Fig. 8.3.41.
La fig. 2.3.9 mostra schematicamente per le varie taglie di impianti, dalla più piccola alle più grandi, la possibile disposizione dei corpi delle turbine di alta, media e bassa pressione, da cui emerge la posizione degli spillamenti per

Forged single discs wheel shrunk and keyed to shaft
Axial split casting
Liner type split sleeve bearings
Flinger type, non-sparking seals
Oil ring lubrication
Cooling water jackets
True center line support
Stainless steel nozzels
Hard chrome plated shaft
Snap-acting bolt type trip
Force actuated trip valve
Removable split carbon ring gland housings
50,000 hour L-10 life thrust bearing
Woodward® TG governor
Permanently lubricated rod end ball joints
Removable stainless steel steam strainer
Low friction carbon sleeve
Snap-acting bolt type trip
Cage guided throttle valve
Permanent lubricated rod end ball joints
Split carbon ring steam sealing glands are readily accessible and easy to remove without disturbing other parts of the turbine.

### Standard Features
- Meets or exceeds API 611 requirements
- Direct drive, oil relay (Woodward TG Series) or NEMA Class A constant speed governor
- Overspeed mechanical trip and shut off system
- Manual speed changer
- Curtis type wheel
- Carbon ring sealing glands
- Built-in removable steam strainer
- Centerline support with vertical jacking screws
- Lagging-blanket insulation (API applications)

### Optional Features
- NEMA Class D and variable speed governors
- Solenoid trips for remote shutdown
- High backpressure trip
- Forged steel wheels
- Manual nozzle hand valves
- Special and double shaft extensions
- Copper-free construction for corrosive atmosphere
- Pneumatic valve actuation
- High inlet and back pressure construction
- Labyrinth, carbon/labyrinth, mechanical and six carbon ring steam seal designs

### Maximum Capabilities

<table>
<thead>
<tr>
<th>Model</th>
<th>Power HP (kW)</th>
<th>Inlet Pressure (PSIG, BARG)</th>
<th>Inlet Temp °F (°C)</th>
<th>Exhaust Pressure (PSIG, BARG)</th>
<th>RPM</th>
<th>Inlet Dia. In (mm)</th>
<th>Exhaust Dia. In (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>RLHA-15</td>
<td>450 (335)</td>
<td>600 (41)</td>
<td>750 (400)</td>
<td>105 (7)</td>
<td>6000</td>
<td>3 (75)</td>
<td>6 (150)</td>
</tr>
<tr>
<td>RLHA-24</td>
<td>2500 (1865)</td>
<td>900 (62)</td>
<td>950 (510)</td>
<td>300 (20)</td>
<td>6300</td>
<td>6 (150)</td>
<td>10 (250)</td>
</tr>
</tbody>
</table>

Note: Steam inlet locations are fixed as illustrated. Steam exhaust locations available as right or left hand orientation.

### Dimensions - in (mm)

<table>
<thead>
<tr>
<th></th>
<th>RLHA15</th>
<th>RLHA24</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>46 (1166)</td>
<td>57 (1454)</td>
</tr>
<tr>
<td>B</td>
<td>5 (136)</td>
<td>5 (136)</td>
</tr>
<tr>
<td>C</td>
<td>13 (324)</td>
<td>22 (552)</td>
</tr>
<tr>
<td>D</td>
<td>35,5 (902)</td>
<td>44 (1110)</td>
</tr>
<tr>
<td>E</td>
<td>22 (562)</td>
<td>42 (1075)</td>
</tr>
</tbody>
</table>

For more information on **RLHA single-stage steam turbines**, contact our Worcester, MA Technology Center at:

**Dresser-Rand**
299 Lincoln Street
Worcester, MA 01605
Tel: 1-888-268-8726
Fax: 508-595-1788

For a complete list of D-R products and services, visit us at [www.dresser-rand.com](http://www.dresser-rand.com) or contact us at the following locations:

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10205 Westheimer Road
Houston, TX 77042 USA
Tel: (Int'l +1) 713-354-6100
Fax: (Int'l +1) 713-354-6110
email: info@dresser-rand.com

**Regional Headquarters**

The Americas
Dresser-Rand
West8 Tower Suite 1000
10205 Westheimer Road
Houston, TX 77042 USA
Tel: (Int'l +1) 713-354-6100
Fax: (Int'l +1) 713-354-6110

EMEA (Europe, Middle East, Eurasia, Africa)
Dresser-Rand S.A.
31 Boulevard Winston Churchill
Cedex 7013
Le Havre 76080 France
Tel: (Int'l +33) 2-35-25-5225
Fax: (Int'l +33) 2-35-25-5366 / 5367

Asia-Pacific
Dresser-Rand Asia Pacific Sdn Bhd
Unit B-1, 8th Floor
Bangunan Malaysian Re
17 Lorong Dungun
Damansara Heights
50490 Kuala Lumpur, Malaysia
Tel: (Int'l +60) 3-2093-6633
Fax: (Int'l +60) 3-2093-2622

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Boiler Feed Pumps

**KEY FEATURES**
- Single Flow
- Impulse blades
- Single or dual inlet
- Broad operating speed range
- Condensing
- Multi valves
- Axial or Radial (up/down) exhaust
- Base or foundation mounting

**PRODUCT CHARACTERISTICS**

<table>
<thead>
<tr>
<th>Feature</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power Rating</td>
<td>up to 20 MW</td>
</tr>
<tr>
<td>Speed Range</td>
<td>3000 to 6000 rpm</td>
</tr>
<tr>
<td>Rated Steam Conditions</td>
<td>170 bar (2465psi)</td>
</tr>
<tr>
<td></td>
<td>565 °C (1050 °F)</td>
</tr>
<tr>
<td>Arrangement</td>
<td>Single casing</td>
</tr>
</tbody>
</table>
**A5/A9 series**

**KEY FEATURES**
- Back-to-Back configuration
- Central admission
- Impulse/Reaction blades
- Condensing
- Sliding and/or fixed pressure control
- Radial (up/down) exhaust
- Foundation mounting

**PRODUCT CHARACTERISTICS**

<table>
<thead>
<tr>
<th>Feature</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power Rating</td>
<td>20 to 100 MW</td>
</tr>
<tr>
<td>Speed Range</td>
<td>3000 to 3600 rpm</td>
</tr>
<tr>
<td>Rated Steam Conditions</td>
<td>140 bar (2030 psi)</td>
</tr>
<tr>
<td></td>
<td>565 °C (1050 °F)</td>
</tr>
<tr>
<td>Arrangement</td>
<td>Single casing</td>
</tr>
<tr>
<td>Condensing LP Stages</td>
<td>Up to 26” (50Hz)</td>
</tr>
<tr>
<td></td>
<td>Up to 23” (60Hz)</td>
</tr>
</tbody>
</table>
SC/SAC series

KEY FEATURES
- Single Flow
- Impulse/Reaction blades
- Condensing
- Sliding and/or fixed pressure control
- Up to two controlled extractions available
- Axial or Radial (up/down) exhaust
- Base or Foundation mounting

PRODUCT CHARACTERISTICS

<table>
<thead>
<tr>
<th>Feature</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power Rating</td>
<td>2 to 100 MW</td>
</tr>
<tr>
<td>Speed Range</td>
<td>3000 to 15000 rpm</td>
</tr>
<tr>
<td>Rated Steam Conditions</td>
<td>140 bar (2030psi) 540 °C (1000 °F)</td>
</tr>
<tr>
<td>Arrangement</td>
<td>Single casing</td>
</tr>
<tr>
<td>Condensing LP Stages</td>
<td>Up to 26” (50Hz) Up to 23” (60Hz)</td>
</tr>
</tbody>
</table>
### Turbine series
Separate high-pressure (H) cylinder and combined intermediate-pressure/low-pressure (IL) cylinder with single flow axial exhaust for 50 Hz and 60 Hz

### Plant type
Combined cycle power plant

### Output range
90 MW to 250 MW

### Main steam (Typical parameters)
- Temperature: up to 565 °C/1,049 °F
- Pressure: up to 177 bar/2,567 psi

### Reheat steam (Typical parameters)
- Temperature: up to 565 °C /1,049 °F

### Exhaust areas
- **50 Hz:** 5 m² to 16 m², 27.5 inches to 56 inches*
- **60 Hz:** 4.4 m² to 11.1 m², 24 inches to 47 inches*

* Last blade profile length

---

### Graphical Representation

![Graphical representation of turbine series and output range](image)

- **SST-3000 series**
- **SST-5000 series**
- **SST-6000 series**
- **SST-9000 series**

**Rating [MW]**

| 0 | 100 | 200 | 300 | 400 | 500 | 600 | 700 | 800 | 900 | 1,000 | 1,100 | 1,200 | 1,300 | 1,400 | 1,500 | 1,600 | 1,700 | 1,800 | 1,900 |
| **SST-3000** | **SST-5000** | **SST-6000** | **SST-9000** |
Siemens Steam Turbine
SST-3000 Series
for combined cycle applications

In our Siemens Steam Turbine (SST™) portfolio, we offer with the SST-3000 series steam turbine a compact arrangement, that features a two-cylinder design with an axial exhaust for application in combined cycle power plants with the latest gas turbine technology.

Turbine modules of different sizes provide a broad range of power ratings. To meet specific project requirements, Siemens selects the appropriate modules and custom engineers the individual blade path.

Proven pre-engineered modules reduce site assembly and commissioning times as well as technical risk. High reliability and availability is demonstrated in a forced outage rate that is less than half of the North American Electric Reliability Council (NERC) average.

SST5-3000 steam turbine in the combined cycle power plant (CCPP) Ribatejo, Portugal
## Turbine series
Separate high-pressure (H) cylinder and combined intermediate-pressure/low-pressure (IL) cylinder with single flow axial exhaust for 50 Hz and 60 Hz

## Plant type
Combined cycle power plant

## Output range
90 MW to 250 MW

## Main steam (Typical parameters)
- Temperature: up to 565 °C/1,049 °F
- Pressure: up to 177 bar/2,567 psi

## Reheat steam (Typical parameters)
Temperature: up to 565 °C/1,049 °F

## Exhaust areas
- **50 Hz:** 5 m² to 16 m²
  - 27.5 inches to 56 inches*
- **60 Hz:** 4.4 m² to 11.1 m²
  - 24 inches to 47 inches*

* Last blade profile length
Leading technology for efficient, flexible and reliable power generation

The SST-3000 series steam turbine

Customer benefits

- Compact two-cylinder design for low-level arrangement and axial exhaust
- Highest element efficiencies due to advanced blading technology 3DV™ profiles – variable reaction-type blading
- Designed for short start-up times and operational flexibility
- Standardized auxiliary modules for optimized plant layout and short installation times
- High availability and reduced maintenance costs with 10-year major inspection intervals
- Proven design for applications in single-shaft and multi-shaft combined cycle configurations
<table>
<thead>
<tr>
<th><strong>Turbine series</strong></th>
<th>Separate high-pressure (H) cylinder and combined intermediate-pressure/low-pressure (IL) cylinder with single flow axial exhaust for 50 Hz and 60 Hz</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Plant type</strong></td>
<td>Combined cycle power plant</td>
</tr>
<tr>
<td><strong>Output range</strong></td>
<td>90 MW to 250 MW</td>
</tr>
</tbody>
</table>
| **Main steam**     | Temperature: up to 565 °C/1,049 °F  
Pressure: up to 177 bar/2,567 psi                                                                                     |
| **Reheat steam**   | Temperature: up to 565 °C/1,049 °F                                                                                              |
| **Exhaust areas**  | 50 Hz: 5 m² to 16 m²  
27.5 inches to 56 inches*  
60 Hz: 4.4 m² to 11.1 m²  
24 inches to 47 inches*                                                                                                 |

* Last blade profile length
Siemens Steam Turbine
SST-5000 Series

for combined cycle and subcritical steam applications

In our Siemens Steam Turbine (SST™) portfolio, we offer the SST-5000 series steam turbine, that features a combined high-pressure/intermediate-pressure (HI) cylinder and a double-flow low-pressure (L) cylinder.

Turbine modules of different sizes provide a broad range of power ratings. To meet specific project requirements, Siemens selects the appropriate modules and custom engineers the individual blade path.

The SST-5000 series is designed for short start-up times and high operational performance.

Proven pre-engineered modules reduce site assembly and commissioning times as well as technical risk. High reliability and availability is demonstrated with a forced outage rate that is less than half of the North American Electric Reliability Council (NERC) average.

SST6-5000 steam turbine in the combined cycle power plant (CCPP) Osprey.
Turbine series

Combined high-pressure/intermediate-pressure reverse-flow (HI) cylinder and low-pressure (L) cylinder for 50 Hz and 60 Hz

Plant type

Combined cycle and conventional steam

Output range

120 MW to 500 MW for combined cycle applications
120 MW to 750 MW for conventional steam applications

Main steam

(Typical parameters)

Temperature: up to 600 °C/1,112 °F
Pressure: up to 190 bar/2,756 psi

Reheat steam

(Typical parameters)

Temperature: up to 600 °C/1,112 °F

Exhaust areas

50 Hz: 5 m² to 16 m²
       27.5 inches to 56 inches*
60 Hz: 4.4 m² to 11.1 m²
       24 inches to 47 inches*

* Last blade profile length
Leading technology for efficient, flexible and reliable power generation

The SST-5000 series steam turbine

1. Large diameter single crossover pipe to minimize losses
2. Exhaust configurations: Down-, single- and double-sided for optimized plant layout
3. Spring back seals in the inner casing for excellent start-up and shut-down behavior
4. Short maintenance times with valves directly connected to the outercasing lower half
5. Fully 3-dimensional high performance variable reaction blading (3DV™) with integral shrouds for high efficiency and excellent damping behavior
6. Push rod arrangement allows the LP-inner casing to follow thermal expansion of the shaft for reduced differential expansion
7. Broad range of state-of-the-art high-performance LP blades for different exhaust area sizes
8. Single fixed bearing between cylinders for simple alignment and stable operation
9. Efficient erosion protection measures for LP blades

Customer benefits
- Compact arrangement with single bearing between turbine cylinders
- Highest element efficiencies due to advanced blading technology 3DV™ profiles – variable reaction-type blading
- Designed for short start-up times and operational flexibility
- Standardized auxiliary modules for optimized plant layout and short installation times
- High availability and reduced maintenance costs with 10-year major inspection intervals
- Proven design for applications in single-shaft and multi-shaft combined cycle configurations as well as for steam power plant applications
Turbine series
Combined high-pressure/intermediate-pressure reverse-flow (HI) cylinder and low-pressure (L) cylinder for 50 Hz and 60 Hz

Plant type
Combined cycle and conventional steam

Output range
120 MW to 500 MW for combined cycle applications
120 MW to 750 MW for conventional steam applications

Main steam
(Typical parameters)
Temperature: up to 600 °C / 1,112 °F
Pressure: up to 190 bar / 2,756 psi

Reheat steam
(Typical parameters)
Temperature: up to 600 °C / 1,112 °F

Exhaust areas
50 Hz: 5 m² to 16 m²
27.5 inches to 56 inches*
60 Hz: 4.4 m² to 11.1 m²
24 inches to 47 inches*

* Last blade profile length
In our Siemens Steam Turbine (SST™) portfolio, we offer the SST-6000 series steam turbine that features a barrel-type high-pressure (H) cylinder, an intermediate-pressure (I) cylinder and up to three low-pressure (L) cylinders. Turbine modules of different sizes provide a broad range of power ratings. To meet specific project requirements, Siemens selects the appropriate modules and custom engineers the individual blade path.

Proven pre-engineered modules reduce site assembly and commissioning times and reduce technical risk. High reliability and availability is demonstrated with a forced outage rate that is less than half of the North American Electric Reliability Council (NERC) average.
Turbine series
Separate high-pressure (H), intermediate-pressure (I) and up to three low-pressure (L) cylinders for 50 Hz and 60 Hz

Plant type
Conventional steam power plant

Output range
300 MW to 1,200 MW for conventional steam applications

Main steam
(Typical parameters)
Temperature: up to 600 °C / up to 1,112 °F
Pressure: up to 300 bar / up to 4,351 psi

Reheat steam
(Typical parameters)
Temperature: up to 620 °C / up to 1,148 °F

Exhaust areas
50 Hz: 5 m² to 16 m²
27.5 inches to 56 inches*
60 Hz: 4.4 m² to 11.1 m²
24 inches to 47 inches*

* Last blade profile length
Leading technology for efficient and reliable power generation

The SST-6000 series steam turbine

Customer benefits
- Compact arrangement with single bearing between turbine cylinders
- Highest element efficiencies due to advanced blading technology 3DV™ profiles – variable reaction type blading
- Designed for short start-up times and operational flexibility

- Standardized auxiliary modules for optimized plant layout and short installation times
- High availability and reduced maintenance costs with 10 year major inspection intervals
- Proven design for applications in subcritical to ultra-supercritical steam power plants
### Turbine series
Separate high-pressure (H), intermediate-pressure (I) and up to three low-pressure (L) cylinders for 50 Hz and 60 Hz

### Plant type
Conventional steam power plant

### Output range
300 MW to 1,200 MW for conventional steam applications

### Main steam
(Typical parameters)
- Temperature: up to 600 °C / up to 1112 °F
- Pressure: up to 300 bar / up to 4351 psi

### Reheat steam
(Typical parameters)
- Temperature: up to 620 °C / up to 1148 °F

### Exhaust areas
- 50 Hz: 5 m² to 16 m²
- 60 Hz: 4.4 m² to 11.1 m²

* Last blade profile length
Siemens Steam Turbine
SST5-9000

For applications in conventional islands of advanced pressurized water reactors

As part of our Siemens Steam Turbine (SST™) portfolio, the SST5-9000 is a highly reliable steam turbine for applications in the conventional islands of advanced pressurized water reactors, with a power output up to 1,900 MW.

The half-speed SST5-9000 features a double-flow saturated steam HP cylinder and up to three double-flow LP cylinders with shrink-on disk rotors.

Turbine modules of different sizes provide a broad range of power ratings. To meet specific project requirements, Siemens offers the appropriate modules and customizes the individual blade paths.

Proven pre-engineered modules reduce site assembly and commissioning time as well as technical risks. Their high reliability is demonstrated by a forced outage rate that is less than half of the North American Electric Reliability Council (NERC) average.

Thanks to their power generation capabilities, Siemens steam turbines have consistently occupied the top positions in worldwide ranking lists for many years.
The design of the modular steam turbine platform provides the flexibility to manage a power range from 1,000 MW to 1,900 MW and diverse site/cooling water conditions in all advanced pressurized water reactors.

### Technical parameters

<table>
<thead>
<tr>
<th>Turbine series</th>
<th>One double-flow saturated steam HP cylinder and up to three double-flow LP cylinders with shrunk-on disk rotors</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Plant type</strong></td>
<td>Advanced pressurized water reactor</td>
</tr>
<tr>
<td><strong>Output range</strong></td>
<td>1,000 MW to 1,900 MW</td>
</tr>
</tbody>
</table>
| **Main steam**          | Temperature: Up to 290 °C  
Pressure: Up to 75 bar                             |
| **Reheat steam**        | Temperature: 275 °C                                                                              |
| **Exhaust areas**       | 4x 20 m² to 6x 30 m²                                                                            |
| **Last blade profile length** | 1,400 mm to 1,830 mm                                                                         |
The design of the modular steam turbine platform provides the flexibility to manage a power range from 1,000 MW to 1,900 MW and diverse site/cooling water conditions in all advanced pressurized water reactors.

### Technical parameters

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Details</th>
</tr>
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</tr>
<tr>
<td><strong>Last blade profile length</strong></td>
<td>1,400 mm to 1,830 mm</td>
</tr>
</tbody>
</table>
Shrunk-on disk design features proven technology: no stress-corrosion cracking that could require replacement of LP rotors or disks

Millions of disk service hours have been accumulated without any indication of stress-corrosion cracking

More than 4 million total fleet operating hours
- More than 60 million disk operating hours
- In operation for up to 250,000 hours
- More than 1,000 disk inspections

Leading technology for efficient, flexible and reliable power generation

The SST5-9000 steam turbine

Customer benefits
- Wide application range from 1,000 MW to 1,900 MW, with sufficient margin for future NPP power increase without changing the steam turbine modules
- Flexibility to meet customer- and site-specific needs based on standardized and certified steam turbine platform modules
- Compact and cost-efficient plant layout, thanks to optimized arrangement concept
- High-efficiency HP and LP turbine, thanks to high-performance blading, optimal number of stages, and minimal radial clearances of symmetrically arranged double-flow steam paths
- Short start-up times/high operational flexibility
- Maximum reliability and availability
- Certified manufacturing quality and experienced project management
- Reduced maintenance expenses with > 10-year major inspection intervals
- Extended lifetime of up to 60 years, thanks to state-of-the-art engineering and advanced service concepts
- Low lifecycle costs as a result of world-class efficiency
- Low-maintenance components, coupled with the years of experience that Siemens has as a product and solution provider
- Short installation and outage times due to modularity, automation and optimized processes
The design of the modular steam turbine platform provides the flexibility to manage a power range from 1,000 MW to 1,900 MW and diverse site/cooling water conditions in all advanced pressurized water reactors.

Technical parameters

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| Exhaust areas  | 4x 20 m² to 6x 30 m²                                                                                    |
| Last blade profile length | 1,400 mm to 1,830 mm                                                    |