Ingersoll Rand

Centac C700 Series

Oil Free Centrifugal Air Compressor

100% OIL-FREE AIR
ISO CLASS 0
TÜV

C700 C80MX3 Model
Standard Scope Of Supply

Date : 20.06.2023
Customer : MONTES TRADING
Ref no : HMK23 / 392

Introduction

The CENTAC C700 compressor is a reliable and efficient integrally geared multistage centrifugal compressor that is designed to provide oil-free compressed air or nitrogen, for indoor or outdoor under roof installations in non hazardous areas.

CENTAC compressors are designed as fully packaged units including an air end, a driver, an Ingersoll Rand developed state-of-the-art control panel with microprocessor, an air cooling system and a self-contained lubrication systems, all mounted on a common fabricated steel baseplate.

Some of the outstanding features and benefits are:

Standard features	*Benefits*
Compact package on rigid baseplate	No special foundation required
Mounted intercoolers and aftercooler	Compact efficient design
Baseplate mounted control panel	Pre-wired and factory tested
Fewest electrical hook-ups	Minimal installation time and cost

2 CENTAC Principles of Operation

Air enters the compressor through the machine mounted inlet control valve and flows to the first stage where the impeller (1) imparts velocity to the air. The air proceeds through the stationary diffuser section (2) where the kinetic energy (velocity) is converted to static energy (pressure). The built-in intercooler (3) removes the heat of compression and improves compressor's efficiency. Air then passes through a stainless steel moisture separator (4) in a low velocity zone to remove condensate. Entrained moisture in the air is reduced when the air is forced through stainless steel moisture separators. This sequence repeats in each succeeding stage until the compressor achieves the desired operating pressure.

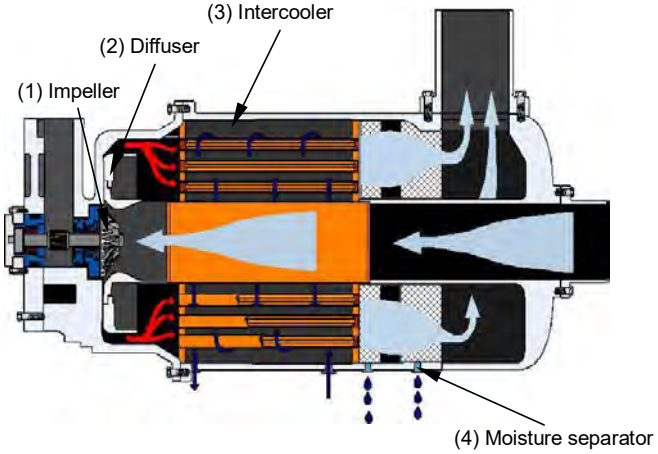


Fig. 1: CENTAC principles of operation

3 General Description

The compressor package contains:

- Two or three high efficiency compression stages, each consisting of an impeller mounted on its own shaft, enclosed within a common cast iron casing.
- A flange or baseplate mounted electric motor coupled to the compressor through a coupling that compensates for angular misalignments between shafts. The motor directly drives a bullgear that is common to all stages.
- Rotors consisting of an integral pinion gear, driven at its optimum speed by the bullgear, and an impeller.
- One or two intercoolers and one aftercooler (except for high pressure units from 12.0 to 18.0 bar(A)).

- A moisture separator and a moisture removal system to remove condensate (not applicable on nitrogen units).

4 Air End

The air end of CENTAC compressor consists of following main components:

- Casing, including:
  Gear casing , gear casing cover , stage heads
- Gearings
- Rotor assemblies
- Impeller
- Diffusers
- Bearings

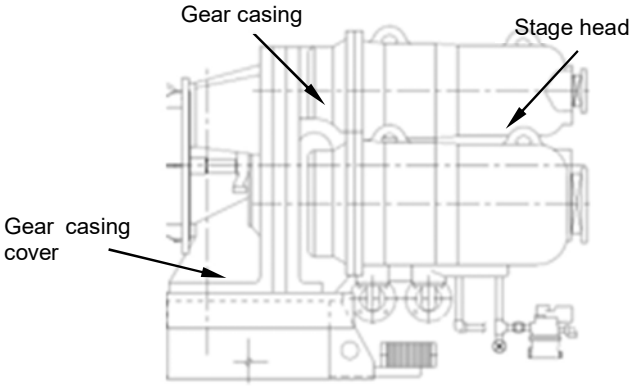


Fig. 2: C700 Air End

4.1 Casing

The casing consists of two halves (gear casing and gear cover) that are bolt together to make-up the linebore. The gear cover is located on the motor side, while the gear casing is located on the compressor side. The vertical split allows an easy insertion and removal of bearings and rotor assemblies without disassembling the gear casing.

Stage heads are bolted to the gear casing and can be easily removed for servicing or inspection. Inlet, discharge and by-pass flanges are integral with the inlet and discharge head covers, providing maximum rigidity and minimum stress on running parts. Inlet and discharge water connection for each cooler are integral with the cooler covers.

On hot discharge units a crossover connects the 2nd stage discharge to the inlet of the 3rd stage head.

4.2 Gearings

Built-in precision helical gearings (AGMA 12) consist of a bull-gear directly coupled to the driver and individual pinion gear for each stage, sized so that each impeller runs at its optimum speed.

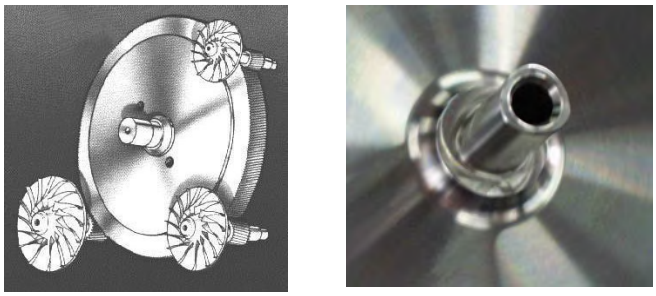


Fig. 4: Bull-gear & ir

4.3 Rotor Assemblies

Each rotor assembly consists of an efficient and high quality stainless steel (15-5 PH) impeller and a removable thrust collar mounted on a helical geared pinion shaft. The thrust collar allows dissipation of aerodynamic thrust loads generated during operations and prevents the transmission of the loads to the main gear train and maximizes gear life.

The impeller and thrust collar are each secured to the shaft by a polygon spline, which tightens under thermal loadings and eliminates the need for stress-producing keyways, and retained with a bolt. The new CENTAC design has the male half on the impeller and the female half in the pinion.

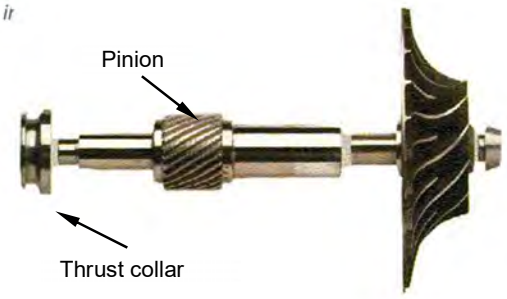


Fig. 5: Rotor assembly

All rotating parts are dynamically balanced as a complete assembly. The correct mechanical behaviour of the rotor assemblies is continuously controlled by radial vibration probes located next to the journal bearing assembly and connected by a cable to a vibration transmitter mounted inside the control panel.

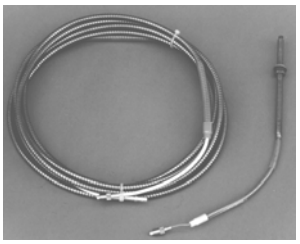


Fig. 7: Vibration probe

Fig. 6: Impeller

4.4 Impellers

Designed to resist corrosion, the impellers are of high quality stainless steel (15-5 PH). Impellers are 5-axis machined and are designed with backward leaning vanes for peak performance and stable operating range.

4.5 Diffusers

The diffuser converts kinetic energy to pressure energy and is located between each impeller and cooler. Diffusion and pressure recovery are accomplished in the first row of vanes in the diffuser. A second row of vanes is located in the axial passageway leading to the cooler inlet in order to remove residual swirling of the air for highest overall stage efficiency. Diffusers are machined single-piece aluminium diffusers with Nituff coating on 2nd and 3rd stage for high protection against corrosion.

Fig. 8: Diffuser

4.6 Bearings

Each pinion is supported by a fixed pad journal bearing on impeller side and by a fixed pad journal bearing with integral thrust bearing (pocket type) and a reverse thrust bearing (tapered land type - for operations in unloaded conditions) on collar side. The journal and thrust bearings are hydrodynamic and have a long lifecycle.

The bullgear also uses hydrodynamic bearings for journal and thrust loads.

All bearings are designed to maximize load carrying capacities and babbitt lined to minimize power loss.

Fig. 10: Fixed pad journal bearing

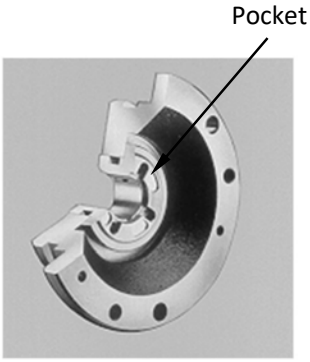


Fig. 9: Thrust bearing

4.7 Seals

There are two types of seals used on CENTAC compressors:

- double lip seals on the bullgear shaft
- a cartridge seal with fully floating non-contact carbon rings on the rotor assembly

The cartridge seal is mounted in the plain bearing housing behind each impeller and consists of three fully floating non-contact carbon rings. One ring is used as an air seal and the remaining two as oil seals. Process air is prevented from being leaked into the compressor casing by the first carbon ring. Seal air is injected between the two oil seal rings at 0.6 bar(G) to prevent oil entering the air stream and to assure that the compressed air is oil-free and environmentally clean for applications such as food, beverage, electronics and pharmaceuticals. A vent to atmosphere is provided between the air and oil seals.

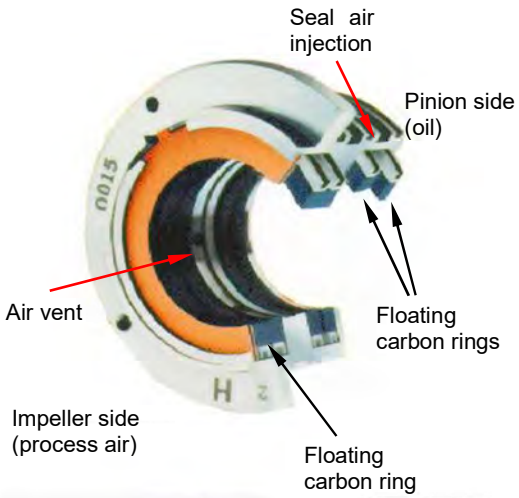


Fig. 11: Cartridge seal

5 Air System

The air system of CENTAC compressor includes following main components:

- inlet air filter
- inlet throttle valve
- air coolers
- moisture separators
- condensate traps
- by-pass valve
- by-pass silencer
- discharge check valve
- instrumentation

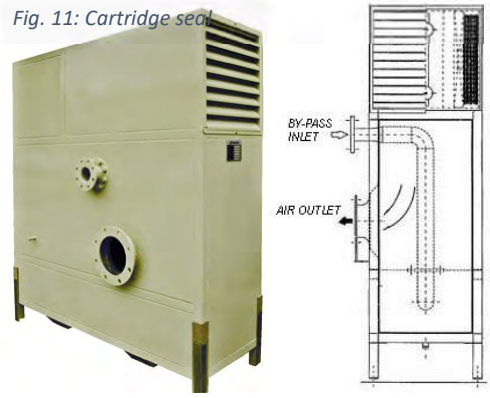


Fig. 12: Inlet air filter with integrated bypass silencer

5.1 Inlet air filter

The inlet air filter is a 2-stage dry type filter with fixed louvre and replaceable elements, with an efficiency >98% at 2 micron. This filter uses a primary and secondary element to filter the incoming air stream. This allows for the removal and cleaning of the first stage filter without shutting down the compressor. The filter includes also an integrated bypass silencer for the blow-off air. The filter is designed for indoor or outdoor under roof installation and covers a variety of flow ranges. The inlet air filter/bypass silencer is shipped loose and is provided with a dirty inlet air filter pressure switch (shipped loose for Customer installation/connection) with related alarm function in the panel.

5.2 Inlet guide vane (IGV)

A maintenance free bevel-gear driven IGV with external pneumatic actuator is integrated in the first stage diffuser to guarantee maximum energy savings in all those cases where the compressor operates at partial loads thanks to the swirling component given to the inlet air in the direction of rotation of the impeller. The IGV modulates the air intake to the compressor to maintain constant discharge pressure under different air requirement in the down stream system. It is machine mounted, complete with pressure regulator, pressure gauge, pneumatic actuator and positioner and with the electropneumatic transducer located in the Xe-145F control panel.

Fig. 13: Inlet guide vane and actuator

5.3 Air coolers

CENTAC C700 compressor has one or two intercoolers (depending on number of stages) and one aftercooler.

The air coolers utilize cartridge coolers mounted internal to the compressor casing. The passage of the heat from the air to water is assisted by the internal fins in the air passages, which greatly increase the effective heat transfer area on the air side. The air side fins are lead coated to resist corrosion. The CENTAC air-in-tube/water-in-shell design with counter flow arrangement provides also following important benefits:

- best heat transfer and lowest pressure drop
- air noise damping
- less performance deterioration due to fouling
- low water flow requirement and less cooler maintenance
- back-flushing capability during operation

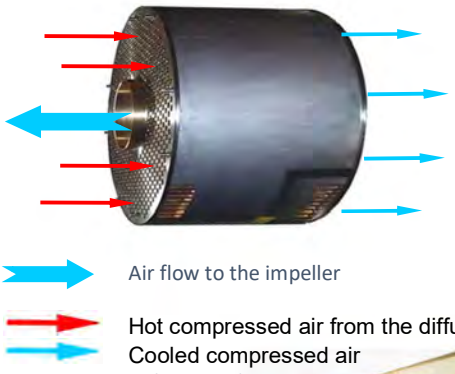


Fig. 14: Intercooler cartridge

Fig. 15: Finned air tube

5.4 Cooling Water Manifold

C700 is provided with a flanged common cooling water manifold that distributes cooling water to each stage and requires a single-point inlet/outlet water connection.

Fig. 17: Cooling water manifold

Fig. 18: Moisture separator

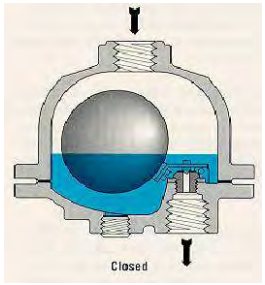
5.5 Moisture Separators

The moisture separator is of stainless steel mesh screen type construction. The thickness of the separator is designed to separate the maximum amount of moisture at a minimal pressure drop. The separators are located at points in the compressor where air velocities are relatively low permitting effective moisture separation.

5.6 Condensate traps

These traps are mounted and piped below each moisture separator for moisture removal. Standard traps (direct ball float type) are furnished complete with a by-pass valve to control the operation of the trap itself.

Fig. 19: Condensate trap



5.7 5.6 By-pass valve

The by-pass valve is machine mounted, complete with electro-pneumatic transducer, pressure regulator, pressure gauge, pneumatic actuator and positioner. It unloads in the recirculation piping the excess of air when the system's requirements falls below the minimum throttle capacity handled by the inlet valve.

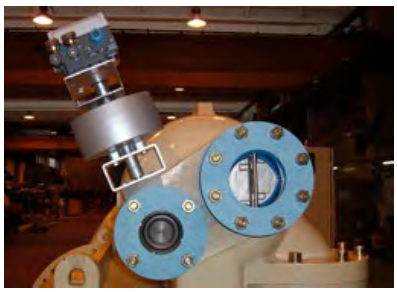


Fig. 16: By-pass valve and check valve

5.7 Discharge check valve

The check valve, machine mounted, is a simple non return valve provided to close the outlet and prevent back-flow of the air from the system to the compressor during off-load periods.

Fig. 20: Demister

6 Lubrication System

The lubrication system of the compressor is completely self-contained and mounted on the baseplate. The oil reservoir is built into the compressor baseplate and coated with epoxy to resist corrosion.

The C700 uses a low pressure lubrication system to provide oil for the gears and the hydrodynamic bearings. The design uses two oil pumps:

- a motor driven pre and post lubrication oil pump (screw type)
- a compressor shaft driven main oil pump

CENTAC lubrication system includes also:

- a suction strainer on oil line inlets
- check valves on the discharge line of the pre and post lubrication oil pump and on the suction line of the main oil pump to prevent reverse flow through the pumps
- a compact multi-function device that incorporates the following components:
  - single element oil filter
  - thermostatic control valve
  - oil pressure regulation valve
  - oil temperature transmitter
- an oil level indicator
- a demister to condition oil vapour and to eliminate pressure build-up in reservoir
- a shell and tube oil cooler designed for a maximum cooling water temperature of 35°C
- an oil reservoir electric heater to insure adequate oil temperature for compressor start-up
- a pressure transducer mounted downstream of oil cooler for low oil pressure with analogic function on control panel
- SAE "dry-tech" compression fittings to avoid oil leakage from oil connections
- First fill of Techtrol Gold (shipped loose), Ingersoll Rand's synthetic fluid that guarantees superior performances and long durability

Fig. 21: Oil cooler

Fig. 22: Electric heater

For the schematic oil flow see also the Process & Instrumentation Diagram.

6.1 Pre and post lubrication oil pump

The pre and post lubrication oil pump lubricates the compressor bearings and gears and fills the oil lines before the compressor starts and maintains lubrication after the compressor has been shutdown.

It is driven by an electric motor and starts when the control panel is energized and runs until the compressor is up to speed and the main oil pump increases oil pressure.

Fig. 23: Multi-function device & pre/post lube oil pump

The pre and post lubrication oil pump shuts down automatically when the main oil pump is supplying the required system pressure. When the compressor trips on the shutdown cycle, the pre and post lubrication oil pump will start immediately and will continue to run until the panel is de-energized, cooling down the compressor.

A seal air pressure transmitter interlock prevents the pre and post lubrication oil pump from operating if seal air pressure is not established.

6.2 Main oil pump

The main oil pump is oversized and is driven by the main motor to supply oil during operation and to protect the bearings during an electrical shutdown. In the event of a main driver or power failure, the main oil pump will continue to supply oil to the bearings and gears during coast down. The main oil pump is mounted on the main compressor shaft.

Fig. 24: Main oil pump

7 Xe-145F control panel

The entire package is carefully managed by Ingersoll Rand's latest generation microprocessor electronic controller. The controller's informative and intuitive display provides a powerful window into all vital signs of the compressor. In addition to insuring peak performance, maintenance becomes predictive through continuous monitoring of critical components, with graphing and trending capability. The Xe-145F controller allows communication through Modbus RTU and TCP in standard to enhance productivity and ease of use through an open Web page style architecture. RS485 and Ethernet ports are also provided to interact with the compressor remotely from almost anywhere.

The IP54/400V/3 phase/50Hz control panel includes pre-lube oil pump motor starter and contactor, lube oil heater contactor and control panel transformer.

Xe-145F control panel is fitted with the latest control algorithms, among which the new 'Energy Smart Setpoint', a feature that allows the compressor to reduce its blow-off when operating in a system with other compressors.

7.1 Standard features

- Full colour, high resolution display
- Spike voltage protection
- Motor current reading
- Motor Amp limits (low/high)
- Main motor thermal overload relay trip
  (for medium voltage motor, relay is customer supply unless otherwise specified)
- Hour meter
- Vibration probe (radial "Y" on each stage) reading and alarm/trip
- Inter stage air temperature reading and alarm/trip
- Inter stage air pressure reading
- Discharge air pressure reading
- Oil temperature reading and low/high alarm/trip
- Oil pressure reading and low alarm/trip
- Surge detection
- Low seal air pressure contact (on/off)

- Low cooling water flow contact (on/off)
- Motor windings temperature reading with alarm/trip function
- High inlet air filter pressure drop (alarm)
- Horn (alarm/trip)
- Auto hot start including Running unload shutdown timer and external water solenoid valve Post run timer contact (110 V)
- 'Running unload', 'Trouble' (alarm or trip) and 'Remote selected' digital outputs
- Wide connectivity options

Customer Monitoring / DCS

Automation / System Control

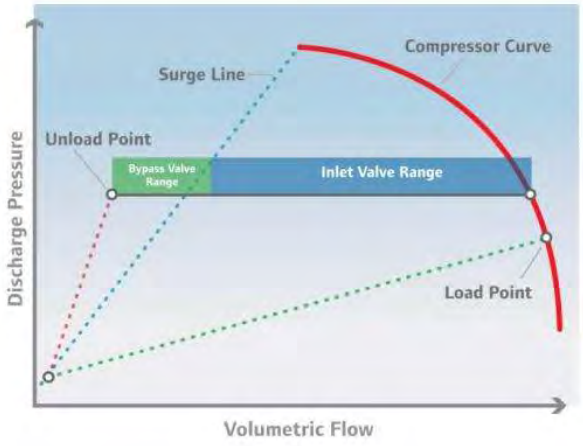
Web-Enabled / LAN connection

USB Service Tool Connection

A controller like no other. Web-enabled simplicity.

7.2 Modulation control mode

Modulation provides a constant discharge pressure with variable capacity from design to zero. This control method is used when stable control of the discharge pressure is required. The compressor will operate along the constant pressure line by modulating the inlet valve within the compressor's throttle range. When system demand is less than the minimum throttled capacity, the discharge pressure is maintained by modulating the bypass valve and venting some of the air to atmosphere. This valve is opened just prior to reaching the surge line. Whenever the bypass valve is open, the inlet valve maintains its position at the minimum throttled capacity setting. Modulation is used commonly for constant use application.



7.3 Autodual control mode

When system demand is within the inlet valve throttle range, constant pressure is maintained in the same manner as modulation. When the system demand is low, Autodual control automatically unloads the machine when the bypass valve is opened beyond the Unload Point. Autodual is used commonly for large intermittent use application or when operating the Centac is a part of a multiple compressor system with a master control system.

Flexible operating modes in order to adapt to system requirements.

8 Drive

8.1 Electric Motor (IR OEM)

Baseplate mounted with the following characteristics;

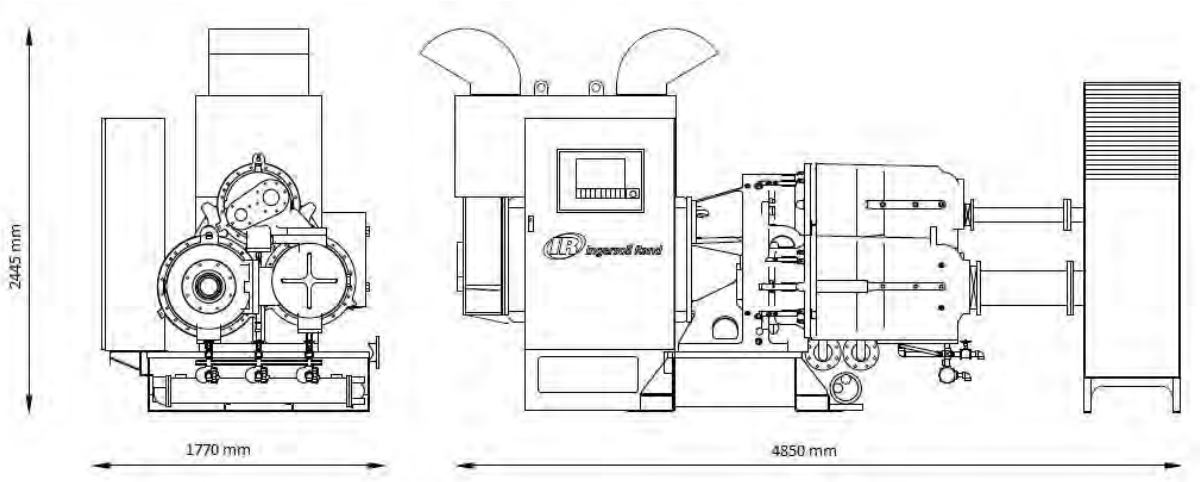
- 400 V, 50 Hz induction,. Squirrel Cage Induction
- IP 55 enclosure
- Nominal two pole speed of 2,975 RPM.
- Ball bearing construction.
- Class “F” insulation with 100°C temperature rise.
- Designed in accordance with I-R motor specification No. I-E-3. Brand will be chosen by IR

Note: motor starter is not included in the scope of supply, unless otherwise specified on price page. Customer starter to include current transformer for current reading (0 to 5 Amps).

9 Standard Documentation

- General Arrangement
- P&I Diagram
- Electrical Schematics
- Instrument List
- Operation and Maintenance Manual (1 hard copy + 1 CD-ROM)
- CE Declaration of Conformity (when applicable)

10 Dimensions and Weight



Weight	kg	9000
Cooling Water		
Water temperature rise	ºC	12
Max water pressure	Bar (g)	5.2
Pressure drop	Bar	0.35
Noise Level		
Without canopy	dB(A)	83

Measured according EN ISO 2151; tolerance ±3 dBA

11 Exclusions from the Supply

Everything not explicitly listed in this offer is intended as excluded from Ingersoll Rand scope of supply.
In particular, unless otherwise specified in this proposal, Customer liabilities are:

- Foundation working
- Piping and installation outside of package for air inlet, air discharge and blow off, cooling water, condensate and instrument air (if applicable)
- Piping and connections between the package and loose items
- Interconnecting piping and cabling to Customer network

12 Performances and Technical Data

CENTAC COMPRESSOR Model C700 C70MX3

Inlet Conditions:

Barometric Pressure	Bar(a)	0.903
Inlet Pressure	Bar(a)	0.903
Inlet Air Temperature	°C	25
Humidity	%	35
Inlet Water Temperature	°C	32

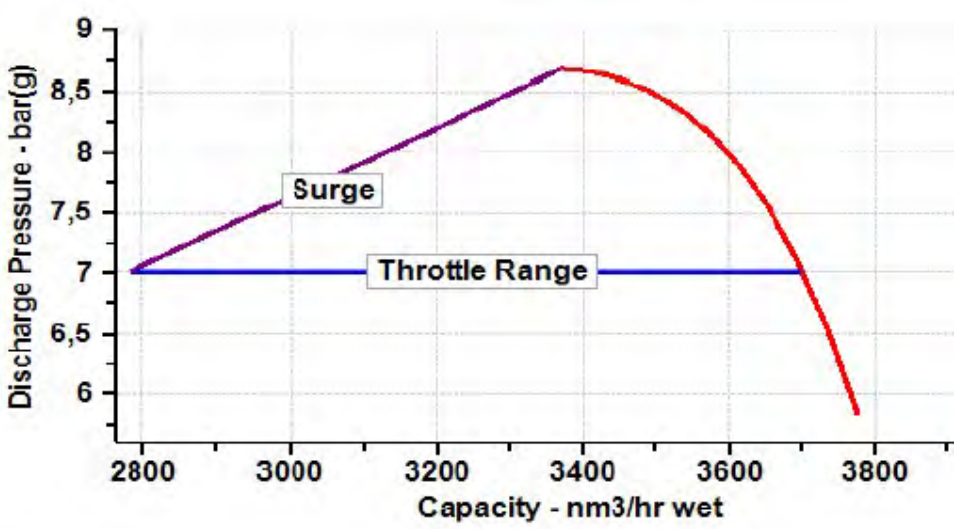
Performance Data:

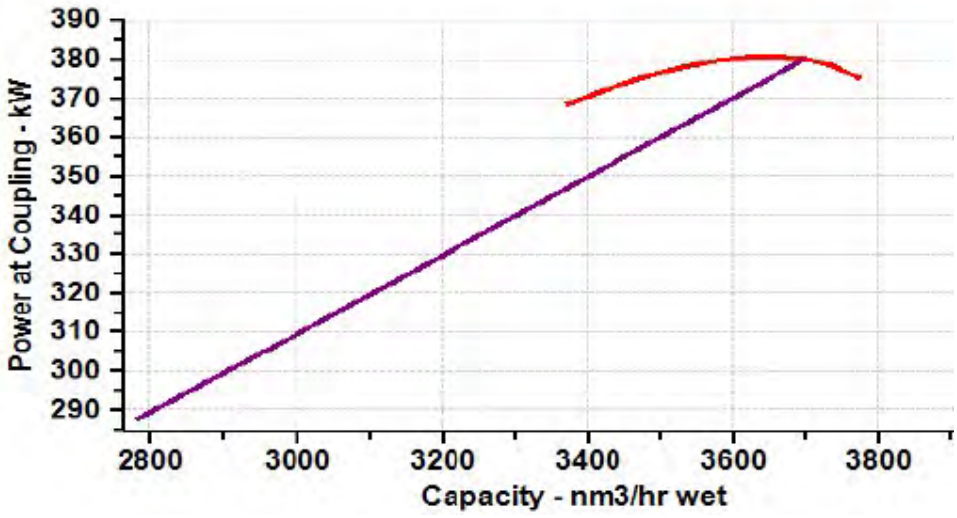
Capacity	Nm^3/h	3700
Surge Pressure	Bar(g)	8.6
Operating Pressure	Bar(g)	7
Shaft Power	KW	380
Specific Power	KWh/ Nm^3	0.103
Motor Power	KW	430
Motor Service Factor		1.0
Motor Efficiency	%	95
Voltage	V/ ph / Hz	400 / 3/ 50
Outlet Air Temperature	°C	43
Cooling Water Flow	L/min	425
Unloaded Power @ Shaft	KW	90
Throttled Capacity Range @ Discharge	**Nm^3/h**	2781 / 3700
Throttled Power Range @ Shaft	KW	287 / 380

(*)Tolerances according ISO 5389 "Turbocompressors - Performance test code" are guaranteed basis the following ;
± 4% on air capacity
± 5% on specific power
Industrial test tolerances are applied.
Nm3 is refered to 1.013,0%,0°C

CENTAC COMPRESSOR Model C700 C70MX3

Performance Curves





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