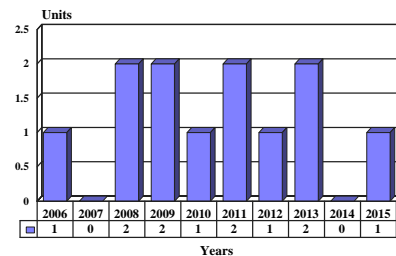


# B+V Steam Turbines - Archived 4/2007

## Outlook

- B+V's current production program emphasizes low-power-output steam turbines
- MARC® systems allow low capital costs, short delivery time, and flexibility of installation
- Since partnering with GE, B+V has been involved with power plants having 10-350 MW electrical power and 15-400 MW thermal power

10 Year Unit Production Forecast  
2006 - 2015



## Orientation

**Description.** Backpressure and condensing steam turbines in the power output range of 2.5-50 MW<sub>el</sub> are produced by B+V Industrietechnik (B+V). The machines can also be equipped with controlled extractions.

**Note:** In this report, the B+V Industrietechnik line of steam turbine generators is referred to as B+V SGT.

**Sponsor.** The B+V SGT line was privately developed by the prime contractor. The current prime contractor is identified in the **Contractors** section below.

**Power Class.** The power output range of the B+V SGT line is 3-50 MW<sub>el</sub> (MW electrical), in four basic machine configurations. The upper power limit depends on the live steam and evaporation conditions.

**Status.** At the start of 2006, the B+V SGT line was in production.

**Total Produced.** At the start of 2006, B+V Industrietechnik had produced in excess of 150 steam turbines worldwide for all applications, including at least eight machines of 20 MW and larger for use in combined-cycle installations.

**Application.** The B+V SGT line can be used separately or as part of a combined-cycle power plant using a variety of fuel sources for electrical generation. The machines are also used to drive pumps and compressors for both industrial and power station uses.

**Price Range.** The manufacturer has chosen not to supply pricing information to non-buyers, but to discuss prices directly with customers.

**Competition.** The steam turbine machines of several manufacturers worldwide compete with the B+V line of steam turbines.

## Contractors

### Prime

**B+V Industrietechnik**

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Comprehensive information on Contractors can be found in Forecast International's "International Contractors Series." For a detailed description, go to [www.forecastinternational.com](http://www.forecastinternational.com) (see Products & Samples/Governments & Industries) or call +1 (203) 426-0800.

Contractors are invited to submit updated information to Editor, International Contractors, Forecast International, 22 Commerce Road, Newtown,

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## OBB+V Steam Turbines - Archived 4/2007

## Technical Data

**Background.** B+V Industrietechnik turbines are designed in accordance with IEC and DIN 4312 rules, and can be designed to meet API regulations or customer standards. They are produced in a standardized method for easy maintenance, and, according the manufacturer, can be optimized for most conditions required by the customer.

### Design Features

**Casing/Outer Housing.** The reaction-type turbines are designed with a horizontally split symmetrical turbine housing and thermal elastically suspended guide blade carriers and inner casings. The outer housing is of a combined cast/welded construction design.

**Blades.** The B+V reaction-type steam turbines feature reaction profiles. The HP blades are provided with milled shrouds, while the last blade rows are mostly designed with conically twisted blades, the blade ends of which are tip-thinned on one side. The rotor blades of the last rows are grouped by means of damping and binding wires.

**Turbine Rotor.** The reaction turbines are designed with a forged drum-type rotor. The turbine rotors, the balance piston and the impulse wheel disc, as well as the subsequent drum parts, are a solid forging of high temperature material.

The bladed rotors are statically and dynamically balanced at operating speed in a modern high-speed vacuum balancing plant so that the shaft vibrations over the entire speed range are considerably below DIN 4312 or API permitted values.

**Dimensions.** The overall dimensions of the B+V SGT line have not been released.

**Performance.** The power output range of the B+V SGT line is 3-50 MW<sub>el</sub> and is covered by four basic machine types. The upper power limit is dependent upon the state of the line steam and exhaust steam condition. Under the Modular Arrangement Concept (MARC), operating parameters of B+V SGT line include the following (**Note:** as used below, “bara” means “bar abs.”):

**Gear Unit/Generator Unit.** The gear unit is directly flanged to the generator as a planetary gear unit.

**Labyrinth Sealing Glands.** A labyrinth type of steam sealing lies between the turbine rotor and the casing located at the casing’s ends. The sealing strips are of high-temperature material and are caulked into the rotor. In case of metal-to-metal contact at the sealing strips, the heat is absorbed by the casing, thus preventing local overheating and deformation of the rotor.

**LP Lubrication Oil System.** This unit is a separately installed oil module that can be flexibly placed in the plant due to its minimal oil volume. The system can be expanded at any time.

**Bearings.** The turbines employ multi-face sleeve or tilting pad-type radial bearings. A stable rotor position is maintained by hydrodynamic oil wedges, equally spaced on the circumference.

The axial forces resulting from pressure differences in the blading are mainly absorbed by the balance piston. A double-sided segmental axial bearing absorbs the residual thrust and the coupling forces.

**Measuring/Control Module.** All necessary systems for the operation and monitoring of the turbogenerator are housed in a single control cabinet. The systems are equipped with visualization systems, and are PC-based. The modules can be flexibly installed independent of the turbine, and are provided with a serial bus to the distributed control systems (DCS).

**MARC® STEAM TURBINES**

<u>Designation</u>	<u>Terminal</u>	<u>Connection Flanges</u>		<u>Speed</u>	<u>Live Steam Conditions</u>
	<u>Power</u>	<u>Live Steam</u>	<u>Exhaust</u>		
MARC 2	3-12 MW	200 bara	1,000°C	10,000-12,500 rpm	90 bara/520°C
MARC 4	8-22 MW	250 bara	1,200°C	8,000-10,500 rpm	118 bara/520°C
MARC 6	12.5-35 MW	300 bara	1,700°C	6,500-8,500 rpm	120 bara/540°C
MARC 8	20-50 MW	350 bara	2,100°C	5,000-6,500 rpm	120 bara/540°C

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## Variants/Upgrades

B+V offers steam turbines in a Modular Arrangement Concept (MARC) (see Performance subsection above). It should be noted that the steam parameters, and thereby the heat drop, determine the internal layout of

the turbine in each individual case/installation. The type of control stage and the number of states of the blading are individually adapted to the power plants' operating conditions.

## Program Review

**Background.** B+V Industrietechnik was founded in 1877 primarily as a ship and machinery construction firm. In 1906 the company built what was the world's largest diesel engine at the time (15,000 hp). In the 1930s, it built its first land-based power plant using steam turbines. By the 1970s, engine production was focused solely on stationary engine power plants in all configurations. Since 1990, the company has delivered complete combined-cycle plants from its own in-house plant engineering department.

In October 1995, the ThyssenKrupp Industries Group separated the shipbuilding activities from the mechanical engineering operations, each being organized under separate companies.

B+V Industrietechnik H is one of the largest engineering facilities in north Germany. Production plants are centered on Hamburg. The major advantage of being located in this port city is worldwide connection by sea, air, rail, and road. In addition to its power generation activities, B+V is also an active player in the shipbuilding and mechanical engineering, defense technology, and maritime component markets.

### *Steam Turbines Offer Versatility*

B+V's steam turbines have been used in industrial power plants, combined heat and power (CHP) plants, the chemical and petrochemical industry, waste incineration plants, and waste heat recovery schemes.

B+V identifies its steam turbines by type as follows:

**Turbine Type B: Backpressure.** The backpressure turbines, Type B series, are used as generator drives in CHP plants, for power generation by industrial companies, in cogeneration plants, and as pump and compressor drives in the chemical and petrochemical industries. For B series machines, the exhaust connection and the casing are integrally cast.

**Turbine Type C: Condensing.** The condensing turbines, C series, are applied to turbogenerators for industrial power plants, incineration plants, and chemical and petrochemical plants.

The extraction steam can be used as heating and production steam or for feedwater heating. For efficient performance at part load, the HP part is designed with nozzle group control. The LP part can be supplied with a throttle control to meet the operating conditions of specific customers. The exhaust connection is of welded construction, and can be fitted facing upward or downward depending on site conditions.

**Turbine Type H: Heating.** The CHP plant is the typical application of the H series. A special feature of this turbine type is the double-pass exhaust section. Due to the regulated steam extraction, pressure stages are optimized to generate water for heating purposes.

### *Modular Arrangement Concept (MARC)*

The modular arrangement concept allows a flexible arrangement of the steam turbines' main components. The turbogenerator unit includes five modules: steam turbine, gearbox/generator unit, LP lubricating oil system, HP control oil system, and measuring and control system. Instead of a generator, a compressor or a pump can be supplied as the driven machine.

Through the MARC concept, the different turbine elements can be optimally designed to meet a specific requirement such as a certain pressure level or extraction steam quantity.

Depending on the live steam condition and specified mode of operation, nozzle group control can be selected with or without bypass or throttle. The control stage, either a single-row or twin-row type, and the number of reaction stages can be designed for a specific requirement. For all reaction stages, the round-head profile with low-loss coefficient developed by B+V is used.

For the MARC 6 and 8 series, a double helical spur gearbox can be used instead of an epicyclic gearbox, depending on the unit's overall power and speed.

### *B+V Relationships with OEMs*

Since its partnering with GE (which supplies the gas turbines for cogeneration plants), B+V has been able to

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be a part of power plants having 10-350 MW electrical power and 15-400 MW thermal power.

B+V Industrietechnik GmbH has also established a cooperative relationship with Solar Turbines Inc to provide small gas turbines (4-10 MW) for

combined-cycle plants for applications where the GE turbines would be too large. The combined-cycle plants, with their stringently regulated exhaust gas contents and temperature levels, are actively promoted by B+V as environmentally friendly solutions in today's world.

## Significant News

**CC Installations** – B+V Industrietechnik last installed a combined-cycle unit in December 2005. (B+V Industrietechnik, 1/06)

**Note:** Market Intelligence Service Subscribers: For additional news, go to the online E-Market Alert page located in the Intelligence Center at [www.forecastinternational.com](http://www.forecastinternational.com) and click on the links to the products you subscribe to.

## Funding

It is unknown whether B+V Industrietechnik relied on outside sources in developing its steam turbine line.

## Contracts / Orders & Options

**Note:** The following contracts are non-military awards.

<u>Contractor</u>	<u>Award (in millions)</u>	<u>Date/Description</u>
Stadtwerke Münster; Germany	N/A	2005 – One MARC 8-H02 steam turbine for a CHP installation in Hafen, Germany.
TECHNIP-COFLEXI P for RWE Power AG; Germany	N/A	2003 – One MARC 4-C10 extraction-condensing steam turbine for a CHP installation in Bochum, Germany.

## Timetable

<u>Month</u>	<u>Year</u>	<u>Major Development</u>
	1877	Company founded by engineers Hermann Blohm and Ernst Voss
	1947	Three-year-long dismantling of company, after suffering bomb damage in WWII
	1951	Work resumes at plant
	1967	Siemens acquires Blohm + Voss capital; production of first corner-tube industrial boiler
	1976	27-MW turbine delivered for a municipal heating plant
	1989	New production plant completed
	1995	Corporate reorganization; mechanical engineering and shipyard operations separated
Thru	2015	Continued B+V steam turbine production projected

## Worldwide Distribution / Inventories

At the start of 2006, more than 150 B+V steam turbine machines had been installed in all types of power plants worldwide. Among these, at least eight machines of 20 MW and larger had been installed for duty in combined-cycle installations, all for customers in **Germany**.

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## Forecast Rationale

B+V Industrietechnik is confident that the market for the smaller (under 50 MW) land-based steam turbines will continue to attract orders for smaller-scale combined-cycle installations. While B+V has not had great success in all corners of the planet, it continues to market its steam turbines aggressively in Central and Western Europe and Asia, the latter most notably including India, Indonesia, and Thailand. It is also marketing complete decentralized turnkey power plant facilities in Eastern Europe, with keen interest in the Czech Republic and Hungary.

Given B+V's relatively narrow geographic marketing arena at present, and the re-emerging health of the electrical generation marketplace worldwide, we project that the company will manufacture 12 steam turbines for combined-cycle installations of 20 MW and larger in the decade extending through 2015.

While B+V is believed to be capable of producing steam turbines in the 50-124 MW class, we believe that the company will wait for more opportune economic conditions before considering whether to actively market products in that power band and, thereby, enter into competition with a host of entrenched entities.

## Ten-Year Outlook

## ESTIMATED CALENDAR YEAR PRODUCTION

Engine/Machine	Application	thru 05	<u>High Confidence Level</u>				<u>Good Confidence Level</u>				<u>Speculative Level</u>			Total 06-15
			06	07	08	09	10	11	12	13	14	15		
B+V 20-49 MW STEAM TURBINES	COMBINED-CYCLE GENERATION	8	1	0	2	2	1	2	1	2	0	1	12	