Rotrex™ EK10AA Fuel Cell Compressor

Technical Datasheet

Product:	EK10AA
Version:	1.5
Page	1 of 8

General description

The EK10AA Fuel Cell compressor is the second generation of Rotrex E-chargers and is founded on the Rotrex traction drive technology, specially designed for fuel cell applications with high requirements to system integration and maintenance. The high-speed permanent magnet synchronous motor (PMSM) in the E-Charger is fully integrated with a direct connection to the traction drive. The result is a compact Fuel Cell compressor with IP67 ingress protection classification. The EK10AA E-Charger has a very low NVH level due to its direct-drive connection and smooth-running surfaces of the traction drive. The E-Charger is supplied with rubber shock dampeners to protect the E-Charger from external shocks and vibrations.

Due to the Rotrex traction drive, continuous operation at high impeller speed is possible, enabling use of the most efficient centrifugal compressor design, without compromising durability and reliability. The traction drive technology has been proven throughout its 20 years existence and specially engineered for the EK10AA E-Charger, utilizing the latest manufacturing processes and technologies.

The EK10AA compressor features a fully integrated oil system based on a dual-action oil pump that works as a dry sump scavenging pump in addition to being the oil supply pump, ensuring oil-free air delivery. Additionally, the E-Charger liquid cooled, enabling simple installation, maintenance and system design.

The E-Charger features a specially designed centrifugal compressor setup developed for aerodynamic operation points matching many fuel cell applications in the range (20kW – 100kW output), resulting in superior compressor (and total system) efficiency. Within the boundaries of the electrical architecture, Rotrex can offer dedicated compressor design for specific application requirements.

Typical applications for the automotive/mobile industry are: Air compressor for mobile fuel cells, pre-boosters for downsized turbocharged engines, forced exhaust gas recirculation, particle filter regeneration systems etc. Typical applications for the industrial industry are: Air compressor for stationary fuel cells, process engineering, educational and R&D applications etc.

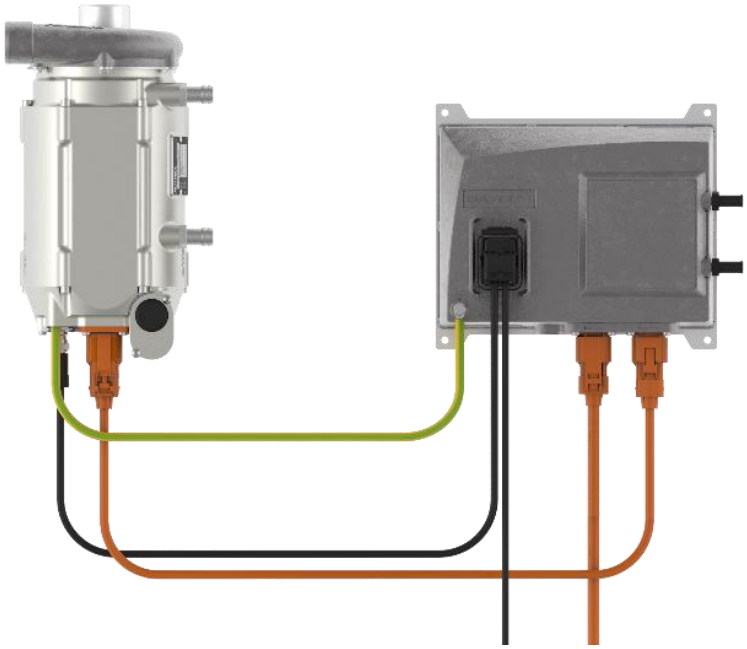
Sevcon HVLP-20 automotive mobile inverter

Operating the EK10AA E-Charger, Rotrex delivers a pre-set Sevcon (BorgWarner) Gen4 HVLP-20, IP67 automotive, mobile inverter.
Notable features from the HVLP-20 is a native, configurable, CAN J1939 communication interface.
200 – 800 VDC input voltage range. And best in class gravimetric and volumetric power densities.

The HVLP-20 is liquid cooled, similarly to the EK10AA E-Charger. Combined is the entire system completely sealed from dirt and contamination, enabling IP67 protection class.

This presently available HVLP-20 is capable of delivering 33 A output current (~22kW @ 700 VDC).

The Sevcon/BorgWarner Gen4 HVLP-20 inverter.



EK10AA illustrated with the Sevcon/BorgWarner Gen4 HVLP-20 inverter.

Parker AC30 Industrial inverter

Rotrex also supplies the EK10AA E-charger with the Parker AC30 inverter, suited for stationary applications in the industrial segment where 3-phase 400-480 VAC is commonly available. The AC30 inverter comes with a 38 A nominal output current (before de-rating).

Additionally, the AC30 inverter comes with a DC supply input, which makes it ideal for laboratory testing of fuel cells. The DC supply range for the inverter is 470-800 VDC.

The AC30 inverter has a variety of communication interfaces, such as CAN (optional), ethernet and analogue control.

The Parker AC30 inverter.

EK10AA E-Charger

Characteristic	EK10AA-PT54	EK10AA-PT57[1]
Recommended air mass flow range	0,025-0,08 kg/s	0,06 – 0,11 kg/s
Recommended pressure ratio range	1,4 – 2,2	1,4 – 2,0
E-Charger physical dimensions	320 x 166 x 182 mm	
Inlet air connection diameter	47 mm (1.85”)	
Discharge air connection diameter	38.5 mm (1.5”)	
Weight incl. fluid	≈ 13 kg	
Discharge angle	Fully adjustable, 360°	
Internal drive ratio	1 : 8.44	
Maximum motor shaft speed	16.600 RPM	
Maximum impeller speed	140.000 RPM	
Recommended air mass flow range (**)	0,035 – 0,080 kg/s	
Recommended pressure ratio range (**)	1.4 – 2.2	
Motor type	Permanent Magnet Synchronous Motor (PMSM)	
Rated motor power (*)	13 kW	
Rated motor current (*)	25 A	
Maximum motor winding temp.	130°C	
Cooling method	50/50 glycol/water mix	
Min coolant flow rate (*)	10 l/min	
Maximum cooling water temp (*)	80°C	
Recommended cooling water temp.	40°C	
Max allowable coolant pressure	1.0 bar gauge	
Enclosure rating, per design	IP67 minimum	

1. Please consult Rotrex for possible operation with the PT57 compressor map
(*) Asterisk marked parameters are interpolated and not guaranteed
(**) With current impeller design. Dedicated impeller design is possible to match customer requirements.

3D model of the EK10AA is available in STEP on our website and/or by request.

Sevcon HVLP-20 mobile inverter (motor controller)

Characteristic	HVLP-20, Liquid cooled
Physical dimensions	255 x 223 x 88 mm
Weight, dry	≈ 2.3 kg
Electrical supply (high power bus)	200-800 VDC (Minimum 400VDC to enable maximum speed of the EK10AA)
Aux supply (control board)	12/24 VDC
Output current	33 A continuous. 53 A_{peak}, 60 sec
Commutation method	Closed loop, UVW, Sin/Cos, AB, resolver absolute position feedback
E-Charger control method	CAN J1939 speed request control
Cooling method	50/50 glycol/water mix
Operating coolant temperature	Coolant temperature: -25°C to +65°C no current derating
Minimum coolant flow rate (*)	6 l/min
Maxi. allowable coolant pressure	1.0 bar gauge
Motor winding overheat shutdown	Integrated thermistor-based shutdown control as standard
Vibration tolerance	3 g, 5 Hz to 500 Hz
Shock tolerance	40 g peak, 6 ms, 1000 bumps in each direction repetition rate 1 to 3 Hz.
Enclosure rating	IP6K9K with connectors mated

(*) Asterisk marked parameters are interpolated and not guaranteed

3D model of the HVLP-20 mobile inverter is available in STEP and IGES upon request.

Parker AC30 industrial inverter (motor controller)

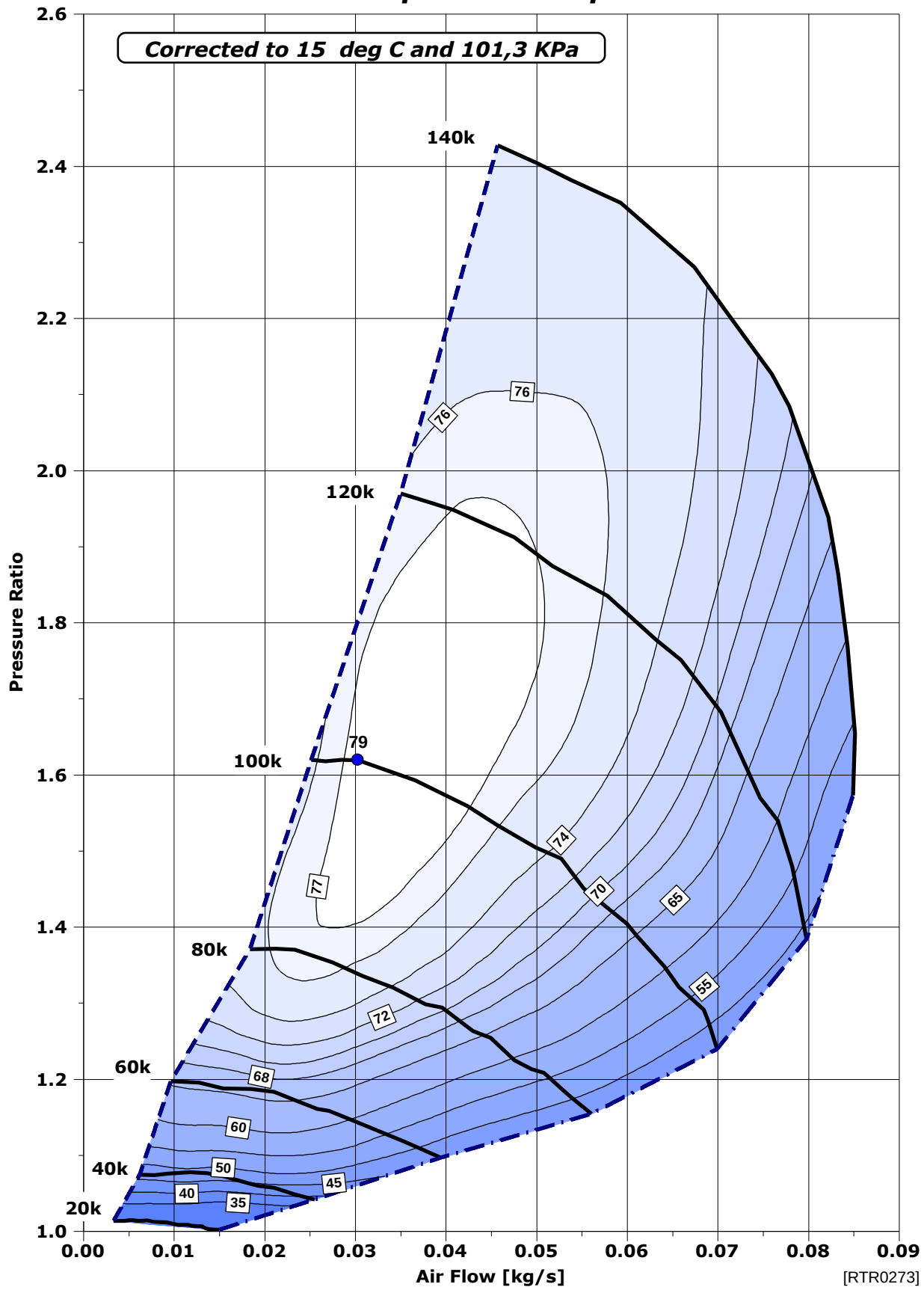
Characteristic	AC30 18.5kW
Drive physical dimensions	350 x 250 x 150 mm
Weight	≈ 10 kg
Electrical supply (DC)	470 - 800 VDC directly on DC bus (requires external pre-charge circuit and fusing)
Electrical supply (AC)	3-phase 400VAC to 480VAC (+/- 10%) 45-65Hz
Maximum continuous output current (including de-rating for high speed) (*)	≈ 30 A
Practical continuous output power at 400VAC/560VDC (*)	≈ 15kW
Commutation method	Closed loop. Sensorless space vector control
E-charger control method	Analog, LAN (build-in application webpage)
Cooling method	Forced convection air cooling with internal fans
Motor winding overheat shutdown	Integrated thermistor-based shutdown control as standard
Overvoltage category	Category III
Enclosure rating	IP20
Optional expansion control methods	PROFIBUS DP-V1, DeviceNet, CANopen, PROFINET I/O, Ethernet IP, RS485, Modbus RTU, BACnet MSTP, BACnet/IP, CC-Link, ControlNet, EtherCat, Ethernet, analog voltage or current

(*) Asterisk marked parameters are interpolated and not guaranteed

3D model of the Parker industrial inverter is available in STEP and IGES upon request.

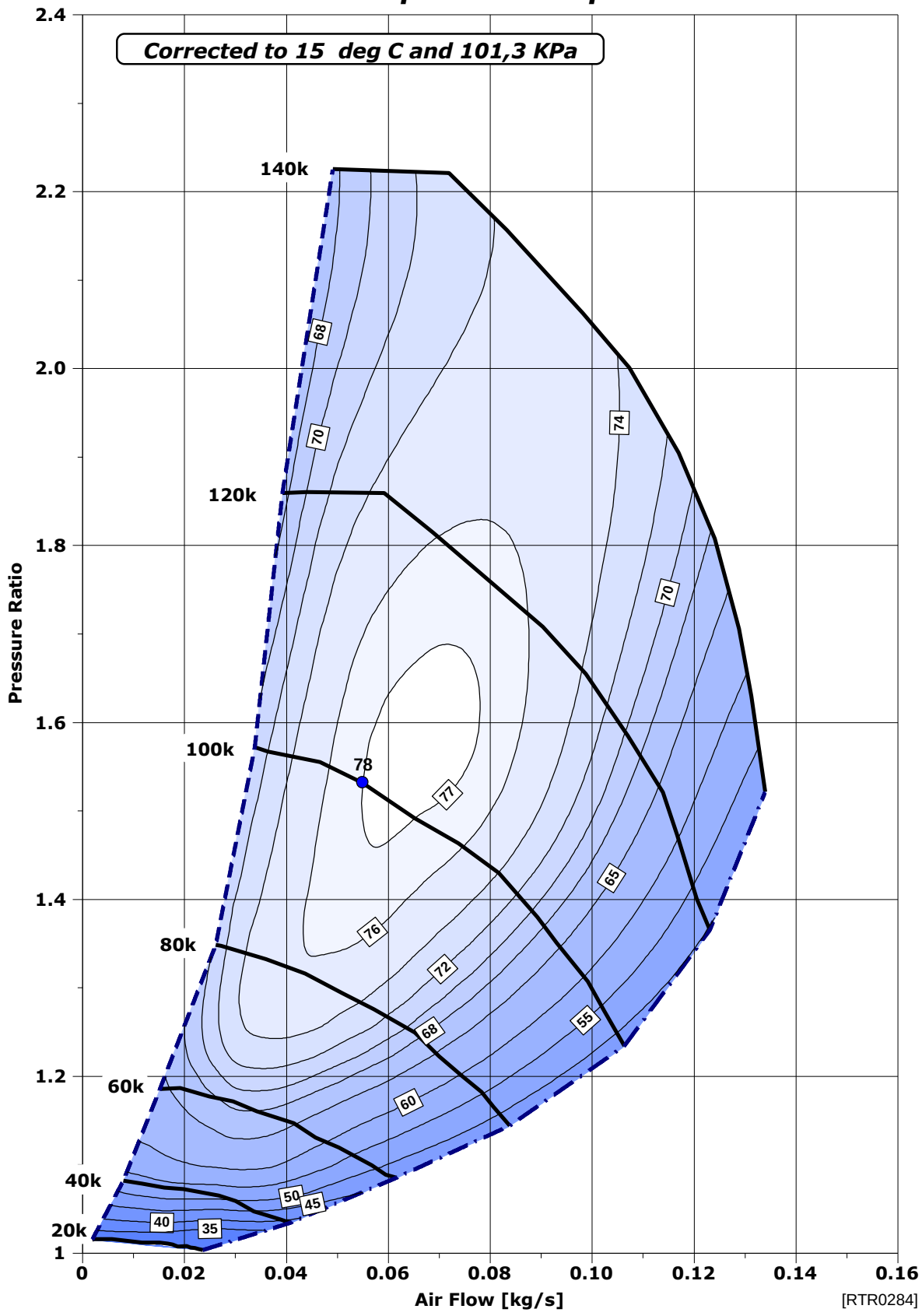
Conversion Toolbox
$°\mathrm{C} = \frac{5}{9} \times (°\mathrm{F} - 32)$ OR $°F = \frac{9}{5} \times °C + 32$
$\mathrm{CFM} = \frac{\mathrm{kg}}{\mathrm{s}} \times 1731.8$ $\frac{\mathrm{kg}}{\mathrm{s}} = \frac{\mathrm{CFM}}{1731.8}$ @15°C and 0.1013MPa
$\frac{\mathrm{kg}}{\mathrm{s}} = 0.0075 \cdot \mathrm{lb/min}$ $\mathrm{lb/min} = \frac{\mathrm{kg/s}}{0.0075}$

EK10AA-PT54 Compressor map



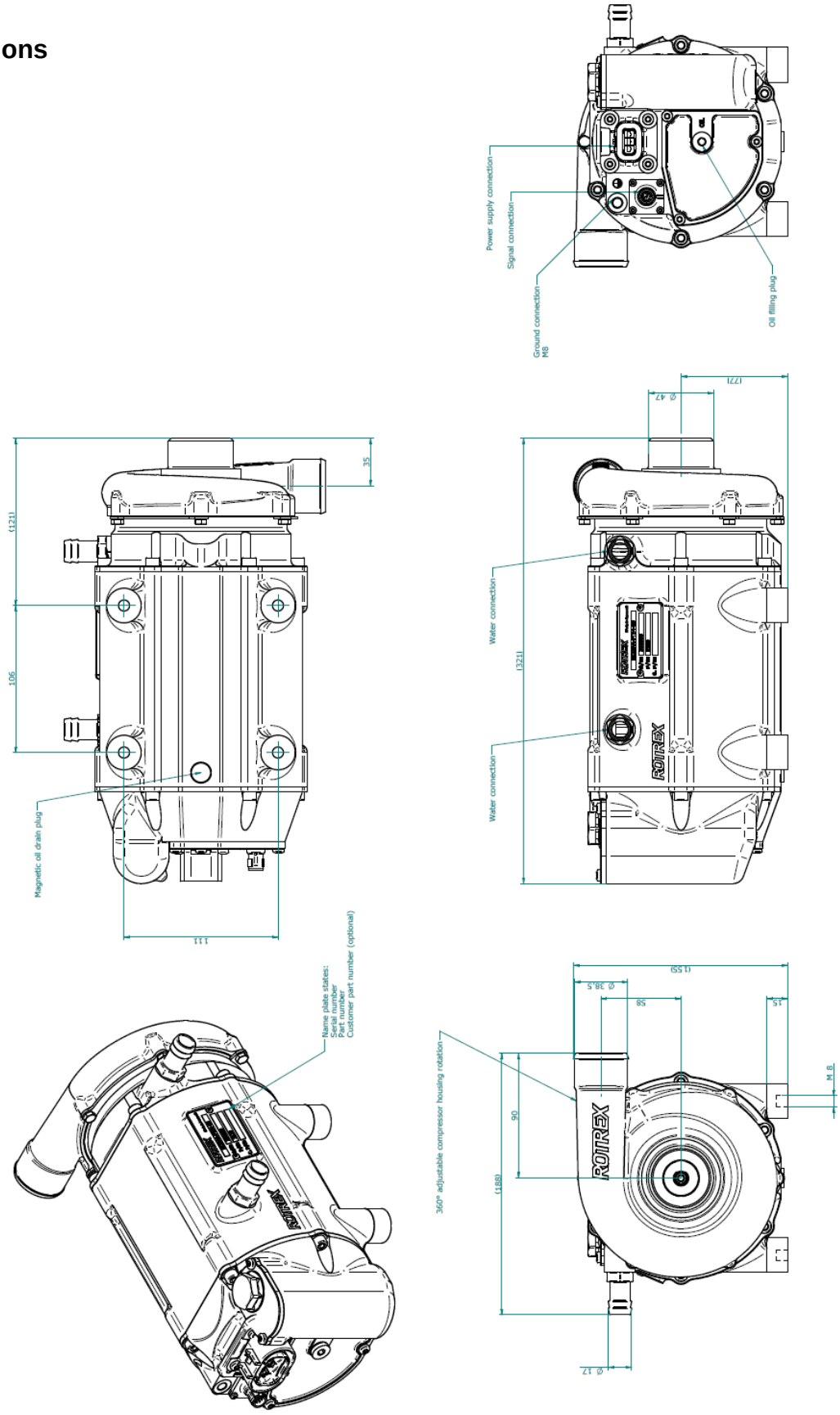
[RTR0273]

EK10AA-PT57 Compressor map



[RTR0284]

Dimensions


Power supply connection
Signal connection
Ground connection M8
Oil filling plug
Water connection
Water connection
Magnetic oil drain plug
Name plate states:
Serial number
Part number
Customer part number (optional)
360° adjustable compressor housing rotation
ROTREX