Efficiency: More value to your facility

Siemens steam turbine portfolio
Steam turbines from 10 kW to 1,900 MW
With over a century of experience and continuous development in steam turbine technology, Siemens has stayed at the forefront of development and is a prime partner for your business. With a fleet of more than 60,000 steam turbines worldwide, Siemens is a reliable and experienced partner.

Siemens Steam Turbines are an essential piece of turbo machinery to many power plants worldwide. They are applied either as a generator drive or a mechanical drive for pumps and compressors. The modular design concept of all steam turbines ensures high flexibility, availability and a reduction of time-to-market.

Content:
- Utility steam turbines from 90 MW to 1,900 MW ..................................... 7
- Industrial steam turbines from 2 MW to 250 MW .................................. 27
- Dresser Rand Steam Turbines from <10 kW to 100 MW ........................... 49
- Reference examples ............................................................................ 67
- Performance data overview ................................................................. 82
## Steam Turbine Overview

<table>
<thead>
<tr>
<th>Output (MW)</th>
<th>10</th>
<th>100</th>
<th>1000</th>
</tr>
</thead>
<tbody>
<tr>
<td>SST-9000</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SST-5000</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SST-5000</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SST-4000</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SST-3000</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SST-700/900</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SST-800/1500</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SST-800</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SST-600</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SST-400</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SST-300</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SST-200</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
# Steam Turbines Overview

<table>
<thead>
<tr>
<th>Model</th>
<th>Output (kW)</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>D-R L/A / RLVA</td>
<td>745</td>
<td>52</td>
</tr>
<tr>
<td>D-R RLH</td>
<td>1,865</td>
<td>54</td>
</tr>
<tr>
<td>D-R SST 350</td>
<td>750</td>
<td>50</td>
</tr>
<tr>
<td>D-R SST 500</td>
<td>2,600</td>
<td>50</td>
</tr>
<tr>
<td>D-R SST 700</td>
<td>3,000</td>
<td>50</td>
</tr>
<tr>
<td>D-R 2TA</td>
<td>3,750</td>
<td>56</td>
</tr>
<tr>
<td>D-R AVTW / GTW</td>
<td>4,500</td>
<td>58</td>
</tr>
<tr>
<td>D-R C</td>
<td>3,600</td>
<td>59</td>
</tr>
<tr>
<td>D-R GAF</td>
<td>4,000</td>
<td>60</td>
</tr>
<tr>
<td>D-R K</td>
<td>4,850</td>
<td>65</td>
</tr>
<tr>
<td>D-R R / RS</td>
<td></td>
<td>64</td>
</tr>
<tr>
<td>D-R B</td>
<td></td>
<td>62</td>
</tr>
<tr>
<td>D-R Tandem (B-B, B-C)</td>
<td></td>
<td>63</td>
</tr>
</tbody>
</table>
Siemens offers a comprehensive range of steam turbine products in the power output range from 90 to 1,900 MW. These are used in conventional fossil-fired steam power plants as well as in nuclear and combined cycle power plants. With more than 8,000 steam turbines in service worldwide we provide proven technology, adapted to the specific local conditions.

Utility steam turbines from 90 to 1,900 MW

SST-3000 ................................................................. 8
SST-4000 ................................................................. 12
SST-5000 ................................................................. 16
SST-6000 ................................................................. 20
SST-9000 ................................................................. 24
The Ribatejo power plant was one of the most technologically advanced combined cycle power plants at the time of construction. In operation: unit1: 02/2004, unit2: 10/2004, unit3: 03/2006

Net plant output: 3 x 390 MW
Steam turbine output: 3 x 142 MW
Scope of supply: 3 x SGT5-4000F, 3 x SST5-3000, 3 x SGen5-2000H
Main steam conditions: 125 bar / 1,813 psi, 565 °C / 1,049 °F
Reheat steam conditions: 555 °C / 1,031 °F

In our Siemens Steam Turbine portfolio, we offer with the SST-3000 series steam turbine a compact arrangement, that features a two-cylinder design with an axial exhaust for use in combined cycle power plants. Steam turbines of SST-3000 series are exceptionally compact machines for use in combined cycle power plants.

- High turbine efficiency
- Enhanced operational flexibility, high availability and long lifetime
- Low complexity and low total plant costs
- Short project schedule and installation time

SST-3000
Utility steam turbine package

Flexible steam turbine for applications in single-shaft and multi-shaft combined cycle configurations

The SST-3000 series covers the power output range from 90 to 250 MW. It features a separate high-pressure (HP) turbine and combined intermediate-pressure / low-pressure (IP/LP) turbine with single flow axial exhaust for 50 and 60 Hz applications.

<table>
<thead>
<tr>
<th>Performance characteristics</th>
<th>90 MW up to 250 MW</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency</td>
<td>50 or 60 Hz</td>
</tr>
<tr>
<td>Main steam conditions</td>
<td>up to 177 bar / 2,567 psi</td>
</tr>
<tr>
<td>Inlet temperature</td>
<td>up to 565°C / 1,049°F</td>
</tr>
<tr>
<td>Last stage blade length</td>
<td>50 Hz: 80 cm to 115 cm / 31 inches to 45 inches, 60 Hz: 76 cm to 95 cm / 30 inches to 38 inches</td>
</tr>
</tbody>
</table>
Bearing

Single bearing arrangement between IP and LP turbine cylinders for simple alignment and stable operation.

High pressure turbine

Barrel type HP turbines, no half joint flange connection.
Single flow high pressure turbine with circular inner and outer casing, optimum thermal loading and small clearances.

Intermediate pressure / low pressure turbine

IP / LP turbine with circular inner and outer casing for minimal thermal deflection and minimal clearances for high efficiency. The exhaust area is designed in a modular way, so it can be adapted to customer site conditions. The condenser is installed in axial direction to create a compact machine house.

Combined stop and control valve

For easy opening of steam turbine casing valves are connected to the lower part of the outer casing via bolt connection.
**Utility steam turbine package**

**Powerful and reliable – thanks to proven design for high efficiency**

The SST-4000 series is our specialized turbine for non-reheat, combined cycle applications. With the specialized design of the blade path, the entire power range from 100 to 500 MW can be covered with the highest reliability and availability. More than 40 turbines of this type are already in operation or in the commissioning stage, with a total installed capacity of approximately 8,200 MW.

The SST-4000 series consists of an intermediate-pressure and a low-pressure turbine. The installation is either high or low level arrangement with down, double-side or single-side exhaust. The turbine is able to provide process steam e.g. for industries or sea water desalination and can provide industrial heating.

Thanks to its systematically modular design, the SST-4000 series can easily be adapted to the individual operating conditions and thermal cycle design of the plant. Its fast installation, thanks to prefabricated, tested modules delivered ready for connection, is of additional advantage.

---

**Al Ezzel, Bahrain**

The power plant makes an important contribution towards meeting the country’s growing power demand in an economic and environmentally compatible manner.

**Customer:**
Al Ezzel Power Company

**Plant type:**
SCC5-2000E multi shaft 2 x 1

**Power output:**
2 x 475 MW (power plant)

**Commercial operation:**
unit 1: 04 / 2006
unit 2: 05 / 2007

---

**Technical data**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power output</td>
<td>100 up to 500 MW</td>
</tr>
<tr>
<td>Frequency</td>
<td>50 or 60 Hz</td>
</tr>
<tr>
<td>Steam conditions</td>
<td>Steam conditions: up to 105 bar / 1,523 psi</td>
</tr>
<tr>
<td>Last stage blade length</td>
<td>up to 116 cm / 45 inches</td>
</tr>
</tbody>
</table>

---

**Suitable for operations in condensation and back-pressure mode**

**Proven designs for highly efficient, continuous operation**

**Low space requirement due to compact design, low investment costs**

**Short start-up times**

**Modular of suitable reaction type**

**Long service intervals lead to low maintenance costs and high availability**
Combined stop and control valve

Valve connection below the horizontal flange of the IP turbine for easy maintenance.

Intermediate pressure turbine

IP turbine with circular inner and outer casing for minimal thermal deflection and minimal clearances for high efficiency.

Low pressure turbine

Inner and outer casing of the double flow turbine are mechanically decoupled. That allows minimal radial clearances resulting in maximum efficiency. The condenser is installed on one side or as a special requirement below, or on both sides of the low pressure turbine.

Single crossover pipe

Crossover pipe designed to minimize losses, reduces plant complexity and minimizes footprint.

Single bearing arrangement between IP and LP turbine cylinders for simple alignment and stable operation.
A steam turbine with short start-up times and variable start-up modes to ensure grid stability

Senners Steam Turbine of the SST-5000 series are operated in combined cycle power plants (CCPP) and in coal-fired steam power plants (SPP). The SST-5000 steam turbine, combined with an SGT-8000H gas turbine, achieves a class record net plant efficiency of more than 63 percent in combined cycle applications.

The SST-5000 is suitable for supercritical and ultra-supercritical steam power plants. Due to its higher pressure and temperature ratings, power plant efficiency increases to more than 46 percent and overall performance is improved. In steam power plants the SST-5000 consists of a combined high pressure/intermediate pressure turbine, and one or two low pressure turbines with down exhaust, single sided or double sided exhaust. It is installed in a low- or high-level arrangement. Various extractions (up to 9 stages) contribute to an optimized plant efficiency.

| Class record efficiency in combined cycle applications |
| Option for combined heat and power |
| Long maintenance intervals to reduce lifecycle costs |
| Flexible steam extractions |
| Short start-up times and flexible start-up modes |
| Highest reliability and availability |
| Remote performance control |

Lausward “Fortuna”, Germany

The combined cycle power plant set three world records: in the acceptance test a maximum electrical net output of 603.8 MW was achieved and the net energy conversion efficiency was around 61.5 percent.

- overall plant efficiency considering thermal extraction was above 85% - 100 MW thermal power extraction through one steam turbine train

Plant type: SCS-8000H 1S (single shaft)
Power output: 604 MW
Efficiency: 61.5%

| Power output | 120 MW to 650 MW | 200 MW to 500 MW |
| Efficiency | 61.5% in combined cycle | 43% for subcritical |
| Frequency | 60 or 60 Hz |
| Main steam conditions | up to 600 °C / 1,112 °F |
| Steam temperature | up to 680°C / 1,264 °F |
| Reheat steam conditions | up to 610°C / 1,130 °F |
| Temperature | up to 610°C / 1,130 °F |
| Last stage blade length | 66 cm to 142 cm / 26 inches to 56 inches |

Remote performance control

Lausward “Fortuna”, Germany

The combined cycle power plant set three world records: in the acceptance test a maximum electrical net output of 603.8 MW was achieved and the net energy conversion efficiency was around 61.5 percent.

- overall plant efficiency considering thermal extraction was above 85% - 100 MW thermal power extraction through one steam turbine train

Plant type: SCS-8000H 1S (single shaft)
Power output: 604 MW
Efficiency: 61.5%
Combined stop & control valve

Crossover pipe designed to minimize losses, reduce plant complexity and minimize footprint.

High-pressure / intermediate-pressure turbine

Value connection below the horizontal flange of the IP turbine for easy maintenance.

Low-pressure turbine

Inner and outer casing of the double-flow turbine are mechanically decoupled. This ensures minimal radial clearances resulting in maximum efficiency. The condenser is installed either below, on one side or on both sides of the low-pressure turbine.

Single bearing arrangement between IP-IP and LP turbine cylinders for simple alignment and stable operation.

Combined HI turbine with circular inner and outer casing for minimal thermal deflection and minimal clearances for high efficiency.
Reduced lifecycle costs with the SST-6000 steam turbine

Siemens Steam Turbines of the SST-6000 series are widely operated in steam power plants with a power output up to 1,200 MW and net plant efficiencies of more than 46 percent. Turbine trains of the SST-6000 series consist of a high-pressure turbine, an intermediate-pressure turbine, and up to three low-pressure turbines for 50 and 60 Hz.

The SST-6000 is installed in a high-level arrangement with down exhaust. Various extractions (up to 10 stages) are available for feedwater preheating, process steam, and district heating. The globally installed capacity of the SST-6000 fleet is more than 100,000 MW.

**SST-6000**

Utility steam turbine package

- Long maintenance intervals to reduce lifecycle costs
- Proven performance throughout the entire product lifetime
- Short start-up times and flexible start-up modes
- Highest reliability and availability

Eemshaven, Netherlands

Thanks to a highly efficient power plant process the Eemshaven steam power plant consumes less hard coal compared to the average of coal-fired power plants. This leads to a reduction in CO₂ emissions of 2.5 million metric tons per year.

**Power output:** 2 × 800 MW

**Efficiency:** 46.2%

**Main Steam:**
- Pressure: 275 bar / 4,066 psi
- Temperature: 590 °C / 1,094 °F

**Reheat Steam:**
- Temperature: 609 °C / 1,128 °F

**Commissioning:** 2014

**CO₂ emissions**

The globally installed capacity of the SST-6000 fleet is more than 100,000 MW.
Intermediate-pressure turbine
- Double-flow intermediate-pressure turbine
  - Circular inner and outer casing for minimum thermal deformation and minimum clearances for high efficiency
  - Shipped to site fully assembled for smooth erection and start

High-pressure turbine
- Barrel type HP turbine, no half joint flange connection
- Single-flow high-pressure turbine with circular inner and outer casing, optimum thermal loading and small clearances.

Bearing
- Fixed bearing
  - Single, fixed bearing arrangement between HP and IP turbine cylinders for simple alignment and stable operation
  - Fixed bearing pedestals on foundation crossbeams

Crossover pipe
- Single crossover pipe
  - Large diameter pipe to minimise losses and to reduce plant complexity and steam turbine footprint.

Low-pressure turbines
- Double-flow low-pressure turbines
  - Inner and outer casing are mechanically decoupled preventing displacement and deformation of the inner casing. That allows minimal radial clearances resulting in maximum efficiency
  - The outer casing is directly welded on the condenser underneath the low pressure turbine casing.

Valve
- Combined stop & control valve
  - For easy opening of steam turbine casing valves are connected to the lower part of the outer casing via bolt connection.
SST-9000
Utility steam turbine package

Leading technology for efficient, flexible and reliable power generation
The SST-9000 is a highly reliable steam turbine for applications in the conventional islands of advanced pressurized water reactors in nuclear power plants, with a power output up to 1,900 MW.

The half-speed SST-9000 features a double-flow saturated steam high-pressure (HP) turbine and up to three double-flow low-pressure (LP) turbines with shrunk-on disk rotors.

Shrunk-on disk design features proven technology: eliminating stress-corrosion cracking and replacement of the low-pressure rotors or disks during the design life-time.

Olkiluoto 3, Finland
Nuclear Power Plant

Customer:
Teollisuuden Voima Oyj (TVO)

Scope of supply:
Conventional Island

Commercial Operation:
Jan 2020 (planned)

Power Output:
Approx. 1,600 MW (net)

Grid Frequency:
50 Hz

Turbine Frequency:
25 Hz

Olkiluoto, Finland

Photo: @TVO

<table>
<thead>
<tr>
<th>SST-9000</th>
<th>Power output (net)</th>
<th>Frequency</th>
<th>Inlet pressure</th>
<th>Inlet temperature</th>
<th>Turbine frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1,000 to 1,900 MW</td>
<td>50 Hz</td>
<td>up to 88 bar / 1,280 psi</td>
<td>up to 390°C / 736°F</td>
<td>25 Hz</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>117 cm to 183 cm / 46 inches to 72 inches</td>
<td>107 cm to 142 cm / 42 inches to 56 inches</td>
<td></td>
</tr>
</tbody>
</table>
As a market leader for industrial steam turbines, we offer a comprehensive range of reliable and versatile steam turbines for the power output range from 2 to 250 MW. Our industrial steam turbines are designed for easy constructability, fast start-up and economical operation.

Industrial steam turbines from 2 to 250 MW

<table>
<thead>
<tr>
<th>Model</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>SST-200</td>
<td>28</td>
</tr>
<tr>
<td>SST-300</td>
<td>30</td>
</tr>
<tr>
<td>SST-400</td>
<td>34</td>
</tr>
<tr>
<td>SST-600</td>
<td>36</td>
</tr>
<tr>
<td>SST-800</td>
<td>40</td>
</tr>
<tr>
<td>SST-800/500</td>
<td>44</td>
</tr>
<tr>
<td>SST-700/900</td>
<td>46</td>
</tr>
</tbody>
</table>
The Siemens SST-200 Siemens industrial steam turbine product line is based on the reaction blade technology. The turbine series follows a modular product philosophy, ensuring a high level of performance and reliability.

The ability to combine standardized casing modules enable optimal design flexibility. This allows the turbine series to achieve high performance in combination with an optimal cost position.

Each steam path is customized for optimal fit to the specific thermal cycle requirements providing high efficiency over the entire operating range.

The inlet and exhaust sections are configured to cover different plant configuration needs and are used in condensing configurations as well as in back pressure applications.

With this flexible approach the SST-200 covers the range of both industrial mechanical drive and industrial power generation applications.

The product design closely follows API 612 requirements.
The SST-300 is an optimal solution for a wide range of applications due to the implementation of the best technology combined with over 20 years of experience. In the last decade alone, this turbine has been installed in over 500 industrial and power applications by customers all over the world.

The flexible configuration of the SST-300 enables it to be used in diverse applications such as waste to energy, chemical processing, pulp and paper, cement and many more.

All components and auxiliaries including the lube oil system are mounted on a common base frame or skid. Short erection time at site due to a “plug and play” system. Fast, easy and flexible layout planning.

**Waste-to-energy plant, Lincoln / UK**

In operation since 2014, the Lincolnshire Waste-to-energy facility provides a safe, sustainable and affordable waste treatment solution to dispose of household waste, with a useful and profitable by-product: electricity. It burns 150,000 t of waste a year.

Power output: 25.15 MW

Speed: 5,300 rpm

Live steam pressure: 58 bar / 841 psi

Live steam temperature: 397 °C / 746 °F

Exhaust steam pressure: 0.07 bar / 1 psi

**SST-300 Industrial steam turbine**

**Typical applications**

- Biomass plants
- Chemical and petrochemical industry
- Cement industry
- Combined cycle power plants and combined heat and power plants
- Concentrated solar power plants
- District heating
- Waste-to-energy plants (waste incineration)
- Pulp and paper mills
- Sugar industry
- Steel works and mines

**Technical Data**

- **Power output**: up to 45 MW
- **Speed**: up to 12,000 rpm
- **Inlet steam parameters**: 140 bar / 2,030 psi
- **Inlet temperature**: 540 °C / 1,004 °F
- **Exhaust steam parameters**: Back pressure up to 16 bar / 232 psi
- **Condensing**: up to 0.3 bar / 4.4 psi
- **District heating**: up to 3.0 bar / 43 psi
- **Controlled extractions (up to 2)**: Single or double, adaptive stage, nozzle control, throttle control, pressure up to 25 bar / 362 psi, temperature 400 °C / 752 °F
- **Uncontrolled extractions (up to 6)**: Pressure up to 60 bar / 870 psi

Waste-to-energy plant, Lincoln / UK
Valve arrangement

Internal valve arrangements (or adaptive stages) control the steam flow and maintain constant process steam extraction pressures over a wide flow range.

Base frame

SST-300 turbines are delivered as packaged units with simple or integrated base frame. The oil tank is inside the base frame. Only a minimal number of external connections, which are clearly defined according to standards, ensure fast and easy installation.

Exhaust

Equipped with upward, downward or axial exhaust orientation

Turbine Casing

The nearly symmetrical casing allows short start-up times and quick load changes.

Reaction Blading

The rotor is fitted with resonance-proof fully shrouded blading. The last stage is free standing with a damping wire (condensing steam turbine).
SST-400

Industrial steam turbine

The SST-400 is a single casing steam turbine, providing geared or direct drive to 50 and 60 Hz generators, or to compressors and pumps. The symmetrical casing with horizontal joint flange enables the SST-400 to achieve short start-up times and rapid load changes. The modular package design allows a wide variety of configurations to satisfy the customer's individual needs in the most economic way. The utilization of selected proven components assures high reliability and easy maintenance.

The SST-400 can be equipped with upsteam, downsteam or axial exhaust to fit with the selected installation. The turbine skid can be combined with standardized gearbox-oil units and generators to a turboset, according to the customer's needs. The turbine skid and gearbox-oil unit are fully assembled in the workshop before being shipped to the site. Our proven installation and maintenance concept lowers maintenance cost by enabling easy access to the installed components, the turbine, gearbox, and generator.

Waste-to-energy plant, Mallorca/Spain

Tourism drives the local development and welfare of the Mediterranean island. The significant increase in hotel capacity causes the population to vary between about 1 million in winter and 6 million in summer. This poses a challenging task for the proper disposal of daily waste. The EfW plant in Palma de Mallorca has a capacity of about 430,000 t per year. Mallorca reached zero landfill waste.

Power output: 38 MW (steam turbine)
Speed: 4,500 rpm
Inlet temperature: 397 °C / 746 °F
Inlet pressure: 50 bar / 725 psi

Typical applications

- Power generation industrial power plants
- Biomass & waste
- District heating
- Combined cycle power plants
- Mechanical drive
- Waste heat recovery
**Typical applications**

- Chemical and petrochemical industry
- Pulp and paper mills
- Steel works
- Mines
- Power plants
- Seawater desalination plants
- Biomass and Waste-to-energy plants (waste incineration)

---

**SST-600**

**Flexible condensing or back-pressure steam turbine**

**Generator drive in various packages**

We deliver a standard steam turbine generator set including the SST-600 (with or without gearbox), a generator, oil system, piping and instrumentation and the control system.

The standard package can be extended to include a condenser, condensing plant or pre-heating system.

The SST-600 with its reliable and flexible design is available with axial or radial exhaust.

**Mechanical drive**

The SST-600 is also an efficient and economic mechanical drive. Since the 1970s, hundreds of projects have been successfully implemented all over the world using the SST-600 to directly drive everything from the smallest boiler feedwater pump just as reliably as the largest compressor even in the most complex processes.

The SST-600 complies with regulations including the API standard.

---

**SST-600**

**Power output up to 200 MW**

**Speed** 3,000 to 18,000 rpm

**Live steam parameters**

- **Inlet pressure** up to 165 bar / 2,393 psi
- **Inlet temperature** up to 565 °C / 1,050 °F

**Exhaust steam parameters**

- **Back pressure** up to 80 bar / 1,160 psi
- **Condensing** up to 1.0 bar / 15 psi
- **District heating** up to 3.0 bar / 43 psi
- **Controlled extractions (up to 2)**
  - Pressure, ext. valve up to 72 bar / 1,044 psi
  - Pressure, int. valve up to 45 bar / 798 psi
  - Temperature up to 480 °C / 895° F
- **Uncontrolled extractions (up to 6)**
  - up to 85 bar / 1,233 psi

---

**Biomass district heating plant, Västergötland / Sweden**

The district heating plant operated by Svedö Energy supplies 91 MWth thermal power and 23 MWe electricity. It has been in operation since 2009 and uses wood as fuel. Siemens delivered the complete turboset (SST-600 and generator).

**Power output:** 25 MW

**Live steam temperature:** 519 °C / 966 °F

**Live steam pressure:** 122 bar / 1,769.5 psi

**Exhaust steam pressure:** 0.5 bar / 7.3 psi

**Speed:** 5,000 rpm

---

**Soft reheat up to 400°C**

**Outstanding efficiency**

**Fast start-up times**

**Highest reliability**

**Economic installation and operation**

**Flexibility for complex, industrial processes**
The possibility of applying up to 3 balancing pistons minimizes thrust and allows smaller axial bearings. Thanks to improved journal bearings less oil and a smaller oil tank are needed. The symmetrical design of the upper and lower halves avoids material concentrations and ensures improved thermal behavior and an improved start up time. Can be designed for straight flow, or equipped with uncontrolled and/or controlled extractions.

Intermediated section

Exhaust section

Blades

The improved cylindrical high pressure blades and tapered intermediate pressure blades allow longer airfoils and contribute to the overall high efficiency.

Sealing

The improved sealing system allows more sealing strips per blade row at both moving and stationary blades.

Intermediate section

Casing

A wide range of exhaust sizes and types is available for back-pressure and condensing applications.

The improved cylindrical high pressure blades and tapered intermediate pressure blades allow longer airfoils and contribute to the overall high efficiency.

Bearing

The possibility of applying up to 3 balancing pistons minimizes thrust and allows smaller axial bearings. Thanks to improved journal bearings less oil and a smaller oil tank are needed.
SST-800
Steam turbine with center steam admission

Generator drive in various packages

The SST-800 is a single casing steam turbine with center steam admission and no sleeve flow inner casing, designed for a direct coupled generator or mechanical drive. The power output with dual casing solution is up to 250 MW.

The highly customized turbine provides for an outstanding efficiency, fast start-up times and high reliability and availability. It supports all requirements for economical installation and operation in combination with highest flexibility for complex industrial processes. A double or even multie casing solution can also be provided.

The SST-800 steam turbine can be used for both condensing and back-pressure applications. It is built up from pre-designed modules combined into a single unit for optimum matching of the required parameters. Turbine auxiliary systems are also designed as pre-engineered modules covering the complete range of turbine sizes.

The SST-800 turbine is equipped with impulse control stage and reaction blading fixed in blade carriers. Furthermore the turbine is offered with throttle controlled inlets. The turbine can be arranged on a foundation or as a package (including oil system and on a base frame). The SST-800 steam turbine design is in accordance with DIN or API standards.

Steam Turbines for Pulp & Paper Industry/SST-800, Klabin / Brazil

Two Siemens SST-800 steam turbines are supplying electricity and process steam to a pulp factory in Brazil. The SST-800 has a capacity of 190 megawatts (MW), making it among the largest steam turbines in use in the pulp and paper industry worldwide.

Power output: 190 MW

Speed: 3,600 rpm

Inlet steam pressure: up to 100 bar / 1,450 psi

Inlet steam temperature: 498 °C / 928 °F

Steam turbine for the pulp plant Klabin, Brazil

Steam turbine with center steam admission

Typical applications

- Combined cycle power plants (CCPP)

- Combined heat and power plants (CHP)

- Oil & Gas industries

- Industrial power plants (e.g. captive power plants in chemical and petrochemical industries, manufacturing industries, paper mills, mines, metal and cement plants, waste heat recovery)

- District heating plants

- Biomass plants and waste-to-energy plants (WtE)

- Concentrated solar power plants (CSP)
SST-800

Center steam admission

The reverse flow adjusts the thrust and relieves the bearings of large steam turbines.

Bearings

Simplified maintenance due to horizontal casing split and/or independently accessible bearings.

Steam path

Highly customized section with up to 2 internally or externally controlled extractions and up to 7 uncontrolled extractions.

Exhaust section

Axial or downward connection for condensing, upward or downward connection for back pressure is provided.

Casing

The steam turbine casing is based on a combined housing concept featuring a cast steel and welded design. The material mix ensures high availability and reduced delivery times.
SST-800/500

Double exhaust flow steam turbine in a single or multi-casing solution

The SST-500 is a single casing, double exhaust flow steam turbine, which can be used as an entire drive or as the low-pressure module of a multiple-casing turbine, directly driven or geared. This turbine, with its capacity to operate over a wide range of speed and power, is ideal for large steam volume flows.

Steam flows into the turbine via non-tangential inlets to equalize thermal loading and blade stress. Emergency stop valves and control valves are installed in the steam inlet pipes. The steam flows tangentially into the inner casing and then axially to both exhausts. The customized design of the steam path allows exact adjustment to surpass general physical limitations of the last stage blades. Double-end drive is available, if required, e.g. for booster pump drive.

SST-800/500 Double-casing reheat solution

BSolarthermal power plant, Morocco
Customer: Masen, Ouarzazate Solar Power Station
Project: Three dual-casing steam turbines put into service at the Noor II (a solar tower plant) in a SST-500/800
Power output: 200 MW
Inlet temperature: 380°C / 716°F
Inlet pressure: 105 bar(a) / 1,522 psi

Power output: up to 100 MW
Speed: up to 15,000 rpm
Inlet pressure: up to 30 bar / 435 psi
Inlet temperature: up to 400 °C / 750 °F

Steam extraction:
- Uncontrolled (up to 2)
- Various pressure levels

Exhaust steam parameters:
- District Heating: up to 1 bar / 14.5 psi
- Condensing: up to 0.5 bar / 7.25 psi

Steam turbine generator set employed in Noor II (a solar tower plant) in a SST-500/800

Power output:
- SST-500: up to 100 MW
- SST-800: up to 200 MW

Inlet pressure: up to 30 bar / 435 psi
Inlet temperature: up to 400 °C / 750 °F

Double-casing reheat or non-reheat solution
- Customized steam path
- Short delivery time due to extensive pre-design
- Easy access to mechanical components facilitates maintenance

Typical applications
- Solarthermal power plants
- Combined cycle plants
- Pump drive (e.g. feedwater pump for large boilers)
- Generator drive
- Compressor drive
- Chemical industry
- Steelworks
- Waste to energy, e.g. waste incinerators
- Waste heat from chemical processes
SST-700 / 900

Industrial steam turbine

- Fast load changes
- Short start up times
- Highest with reheat efficiency
- Increased life cycle
- Low level arrangement
- Reheat application

Economical dual casing steam turbine for reheat applications

The SST-700 / 900 is a standard turbine solution with short delivery time due to its fixed pre-engineered design. Predefined modules enable a short manufacturing period, cost-efficient material supply and a fast ex-works delivery. The straight flow turbine solution with power output of up to 250 MW consists of a geared high-pressure steam turbine (backpressure), an intermediate/low-pressure steam turbine (condensing), both driving a generator installed in between.

The dual casing reheat turbine configuration with inner casing is a competitive and optimized product for combined cycle power plants and concentrated solar power plants.

Parabolic trough technology in Morocco

On February 4, 2016, the King of Morocco, Mohammed VI, inaugurated the Noor I unit of Ouarzazate Solar Power Station. This is the first of four phased Noor projects at Ouarzazate site which are expected to provide a total electrical generating capacity of 580 megawatts, making it the largest complex of its kind in the world. Siemens is supplying three turbine-generator sets for the power station.

Steam turbine: SST-700/900

Power output: 160 MW

Inlet steam temperature: 380°C / 716°F

Inlet steam pressure: 168 bar(a) / 2,437 psi

Exhaust pressure: 0.06 bar(a) / 0.87 psi

“Fast load changes”

“Short start up times”

“Highest with reheat efficiency”

“Increased life cycle”

“Low level arrangement”

“Reheat application”

Steam turbine SST-900 for the CSP-plant NOOR III, Morocco

Typical applications

- Combined cycle power plants
- Concentrated solar thermal power plants
- Biomass-fired power plants
With the D-R steam turbine portfolio Siemens has the most comprehensive range of API turbines available on the market, including:

- Standard single stage turbines for pump, fan & small compressor drives according to API 611 General Purpose (GP) standard
- Standard and engineered single stage turbines as generator drives for waste heat recovery applications
- Engineered single stage turbines for applications according to API 611 (General Purpose — GP) or API 612 (Special Purpose — SP) standards
- Standard multistage turbines for larger pumps, fans & compressors to API 611 or API 612 standards, or for power generation
- Turbines for geothermal plants
- Turbines for expansion of ORC and process fluids

As required either bare ST drivers to OEMs, or complete packages including gears, lube oil systems and controls are supplied

Benefits:

- Highest levels of quality & reliability for the most critical services in the business
- All units factory tested in accordance with API and customer requirements
- Units with modular designs, but engineered to order, according to customer project specifications & standards and local environmental requirements
D-R SST 350 / 500 / 700

Standard single stage steam turbine

- Rugged, versatile design
- Woodward TG-OE Relay NEMA Class A constant speed governor or electronic governor
- Horizontally split casing with centerline support
- Overspeed mechanical trip valve, separated from governor valve
- Carbon ring or labyrinth sealing glands
- Built-in, removable steam strainer

- API style blanket lagging/insulation (API applications)
- Oil ring lubricated with forced pressure lubrication or circulating oil cooling options
- Rolling element or Tiltpad thrust bearings
- Broad range of controls and accessories available
- WORTHINGTON heritage

Typical applications
- Refineries
- Petrochemical plants
- Palm oil plants
- Food processing
- Steel industry
- Pulp & Paper
- Institutional
- Process waste heat recovery
- Replacement of steam pressure reduction valve
- Feed water pumps
- Process pump drives
- Cooling water pumps
- Fans
- Compressors
- Generators

Technical Data

<table>
<thead>
<tr>
<th>Specification</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power Output (kW)</td>
<td>2,460</td>
</tr>
<tr>
<td>Turbine Speed (rpm)</td>
<td>≤ 12,000</td>
</tr>
<tr>
<td>Inlet Steam Temperature (°C)</td>
<td>≤ 482</td>
</tr>
<tr>
<td>Inlet Steam Pressure (bar(a))</td>
<td>≤ 63</td>
</tr>
<tr>
<td>Back Pressure (bar(a))</td>
<td>≤ 21</td>
</tr>
<tr>
<td>Type of wheel/ blades</td>
<td>Curtis/Impulse</td>
</tr>
<tr>
<td>API 611 and API 612</td>
<td>Yes</td>
</tr>
<tr>
<td>Bearings</td>
<td>Sleeve, Thrust or Tiltpad</td>
</tr>
</tbody>
</table>

Standard single stage steam turbine

D-R SST 350 / 500 / 700

- Rugged, versatile design
- Woodward TG-OE Relay NEMA Class A constant speed governor or electronic governor
- Horizontally split casing with centerline support
- Overspeed mechanical trip valve, separated from governor valve
- Carbon ring or labyrinth sealing glands
- Built-in, removable steam strainer

- API style blanket lagging/insulation (API applications)
- Oil ring lubricated with forced pressure lubrication or circulating oil cooling options
- Rolling element or Tiltpad thrust bearings
- Broad range of controls and accessories available
- WORTHINGTON heritage

Typical applications
- Refineries
- Petrochemical plants
- Palm oil plants
- Food processing
- Steel industry
- Pulp & Paper
- Institutional
- Process waste heat recovery
- Replacement of steam pressure reduction valve
- Feed water pumps
- Process pump drives
- Cooling water pumps
- Fans
- Compressors
- Generators

Technical Data

<table>
<thead>
<tr>
<th>Specification</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power Output (kW)</td>
<td>2,460</td>
</tr>
<tr>
<td>Turbine Speed (rpm)</td>
<td>≤ 12,000</td>
</tr>
<tr>
<td>Inlet Steam Temperature (°C)</td>
<td>≤ 482</td>
</tr>
<tr>
<td>Inlet Steam Pressure (bar(a))</td>
<td>≤ 63</td>
</tr>
<tr>
<td>Back Pressure (bar(a))</td>
<td>≤ 21</td>
</tr>
<tr>
<td>Type of wheel/ blades</td>
<td>Curtis/Impulse</td>
</tr>
<tr>
<td>API 611 and API 612</td>
<td>Yes</td>
</tr>
<tr>
<td>Bearings</td>
<td>Sleeve, Thrust or Tiltpad</td>
</tr>
</tbody>
</table>
D-R RLA / D-R RLVA
Standard single stage steam turbine

**Typical applications**
- Refineries
- Petrochemical and chemical plants
- Food processing
- Institutional
- Process pump drives
- Process waste heat recovery
- Replacement of steam pressure reduction valves
- Lube oil pumps

**RLA**
- Rugged, versatile design
- Radially split casing with centerline support
- Woodward TG Oil Relay NEMA Class A constant speed governor
- API 611 compliant, positive seating, mechanical overspeed trip valve
- Built-in removable steam strainer
- Removable carbon ring sealing glands
- API style blanket lagging / insulation (API applications)
- API ring lubricated
- Separate double seated governor valve
- Broad range of controls and accessories available
- COPPUS heritage

**RLVA**
- Rugged, versatile design
- Radially split casing
- Vertical shaft design with NEMA motor mounting flange & various ball thrust bearing configurations
- Woodward TG Oil Relay NEMA Class A constant speed governor
- API 611 compliant, positive seating, mechanical overspeed trip valve
- Separate double seated governor valve
- Built-in removable steam strainer
- Removable carbon ring sealing glands
- API style blanket lagging / insulation (API applications)
- Grease lubricated with circulating oil options
- Wide range of controls and accessories available
- COPPUS heritage

**Technical Data**

<table>
<thead>
<tr>
<th>D-R RLA / RLVA</th>
<th>Power (kW)</th>
<th>745 / 1,000 HP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Turbine speed</td>
<td>≥ 6,000 rpm</td>
<td></td>
</tr>
<tr>
<td>Inlet steam temperature</td>
<td>≤ 440 °C / 825 °F</td>
<td></td>
</tr>
<tr>
<td>Inlet steam pressure</td>
<td>≤ 47 bar(a) / 682 psi</td>
<td></td>
</tr>
<tr>
<td>Back pressure</td>
<td>≤ 12 bar(a) / 179 psi</td>
<td></td>
</tr>
</tbody>
</table>

**Type of wheel / blades**
- Curtis / Impulse

**API 611 compliant**
- Yes

**Lubrication**
- Ball bearing journal & thrust
D-R RLH

Standard single stage steam turbine

Typical applications
- Refineries
- Petrochemical plants
- Food processing
- Institutional
- Process waste heat recovery
- Replacement of steam pressure reduction valve
- Process pump skids
- Feed water pumps
- Lube oil pumps

D-R RLH

- Rugged, versatile design
- Woodward TG Oil Relay NEMA Class A constant speed governor or electronic governor
- Horizontally split casing with centerline support
- API 611 compliant, positive seating, mechanical overspeed trip valve
- Separate double seated governor valve
- Built-in removable steam strainer
- Carbon ring sealing glands
- API style blanket lagging/insulation (API applications)
- Carbon ring sealing glands
- Oil ring lubricated with forced pressure lubrication or circulating of cooling options
- Broad range of controls and accessories available
- COPPER heritage

Technical Data

<table>
<thead>
<tr>
<th>Specification</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power output</td>
<td>1,865 kW / 2,500 HP</td>
</tr>
<tr>
<td>Turbine speed</td>
<td>6,000 rpm</td>
</tr>
<tr>
<td>Inlet steam temperature</td>
<td>≤ 482°C / 900°F</td>
</tr>
<tr>
<td>Inlet steam pressure</td>
<td>≤ 97 bar(a) / 1.414 psi</td>
</tr>
<tr>
<td>Back pressure</td>
<td>≤ 22 bar(a) / 314 psi</td>
</tr>
<tr>
<td>Type of wheel/blades</td>
<td>Curtis/Impulse</td>
</tr>
<tr>
<td>API 611 compliant</td>
<td>Yes</td>
</tr>
<tr>
<td>Bearings</td>
<td>Ball and sleeve bearing designs</td>
</tr>
</tbody>
</table>
**D-R 2TA**

**Single stage steam turbine**

- Horizontally split casings
- Between bearing design
- Multi Valve or Single Valve inlet
- Solid or built-up rotor
- Carbon ring or labyrinth glands
- Electronic governor
- Electronic overspeed trip
- Separate mechanical or hydraulic trip and throttle valves (option w/o exerciser)
- Auto / quick start capability
- Terry heritage

**Typical applications**
- Pumps and fans drives
- Compressors drives

**Technical Data**

<table>
<thead>
<tr>
<th>D-R 2TA</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Power output</td>
<td>3,640 kW/4,880 HP</td>
</tr>
<tr>
<td>Turbine speed</td>
<td>≤ 12,500 rpm</td>
</tr>
<tr>
<td>Inlet steam temperature</td>
<td>≤ 530 °C/986 °F</td>
</tr>
<tr>
<td>Inlet steam pressure</td>
<td>≤ 104 bar(a)/1,515 psi</td>
</tr>
<tr>
<td>Back pressure (back)</td>
<td>≤ 33 bar(a)/480 psi</td>
</tr>
<tr>
<td>Type of wheel blades</td>
<td>Curtis/Rateau impulse</td>
</tr>
<tr>
<td>API 611 &amp; 612 compliant</td>
<td>Yes</td>
</tr>
<tr>
<td>Bearings</td>
<td>Tilting pad / sleeve</td>
</tr>
</tbody>
</table>

**D-R 2TA**

Power output: 3,640 kW / 4,880 HP

Turbine speed: ≤ 12,500 rpm

Inlet steam temperature: ≤ 530 °C / 986 °F

Inlet steam pressure: ≤ 104 bar(a) / 1,515 psi

Back pressure (back): ≤ 33 bar(a) / 480 psi

Type of wheel blades: Curtis/Rataneau impulse

API 611 & 612 compliant: Yes

Bearings: Tilting pad / sleeve

**Technical Data**

56
D-R AVTTW / GTW

Single stage steam turbine

- Radially split casings
- Integrally geared or direct drive overhung turbine design
- Available in horizontal or vertical configuration (AVTTW)
- Axially split casing
- Multivalve or single valve inlet
- Derivative GTW frame used for compressor drives
- GTW overhung turbine design, direct drive
- Electronic governor
- Electronic overspeed trip

Typical applications
- Waste to Energy
- Biomass Plants
- Marine Applications
- Chemical Industries
- Paper / Sugar Mills
- ORC
- Waste heat recovery

Technical Data

<table>
<thead>
<tr>
<th>D-R AVTTW / GTW</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power output</td>
</tr>
<tr>
<td>Turbine speed</td>
</tr>
<tr>
<td>Inlet steam temperature</td>
</tr>
<tr>
<td>Inlet steam pressure</td>
</tr>
<tr>
<td>Back pressure</td>
</tr>
</tbody>
</table>

Type of wheel / blades: Curtis / Rateau Impulse

API 611 compliant: Yes (with comments)

Bearings: Tilting / Sleeve

D-R C

Single stage steam turbine

- Radially split casings
- Direct drive or Integral Gear operation
- Overhung rotor design
- Multi-Valve or Single Valve Inlet
- Marine Classification approval
- Auto / Quick start ability
- Carbon ring or labyrinth glands
- Nadrowski heritage

Typical applications
- Waste to Energy
- Biomass Plants
- Marine Applications
- Chemical Industries
- Paper / Sugar Mills
- ORC
- Waste heat recovery

Technical Data

<table>
<thead>
<tr>
<th>D-R C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power output</td>
</tr>
<tr>
<td>Turbine speed</td>
</tr>
<tr>
<td>Inlet steam temperature</td>
</tr>
<tr>
<td>Inlet steam pressure</td>
</tr>
<tr>
<td>Back pressure</td>
</tr>
<tr>
<td>Condensing pressure</td>
</tr>
</tbody>
</table>

Type of wheel / blades: Curtis / Rateau Impulse

API 611 & 612 compliance: with revision

Bearings: Tilting / Sleeve
D-R GAF

• Condensing or back pressure steam turbine
• Horizontal casing split
• Between bearings rotor design
• Max. 6 stages
• Single valve inlet
• API 611 or 612 design
• Terry heritage

Typical applications
• API mechanical drive (e.g. pump fans)
• Turbogenerator sets

Technical Data

<table>
<thead>
<tr>
<th></th>
<th>D-R GAF</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power output</td>
<td>3,500 kW / 4,690 HP</td>
</tr>
<tr>
<td>Turbine speed</td>
<td>≤ 6,000 rpm</td>
</tr>
<tr>
<td>Inlet steam temperature</td>
<td>≤ 440 °C / 825 °F</td>
</tr>
<tr>
<td>Inlet steam pressure</td>
<td>≤ 49 bar(a) / 715 psi</td>
</tr>
<tr>
<td>Back pressure</td>
<td>≤ 6 bar(a) / ≤ 87 psi</td>
</tr>
<tr>
<td>Condensing pressure</td>
<td>vacuum</td>
</tr>
<tr>
<td>Type of Blading</td>
<td>Impulse</td>
</tr>
<tr>
<td>API 611 &amp; 612 compliance</td>
<td>Yes</td>
</tr>
<tr>
<td>Bearings</td>
<td>Tilting Sleeve</td>
</tr>
</tbody>
</table>
D-R B

Standard multi-stage steam turbine

D-R B

- Low cost design for high efficiency
- Multivalve inlets
- Multiple uncontrolled bleeds
- External controlled induction
- Double shaft end
- Available as single casing or multiple (tandem) casing machine
- Compact integral package designs
- Multiple externally controlled bleeds

D-R B Tandem

- Multivalve inlets
- Multiple uncontrolled bleeds
- Single automatic controlled extraction/induction
- Extraction pressure up to 40 bar
- Nadrowski heritage

Typical applications
- Turbogenerator sets
- Mechanical drives
- Sugar mills
- Pulp and paper mills
- Metal & Steel
- Waste to energy plants
- Marine applications
- Waste heat recovery

Typical applications

85-87 Tandem

Technical Data

<table>
<thead>
<tr>
<th></th>
<th>D-R B</th>
<th>D-R B Tandem</th>
</tr>
</thead>
<tbody>
<tr>
<td>Max. Power output</td>
<td>12,5 MW</td>
<td>11 MW</td>
</tr>
<tr>
<td>Turbo speed</td>
<td>≤ 9,500 rpm</td>
<td>8,500 rpm</td>
</tr>
<tr>
<td>Inlet steam temperature</td>
<td>≤ 500°C / 932°F</td>
<td>≤ 530°C / 986°F</td>
</tr>
<tr>
<td>Inlet steam pressure</td>
<td>≤ 65 bar / 942 psi</td>
<td>≤ 121 bar / 1,750 psi</td>
</tr>
<tr>
<td>Back pressure</td>
<td>13 bar / 189 psi</td>
<td>13 bar / 188 psi</td>
</tr>
<tr>
<td>Condensing pressure</td>
<td>Vacuum</td>
<td>Vacuum</td>
</tr>
<tr>
<td>Type of wheel / blades</td>
<td>Impulse</td>
<td>Impulse</td>
</tr>
<tr>
<td>API 611 &amp; 612 compliant</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Casing / fluence</td>
<td>Multiple / 1</td>
<td>Multiple / 1</td>
</tr>
<tr>
<td>Bearings</td>
<td>Tilting or sleeve</td>
<td>Tilting or sleeve</td>
</tr>
</tbody>
</table>

85-87 Tandem
Typical applications

- API 611/612 compressor, fan and pump drives
- Hydrogenerator sets, oil & gas and industrial
- Oil & gas, refineries
- Chemical plants
- Food and beverage
- Sugar mills
- Pulp & paper mills
- Waste to energy plants
- Biomass / palm oil plants
- Waste heat recovery

Typical applications – K

- Non-API mechanical drive
  (e.g. pump fans)
- Air conditioning chiller / compressor drives
- Small, low pressure turbogenerator sets

D-R R/RS
Standard multi-stage steam turbines

- Single valve or multi-valve inlets
- Multiple uncontrolled bleeds
- Dual-acting, hydrodynamic, Tiltpad thrust-bearing
- Spherically seated or Tiltpad type journal bearings
- Interchangeable parts
- Standard assemblies and components
- API and non-API options
- Controlling or back pressure
- Up to 11 stages
- Murray heritage

Technical Data

<table>
<thead>
<tr>
<th>Feature</th>
<th>D-R R/RS 25,000 kW / 33,500 HP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power output</td>
<td>25,000 kW / 33,500 HP</td>
</tr>
<tr>
<td>Turbine speed</td>
<td>≤ 15,000 rpm</td>
</tr>
<tr>
<td>Inlet steam temperature</td>
<td>≤ 510 °C / ≤ 950 °F</td>
</tr>
<tr>
<td>Inlet steam pressure</td>
<td>≤ 67 bar(a) / ≤ 972 psi</td>
</tr>
<tr>
<td>Back pressure</td>
<td>≤ 19 bar(a) / ≤ 415 psi</td>
</tr>
<tr>
<td>Condensing pressure</td>
<td>vacuum</td>
</tr>
<tr>
<td>Type of Blading</td>
<td>Impulse</td>
</tr>
<tr>
<td>API 611 &amp; 612 Compliance</td>
<td>Yes</td>
</tr>
<tr>
<td>Bearings</td>
<td>Tiltpad or sleeve</td>
</tr>
<tr>
<td>Bleeds</td>
<td>Multiple / core</td>
</tr>
<tr>
<td>Pressure capability increases above 900 psig at reduced temperature.</td>
<td></td>
</tr>
</tbody>
</table>

D-R K
Standard multi-stage steam turbine

- Condensing or back pressure
- Low cost applications
- Single valve inlet
- For wide range of speeds throughout continuous operation
- Up to 12 stages
- Murray heritage

Technical Data

<table>
<thead>
<tr>
<th>Feature</th>
<th>D-R K 4,850 kW / 6,500 HP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power output</td>
<td>4,850 kW / 6,500 HP</td>
</tr>
<tr>
<td>Turbine speed</td>
<td>≤ 10,000 rpm</td>
</tr>
<tr>
<td>Inlet steam temperature</td>
<td>≤ 389 °C / ≤ 750 °F</td>
</tr>
<tr>
<td>Inlet steam pressure</td>
<td>≤ 28,5 bar(a) / ≤ 415 psi</td>
</tr>
<tr>
<td>Back pressure</td>
<td>≤ 6 bar(a) / ≤ 90 psi</td>
</tr>
<tr>
<td>Condensing pressure</td>
<td>vacuum</td>
</tr>
<tr>
<td>Type of Blading</td>
<td>Impulse</td>
</tr>
<tr>
<td>API 611 &amp; 612 Compliance</td>
<td>No</td>
</tr>
<tr>
<td>Bearings</td>
<td>Tiltpad, Sleeve</td>
</tr>
</tbody>
</table>

Pressure capability increases above 900 psig at reduced temperature.
Reference examples

Our steam turbines meet customer requirements for economic installation and operation as well as providing excellent flexibility for complex processes. Worldwide, hundreds of successfully installed generator drives for power generation or mechanical drives for compressors, blowers and pumps are in operation and reliably provide power.
Reference examples  Steam Power Plants

Ultra-supercritical steam power plant  
Lünen, Germany

Lünen is the cleanest and most efficient hard-coal-fired power plant in Europe. It provides electricity for around 1.5 million households. It also supplies the city of Lünen with district heating.

Using leading-edge Siemens technology makes it possible to save up to a million tons of CO₂ every year.

Power output: 812 MW  
Efficiency: 46%  
Commercial operation: 2013

Ultra-supercritical steam power plant  
Waigaoqiao III, China

Since startup in 2008, Waigaoqiao III has compared to an average Chinese coal-fired power plant saved 900,000 million metric tons of raw coal. The plant reaches an efficiency of up to 45% making it a highly efficient coal plant.

In 2009, Waigaoqiao III was “Asian Power Plant of the Year”, and got an “Asian Power Award”.

Power output: 2 × 1,000 MW  
Efficiency: 43%  
Commercial operation: 2008

Ultra-supercritical steam power plant  
Isogo, Japan

At the time, Siemens was the first company to supply a machine for this temperature range.

Power output: 600 MW  
Steam conditions: 600 °C/610 °C  
Commercial operation: 2002

Ultra-supercritical steam power plant  
Yuhuan, China

In 2008, Yuhuan was China’s most advanced coal-fired power plant and got the “Asian Power Award”.

Power output: 4 × 1,000 MW  
Efficiency: 45%  
Commercial operation: 2007
Reference examples

**Combined Cycle Power Plants**

**Combined cycle power plant Dangjin III**
South Korea

Siemens turbines are making Dangjin III the most efficient combined cycle power plant currently operating in Asia.

- **Power output:** 400 MW
- **Efficiency:** 60%
- **Commercial operation:** 2013

**Combined cycle power plant for the mining industry**
Diamantina, Australia

- **Power output:** 400 MW
- **Efficiency:** 60%
- **Commercial operation:** 2013

**Combined cycle power plant**
Panda Sherman Power Project, Texas, USA

- **Power output:** 758 MW
- **Efficiency:** 60%
- **Commercial operation:** 2013

**Combined cycle power plant for the mining industry**
Diamantina, Australia

Two Power Islands each performing at well in excess of 51% efficiency. The plant provides a total capacity of 242 MW to supply ecofriendly electricity to local mines and to people living in the region.

- **Power output:** 242 MW
- **Commercial operation:** 2014

**Power block for combined cycle power plant**
Nhon Trach 2, Vietnam

The power plant reaches an efficiency of over 57 percent and has very low nitrogen oxide emissions. It entered commercial operation after just 28.5 months.

- **Power output:** 760 MW
- **Efficiency:** 57%
- **Commercial operation:** 2011
Igelsta
Södertalje, Sweden

SST-800: Biomass District Heating Plant

Sweden’s largest biomass plant

Inaugurated in March 2010, the plant uses a biomass fuel mix consisting of about 90% renewable fuels like forest refuse, wood chips, tree bark, and 10% non-recyclable waste paper and plastic. It produces 200 MWe heat and 85 MWe electricity, the equivalent of heating 50,000 households and generating electricity for 100,000 residences.

Steam turbine: SST-800
Power output: 90 MW
Inlet pressure: 85 bar / 1,260 psi
Inlet temperature: 540 °C / 1,004 °F

Afval Energie Bedrijf
Amsterdam/Netherlands

Afval Energie Bedrijf (AEB, Waste and Energy Company Amsterdam) burns 1.7 million tonnes of waste per year and has recently increased its energy generation efficiency from 22% to 30%. The 8% increase resulted from installing a new SST-700 with a steam reheat system.

AEB not only generates power from Amsterdam’s municipal waste, but also recovers and sells materials from the waste stream such as metals and gypsum.

Steam turbine: SST-700, Reheat
Power output: 74 MW
Inlet pressure: 126 bar / 1,813 psi
Inlet temperature: 440 °C / 824 °F
Fuel: Municipal solid waste

Biomass Power Plant Simmering
Vienna, Austria

The Simmering biomass power plant, owned by the Viennese utility Wien Energie, is exclusively fed with fresh wood from the forest. Producing 23.4 MWe electricity in summer and 15.06 MWe plus 37 MWth for district heating in winter, the plant reduces Vienna’s CO2 emissions by 144,000 tons per annum. In operation with heat extraction, total efficiency is 83%.

Steam turbine: SST-400, Reheat
Power output: 23.4 MW
Inlet pressure: 120 bar / 1,740 psi
Inlet temperature: 520 °C / 968 °F
Fuel: Fresh wood

Afval Energie Bedrijf
Amsterdam/Netherlands

Afval Energie Bedrijf (AEB, Waste and Energy Company Amsterdam) burns 1.7 million tonnes of waste per year and has recently increased its energy generation efficiency from 22% to 30%. The 8% increase resulted from installing a new SST-700 with a steam reheat system.

AEB not only generates power from Amsterdam’s municipal waste, but also recovers and sells materials from the waste stream such as metals and gypsum.

Steam turbine: SST-700, Reheat
Power output: 74 MW
Inlet pressure: 126 bar / 1,813 psi
Inlet temperature: 440 °C / 824 °F
Fuel: Municipal solid waste

SST-300 North Hykeham
Lincoln, UK

“We would definitely recommend Siemens. First because we would work again with them, they have provided a machine that is hard to make and hard to integrate into such a kind of plant, and they have been successful with this project” - Tangay Carrabin, Project Manager at CNIM

Power output: 25.15 MW
Speed: 5,300 rpm
Live steam pressure: 58 bar(a)
Live steam temperature: 317°C
Customer: CNIM
Operator: FCC Environment

Reference examples Biomass and Waste-to-energy
Reference examples  Concentrated solar plants

ANDASOL 1 & 2, Granada, Spain

The two CSP plants are located in the Granada area, each covering a field of 1.95 km² of which the mirror field size is about 510,000 m². Both Andasol plants have a thermal storage system using molten salt to absorb part of the heat produced in the solar field during the day. This process almost doubles the number of operational hours per year at the solar thermal power plant. Andasol I went online in 2008 and Andasol II in 2009.

Parabolic trough (O4)
300 MW(th) each.

Steam turbine: 2 x Siemens SST­120
Power output: 2 x 300 MW(e)
Inlet steam pressure: 100 bar / 1,450 psi
Inlet steam temperature: 377 °C / 711 °F

IVANPAH SOLAR POWER COMPLEX, California, USA

BrightSource Energy, a privately owned energy company, developed the Ivanpah Solar Energy Generating System in California's Mojave Desert. It consists of three separate plants using tower technology and provides approximately 400 MW electricity to the US electrical grid. The Ivanpah complex generates enough electricity to power more than 140,000 homes.

Solar Power Tower (Water/Direct Steam)
3 plants, 392 MW(e) in total
Steam turbine: 3 x Siemens SST­900
Power output: 3 x 123 MW(e)
Inlet steam pressure: 160 bar(1,770 psi)
Inlet steam temperature: 540 °C/1,004 °F

IVANPAH SOLAR POWER COMPLEX, California, USA

The PE1 Linear Fresnel demonstration plant, developed by Novatec Biosol AG, commenced selling power to the Spanish grid in March 2009. The 1.4 MW plant, located in Calasparra in the region of Murcia, Spain, has two rows of receivers, each with a length of 860 m, providing direct steam to the steam turbine. Each receiver uses 16 parallel lines of mirrors with a total surface of 18,662 m². A Ruth heat storage system, which utilizes hot water and saturated steam, is used for steam buffering.

Linear Fresnel (Water/Direct Steam)
1.4 MW(e)
Steam turbine: Siemens SST­120
Power output: 1.4 MW(e)
Inlet steam pressure: 55 bar/798 psi
Inlet steam temperature: 270 °C/518 °F (saturated steam)

IVANPAH SOLAR POWER COMPLEX, California, USA

On February 4, 2016, the King of Morocco, Mohammed VI, dedicated the Noor I unit of Ouarzazate Solar Power Station. This is the first of four phased Noor projects at Ouarzazate site which are expected to provide a total electrical generating capacity of 580 megawatts, making it the largest complex of its kind in the world. Siemens is supplying three turbine-generator sets for the power station.

Steam turbine: Siemens SST­700/900
Power output: 160 MW
Inlet steam temperature: 380 °C / 716 °F
Inlet steam pressure: 168 bar(2,437 psi)
Exhaust pressure: 0.06 bar(0.87 psi)
Khanh Hoa (Cam Ranh), Sugar Plant, Vietnam
The Khanh Hoa Sugar Plant is located in the Cam Lam District in central coastal Khanh Hoa Province. It handles roughly 3,000 tons of sugarcane per day.

Technology: SST-300
Complete: 1999
Power output: 25 MW
Speed: 7,161 rpm
Inlet steam pressure: ≤ 46 bar(a) / 667 psi
Inlet steam temperature: ≤ 450 °C / 842 °F
Exhaust pressure: 2.5 bar(a) / 36.9 psi

Mitr Phol, Sugar Plant, Thailand
In 1946 Mitr Phol sugar business was initially established in Ratchaburi province as a small family business producing and trading condensed syrup to sugar mills. Meanwhile, it expanded to an internationally engaged enterprise acting in China, Laos, Australia and other countries.

Technology: SST-300
Complete: 2010
Power output: 26 MW
Switchable bleed for deaerator

Grupo Delta Sucreenergia / Brazil
The efficiency of the SST-600 steam turbine convinced the customer Grupo Delta Sucreenergia. Siemens installed the biggest steam turbine in the sugar-ethanol sector with an power output of 73.5 MW. It is also the first turbine in Brazil to waive the use of gears with direct drive for the generator.

Technology: SST-600
Complete: 2013
Power output: 73.5 MW
Inlet steam temperature: 520°C
Inlet steam pressure: 67 bar(a)
Exhaust: radial downward
Length: 8.5 m
Weight: 130 t

Simbhaoli Sugar, Sugar Plant, India
Simbhaoli Sugars is a technology company with a business mix that spans specialty sugars, quality liquor, technology consultancy, co-generated power, extra neutral alcohol (ENA), ethanol and bio-manure. As India’s largest integrated sugar refinery, the Company has pioneered path-breaking innovations in sugar refining (Multi-Stage Refining and Ion Exchange technology), high value, niche products (specialty sugars) and clean energy (ethanol).

Technology: SST-300
Complete: 2013
Power output: 18 MW
Speed: 6,000 rpm
Inlet steam pressure: 86 ata
Inlet steam temperature: 520°C (950°F)
Exhaust steam pressure: 0.1 ata

Reference examples  Sugar Mills
Siemens Industrial Technologies was appointed as general contractor for the entire electrical engineering, while Siemens Energy won the order for the Hainan Pulp Mill’s power plant.

Technology: 2 x SST-800
Present: 2004
Power output: 120 MW (each)
Inlet steam temperature: 475 °C / 887 °F
Inlet steam pressure: 80.5 bar / 1,167.5 psi
Speed: 3,000 rpm
Extraction steam pressure: 6.5 bar / 94.3 psi
Exhaust steam pressure: 0.13 bar / 1.88 psi

Two Siemens SST-800 steam turbines are supplying electricity and process steam to a pulp factory in Brazil. The SST-800 has a capacity of 190 megawatts (MW), making it among the largest steam turbines in use in the pulp and paper industry worldwide.

Power output: 190 MW
Speed: 3,600 rpm
Inlet steam pressure: 100 bar / 1,450 psi
Inlet steam temperature: 498 °C / 928 °F
Extraction pressure: 10 bar / 145 psi
Exhaust pressure: 5.4 bar / 78.3 psi

Siemens custom designed its SST-300 steam turbine to meet UPM’s specific requirements at the plant and also provided the control systems. The plant incorporating Siemens technologies has enabled the mill to meet all its steam requirements involved in the production of coated papers – and in particular, drying of the paper.

Technology: SST-300
Power output: 27 MW
Speed: 6,800 rpm
Inlet steam pressure: 90 bar / 1,305 psi

Siemens’ mill is responsible for a third of all industrial and commercial electricity consumed across Scotland. With huge amounts of electricity and heat required to drive processes in the pulp and paper industry, UPM was keen to explore ways of reducing its energy costs while improving site competitiveness.

Technology: SST-300
Power output: 27 MW
Speed: 6,800 rpm
Inlet steam pressure: 90 bar / 1,305 psi
Kuwait is forging ahead with a new refinery project costing 4 billion Kuwaiti dinars (Dh49.7bn) despite the oil price slump, Kuwaiti officials said.
The construction of Al Zour refinery is part of plans to boost refining capacity to 1.4 million barrels per day (bpd) by 2019 from 940,000 bpd at present.

Scope of Supply: 57 SSTs for process and water pump drives
Model: RLHB 24
Completion year: 2018 expected completion

Steam Turbine Applied as a Gas Expander Emergency Shut Down Drive
Approximately 85 world wide

Dresser Rand supplied special expander turbines which operate only when a power outage or other mechanical fault causes tripping of the process compressor and/or the main motor drive. When a “kill cycle” is initiated polyethylene or polypropylene reactor gases are routed from the compressor discharge to the turbine inlet (the turbine exhausts to flare) which spins the turbine and drives the compressor train through an SS5 clutch at reduced speed and load for 10 minutes or less. This is adequate time for the process to be poisoned by a “kill gas” which is injected into the reactor vessel thus preventing “solidification” which would require personnel with jackhammers to enter and clean the reactor vessel at a cost of millions in lost production.

Reference examples  Dresser Rand

Morning Star Packing, 24 Single Stage Steam Turbines
California, USA
Application: Mechanical drive for feed water pumps, boiler fans, hydraulics, generators, slurry pumps, fire systems.
The tomato processing window in the US is May through October. Six months of non-stop production requires rugged, reliable equipment which the RLHB24 has earned over the years.
Scope of Supply: 24 Single Stage Turbines
Model: RLHB 24
Shipped: 2014

KNPC New Refinery Single Stage, Mechanical Drive steam turbines
Kuwait
Kuwait is forging ahead with a new refinery project costing 4 billion Kuwaiti dinars (Dh49.7bn) despite the oil price slump, Kuwaiti officials said.
The construction of Al Zour refinery is part of plans to boost refining capacity to 1.4 million barrels per day (bpd) by 2019 from 940,000 bpd at present.

Scope of Supply: 57 SSTs for process and water pump drives
Model: RLHB 24
Completion year: 2018 expected completion

The tomato processing window in the US is May through October. Six months of non-stop production requires rugged, reliable equipment which the RLH24 has earned over the years.
Scope of Supply: 24 Single Stage Turbines
Model: RLHB 24
Shipped: 2014
## Performance data overview

<table>
<thead>
<tr>
<th>Name</th>
<th>Turbine type</th>
<th>Output (MW)</th>
<th>Net efficiency</th>
<th>Rotational Speed</th>
<th>Control</th>
<th>Extraction</th>
<th>Exhaust Pressure</th>
<th>Last stage blade length</th>
</tr>
</thead>
<tbody>
<tr>
<td>SST­9000</td>
<td>1,000–1,900</td>
<td>50 / 60</td>
<td>80 / 1,160</td>
<td>310 / 590</td>
<td>3,000–3,600</td>
<td>117 to 183 / 46 to 72</td>
<td>79.8 to 114.6 / 31.4 to 45.1</td>
<td>76.2 to 95.4 / 30 to 37.6</td>
</tr>
<tr>
<td>SST­8000</td>
<td>800–1,800</td>
<td>50 / 60</td>
<td>565 / 1,049</td>
<td>610 / 1,130</td>
<td>3,000–3,600</td>
<td>72 / 1,044</td>
<td>1.5 / 21.75</td>
<td>79.8 to 114.6 / 31.4 to 45.1</td>
</tr>
<tr>
<td>SST­6000</td>
<td>600–1,200</td>
<td>50 / 60</td>
<td>400 / 750</td>
<td>60 / 870</td>
<td>3,000–8,000</td>
<td>450 / 842</td>
<td>610 / 1,130</td>
<td>79.8 to 114.6 / 31.4 to 45.1</td>
</tr>
<tr>
<td>SST­5000</td>
<td>450–900</td>
<td>50 / 60</td>
<td>140 / 2,030</td>
<td>540 / 1,004</td>
<td>12,000</td>
<td>25 / 363 (up to 2)</td>
<td>450 / 842</td>
<td>79.8 to 114.6 / 31.4 to 45.1</td>
</tr>
<tr>
<td>SST­4000</td>
<td>250–750</td>
<td>50 / 60</td>
<td>120 / 1,740</td>
<td>540 / 1,004</td>
<td>14,600</td>
<td>20 / 290</td>
<td>450 / 842</td>
<td>79.8 to 114.6 / 31.4 to 45.1</td>
</tr>
<tr>
<td>SST­3000</td>
<td>90–250</td>
<td>50 / 60</td>
<td>165 / 2,393</td>
<td>565 / 1,049</td>
<td>12,000</td>
<td>25 / 363 (up to 2)</td>
<td>450 / 842</td>
<td>79.8 to 114.6 / 31.4 to 45.1</td>
</tr>
<tr>
<td>SST­2000</td>
<td>≤ 200</td>
<td>50 / 60</td>
<td>140 / 2,030</td>
<td>540 / 1,004</td>
<td>14,600</td>
<td>1</td>
<td>350 / 562</td>
<td>450 / 842</td>
</tr>
<tr>
<td>SST­1000</td>
<td>≤ 100</td>
<td>50 / 60</td>
<td>30 / 435</td>
<td>400 / 750</td>
<td>15,000</td>
<td>50 / 653 (up to 4)</td>
<td>450 / 842</td>
<td>79.8 to 114.6 / 31.4 to 45.1</td>
</tr>
<tr>
<td>SST­500</td>
<td>≤ 60</td>
<td>50 / 60</td>
<td>140 / 2,030</td>
<td>540 / 1,004</td>
<td>14,600</td>
<td>1</td>
<td>350 / 562</td>
<td>450 / 842</td>
</tr>
<tr>
<td>SST­300</td>
<td>≤ 45</td>
<td>50 / 60</td>
<td>140 / 2,030</td>
<td>540 / 1,004</td>
<td>12,000</td>
<td>25 / 363 (up to 2)</td>
<td>450 / 842</td>
<td>79.8 to 114.6 / 31.4 to 45.1</td>
</tr>
<tr>
<td>SST­200</td>
<td>≤ 20</td>
<td>50 / 60</td>
<td>120 / 1,740</td>
<td>540 / 1,004</td>
<td>14,600</td>
<td>1</td>
<td>350 / 562</td>
<td>450 / 842</td>
</tr>
<tr>
<td>SST­100</td>
<td>≤ 10</td>
<td>50 / 60</td>
<td>105 / 1,523</td>
<td>565 / 1,049</td>
<td>3,000–8,000</td>
<td>45 / 653 (up to 4)</td>
<td>450 / 842</td>
<td>79.8 to 114.6 / 31.4 to 45.1</td>
</tr>
<tr>
<td>SST­700</td>
<td>≤ 250</td>
<td>≤ 250</td>
<td>50 / 60</td>
<td>180 / 2,611</td>
<td>585 / 1,085</td>
<td>60 / 870</td>
<td>1.5 / 21.75</td>
<td>79.8 to 114.6 / 31.4 to 45.1</td>
</tr>
<tr>
<td>SST­600</td>
<td>≤ 200</td>
<td>≤ 200</td>
<td>50 / 60</td>
<td>165 / 2,393</td>
<td>565 / 1,049</td>
<td>3,000–8,000</td>
<td>450 / 842</td>
<td>79.8 to 114.6 / 31.4 to 45.1</td>
</tr>
<tr>
<td>SST­500</td>
<td>≤ 100</td>
<td>50 / 60</td>
<td>120 / 1,740</td>
<td>540 / 1,004</td>
<td>14,600</td>
<td>1</td>
<td>350 / 562</td>
<td>450 / 842</td>
</tr>
<tr>
<td>SST­400</td>
<td>≤ 60</td>
<td>50 / 60</td>
<td>105 / 1,523</td>
<td>565 / 1,049</td>
<td>3,000–8,000</td>
<td>45 / 653 (up to 4)</td>
<td>450 / 842</td>
<td>79.8 to 114.6 / 31.4 to 45.1</td>
</tr>
<tr>
<td>SST­300</td>
<td>≤ 45</td>
<td>50 / 60</td>
<td>105 / 1,523</td>
<td>565 / 1,049</td>
<td>3,000–8,000</td>
<td>45 / 653 (up to 4)</td>
<td>450 / 842</td>
<td>79.8 to 114.6 / 31.4 to 45.1</td>
</tr>
<tr>
<td>SST­200</td>
<td>≤ 20</td>
<td>50 / 60</td>
<td>120 / 1,740</td>
<td>540 / 1,004</td>
<td>14,600</td>
<td>1</td>
<td>350 / 562</td>
<td>450 / 842</td>
</tr>
<tr>
<td>SST­100</td>
<td>≤ 10</td>
<td>50 / 60</td>
<td>105 / 1,523</td>
<td>565 / 1,049</td>
<td>3,000–8,000</td>
<td>45 / 653 (up to 4)</td>
<td>450 / 842</td>
<td>79.8 to 114.6 / 31.4 to 45.1</td>
</tr>
</tbody>
</table>

**Note:** All data is preliminary.
Performance data overview

<table>
<thead>
<tr>
<th>Steam turbine type</th>
<th>Power output (HP)</th>
<th>Inlet Pressure (bar / psi)</th>
<th>Inlet Temperature °C / °F</th>
<th>Rotational Speed rpm</th>
<th>Uncontrolled extraction pressure bar / psi</th>
<th>Reheating</th>
<th>Exhaust Pressure (back) bar / psi</th>
<th>Exhaust Pressure (cond.) bar / psi</th>
<th>Bearings Type of wheel / blades</th>
<th>API compliant</th>
</tr>
</thead>
<tbody>
<tr>
<td>D-R BLAUXA</td>
<td>1,000</td>
<td>47 / 692</td>
<td>540 / 986</td>
<td>4,300–6,000</td>
<td>22 / 305</td>
<td>Impeller</td>
<td>0 / 15</td>
<td>Impeller</td>
<td>Impeller</td>
<td>API-1</td>
</tr>
<tr>
<td>D-R BLUX</td>
<td>965 (HP)</td>
<td>47 / 692</td>
<td>540 / 986</td>
<td>6,000</td>
<td>21 / 305</td>
<td>Impeller</td>
<td>0 / 15</td>
<td>Impeller</td>
<td>Impeller</td>
<td>API-1</td>
</tr>
<tr>
<td>D-R SST/ST/STB</td>
<td>2,500</td>
<td>60 / 862</td>
<td>540 / 986</td>
<td>8,250</td>
<td>27 / 385</td>
<td>Impeller</td>
<td>0 / 15</td>
<td>Impeller</td>
<td>Impeller</td>
<td>API-1 / 1.2</td>
</tr>
<tr>
<td>D-R STLX</td>
<td>3,440</td>
<td>62 / 882</td>
<td>540 / 986</td>
<td>10,250</td>
<td>33 / 502</td>
<td>Impeller</td>
<td>0 / 15</td>
<td>Impeller</td>
<td>Impeller</td>
<td>API-1 / 1.2</td>
</tr>
<tr>
<td>D-R KITRÆST/STT</td>
<td>4,000</td>
<td>62 / 882</td>
<td>540 / 986</td>
<td>14,500</td>
<td>52 / 785</td>
<td>Impeller</td>
<td>0 / 15</td>
<td>Impeller</td>
<td>Impeller</td>
<td>API-1 / 1.2</td>
</tr>
<tr>
<td>D-R K</td>
<td>5,000–2,500</td>
<td>52 / 785</td>
<td>540 / 986</td>
<td>18,000</td>
<td>71 / 105</td>
<td>Impeller</td>
<td>0 / 15</td>
<td>Impeller</td>
<td>Impeller</td>
<td>API-1 / 1.2</td>
</tr>
<tr>
<td>D-R GAF</td>
<td>6,500</td>
<td>64 / 925</td>
<td>540 / 986</td>
<td>22,500</td>
<td>93 / 135</td>
<td>Impeller</td>
<td>0 / 15</td>
<td>Impeller</td>
<td>Impeller</td>
<td>API-1 / 1.2</td>
</tr>
<tr>
<td>D-R KAF</td>
<td>8,500</td>
<td>64 / 925</td>
<td>540 / 986</td>
<td>30,000</td>
<td>115 / 170</td>
<td>Impeller</td>
<td>0 / 15</td>
<td>Impeller</td>
<td>Impeller</td>
<td>API-1 / 1.2</td>
</tr>
<tr>
<td>D-R K</td>
<td>20,500</td>
<td>91 / 1,700</td>
<td>540 / 986</td>
<td>50,000–75,000</td>
<td>1 Joel / 10 Joel</td>
<td>Impeller</td>
<td>0 / 15</td>
<td>Impeller</td>
<td>Impeller</td>
<td>API-1 / 1.2</td>
</tr>
<tr>
<td>D-N E</td>
<td>6,500–2,500</td>
<td>52 / 785</td>
<td>540 / 986</td>
<td>16,000</td>
<td>71 / 105</td>
<td>Impeller</td>
<td>0 / 15</td>
<td>Impeller</td>
<td>Impeller</td>
<td>API-1 / 1.2</td>
</tr>
<tr>
<td>D-R B</td>
<td>8,500</td>
<td>60 / 942</td>
<td>540 / 986</td>
<td>22,500</td>
<td>93 / 135</td>
<td>Impeller</td>
<td>0 / 15</td>
<td>Impeller</td>
<td>Impeller</td>
<td>API-1 / 1.2</td>
</tr>
<tr>
<td>D-R B Tandem</td>
<td>12,000</td>
<td>54 / 785</td>
<td>540 / 986</td>
<td>30,000</td>
<td>1 Joel / 10 Joel</td>
<td>Impeller</td>
<td>0 / 15</td>
<td>Impeller</td>
<td>Impeller</td>
<td>API-1 / 1.2</td>
</tr>
<tr>
<td>D-R B Tandem</td>
<td>12,000</td>
<td>54 / 785</td>
<td>540 / 986</td>
<td>30,000</td>
<td>1 Joel / 10 Joel</td>
<td>Impeller</td>
<td>0 / 15</td>
<td>Impeller</td>
<td>Impeller</td>
<td>API-1 / 1.2</td>
</tr>
</tbody>
</table>