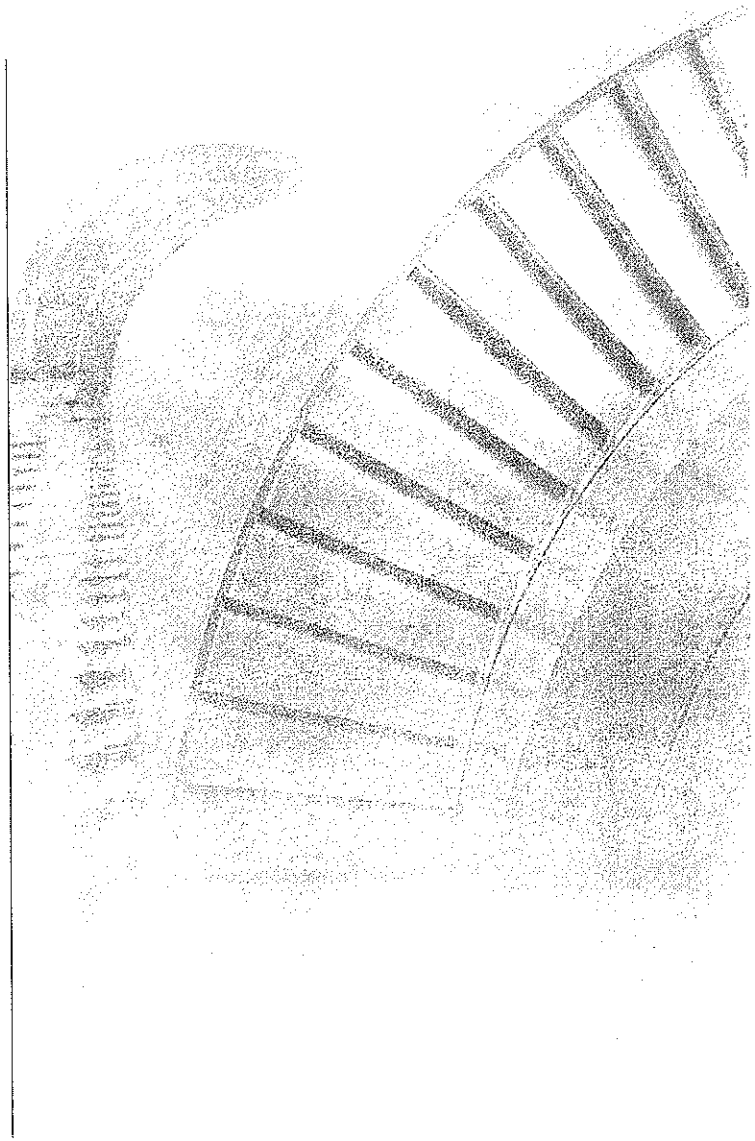
STEAM TURBINE PRODUCTS

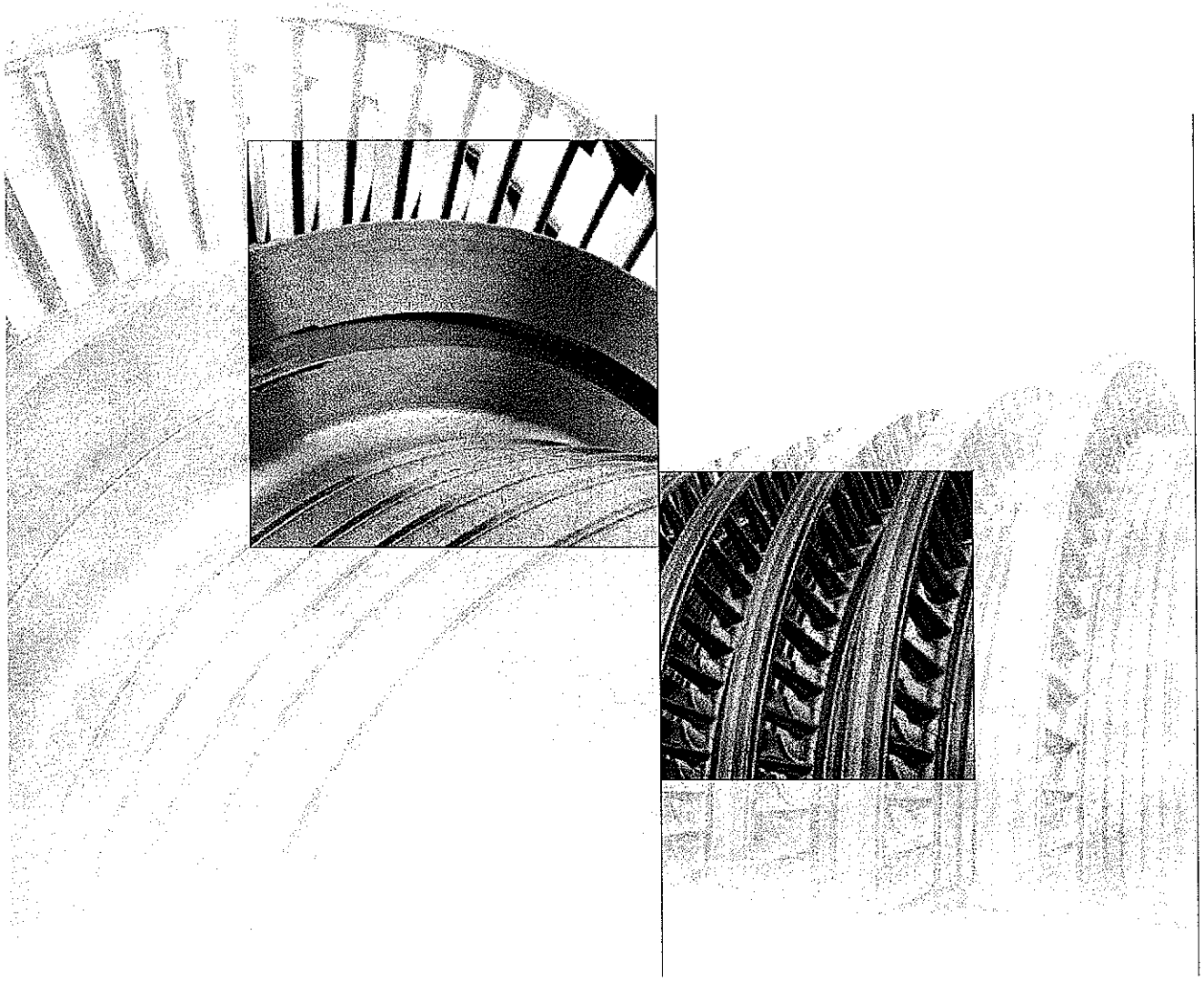


imagination at work

The Power of Technology, Experience and Innovation

From small industrial units to large combined cycle and nuclear designs, GE steam turbines offer high reliability and performance. With a wide range of flexible configurations, GE offers a full range of products to meet the challenges of today's demanding energy environment.





GE ENERGY
STEAM TURBINE PRODUCTS

Steam Turbine Technology

Leading Technology for All Applications

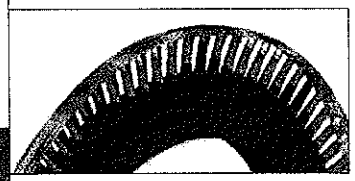
With over 530 GW of steam turbine capacity in more than 5600 units installed or on order, GE Energy is a world leader in the design, development and application of steam turbine technology.

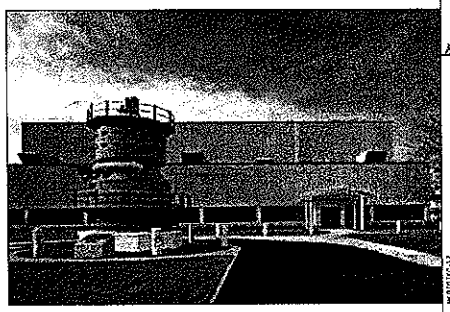
Drawing from this extensive steam turbine design experience and aerodynamic experts at GE Transportation and GE Global Research , GE drives technology and offers a wide array of steam turbines ranging from small industrial units to large combined cycle and nuclear designs.

Our steam turbines can be found in fossil-fired, combined cycle, integrated gasification combined cycle, industrial, petrochemical and nuclear plants around the globe. Throughout the range of sizes and applications, our steam turbines provide high reliability, sustained high efficiency and ease of maintenance.

Our teams of engineers and scientists use Six Sigma methodology coupled with the latest computational fluid dynamics and finite element analysis tools to develop steam turbines with the reliability, performance and output flexibility characteristics necessary to meet the challenges that our customers face in today's most demanding application environments.

GE employs cutting-edge engineering analysis and design tools to improve steam turbine designs.





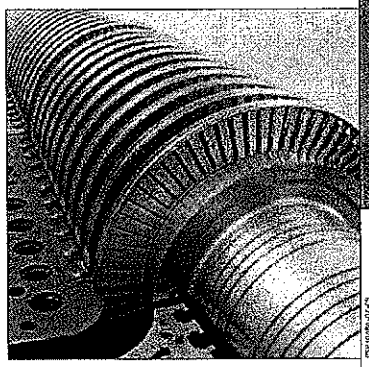
The Low Pressure Steam Turbine Test Facility continues GE's long history of driving steam turbine technology, which includes the first large-scale steam turbines like this groundbreaking 5 MW model from 1900.

GE's commitment to customer value and technology evolution is demonstrated in our ongoing investment in product development. Our steam turbine low pressure development test facility provides a broad range of LP test capabilities and contributes to our ability to validate new product designs.

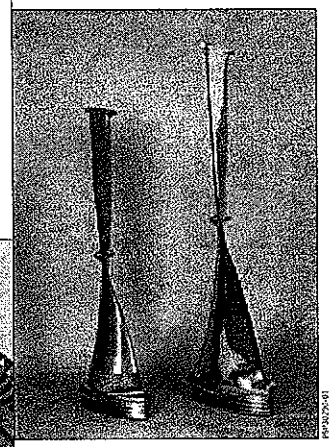
Innovations such as 40" and 48" stainless steel last-stage buckets provide increased power plant efficiency. The use of steel results in a lower cost to the customer and avoids uncertainty in the supply and, therefore, price of high-quality titanium forgings typically used for last-stage buckets of this size.

For combined cycle applications, GE's HEAT™ (High Efficiency Advanced Technology) steam turbines incorporate design advances across our steam turbine product line, including high-reaction drum rotor construction, 2400 psia/565 bar pressure capability, optimized seal clearances, low pressure-drop valve designs, longer and higher efficiency last-stage bucket designs, and advances in material technology. HEAT™ steam turbines improve combined cycle plant efficiency, leading to a lower cost of producing electricity, which is critical to success for every company involved in today's energy business.

We are committed to the continuous development of cutting-edge steam turbine technology with the primary goal of offering the widest range of world-class power generation products that contribute to our customers' success.



GE's HEAT™ steam turbine incorporates design advances like this high-reaction drum rotor.



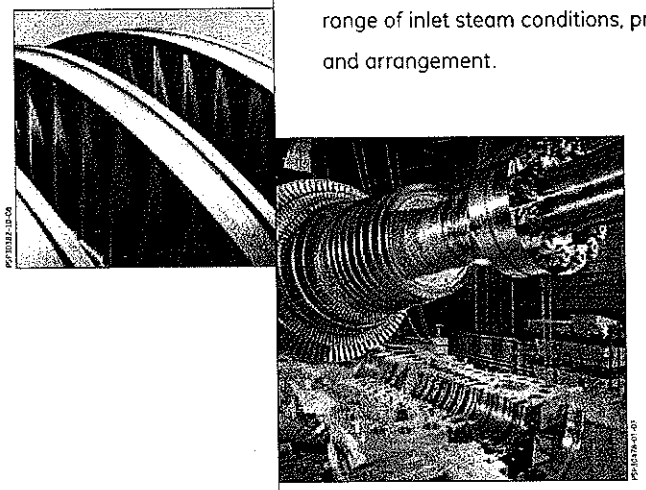
40" and 48" stainless steel last-stage buckets provide increased power plant efficiency.

Reheat—Combined Cycle A Series

Turning on the HEAT™...High Efficiency Advanced Technology for Combined Cycle Applications

GE's A series reheat steam turbines deliver exceptional reliability and availability in today's demanding energy environment. The A series is optimized for maximum output and efficiency in GE STAG™ (steam and gas) combined cycle systems. Included in the A series is our HEAT™ steam turbine featuring high-reaction drum rotor design.

The A series steam turbines are available in 50 Hz single-shaft or multi-shaft configurations and 60 Hz multi-shaft applications and are suitable for a wide range of inlet steam conditions, providing maximum flexibility in plant operation and arrangement.



GE's HEAT™ steam turbines improve combined cycle plant efficiency, leading to a lower cost of electricity.

KEY FEATURES

- Designed for robust operation and rapid start-up
- Compact design—maximizes power density
  - Separate HP casing
  - Combined IP/LP casing
- Single-flow LP
- Axial exhausts
- Wide range of last-stage buckets—accommodate site-specific backpressure conditions
- High efficiency LP hood and diffuser
- Robust low pressure-drop combined stop and control valves

PRODUCT CHARACTERISTICS

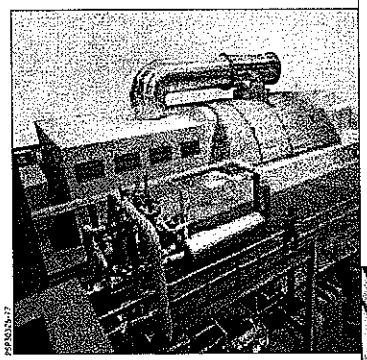
Power rating	85–150 MW
Maximum steam conditions	2400 psig/1050°F/1050°F
Arrangement	HP + combined IP/LP
LP designs	60 Hz: 1x20"/1x26"/1x33.5"/1x40" 50 Hz: 1x33.5"/1x42"/1x48"

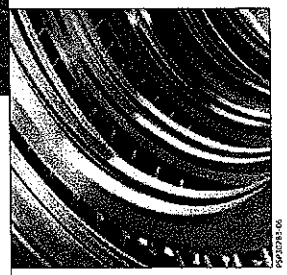
Reheat—Combined Cycle D Series

Structured Designs for Large Combined Cycle Applications

GE's D series reheat steam turbines deliver high thermal efficiency in GE STAG™ combined cycle systems. Available in 50 or 60 Hz single-shaft and multi-shaft configurations, the D series is designed for a wide range of inlet steam conditions and HRSG firing capabilities.

Structured designs provide significant customer benefits by standardizing many of the major components while maintaining the flexibility to adapt the D series to specific application conditions.





GE's D series reheat steam turbines are designed for a wide range of inlet steam conditions and HRSG firing capabilities.

KEY FEATURES

- Structured steam path design—minimizes design and delivery cycles
- Pre-assembled single-shell HP/IP section—reduces site installation time required
  - Diaphragms pre-installed
  - Rotor pre-installed and aligned
- Standardized instrumentation package—for enhanced operation and monitoring
- Wide range of last-stage buckets—accommodate site-specific backpressure conditions
- High efficiency LP hood
- Standardized parts platform—allows for reduced spare parts inventories
- Dense Pack™ design HP/IP—increases efficiency and lowers cost of electricity
- Robust low pressure-drop combined stop and control valves

PRODUCT CHARACTERISTICS

Power rating	120–425 MW
Maximum steam conditions	1920 psig/1050°F/1050°F
Arrangement	Combined HP/IP 2-flow LP
Double-flow LP designs	60 Hz: 2x20"/2x26"/2x33.5"/2x40" 50 Hz: 2x26"/2x33.5"/2x42"/2x48"

Non-Reheat

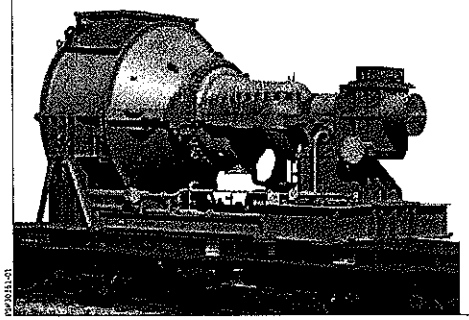
Flexible Performers for Mid-Size Applications

GE's non-reheat steam turbines are available as single casing, single-flow or double casing, double-flow configurations. GE's flexible and reliable non-reheat line is well proven in combined cycle, cogeneration, district heating, industrial and small power generation applications around the globe.

Single casing turbines feature a compact design, using an HP casing bolted to a single-flow, low pressure section, available in an axial or down exhaust configuration. For larger non-reheat condensing applications, GE offers a two-casing design featuring a separate HP and a double-flow LP. For non-condensing applications, the HP and exhaust casing sections are a single casting.

Combined cycle applications utilize designs employing sliding pressure control with off-shell-mounted combined stop and control valves. Cogeneration designs utilize fixed-pressure control with shell-mounted inlet and extraction control valves, enabling constant inlet pressure and precise process extraction steam pressure control.

GE non-reheat steam turbines are optimized for combined cycle applications in plants using GE's small to mid-size heavy-duty gas turbines, including the 6F, 6C, 6B, 7E, 9E and with GE's LM6000 aeroderivative gas turbine.



Typical base-mounted, factory-assembled, sliding-pressure combined cycle steam turbine and axial exhaust.

KEY FEATURES

- Compact design—maximizes power density
- Single-flow or double-flow LP
- Condensing and non-condensing designs
- Up to two controlled extractions available (backpressure dependent)
- Sliding-pressure and fixed-pressure control available
- Suitable for base mounting—maximum factory assembly
- Axial and down exhausts—provide flexibility in plant arrangement

PRODUCT CHARACTERISTICS

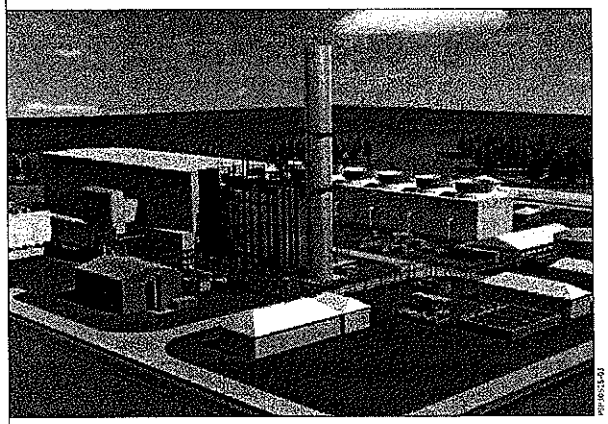
Power rating	Up to 250 MW
Steam conditions	Up to 1800 psig/1000°F
Arrangement	HP/LP—front or rear drive
Condensing LP designs	60 Hz: 1x17.5"/1x20"/1x23"/1x26"/1x30"/1x33.5" 50 Hz: 1x17.5"/1x26"/1x33.5"/1x42"

STAG™ Combined Cycle Reference Guide

Steam and Gas Combined Cycle

GE's STAG™ combined cycle systems are designed to deliver high efficiency, reliability and flexibility.

With our STAG™ combined cycle product line we can provide an optimized and matched system of high-technology power generation equipment, software and services configured for convenient integration with customers' auxiliaries and balance of plant equipment to form an economical power plant.



	STAG™ Configuration	Frequency (Hz)	CC Output MW (Unfired)*	ST Code	ST Generator Code
Reheat	109FB SS	50	412.9	A	450H
	109FB MS	50	412.9	A	9A5
	209FB	50	825.8	D	390H
	107FB	60	280.3	A	9A4
	207FB	60	560.6	D	7FH2/324
	307FB	60	840.9	D	390H/324
	109FA SS	50	390.8	D	390H
	109FA MS	50	390.8	A	9A4/9A5
	209FA	50	781.6	D	324/390H
	107FA	60	262.6	A	9A4
	207FA	60	525.2	D	7FH2/324
	307FA	60	787.8	D	390H/324
Non-Reheat	109E	50	193.2	SC	7A6/9A4
	209E	50	386.4	SC	9A5
	107E	60	130.2	SC	6A8
	207E	60	260.4	SC	7A6
	106F	50/60	117.7/118.1	SC	6A8
	206F	50/60	237.9/237.5	SC	7A6
	106B	50/60	64.3	SC/MC	4-Pole
	206B	50/60	130.7	SC	6A8
	106C	50/60	62.8	SC/MC	4-Pole
	206C	50/60	126.7	SC	6A8
	160**	50/60	64.5/65.3	SC/MC	4Pole
	260**	50/60	129.0/130.5	SC	6A8
	360**	50/60	193.5/195.8	SC	6A8
	460**	50/60	258.0/261.0	SC	7A6

*Combined cycle output is at ISO conditions for straight power generation applications with no cogen or steam extractions.

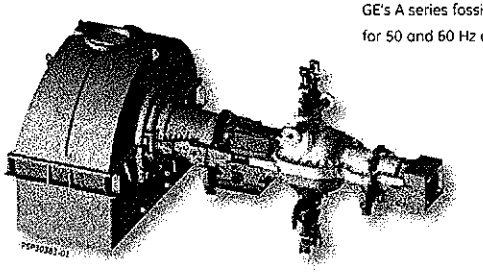
**Based on LM6000 PC. Other LM6000 configurations are available.

Fossil—A Series

Rugged Designs for Small Fossil Plant Applications

GE's A series fossil steam turbines are full-arc or partial-arc admission, tandem compound reheat steam turbines, ideal for 50 and 60 Hz subcritical applications up to 250 MW.

The A series steam turbines feature a compact design using a separate HP casing along with a single-casing, intermediate pressure/low pressure section. The combined IP/LP section is shorter than a multi-casing arrangement and eliminates the need for crossover piping.



GE's A series fossil steam turbines are available for 50 and 60 Hz applications up to 250 MW.

KEY FEATURES

- Compact design—maximizes power density
  - Separate HP casing
  - Combined IP/LP casing
- Dense Pack™ steam path—increased stage count, higher reaction
- Integral cover buckets (ICBs)—improve tip sealing and reliability
- Partial-arc (2) and full-arc admission—360-degree nozzle box/plate
- Shell-mounted control valves with individual actuators—permit online selection between full-arc and partial-arc admission modes

PRODUCT CHARACTERISTICS

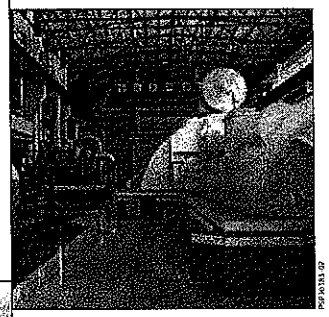
Power rating	Up to 250 MW
Maximum steam conditions	2520 psig/1050°F/1050°F
Arrangement	HP + combined IP/LP
Single-flow LPs	60 Hz: 1x26"/1x30"/1x33.5"/1x33.5"/1x40" 50 Hz: 1x33.5"/1x48"

Fossil—D Series

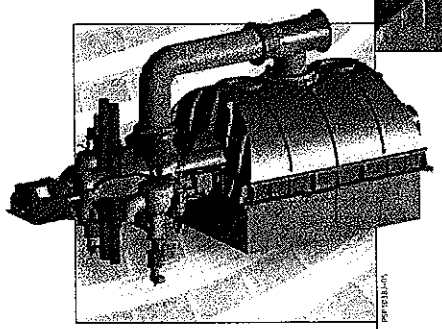
Reliable Designs for Medium Fossil Applications

GE's D series are full-arc or partial-arc admission, tandem compound reheat steam turbines, ideal for 50 and 60 Hz subcritical and supercritical power generation applications up to 550 MW.

D series turbines feature a two-casing, double-flow design for 2,400 or 3,500 PSI applications.



This D series steam turbine, rated at 350 MW, is installed and operating at Heilojiang Electric Power Company's Qitaihe power plant in China.



GE's D series fossil steam turbines are ideal for 50 and 60 Hz applications up to 550 MW.

KEY FEATURES

- Single-casing HP/IP section—reduces turbine hall construction cost and shortens installation time
- Dense Pack™ steam path—increased stage count, higher reaction
- Integral cover buckets (ICBs)—improve tip sealing and reliability
- Partial-arc (2) or full-arc admission—360-degree nozzle box/plate
- Control valves with individual actuators—permit online selection between full-arc and partial-arc admission modes

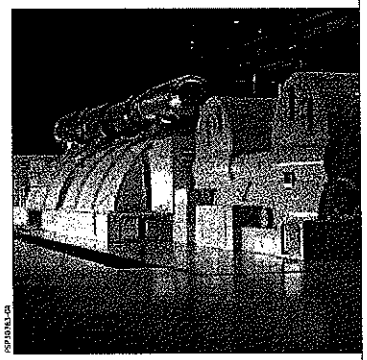
PRODUCT CHARACTERISTICS

Power rating	200–550 MW
Subcritical or supercritical steam conditions	
Full-arc/partial-arc (2) admission	
Opposed-flow combined HP/IP	
Double-flow LP	60 Hz: 2x26"/2x30"/2x33.5"/2x40" 50 Hz: 2x26"/2x33.5"/2x42"/2x48"

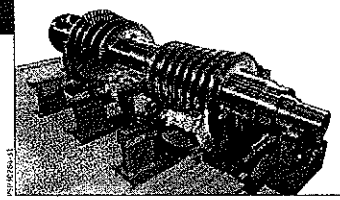
Fossil—G Series

High Efficiency Designs for Modern Steam Plants in Subcritical and Supercritical Applications

GE's G series are full-arc or partial-arc admission, tandem compound reheat steam turbines ideal for power generation in subcritical and supercritical applications up to 900 MW. The G series includes a three-casing design with a single-casing HP/IP and two LP casings or a four-casing design with separate HP and IP casings and two LP casings. G series steam turbines are offered for both 50 and 60 Hz applications worldwide.



This GE G series steam turbine, rated at 660 MW, is installed and operating at Huaneng Power International's Dezhou Phase III power plant in China.



This GE G series steam turbine rotor is displayed on half shell.

KEY FEATURES

- Dense Pack™ steam path—increased stage count, higher reaction
- Integral cover buckets (ICBs)—improve tip sealing and reliability
- Partial- (2) and full-arc admission—360-degree nozzle box/plate
- Labyrinth packings—minimize steam leakage
- Control valves with individual actuators—permit online selection between full-arc and partial-arc admission modes

THREE-CASING G SERIES – PRODUCT CHARACTERISTICS

Power rating	400–750 MW
Subcritical steam conditions	2400 psig/1000°F/1000°F
Supercritical steam conditions	3500 psig/1050°F/1100°F
Full-arc/partial-arc (2) admission	
Opposed flow combined HP/IP	
Four-flow LP	60 Hz: 4x26"/4x30.0"/4x33.5" 50 Hz: 4x26"/4x33.5"/4x42.0"/4x48"

FOUR-CASING G SERIES – PRODUCT CHARACTERISTICS

Power rating	650–900 MW
Subcritical steam conditions	2400 psig/1000°F/1000°F
Supercritical steam conditions	3500 psig/1050°F/1050°F
Full-arc/partial-arc (2) admission	
Separate HP/double-flow IP	
Four-flow LP	60 Hz: 4x33.5"/4x42.0" 50 Hz: 4x33.5"/4x42.0"/4x48"

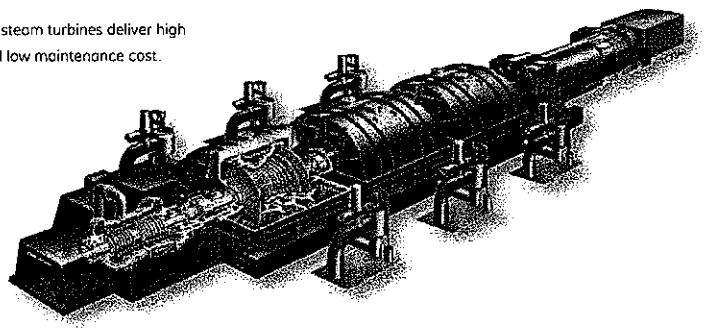
Nuclear—N Series

High Reliability Designs for Nuclear Plant Applications

GE's N series steam turbines are two-stage, reheat, tandem compound designs for nuclear applications up to 1500 MW.

N series turbines feature monoblock LP rotors, delivering high reliability and low cost of maintenance.

GE's N series steam turbines deliver high reliability and low maintenance cost.



KEY FEATURES

- Monoblock LP rotors—eliminate susceptibility to fretting and loosening of shrunk-on components
- Moisture capture and removal provisions—improve wet-stage performance
- Labyrinth packings—minimize steam leakage
- Modern aerodynamic bucket profiles—eliminate flow separation and reduce losses

PRODUCT CHARACTERISTICS

Power rating	Up to 1500 MW
1020 psia/550°F	
Two-stage moisture separator reheaters	
Six-flow LP	60 Hz: 6x38"/6x43"/6x52.0"
	50 Hz: 6x35"/6x41"/6x52.0"

Small Steam Turbines

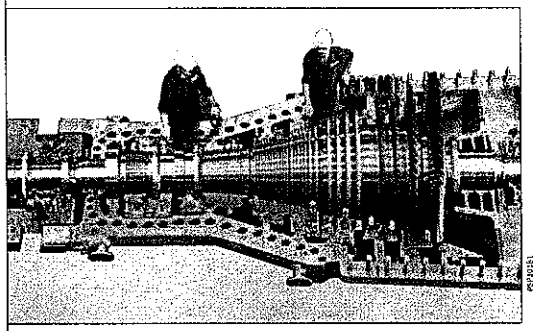
Product Overview

GE offers a complete line of small steam turbines for mechanical and generator drive requirements in industrial plants and Oil & Gas applications.

GE's small steam turbines are based on modular product structures, assuring reliable design and outstanding turbine performance through standardization. This structure enables optimization of turbine configurations for a customer's specific operating conditions.

By selecting and integrating pre-engineered and field-proven components from an array of alternate offerings and designing a custom steam path, the unique requirements of the application are satisfied. Using this flexible modular structure maximizes performance and reliability while keeping product cost and delivery cycle to a minimum.

Turbine Code	Type	Backpressure Limit	Max. Pressure	Max. Temp.	Single/ Multivalve	Power Range	Speed Range	Steam Path Technology
SC/SAC	Condensing	N/A	140 bar 2000 psi	540°C 1000°F	Multi	2 to 100 MW	3000 to 16000 RPM	Impulse/ Reaction
SNC/ SANC	Backpressure	60 bar	140 bar 2000 psi	540°C 1000°F	Multi	1 to 50 MW	3000 to 16000 RPM	Impulse/ Reaction
SGC/ SGDFC	Condensing Geothermal	N/A	30 bar 435 psi	300°C 572°F	Multi	5 to 100 MW	3000 or 3600 RPM	Impulse/ Reaction
A5/A9	Condensing Reheat	N/A	140 bar 2000 psi	565°C 1049°F	Multi	20 to 100 MW	3000 or 3600 RPM	Impulse/ Reaction
SDFC	Condensing Double Flow	N/A	30 bar 435 psi	300°C 572°F	Multi	5 to 100 MW	3000 to 16000 RPM	Impulse/ Reaction
P	Backpressure	20 bar	80 bar 1150 psi	480°C 900°F	Single	Up to 5 MW	Up to 16000 RPM	Impulse
MP	Backpressure	60 bar	150 bar 2150 psi	540°C 1000°F	Multi	Up to 40 MW	Up to 16000 RPM	Impulse
C	Condensing	N/A	80 bar 1150 psi	480°C 900°F	Single	Up to 6 MW	Up to 16000 RPM	Impulse
MC	Condensing	N/A	150 bar 2150 psi	540°C 1000°F	Multi	Up to 40 MW	Up to 16000 RPM	Impulse



GE offers a complete line of small steam turbines that maximize performance and reliability while minimizing product cost.

GE Value

GE is a leading global supplier of power generation technology, energy services and management systems, with an installed base of power generation equipment in more than 120 countries. GE Energy provides innovative, technology-based products and service solutions across the full spectrum of the energy industry.

Our people, products and services provide enhanced performance, competitive life cycle costs and continuous technological innovation with unmatched experience. Our Customer-Centric approach, combined with Six Sigma quality methodology, assures that customer needs are defined up front and that performance against customer expectations is measured and managed every step of the way.

Industries Served:

- Commercial and industrial power generation
- Distributed power
- Energy management
- Oil & Gas
- Petrochemical
- Gas compression
- Commercial marine power
- Energy rentals