

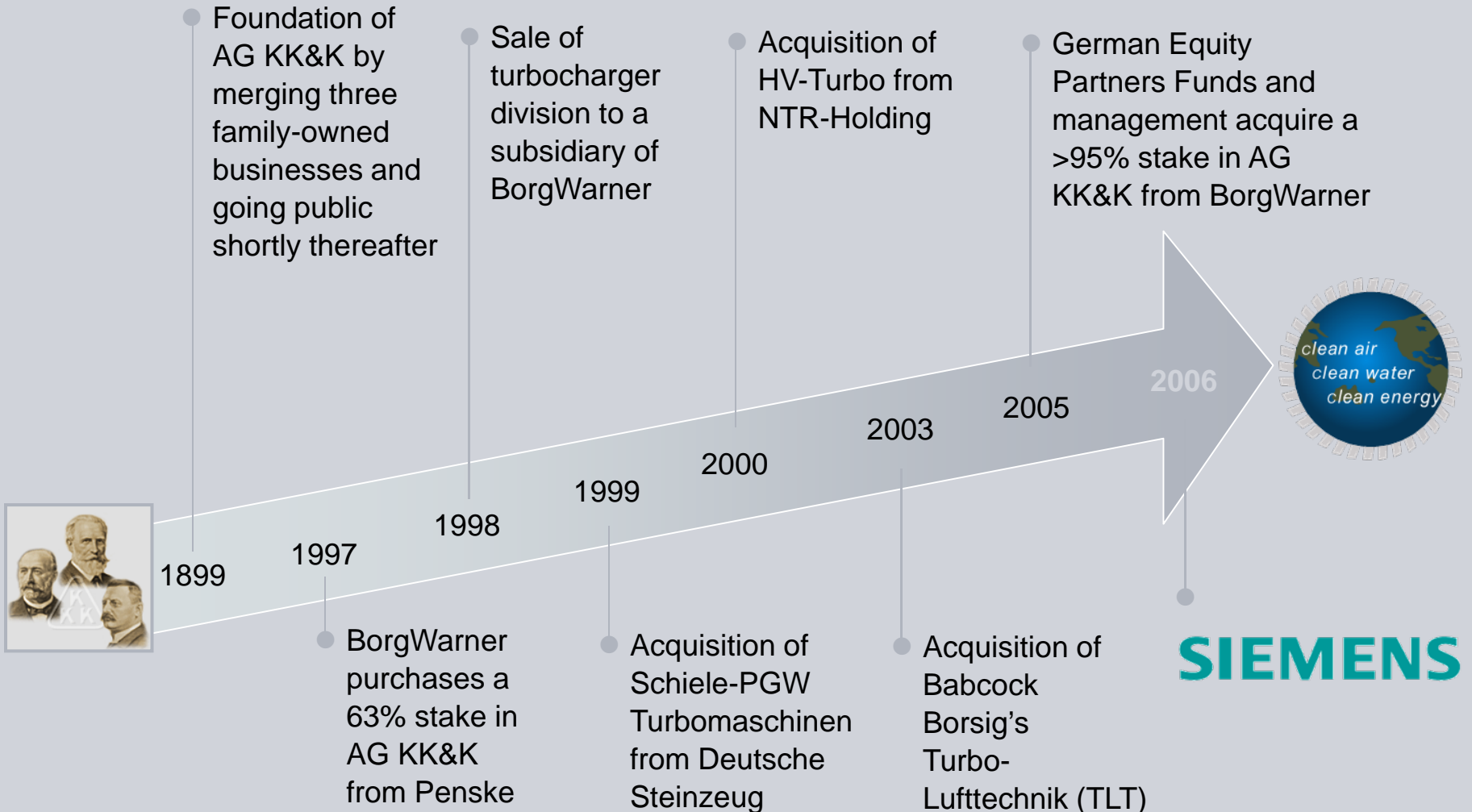
# IEA Bioenergy Task 32 / 33

- Copenhagen -

07.10.2010

# **Siemens Turbomachinery Equipment (STE) GmbH**

## Company history



## Manufacturing in Frankenthal: Facts and Figures

|                      |                                |
|----------------------|--------------------------------|
| Factory site:        | 120.000 qm                     |
| Manufacturing:       | 30.000 qm                      |
| Employees:           | 650                            |
| Machines:            | 160                            |
| Manufacturing hours: | 230.000 h                      |
| Skilled workers:     | 98%                            |
| Average seniority:   | 24 years                       |
| Fluctuation:         | about 0<br>(5 years 4 workers) |





## Manufacturing in Frankenthal: Test field



Steam flow: **apprx. 8.5 t/h**

Live steam pressure: **apprx. 35 bara**

Live steam temperature: **apprx. 380 °C**

# **1. Overview steam turbines portfolio**

## Siemens Steam Turbines Portfolio



Siemens utility  
steam turbines  
200 up to 1900 MW



Siemens industrial  
steam turbines  
5 up to 200 MW



Siemens pre-designed  
steam turbines  
45 kW up to 10 MW

## STE Product Lines

### SST-050 up to 750 kW

BF 3,5  
BF4/80  
BF4/125  
AF 3,5 Gs  
AF4 Gs



### SST-060 up to 5 000 kW

AFA 3,5  
AFA 4  
CFA 4  
CFR 3  
CFR 5



### SST-110 up to 7 000 kW

TWIN AFA 44  
TWIN AFA 46  
TWIN CA 34  
TWIN CA 36  
TWIN CA 54  
TWIN CA 56  
etc.



### SST-120 up to 10 000 kW

Tandem  
Machines





## Basic Technical Values

**Live steam pressure:**

**3 – 131 bar\_a**

**Live steam temperature:**

**dry. sat - 530°C**

**Exhaust steam pressure:**

**0.08 – 29 bar\_a**

**Speed:**

**500 – 23 000 rpm**

**Power:**

**Up to 10 000 kW**

## Customers and Applications

### Our customers

- Producer of Pumps, Compressors ...
- IPP / Contracting / Engineering
- Energy-from-waste plants
- Utilities
- Smelters / Steel
- Wood / Paper
- Chemistry
- Petrochemistry / Refineries
- Food
- Sugar / Palmoil
- Ship / Offshore

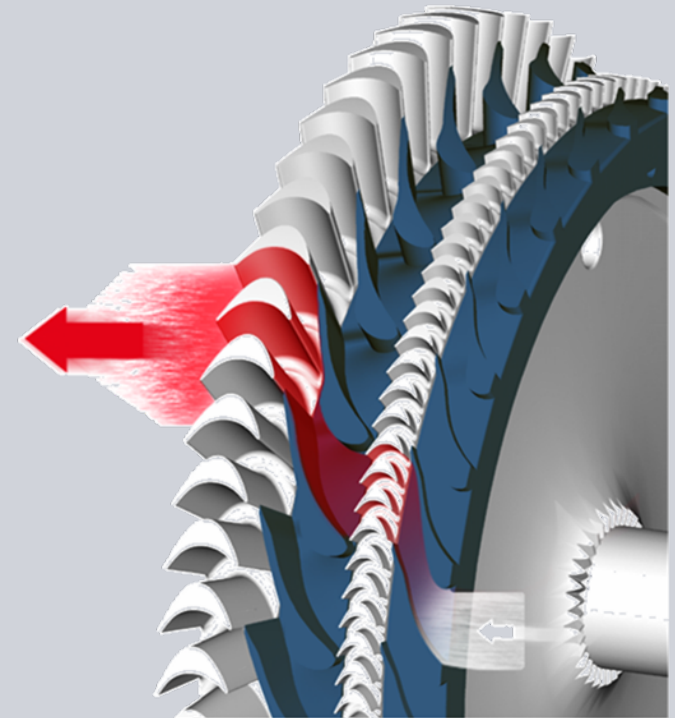
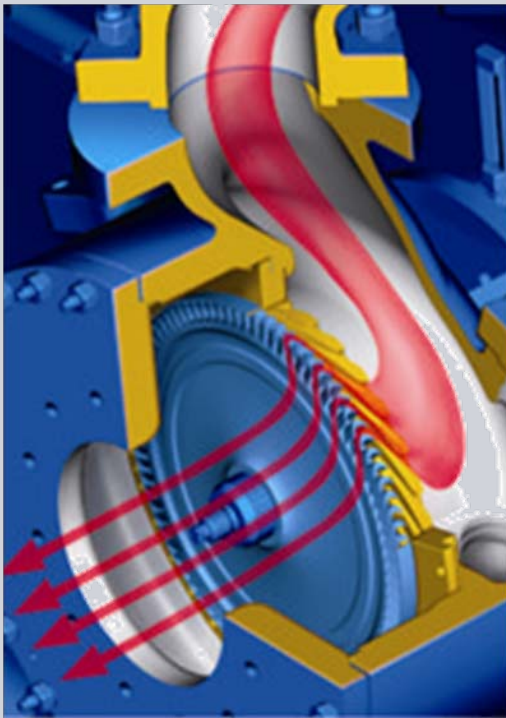
### Main applications

- **Waste-to-energy**
- **Mechanical Drives**
- **Biomass**
- **Cogen / CHP**
- **Heat-recovery**
  
- Gas expansion
- Geothermal plants / ORC

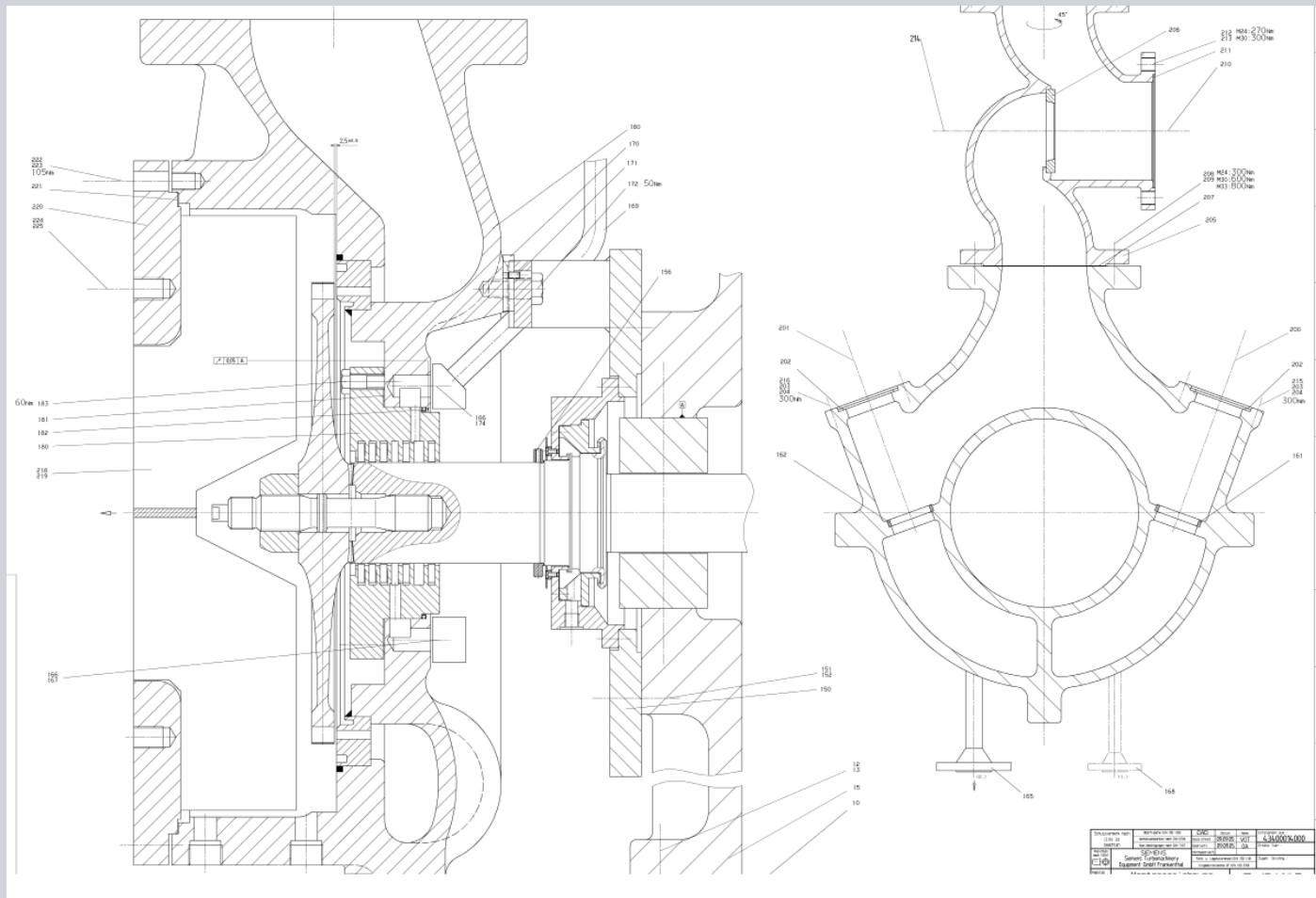
## **2. Design of the STE steam turbines**

## Operating Principle

Steam flow: SST-060 (AFA / CFR / Condensing Module)



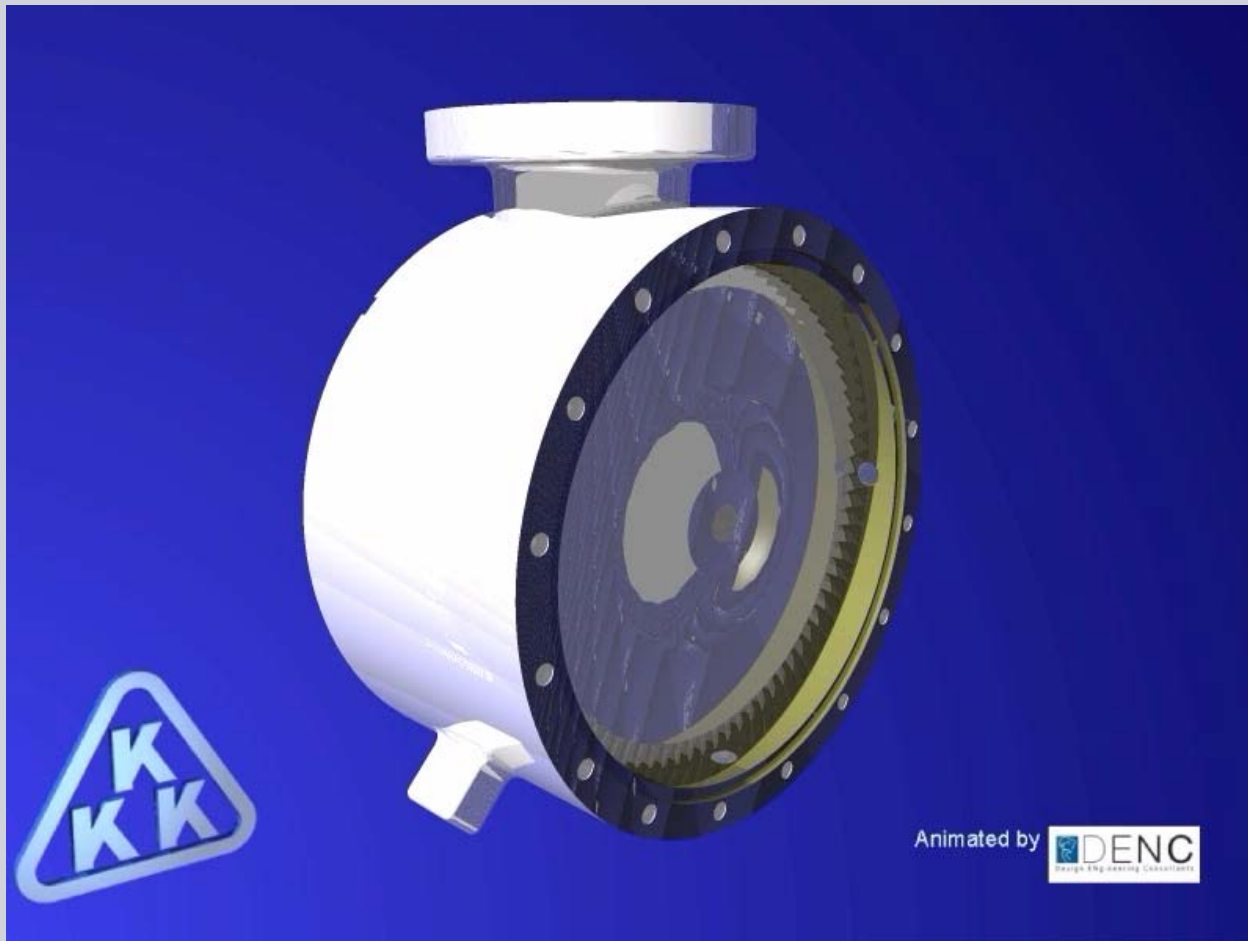
## Operating Principle





## Operating Principle

Steam Flow: SST-060



## In-house production: Monobloc-design

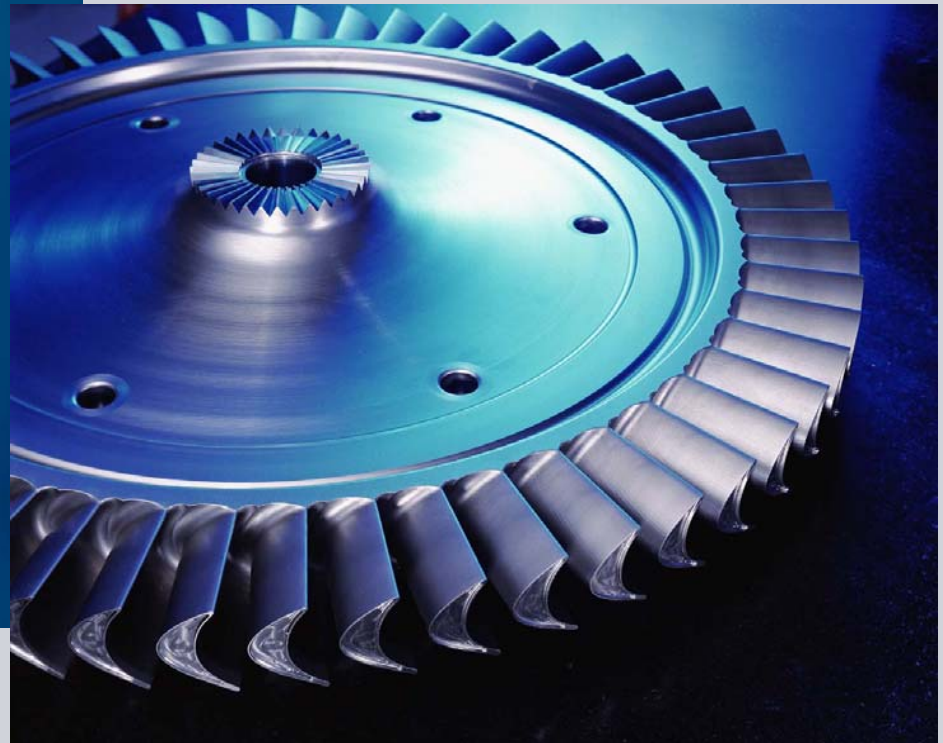
### Turbine wheel manufacturing





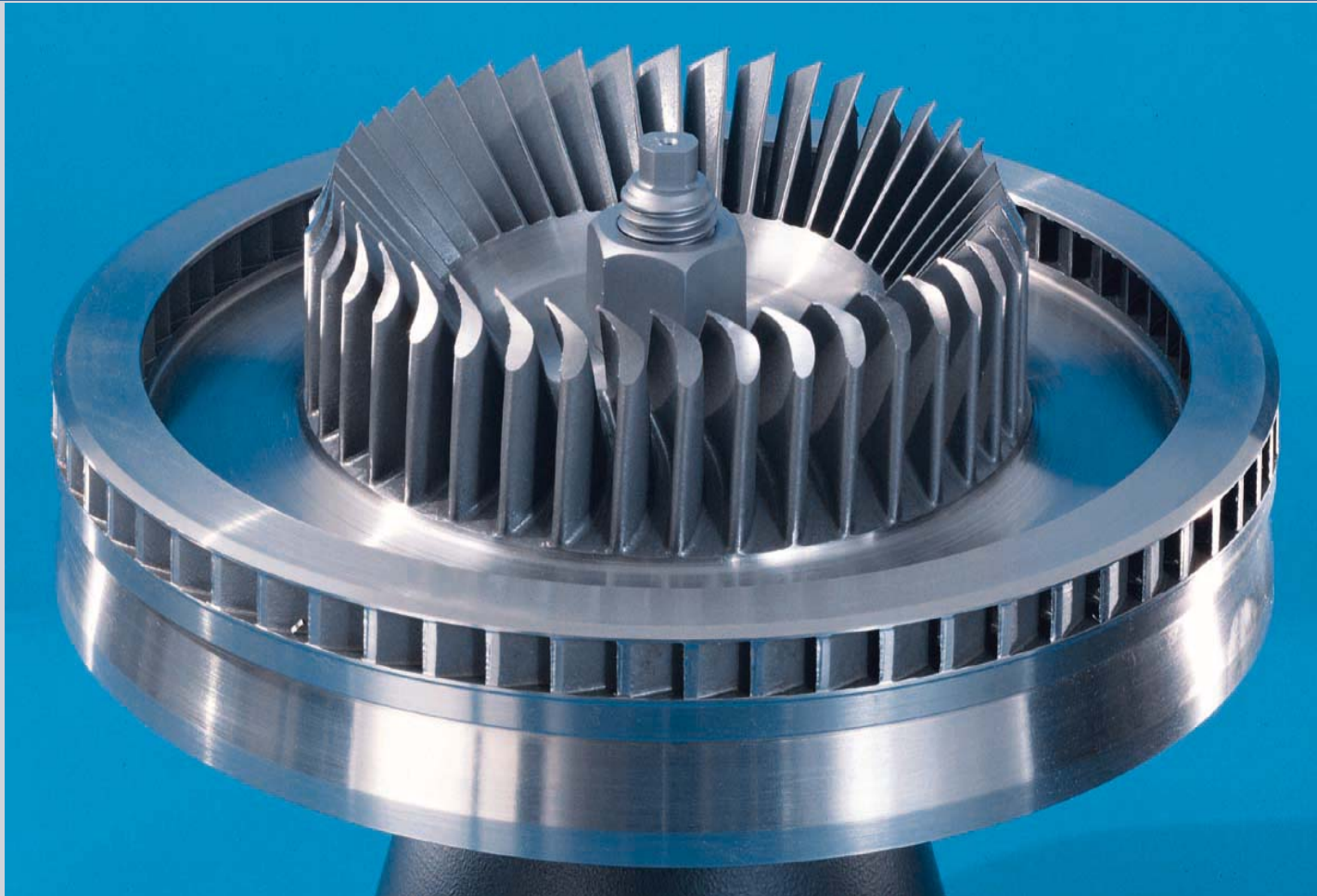
## In-house production: Monobloc-design

Turbine wheel AFA-type



## In-house production: Monobloc-design

Turbine wheel CFR-type



## In-house production: Monobloc-design

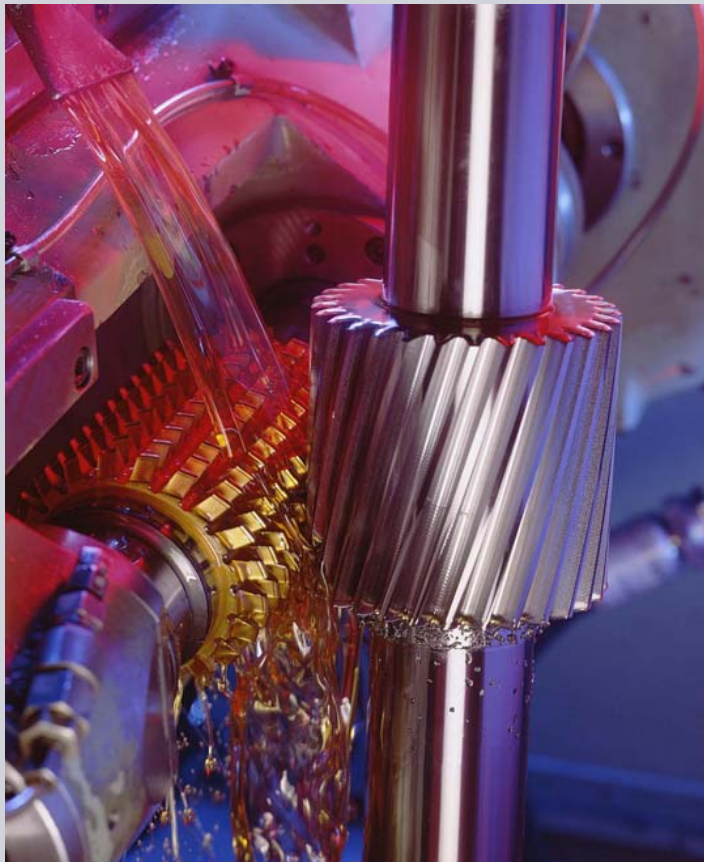
Nozzle ring CFR-type





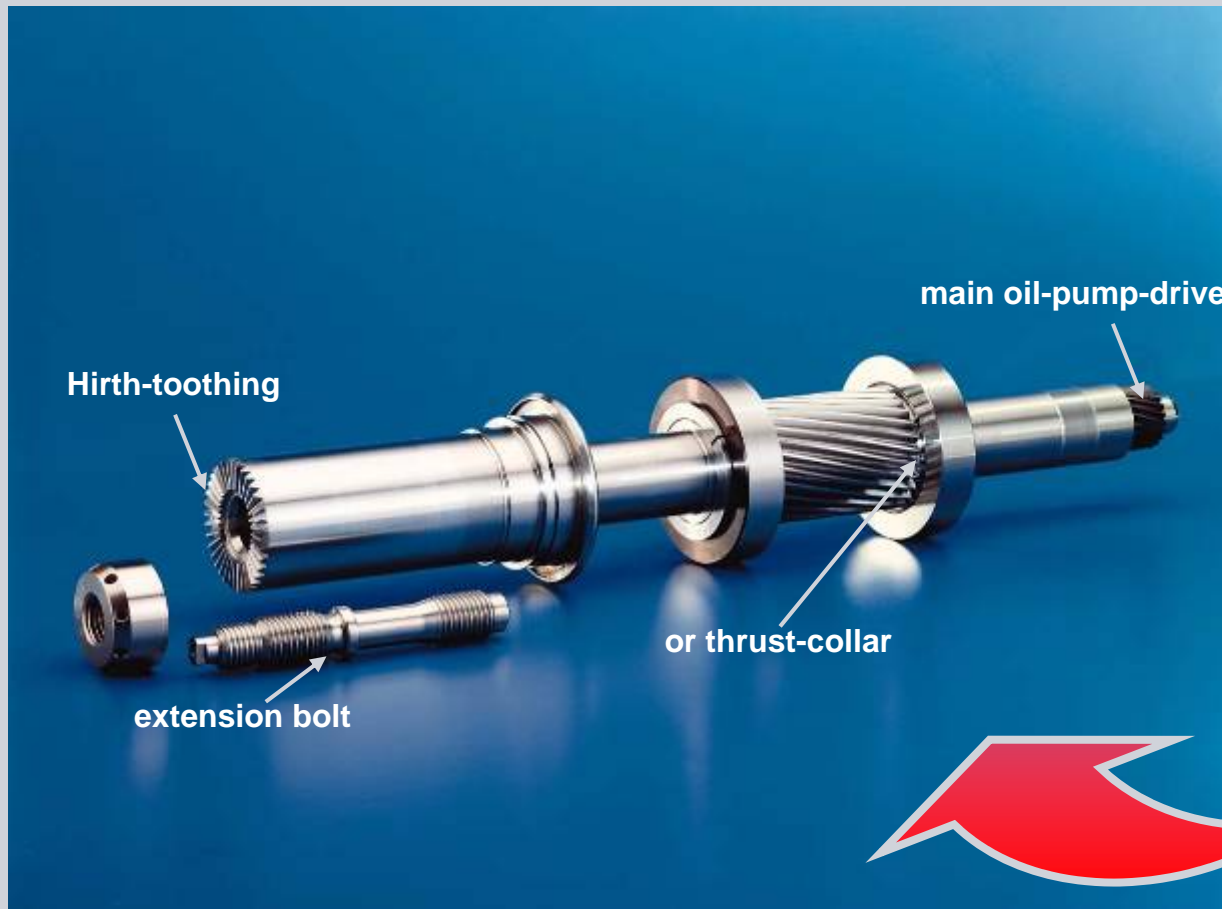
# In-house production

## Integral gear-box



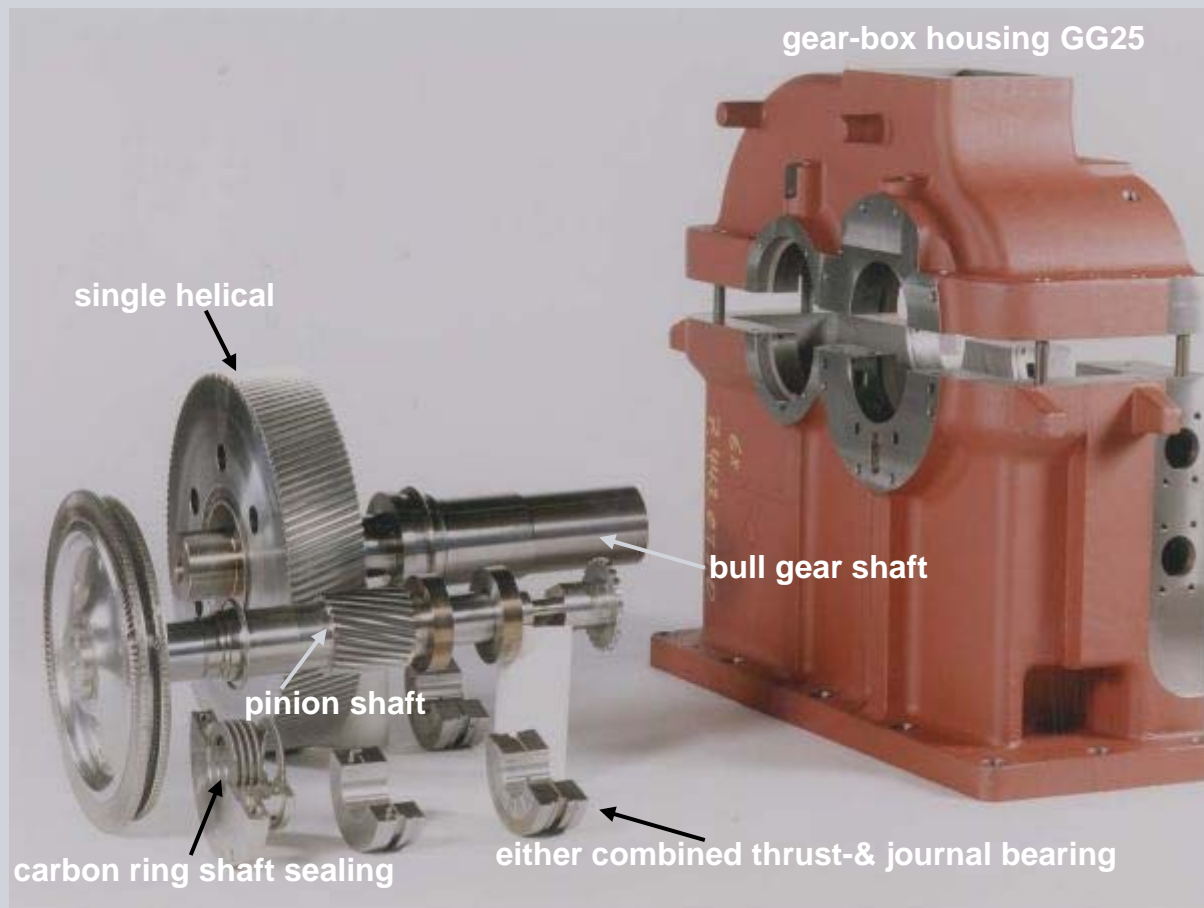
## In-house production

### Turbine shaft – Hirth tothing – thrust collar



## In-house production

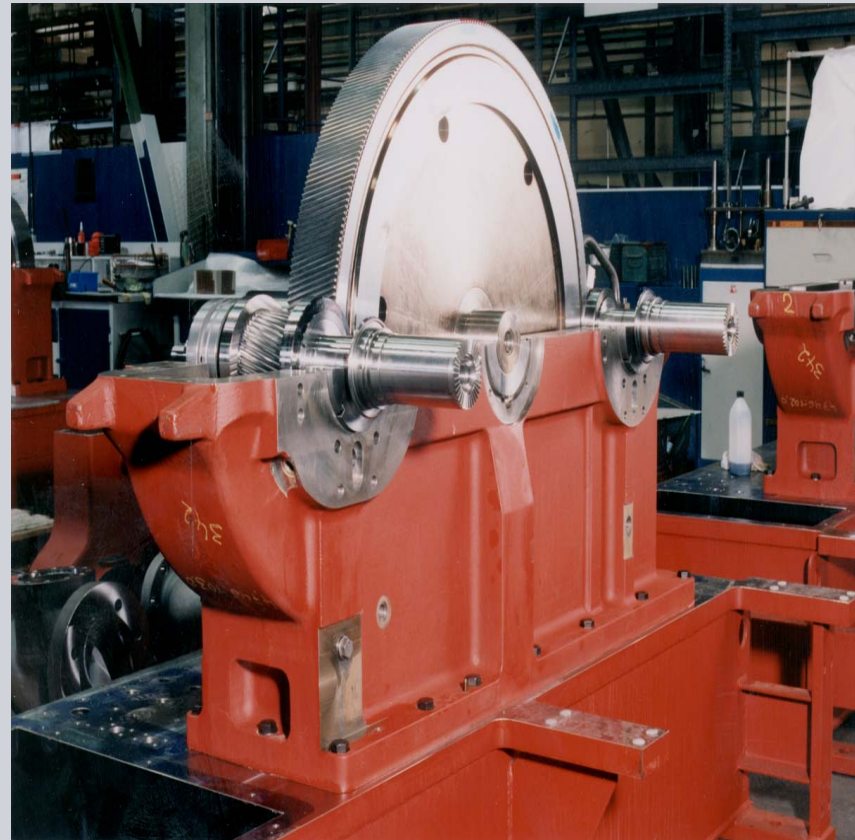
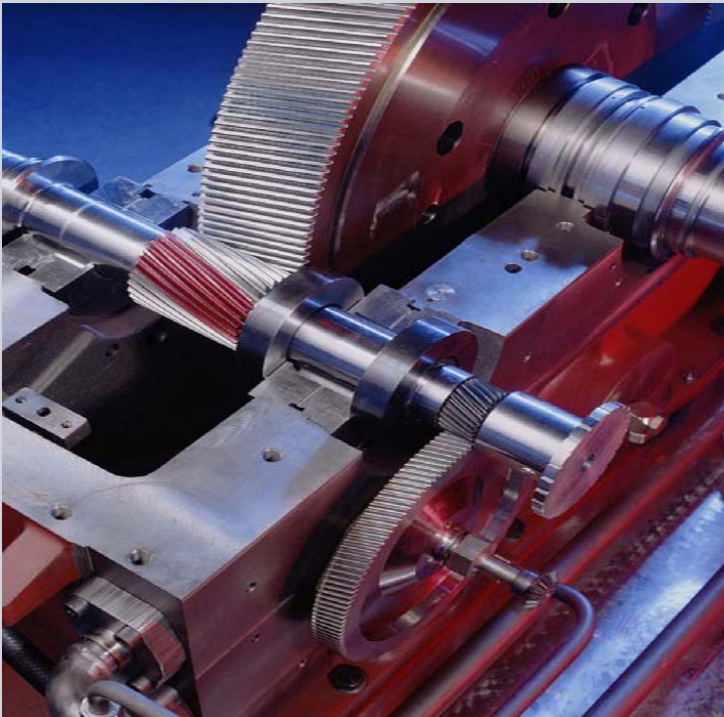
### Integral gear-box





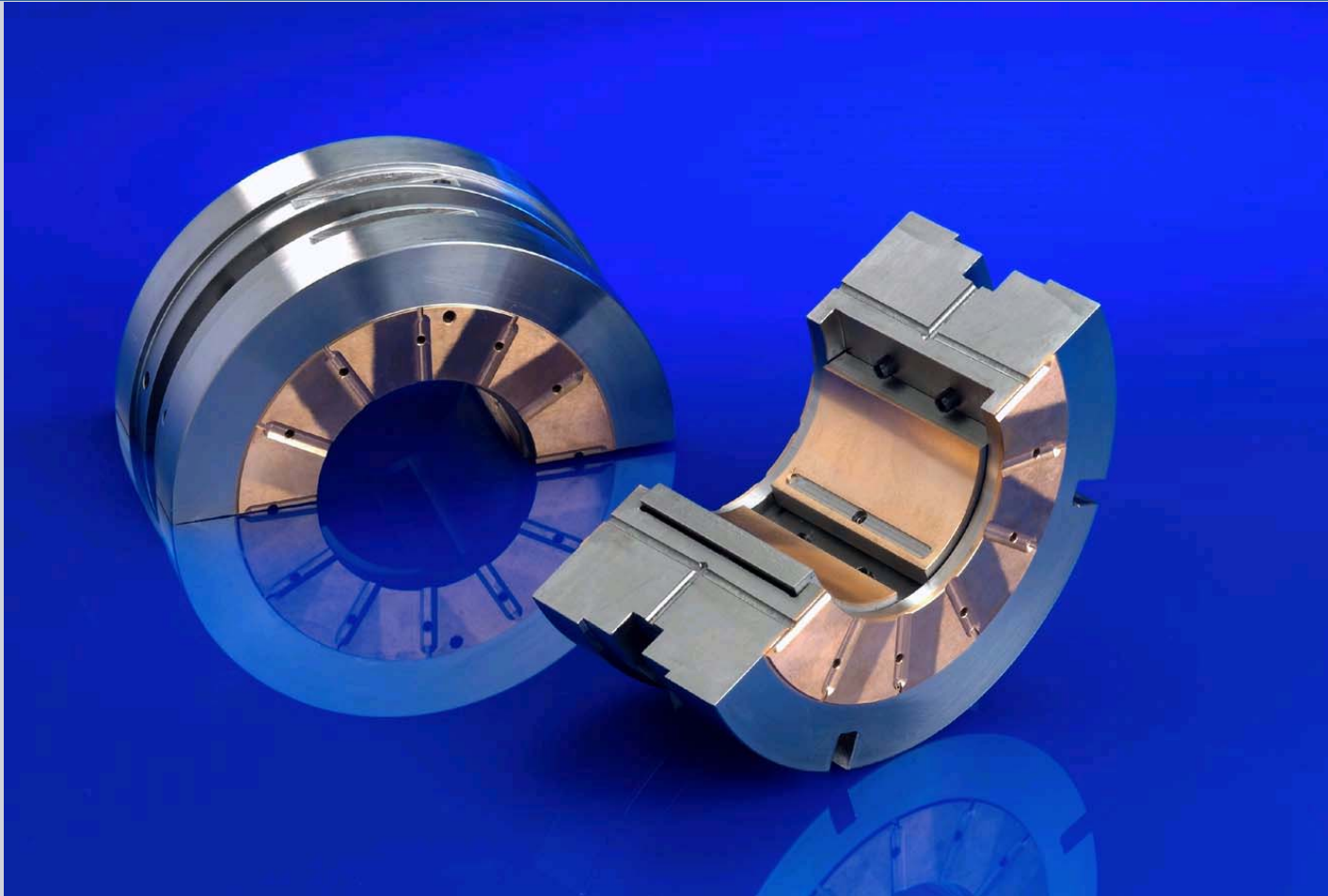
## In-house production

### Integral gear-box



**In-house production**

**Sleeve bearing**





**3. Turbines for mechanical drives (SST-060)**  
**+ Turbo Gen Sets (SST-060, SST-110, SST-120)**

## Turbine series

Turbine series SST-060 (AFA 3,5 + AFA 4 + AFA 6 + AFA10 and CFA4 type) – up to 5 000 kW

### Products:



### Application:

- ▶ Mechanical drives, Cogeneration, Biomass, Waste-to-energy, Heat-recovery, Gas expansion

### Market: (Examples)

- ▶ Producer of Pumps, Compressors, Fans etc., Chemistry, Petrochemistry / Refineries, Sugar / Palmoil, Wood / Paper, Electricity Supplier / Municipal Utilities, Smelters / Steel, IPP / Contracting / Engineering, Food, Energy-from-waste Plants, Ship / Offshore

## Turbine series

### Turbine series SST-060 (AFR / CFR – type)

| General   |                  |
|---|------------------|
| Integral gear design<br>Overhung design   |                  |
| Technical Data (max)  |                  |
| • Power   | 5,0 MW           |
| • Live steam pressure   | 65 bar a         |
| • Live steam temperature  | 480 °C           |
| • Saturated steam   |                  |
| • Speed   | up to 24 900 rpm |
| • Exhaust steam pressure  | up to 17 bar a   |
| • Turbine wheel diameter  | 300 / 500 mm     |
| • 5 different gearing sizes   |                  |
| Typical dimensions  |                  |
| Length 1,5 m<br>Width 2,5 m<br>Height 2,5 m<br>Weight: Turbine inkl. oil reservoir and coupling: up to 12 t |                  |

| Characteristics   |
|---|
| <ul style="list-style-type: none"> <li>• Exhaust steam pressure type</li> <li>• Package unit design</li> <li>• Flexible rotor</li> <li>• Oil unit integrated in base frame</li> <li>• Quick start without pre-heating</li> <li>• Custom made</li> <li>• Short delivery times</li> </ul> |
| Scope of supply   |
| <ul style="list-style-type: none"> <li>• Turbine package</li> <li>• Oil unit</li> <li>• Electrical scope of supply</li> <li>• Generator</li> <li>• Short delivery times</li> </ul>  |

## Turbine series

Turbine series SST-060 CFR 3 + CFR 5 – up to 5 000 kW

### Products:



### Application:

- ▶ Cogeneration, Biomass, Waste-to-energy, Gas expansion

### Market: (Examples)

- ▶ Chemistry, Petrochemistry / Refineries, Wood / Paper, Electricity Supplier / Municipal Utilities, IPP / Contracting / Engineering, Food, Energy-from-waste Plants



## Turbine series

### Turbine series SST-060 (CFR – type)

| General   |                  |
|---|------------------|
| Integral gear design<br>Overhung design   |                  |
| Technical Data (max)  |                  |
| • Power   | 5,0 MW           |
| • Live steam pressure   | 65 bar a         |
| • Live steam temperature  | 480 °C           |
| • Saturated steam   |                  |
| • Speed   | up to 24 900 rpm |
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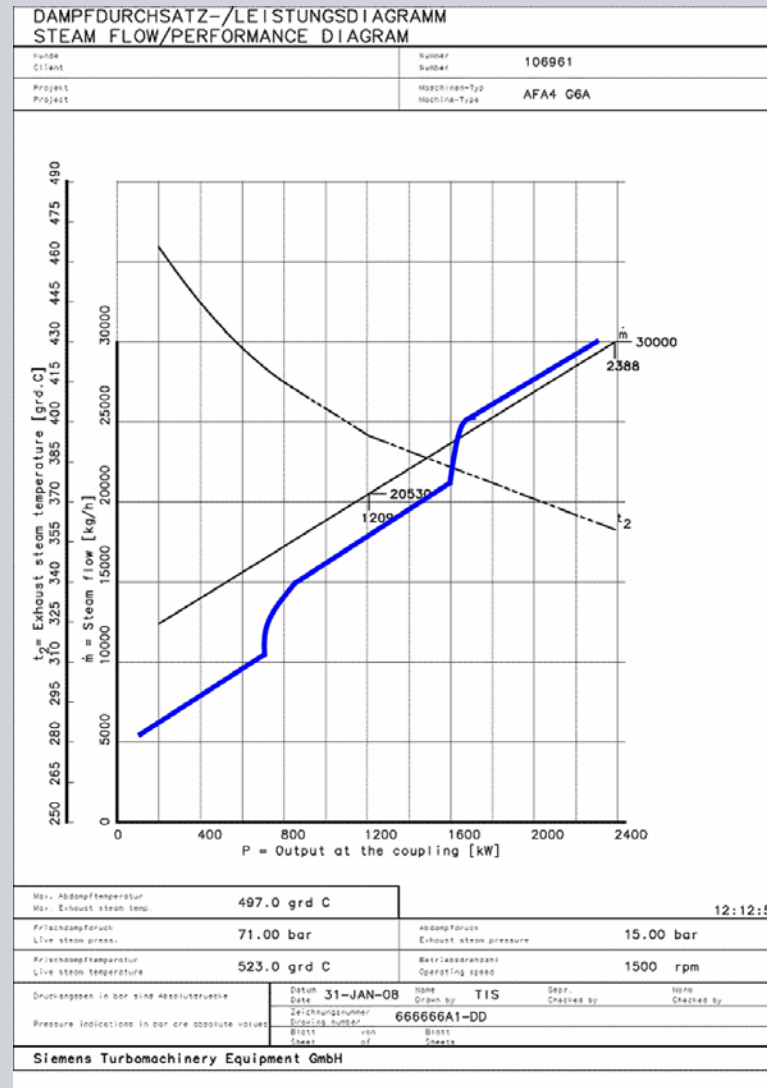
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## Turbine series SST-110 (TWIN) and SST-120 (Tandem)

### TWIN-Design



## Nozzle Group Control



## Turbine series SST-110 (TWIN) and SST-120 (Tandem)

Turbine series SST-110 / SST-120 (TWIN / Tandem-Typ) – up to 10 000 kW

### Products:



### Applications:

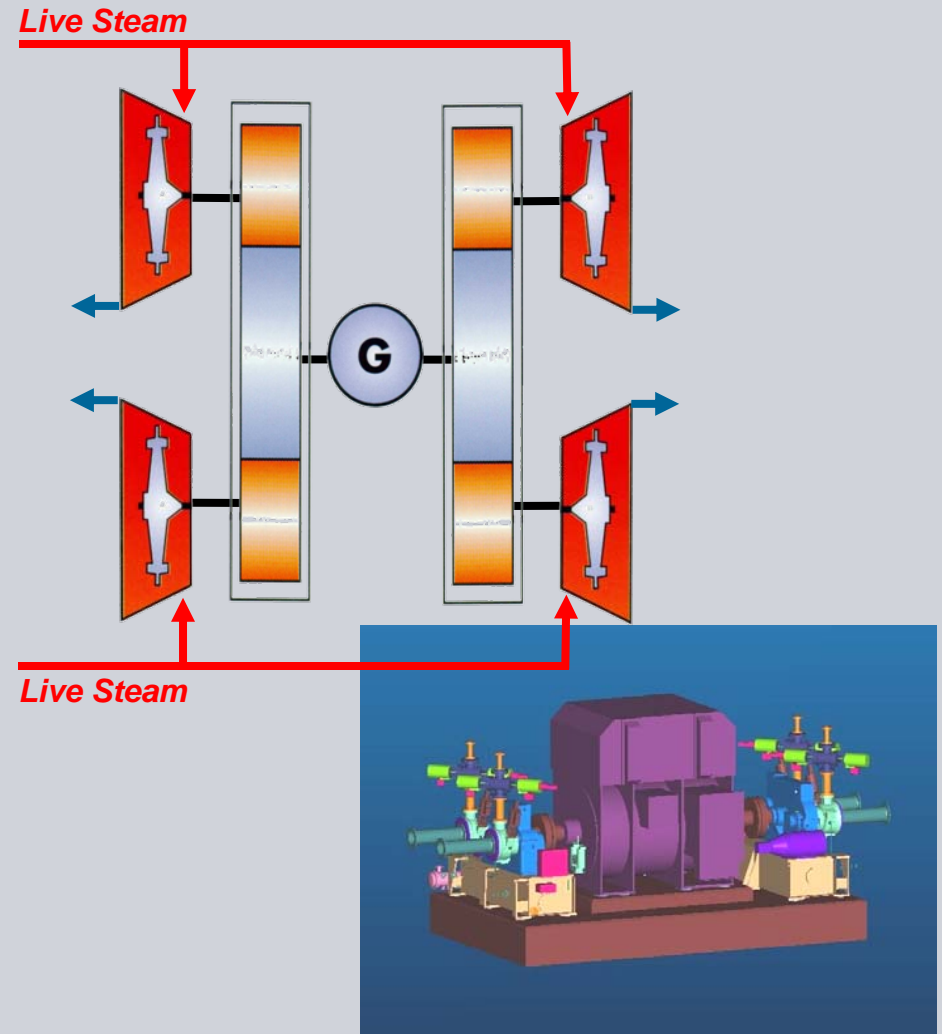
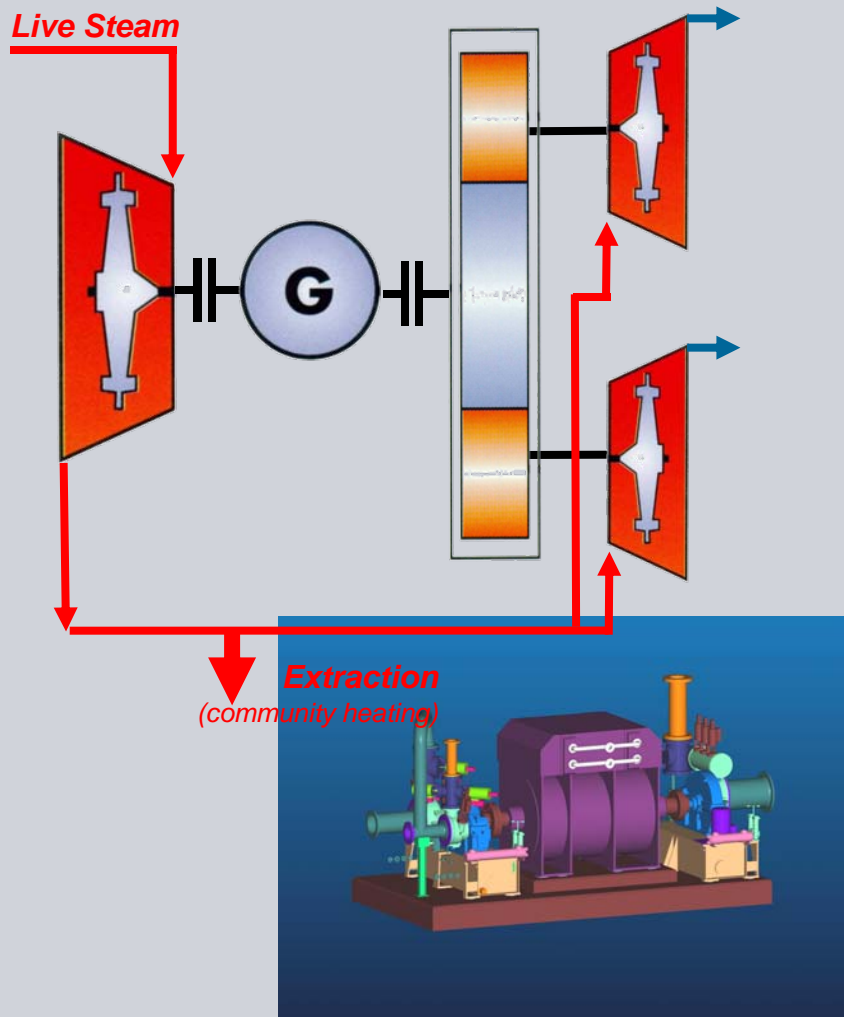
- ▶ Combined heat and power (CHP), Biomass, Waste-to-energy, Heat recovery

### Markets: (Examples)

- ▶ Chemistry, Wood / Paper industry, Utilities, Municipalities, Mills / Steel industry, IPP / Contracting / Engineering, Food & Beverage, Waste incineration plants



## Turbine series SST-110 (TWIN) and SST-120 (Tandem)

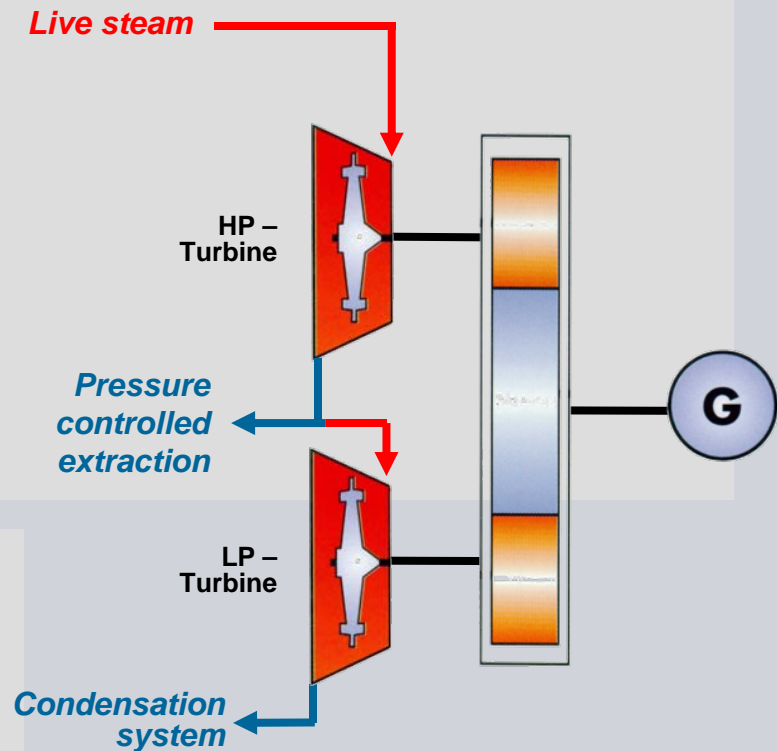
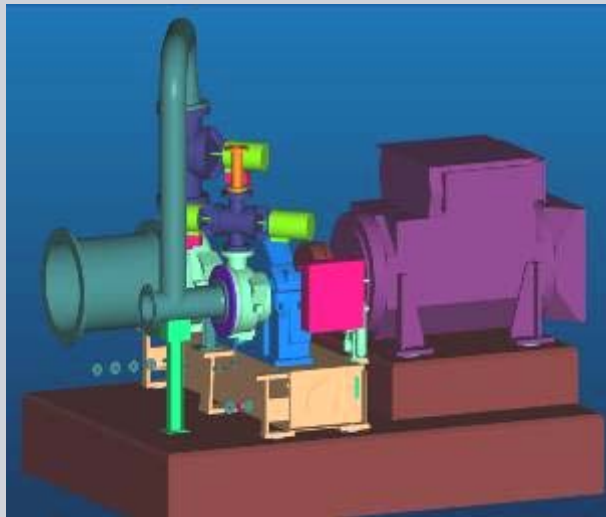


**TWIN SST-110 (former CA 56k)**

## Technical Details:

### SST-110 TWIN - Offer 114790-1A

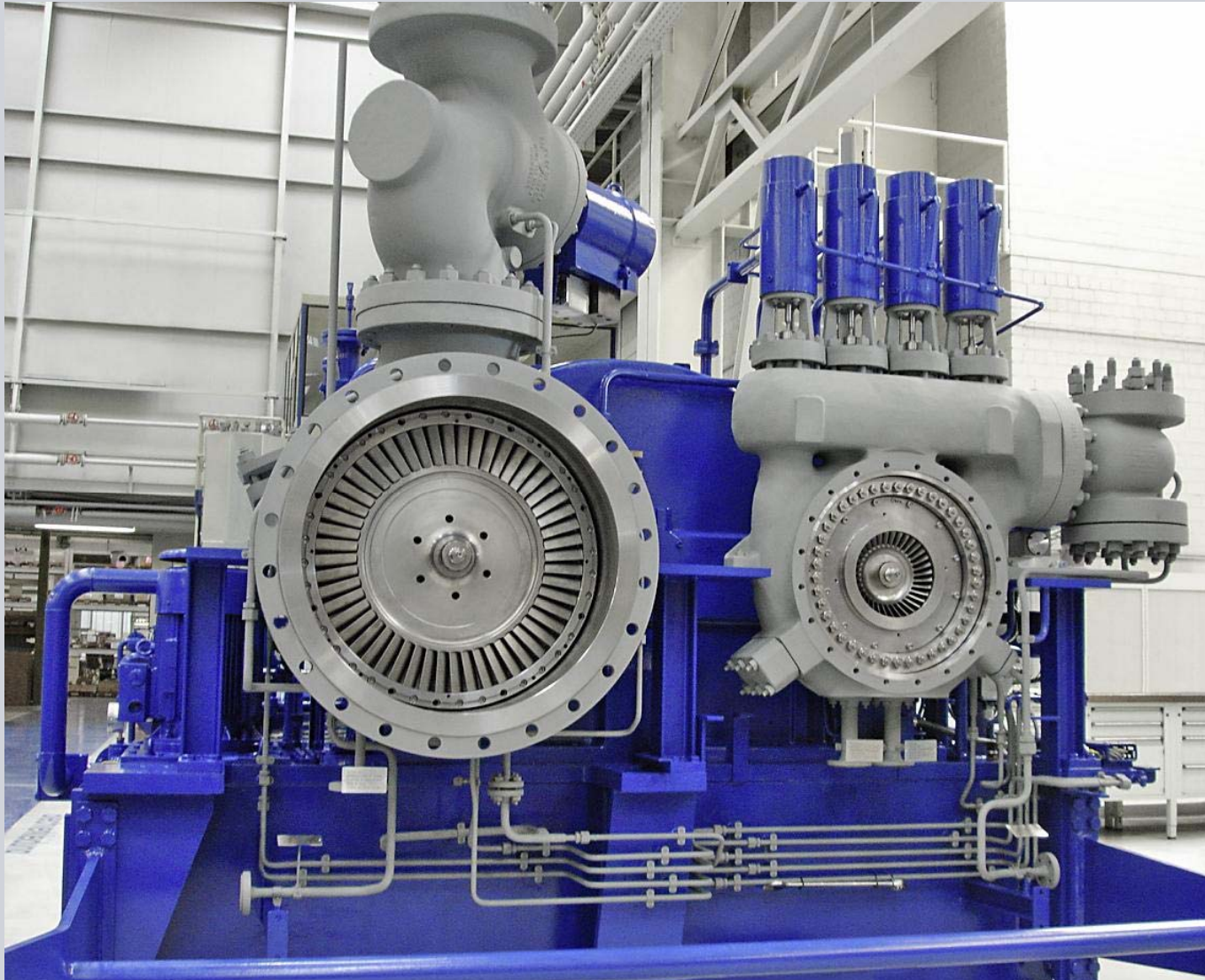
**SST-110  
(TWIN-CA 56k)**



**Operating data:**

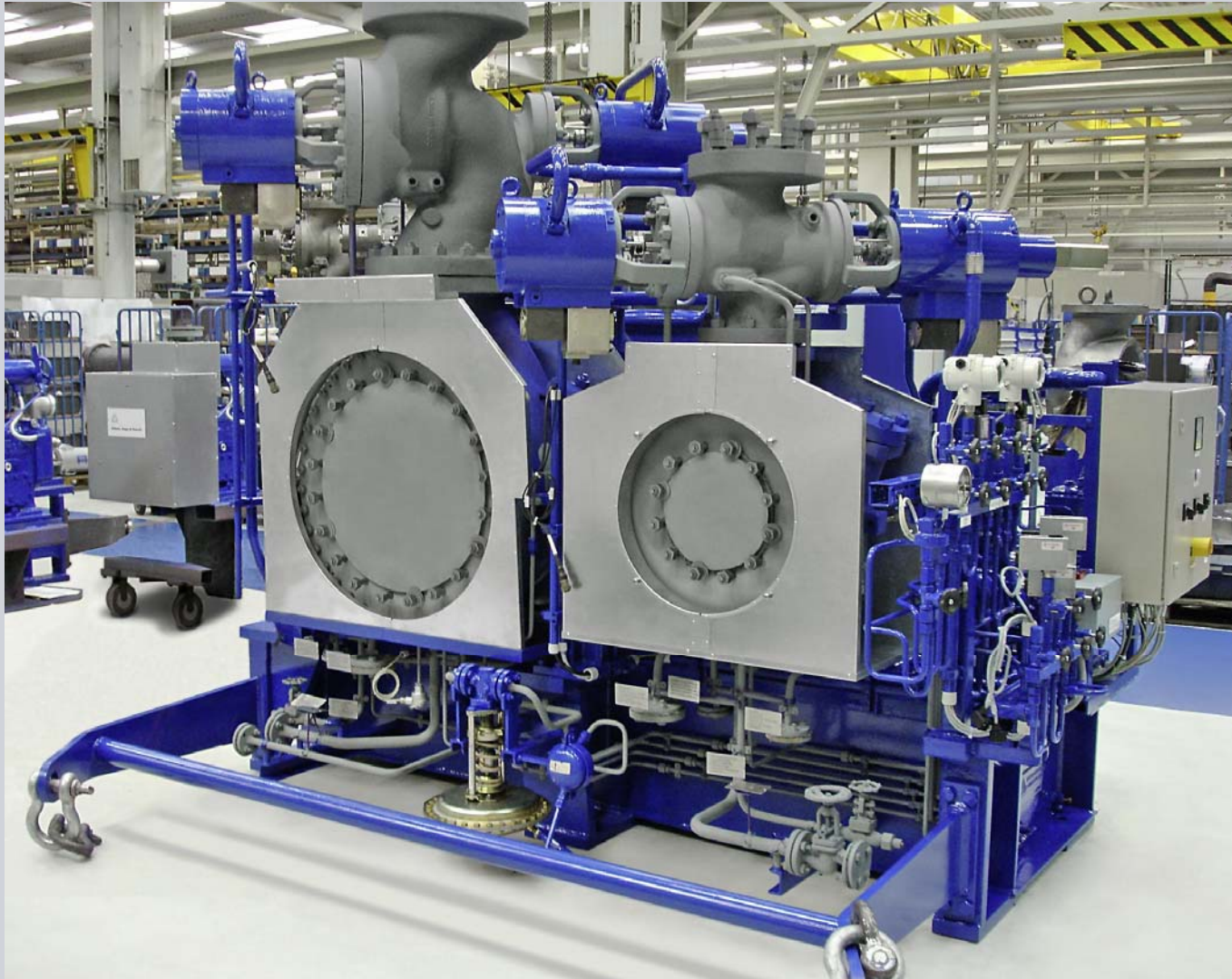
|                         |              |
|-------------------------|--------------|
| Live steam pressure:    | 18.0 bar a   |
| Live steam temperature: | 445°C        |
| Condensing pressure:    | 0,12 bar a   |
| Extraction pressure:    | 3 bar a      |
| Electrical output:      | to 2 842 kWe |

## Technical Details





## Technical Details





**Thank you for your attention**

