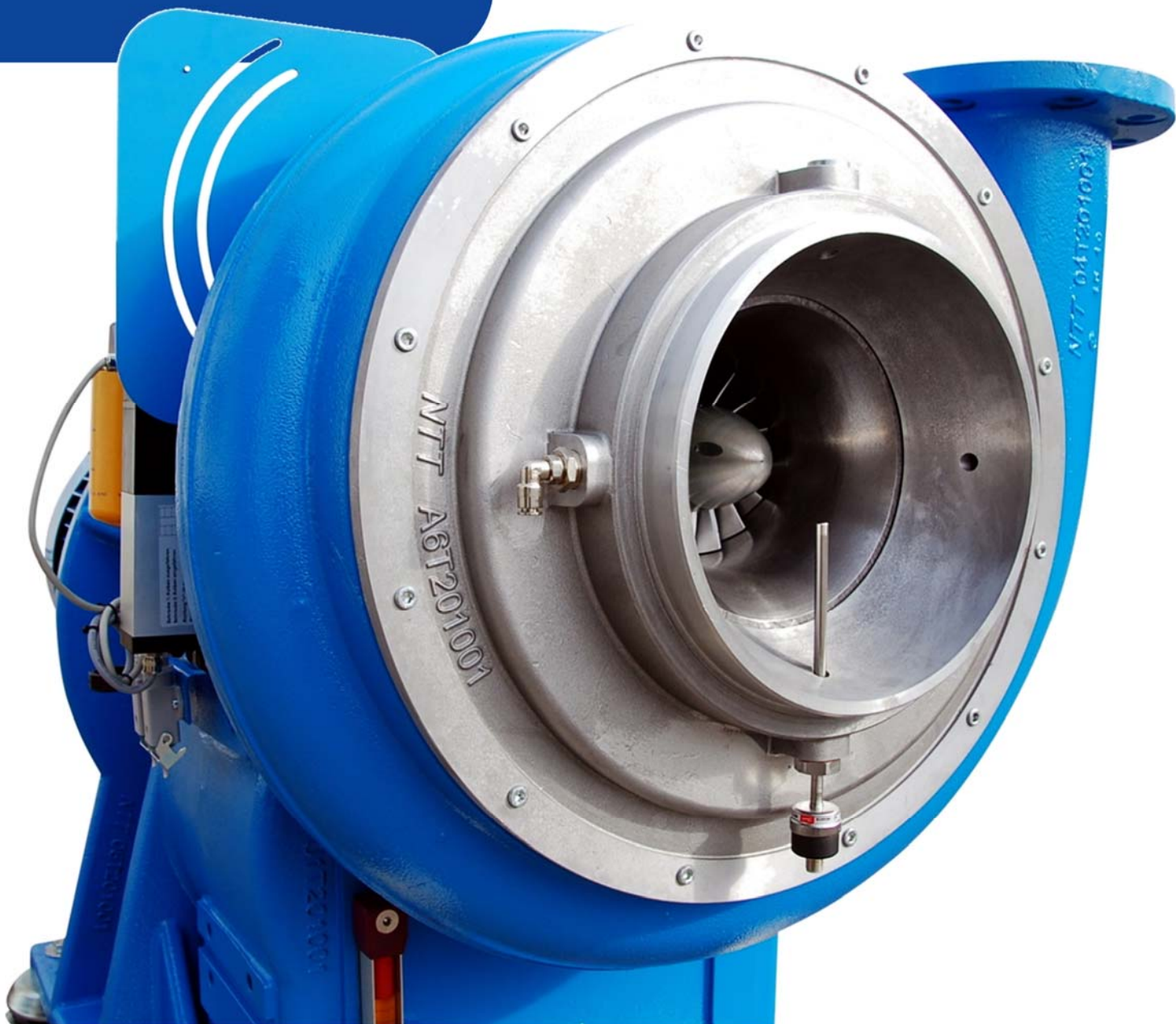


Single Stage Integrally Geared Turbocompressor



NexTurbo
TECHNOLOGIES



A passionate and experienced team

NTT was founded with the belief that robust integrally geared turbocompressors are a requirement within the municipal and industrial waste water industry – today and for years to come.

The management team combines nearly one hundred years of experience within the industry and is passionate about turbocompressors. We build a machine from the ground up, relying on state-of-the-art materials and design techniques to create the smartest turbo on the market. Our mission is to provide the industry with a modern, robust and lasting in heavy duty conditions product that can be absolutely depended on.

The main factory is located in the municipality of Varese in Northern Italy, close to Milano and the Swiss border. As one of the most industrialized areas in Northern Italy, with major global aviation and military manufacturing companies operating here, it sustains a landscape of highly specialized machining companies.

We look forward to welcoming you to witness first hand our capabilities and witness compressor performance test.





A turbocompressor for every flow

Is that not too expensive?

Historically, the low flow end of the waste water treatment aeration industry has traditionally been dominated by volumetric blowers. With more and more focus on energy efficiency and cost competitive centrifugal technologies, the paradigm is shifting.

Is a packaged solution possible?

The plug & play package concept is gaining momentum in the industry. This concept is applied to NTT's integrally geared turbocompressor line.

Why accept limitations?

Volumetric machines face low design efficiencies and direct driven turbocompressors have a limited turndown, reduced lifetimes, and are more sensitive to ambient conditions.

The NTT integrally geared single stage turbocompressor line combines all the advantages of well established geared turbocompressors and the latest engineering developments in rotating equipment and fluid dynamics.

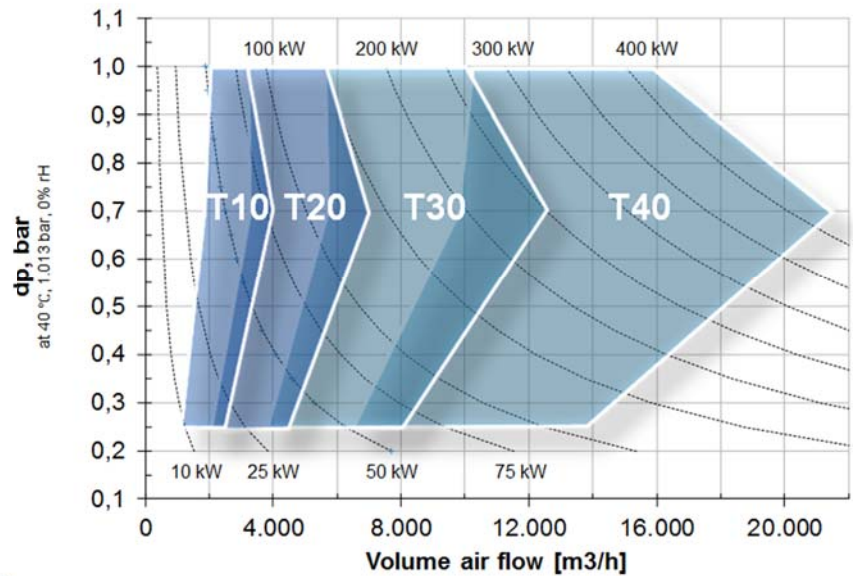
- **Our most competitive turbo** compares well with direct drive and screw-type compressors in low flow applications.
- **Highest efficiency** in our customized and optimized compressor design.
- **Stable with high efficiency** across the full operating envelope range with our 2-point control.
- **Maximum airflow regulation turndown** with our discharge diffuser vane system, allowing between 40-100% of airflow.
- **Fully enclosed plug & play package** for the compressor and all its auxiliaries.
- **Full integration of automation solution** with Local and Master Control as well as Oxygen Control available.

The advantages of recent technologies without their limitations. An affordable, robust, highest efficiency machine with maximum turndown.

Product Portfolio



GTB – T series



Our product portfolio

Our integrally geared centrifugal turbocompressor range features four distinct frame families up to 450 kW installed motor power, customizable to your project needs.

The frame families are available in a plug & play compact package with all auxiliary parts fully enclosed and ready to start, or with a more traditional assembled modular enclosure.

The drive configuration can be chosen as either low voltage B3 or B5 (flange); as well as medium voltage B3.

All NTT turbocompressor models feature discharge diffuser vanes to achieve exceptional turndown range and 1-point or 2-point regulation control.

Flexibility/ stability in blower operations- with wide real-airflow-turndown of 40-100%

Highest efficiency over entire turndown range with our diffuser vane regulation

Power optimization – with our mechanical or electrical 2-point regulation control

Longest lifetime - offers more than 20 years of lifetime for your investment

Reliable operations – thanks to a robust mechanical design; perfect for challenging environments

Proven technology – with a global reference base in waste water aeration applications

Spare parts security– with standard main auxiliaries readily available on the market

Product naming explained

Example

GTB-T20XY

GT	Geared Turbocompressor
B	Ceramic ball bearings 'B' or Hydrodynamic bearings 'H'
T20	Frame size Turbo T10,T20,T30,T40
XY	Compressor regulation control: X, XY, XZ see explanation box on next page

What really matters!

At the heart of each turbocompressor package is the compressor core unit and its most important characteristic: the flow/ pressure regulating system. The choice of regulating system determines the turbocompressor's performance over the entire operating range, especially in off-design conditions. It also determines the level of turndown possible. All NTT turbocompressors typically feature a wide 40-100% airflow regulation range.

Regulation type 'X'

Mechanical 1-point-control

Flow- and pressure regulation using discharge diffuser vanes for wide turndown capabilities. By adjusting the discharge diffuser vanes the compressor operating envelope is extended along the flow-axis.

Regulation type 'XZ'

Electrical 2-point-control

Flow- and pressure regulation using both discharge diffuser vanes and a variable frequency drive for increased flexibility. The operating envelope of our X-type control is extended along the pressure-axis.

Regulation type 'XY'

Mechanical 2-point-control

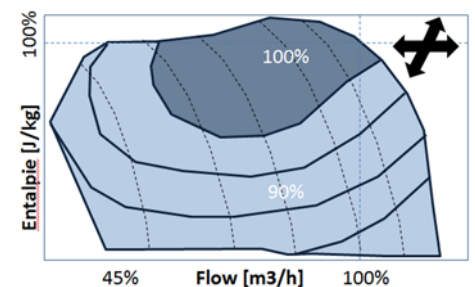
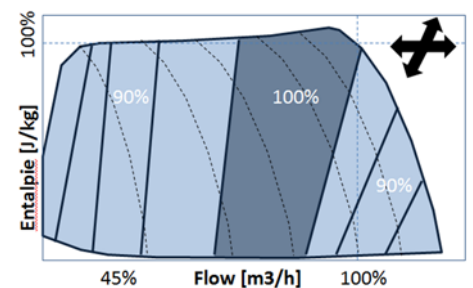
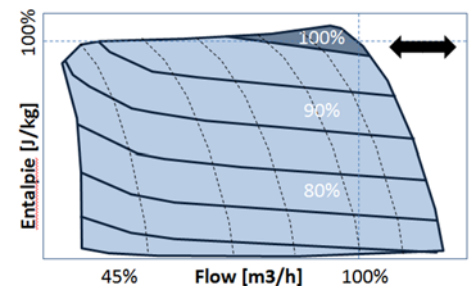
Flow- and pressure regulation using the discharge diffuser- and inlet guide vane systems for optimal efficiency. The wide turndown of an X-type machine is combined with mechanical power optimization to compensate for air temperature, humidity, and pressure fluctuations.



Turbocompressor Regulation Control

Compressor envelope and -curves

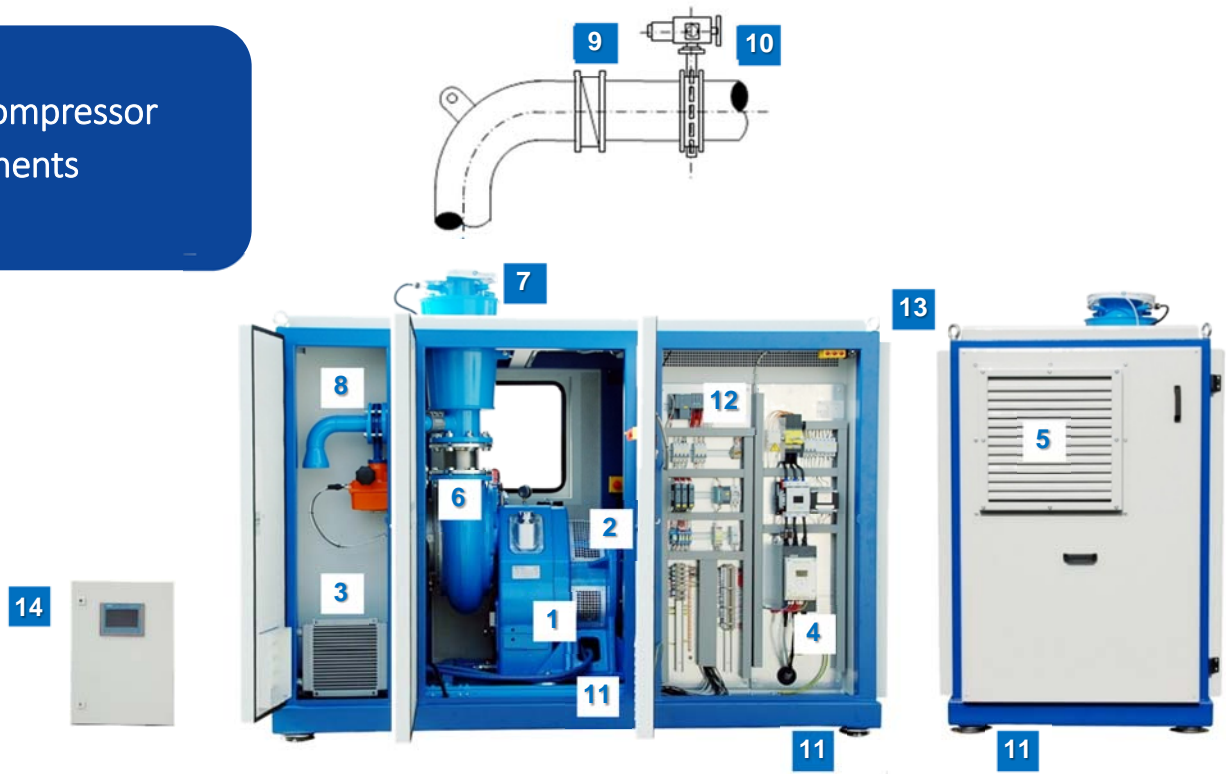
from top to bottom: Regulation type 'X', Regulation type 'XZ', Regulation type 'XY'



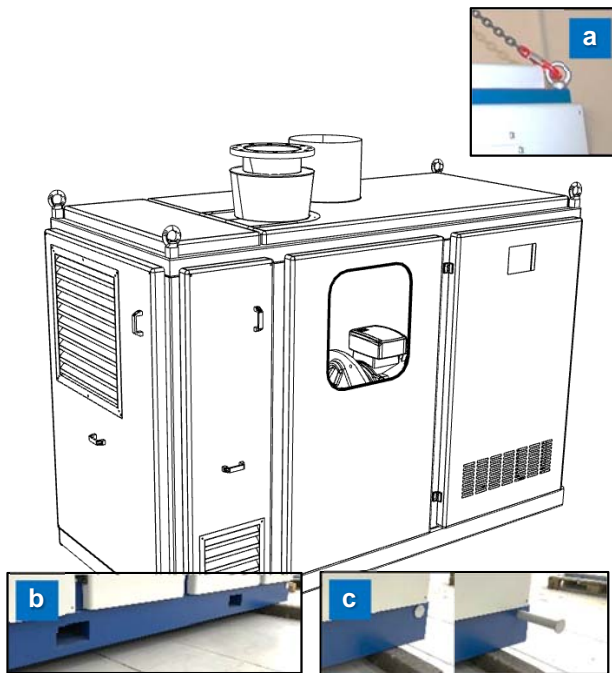
Speed-control with VFD is the most common, but not the only regulation method

Most turbocompressors on the market, especially directly driven ones, apply the simple speed control to regulate airflow. An adjustment in speed reduces the flow linearly, but the differential pressure is reduced by the power of two. This choice of regulation forces a trade-off between regulation range and efficiency. In order to allow a reasonable flow turndown, the compressor needs to be oversized in its pressure capabilities in order to meet the water column back-pressure requirement over the entire flow range.

Basic Compressor Components



- 1 Turbocompressor** – Integrally geared turbocompressor with integrated gearbox and lubrication system, utilizing 1-point or 2-point regulation control system for wide turndown and highest efficiency.
- 2 Electrical drive motor** – Available in standard B3 or B5 (flanged) low voltage configuration for 50 or 60Hz. Utilizing medium voltage motors is also possible. Motors selected from first class manufacturers, IEC3 high efficiency standard.
- 3 Air/Oil heat exchanger** – complete independent cooling loop system air to oil integrated
- 4 Motor control center** - full motor control center, either as DOL, Soft Starter or Variable Frequency Drive with all auxiliaries and optional electrical filters.
- 5 Inlet silencer/filter** - Inlet silencer as a labyrinth-type with coarse inlet pre-filter and fine pocket filter with 95% filtration as per G4 EN779.
- 6 Flexible compensator** - Flexible discharge compensator with stainless steel AISI 321 flexible element and turn-able aluminum flanges.
- 7 Discharge cone diffuser**- Conical diffuser cone with integrated outlet silencer, for recovery of up to 90% of the dynamic pressure.
- 8 Blow-off valve/ silencer** - Butterfly valve for mounting between flanges according to DIN 2501, PN10, and equipped with an electric actuator as well as a hand wheel for manual operation, includes limit switches.
- 9 Check valve** – Non-return check valve, with dual spring loaded flaps.
- 10 Isolation valve (electrical)** - Butterfly valve for mounting between flanges according to DIN 2501, PN10, and equipped with an electric actuator as well as a hand wheel for manual operation, includes limit switches.
- 11 Vibration dampers/ mounts** - for 95% vibration reduction. The vibration dampers are mounted between the compressor base and the compact enclosure floor.
- 12 Local control panel (LCP)** – Equipped with Siemens PLC and Siemens HMI touch screen. Features all functions for start/stop of the compressor, air flow regulation, as well as the security system.
- 13 Acoustic enclosure**- Silencer hood integrated with all accessories, factory mounted and tested. All side and top panels are either hinged as a door, or quickly and easily removable for comfortable access to the internal components. Each side is equipped with an inspection window. The hood is equipped with an internal light, and a heat extraction fan, all operated from the local control panel.
- 14 Master control system (MCS)** - Master control system to automatically regulate the air flow of each compressor via cascade control. The MCS is equipped with Siemens S7 PLC and a Siemens HMI.



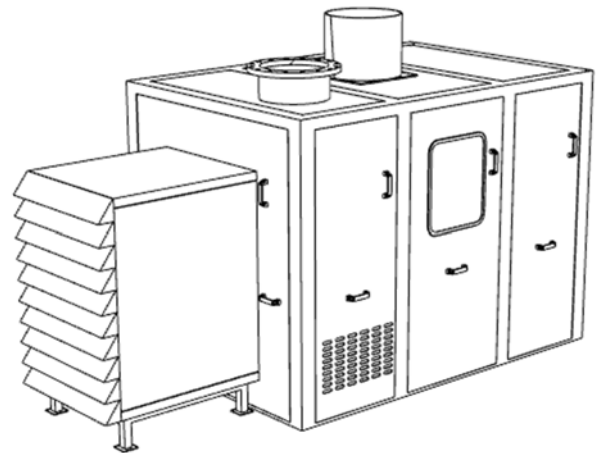
Compact enclosure for compressor with B5 flanged console, available up to 315 kW motor size. All components fully enclosed, including optional Motor Control Center. According to configuration the compact enclosure can be lifted via eyebolts (a), forklift (b) or special bolts (c).

Compact plug & play package

A fully enclosed, pre-wired and tested plug & play solution

The compact acoustic enclosure integrates all required accessories, factory mounted and tested. Main steel structure comes with all side and top panels either hinged as a door, or is quickly and easily removable for comfortable access to the internal components. Each side is equipped with an inspection window. The compact enclosure comes with an internal light and heat extraction fan, controlled from the local control panel. The peak noise during start and stop is eliminated due to the integrated blow-off valve and silencer. The package is easy to handle due to access holes for fork-lift at the base plate and dedicated lifting lugs on top of the enclosure.

Dedicated compartments can be provided for local control panel, MCC configuration with VFD, soft starter, DOL and the inlet system. Only one external connection at power supply is necessary, accessible from top or from bottom. The Next step is to press the start button.



Modular enclosure for compressors both with B5 flanged console or B3 basement, delivered as a build up kit, covers the full range up to 450 kW motor size. The local control panel and the optional Motor Control Center are built as stand alone panels, as well the blow-off valve, check valve and inlet system are external.

Modular package

A traditional modular enclosure, for easy installation customised to site conditions

The modular enclosure is built around the compressor unit, which is installed on the floor. The modular enclosure consists of several doors (modules) which are easily removed in case of maintenance (lift and remove). Some doors are hinged and equipped with a window. Both structure and sound absorbing panels are made of sandwich bended Aluzinc steel sheets filled with mineral wool and a plaster sheet.

The inlet silencer is installed in front of the unit and connected to the compressor inlet via a flexible metal joint. The local control can be provided loose, mounted outside of the enclosure.

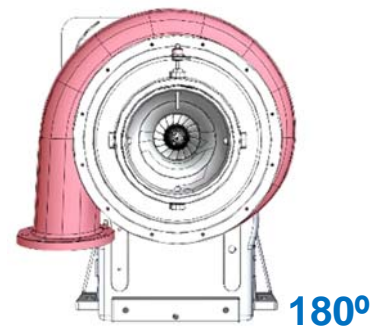
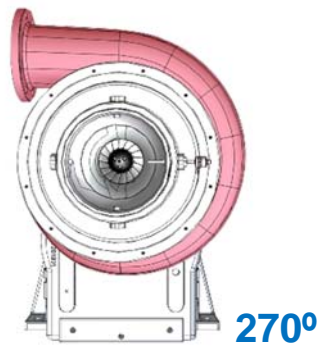
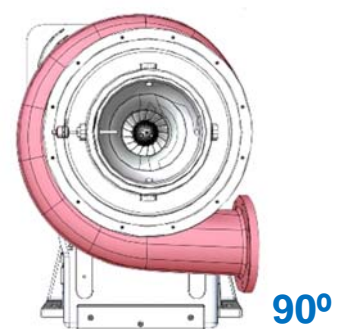
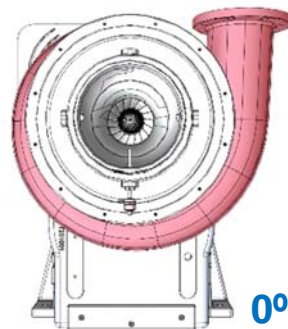
Both Compact and Modular solutions are available with outdoor installation configuration

Customization Options

Compressor discharge configurations:

Available discharge orientations within a compact enclosure as integrated packaged solution.

A modular enclosure can include discharge orientations every 15°.



Other upgrade options

Safety instrumentation options

Extend the instrumentation of the machine with the below options:

- Compressor bearing temperature monitoring
- Vibration monitoring
- Extended motor winding temperature monitoring
- Motor bearing temperature monitoring
- Reverse rotation monitoring

Motor space heater – for cold and humid environments.

Other PLC or network platforms –

Choose between Siemens S7, Allen Bradley and Schneider. Profibus, Ethernet or Modbus.

Remote monitoring & service – Integrate our intensive care and fast troubleshooting options.

Commissioning or training of staff on site – support on site for a successful start-up.

Service packages and kits – Wear and tear as well as recommended spare parts.

Medium voltage drive motor – Reduce investments in your electrical plant setup by utilizing medium voltage drive motors.

Water cooling – Exchange oil-air cooling with a water cooling option for hot climates.

Extended inspection and test plan – Add additional ITP items, such as:

- Overspeed test of impeller
- Dye penetrant test of impeller
- Hydrostatic test of volute

Performance or performance verification test – Performance test according to ISO 5389 and verification of guaranteed power figures. Vibration-, sound measurements and mechanical run test are standard scope items for each delivery.

Material description

Main Castings	Nodular cast iron EN GJS-400/15 EN1563, design: 6,5 bar, 200°C	Vanes	Stainless steel AISI 316
Impeller	Aluminum W.Nr.3.1924 AlCu2MgNi; milled from a solid forged block; open, with radial backward-leaning blades, can withstand corrosion up to 10ppm of H2S	Bearings fast shaft	High precision ceramic angular contact ball bearings
Mechanical components	Steel	Bearings slow shaft	Deep groove ball bearings
Labyrinth seals	Aluminum alloy	Gearwhells	High tensile steel 16NiCrS4, hardened and ground
		Lubrication	Forced oil mist lubrication with integrated positive displacement pump, oil/air cooler, oil filter 10 µm

Power connection

Low voltage - between 380 and 690Vac – 3-phase - 50 or 60Hz. Compact enclosure includes all power switches and connections. Main power connection accessible from bottom or top.

Medium voltage – between 3300Vac and 6600Vac – 3-phase – 50 or 60Hz, B3 frame equipped with selectable instrumentation and flexible coupling.

Inlet filter/ silencer

Selection criteria - Inlet suction air volume, designed to reduce air-speed to 4m /s. The below dimensions are for the coarse pre-filter as well as for the fine pocket filter.

Max airflow	Filter size	Weight
< 4.000 m3/h	60 x 60	200 kg
4.000 – 8.000 m3/h	90 x 90	350 kg
8.000 – 12.000 m3/h	90 x120	410 kg
12.000 – 16.500 m3/h	120 x120	500 kg
16.500 – 19.000 m3/h	120 x160	620 kg
19.000 – 25.000 m4/h	160 x160	710 kg

Filter is constructed from standardized half or full pocket filters 610 x 610 or 610 x 305 mm sizes.

Discharge cone diffuser

Selection criteria - The air-speed at the discharge flange of the cone, designed not to exceed 25 m/s in order to minimize piping pressure losses and reduce acoustic noise in the pipe.

Model	Cone size	Weight
GTB-T10	125/200	75 kg
GTB-T10	125/250	80 kg
GTB-T20	150/250	120 kg
GTB-T20	150/300	130 kg
GTB-T30	200/350	170 kg
GTB-T30	200/400	175 kg
GTB-T40	250/350	190 kg
GTB-T40	250/400	200 kg
GTB-T40	250/500	210 kg

Local control panel

The local control panel (LCP) features the main functions for start and stop of the compressor, as well as the security procedures. Within the compact enclosure, the LCP is fully integrated in its own compartment.

Other features:

- All compressor controls, alarms, trips and all auxiliaries
- Diffuser capacity control (flow control)
- Connection to master control system (MCS) or plant control system (DCS)
- Power supply 3 x 400Vac + N + PE

Master control system (MCS)

The MCS (Master Control System) controls the turbocompressor air flow with a high efficiency cascade control that perfectly matches process air requirements and equalizes compressor duty hours. The MCS is a stand-alone panel situated in the blower room.

The master control system with integrated dissolved oxygen (DO) control

The MCS-DO system covers all the functions of the MCS system, and additionally controls the aeration valves in the treatment basin based on the DO set-point and the DO process value.

The DO transmitters, as well as the aeration control valves, are connected to the MCS-DO panel (via hardwire or network). The MCS-DO CPU's software, with multiple parallel algorithms, compares the DO process value to the set-point and adjusts the aeration valves accordingly.

In the highly fluctuating aeration environment, the overall system pressure in the pipe is constantly changing. The MCS-DO automatically calculates the system lowest pressure using MOV (Most Open Valve) philosophy. This function allows the system pressure to be kept at a minimum because the aeration valves will be operated in their most efficient operational ranges, reducing operating costs. The hunting phenomena which many plants are subject to, is also minimized by adopting this functionality.

Available PLC platforms & networks:

Model	Network
Siemens S7-ET200SP	Ethernet, Profibus
Siemens S7-300	Profibus, Ethernet
Allan Bradley	Ethernet
Schneider Modicon M2xx	Ethernet, Modbus

Cascade control

The cascade control requires a large turndown from the compressors – usually 40-45% of the design airflow. This allows an overlap of the operating ranges of the multiple machines and results in energy consumption optimization and increased process stability.

W

recognize the fact that today's planners and designers have high information needs, especially in the early stages of a project. Access to the supplier's design tools are essential in today's fast paced world.

Aeration Customer
Web Portal

Our design programs at your disposal

Our Customer Portal at <http://www.next-turbo.com> allows you to design and configure your NTT turbocompressor in four simple steps. The result is a full set of customized pre-engineering documentation to allow you to move forward with your project.

Step 1: Manage your project

Create and edit your projects and request a quotation or assistance from a supplier expert.

Step 2: Performance setting

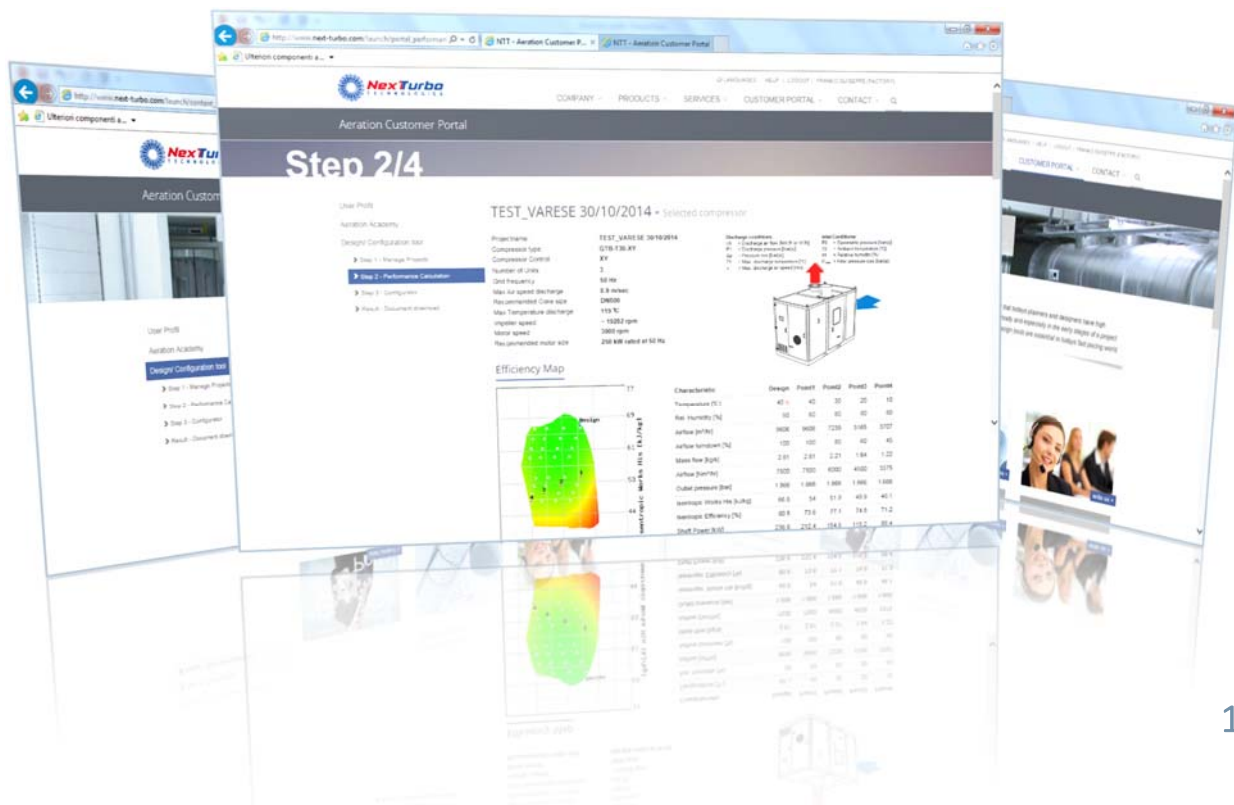
Enter air flow and pressure requirements over the whole operating range and get detailed power figures and compressor operating curves.

Step 3: Configure your units

Choose from a set of upgrade options to customize your compressor selection; from instrumentation to services.

Step 4: Pre-engineering documents

Choose from a set of pre-documentation such as: P&ID, G&A drawing, scope description, sound emission analysis, performance diagram, documentation list, instrument list, inspection & test plan (ITP), datasheets of main components, and other technical documents.





NTT SpA
cares about
details



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