

SINGLE STAGE TURBOCOMPRESSOR / TCH 35 SERIES

DETAILED ENGINEERING DESCRIPTION**A.1 GEARBOX**

The gearbox housing is compact design, vertically split with removal inspection plate to allow easy inspection and maintenance. The gears are designed according to ISO 6336:2006 and the quality is ISO 1328-1 Grade 4 to 6 (AGMA 11 to 13). This gear is consisting of one high speed pinion shaft and one bull gear, of helical configuration and of alloy steel.

- Gear case in cast iron grade 250
- Speed increasing gear is helical type with gear reaction load opposing impeller axial load to minimize load on thrust bearing
- Service factor is minimum 1.4
- Shafts and bull gear are fully machined from high grade steel alloy.
- Low speed bearings are cylindrical journal type and Flat Land Thrust type.
- High speed bearings are elliptical journal type and tapered land thrust type, or tilting pad type in option. Axial loading is absorbed by thrust collar to minimize power loss.
- Bearings and gears are oil lubricated from the pressure oil lubrication system.

A.2 COMPRESSOR HOUSING

The compressor housing is vertically split and directly mounted onto the gearbox with openings for inspection, cleanout and drain.

- Casing in cast iron grade 250. Stainless steel in option
- Axial inlet (DN 500)
- Tangential discharge (DN 300)
- Flanges conform to ISO 7005-1 or 7005-2

A.3 IMPELLER

We use the latest CFD (Computal Fluid Dynamics) and FEA (Fine Element Analysis) technology to develop our impellers. Each geometric specification is determined with many optimizations and we can specifically adjust the backward and lean angle among many other parameters to ensure mechanical strength, flow range and improve efficiency to meet your needs.

- Open Impeller fully machined from solid forging by CNC machines
- Impeller material are high grade aluminum alloy (2618A) or Stainless Steel in option
- Balancing to ISO 1940 Specification
- Attached to the shaft by shrink fit and locknut arrangement
- Over speed tested to a 115% of operating speed

A.4 SHAFT SEALS

Shaft sealing system (air & oil) is of the non-contact labyrinth type. This system is designed with air vent to atmosphere to guarantee oil free air discharge.

A.5 INLET GUIDE VANE

The Variable Inlet Guide Vane (IGV) control optimize the efficiency of our machines by changing operating conditions such as inlet temperature, relative humidity, outlet pressure.

- Casing in cast iron grade 250
- Guide Vane material are aluminum or stainless steel in option
- Guide Vane are supported in self-lubricating plain bearing
- Actuation is by a single spindle (non-lubricated linkage system)
- Fitted with electric linear actuator, for modulating control, complete with integral positioner, linkage, bracket and fittings which will be located upon IGV Housing. (Pneumatic actuator in option)

A.6 VARIABLE DIFFUSER VANE

The Variable Diffuser Vane (VDV) control offers a wide operating flow range with excellent efficiency while maintaining a constant speed motor.

- Casing in cast iron grade 250
- Diffuser Vane material are stainless steel
- Diffuser Vane are supported in self-lubricating plain bearing
- Actuation is by a single spindle (non-lubricated linkage system)
- Fitted with electric linear actuator, for modulating control, complete with integral positioner, linkage, bracket and fittings which will be located upon IGV Housing. (Pneumatic actuator in option)

B. BASE FRAME

- Base frame for the compressor, gearbox, oil system and main driver for direct installation
- Base frame is welded with fabricated carbon steel
- Oil reservoir integrated in the Base frame.

C. COUPLING

Multi-disc coupling with spacer including guard (torsionally stiff)

D. PRESSURE LUBRICATION SYSTEM

The pressure lubrication system provide a safe and reliable oil lubrication for the gear set and bearings and cooling for the bearings and gears. This complete system is designed to comply the API 614-5th (in option) and factory assembled and tested.

The oil lubrication system consist of the following components:

D.1 MAIN OIL PUMP

The main oil pump is mechanically driven from low speed shaft.

- Gear type
- Pump body in carbon steel

D.2 AUXILIARY OIL PUMP

The auxiliary oil pump is a pump with electrical motor, installed vertically and submerged into the oil reservoir. It has the equal capacity to the main pump and is used to prime the system before start-up and act as a standby unit in emergency and during shutdown.

- Gear type
- Pump body in carbon steel

D.3 OIL RESERVOIR

The oil reservoir is integrated in the base frame and including fill connection, inspection opening, gauge glass and ventilation.

- Carbon steel
- Painted with an oil resistant paint
- 3 min retention time

D.4 OIL FILTER

Duplex element oil filters connected with a manual change-over valve.

- 10 µm filtration
- Electrical & visual clogging indicator
- Casing in Aluminum

D.5 OIL COOLING HEAT EXCHANGER

- Air-cooled or Water-cooled

D.6 OIL HEATER (OPTION)

The heating element will ensure that the oil maintains a minimum temperature in case of stand-still or site conditions

E. INSTRUMENTATION & CONTROL

The control and monitoring systems shall ensure correct operating conditions at start and stop of the compressor as well as during operation.

The control system runs the start and stop functions, the compressor operation, the lubricating oil system, and the activation of the blow-off valve, the IGV and VDV.

E.1 LOCAL CONTROL PANEL

The local control panel can be mounted on the base frame

E.1.1 PANEL

- carbon steel, epoxy-polyester power painted, protection class IP54,
- operating items at the front side
- key switch to select operation mode "Unavailable / Remote / Local"
- push buttons (and lamps) to start / stop the compressor (operation mode: local)
- push button "emergency stop"
- push button "failure acknowledgement"
- lamps to monitor compressor status (Running / Warning / Failure)

E.1.2 PROGRAMMABLE LOGIC CONTROLLER (PLC)

- Siemens ET200SP CPU, with two Profinet sockets, I/O modules and software for fully automatic start / stop sequence and monitoring the process values.

or

- Allen Bradley Compact Logix 5069 , I/O modules and software for fully automatic start / stop sequence and monitoring the process values

E.1.3 HUMAN MACHINE INTERFACE (HMI)

- Siemens KTP700 Basic PN, 7", IP65 or • Allen Bradley PanelView Plus 600, 6", IP66

Installed at the front side of the panel

E.1.4 COMMUNICATION (DSC, MCC)

- Modbus TCP (the control panel is a Modbus server)

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E.2 INSTRUMENTATION

- Differential Pressure Switch for Inlet Filter clogging
- Relative Pressure transmitter 4-20mA @ Filter/Silencer, inlet and outlet
- Air Temperature transmitter 4-20mA @ Inlet & discharge
- Oil Temperature Switch @ oil tank
- Bearing Temperature RTD @ Gear Box & Motor
- Oil Pressure Switch @ Oil Pump
- Low Oil Level Switch @ Tank
- Differential Oil Pressure Switch @ Oil Filter
- Vibration Transmitter 4-20mA @ Gear Box
- X,Y & Z configuration Vibration detector @ gearbox pinion shaft (Bentley Nevada)
- IGV & VDV Position Transmitter (Potentiometer)
- Bypass Valve Position Transmitter 4-20mA
- Surge Switch

E.3 CONTROL

- Pressure or Flow regulation with IGV & VDV control
- Efficiency optimization through temperature and pressure reading (Geometry actuation)
- Surge monitoring through turbo parameters monitoring (Temperature and pressure reading, by-pass valve and geometry actuation)
- Gearbox monitoring (vibration , bearing temperature, shaft displacement)
- Oil circuit monitoring including :
 - Cooling/heating control
 - Pressure and temperature safeties & monitoring
 - Level indicators
 - Mechanical & electrical pump management
 - Oil filter monitoring
 - Motor monitoring (overload, winding and bearing temperature)
 - Sound enclosure fan control

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F. ACCESSORIES

F.1 BLOW-OFF VALVE

Blow-off butterfly-valve with electrical actuator including electro-positioner 4...20 mA input-signal or ON-OFF solenoid (Pneumatic actuator in option), limit switches, clamped between flanges; fail safe: open.

Turbo Compressor with accessories equipment

F.2 INTAKE AIR FILTER-SILENCER

Suction filter installed for the separation of particles out of the transported air before entering the blower, fitting to the suction-side of the blower, including the first set of filter inserts, baffle with sound-proof and differential pressure instrument to indicate the degree of contamination.

Including of

- Bird screen
- Filter Panel and baffles in removable casing for easy cleaning
- Differential pressure gauge and switch (alarm)
- Sound pressure level decreased around 20dB(A) @ inlet
- Bird screen (OPTION)

F.3 INLET SAND TRAP (OPTION)

Inertia filter type to prevent sand ingress into air inlet pipe when suction is done directly from outside of the building.

F.4 WATER HEAT EXCHANGE HEATER (OPTION)

Heat exchanger down to Outside Inlet Air @ -50°C to Filter/Silencer to Air outlet @ -10°C – Design based on site Water supply 70°C @ 9 Barg, hypothesis - SS316L pipe and BG1640Q1 Aluminum fin.

F.5 DIFFUSER CONE SILENCER

Steel rolled pipe adapter installed at blower outlet to reduce air speed below 20m/s. Inlet diameter DN250 to outlet diameter range from DN350 to DN 500. Walls are insulated for sound reduction and heat protection.

F.6 EXPANSION JOINT

Expansion joint for the connection of the blower to the process piping/duct. Flanges according to DIN standard on both sides. Material of expansion joint and guide plate stainless steel with carbon steel flanges.

F.7 SOUND ENCLOSURE (OPTION)

Sound enclosure for noise reduction of inside location. Sound pressure level to 85 db(A) @ 1 m