Hellanor

Webasto
Feel the Drive

Air Top Evo 40 and Air Top Evo 55

Comparison to Air Top Evo 3900 und Air Top Evo 5500

Differences Air Top 3900/5500 to Air Top Evo 40/55

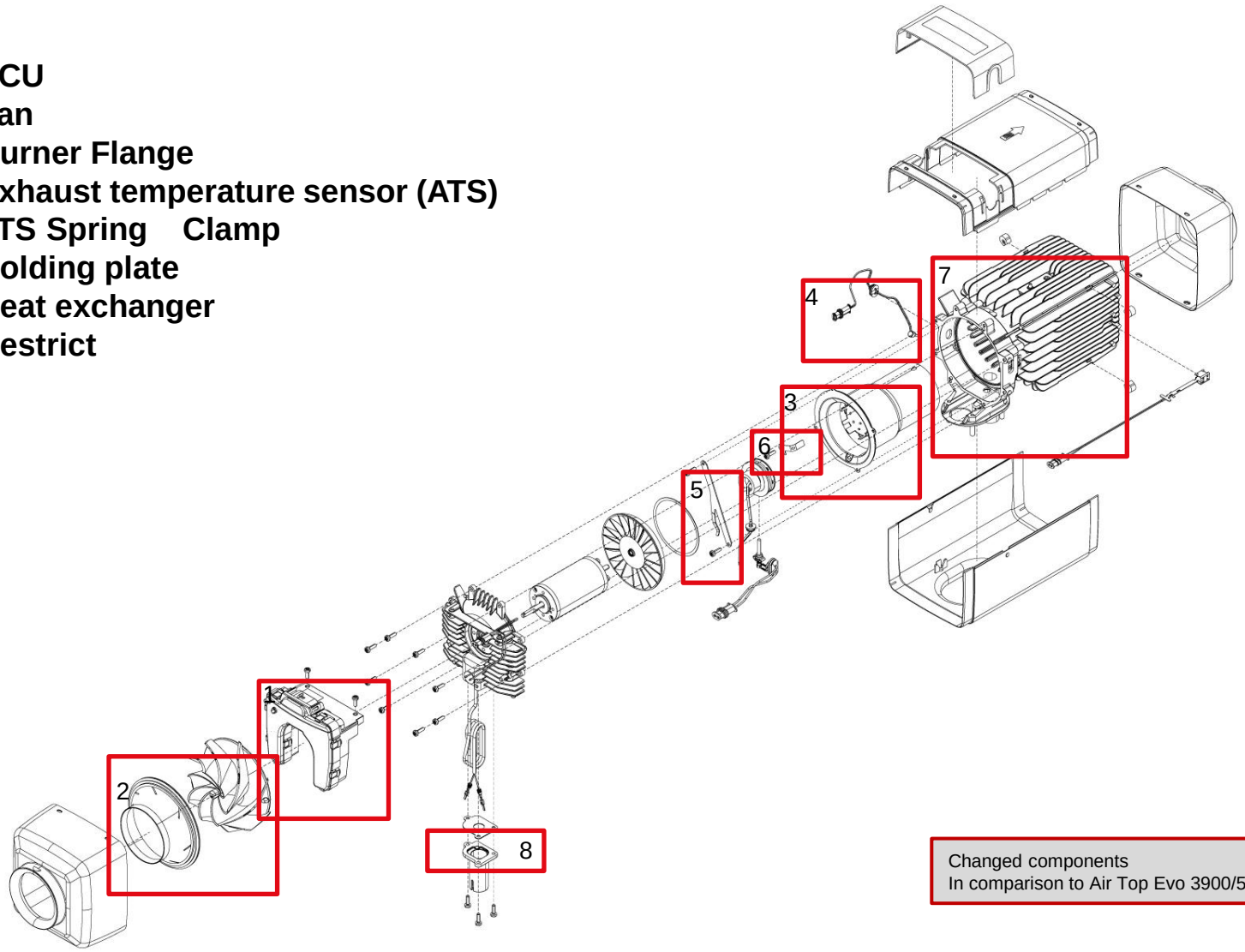
Overview
Improvement in quality and function

Changes Air Top Evo 40/55 vs. Air Top Evo 3900/5500	Benefit and Implementation
New flame detection by exhaust gas temperature sensor	√ Patented solution evaluation √ High accuracy leads to a stable system √ Improvement in life expectancy √ "Long-lasting-heating"„ (long time in the same heating level)
Increased heating power: 4 kW instead of 3.9 kW	√ Better argument against the competitor D4 √ Boost time for EVO 40 extended to 6 hours
Change of fuel pump control (modulated PWM-signal)	√ Noise reduction
Intelligent blower control	√ **Reduction of electric power consumption** √ Noise reduction √ **Higher back pressure resistance**
Improved starting logic	√ Faster start with cold heater
Intelligent low voltage cut-out	√ Low voltage cut-out has now been lowered to 9,5V during glowing period. In normal operation it stays at 10,5V to save the battery.
Intelligent altitude adjustment	√ Intelligent altitude adjustment (compensation starts only above 600m above sea level → reduced electrical power consumption

Overview Air Top Evo 40 / 55

Changed components compared to Air Top Evo 3900/5500

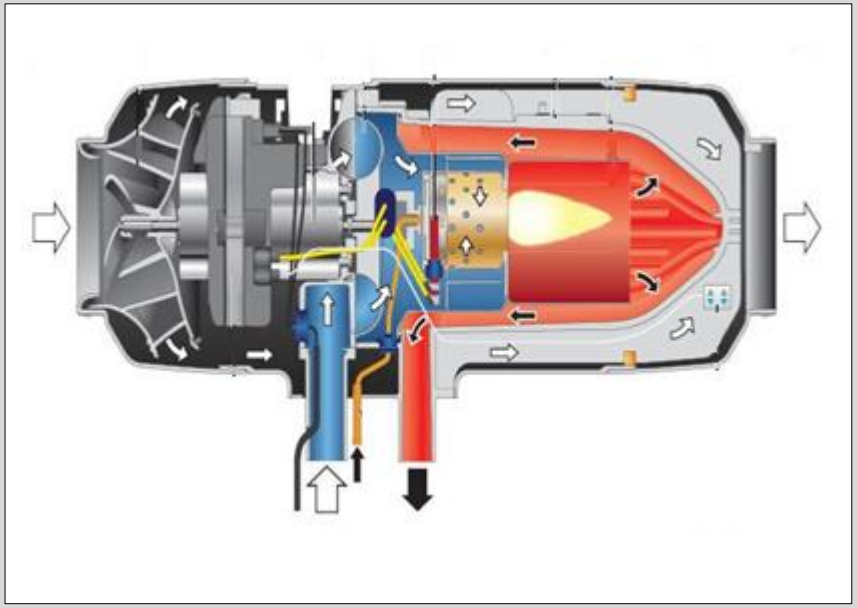
1. ECU
2. Fan
3. Burner Flange
4. Exhaust temperature sensor (ATS)
5. ATS Spring Clamp
6. Holding plate
7. Heat exchanger
8. Restrict



Changed components
In comparison to Air Top Evo 3900/5500

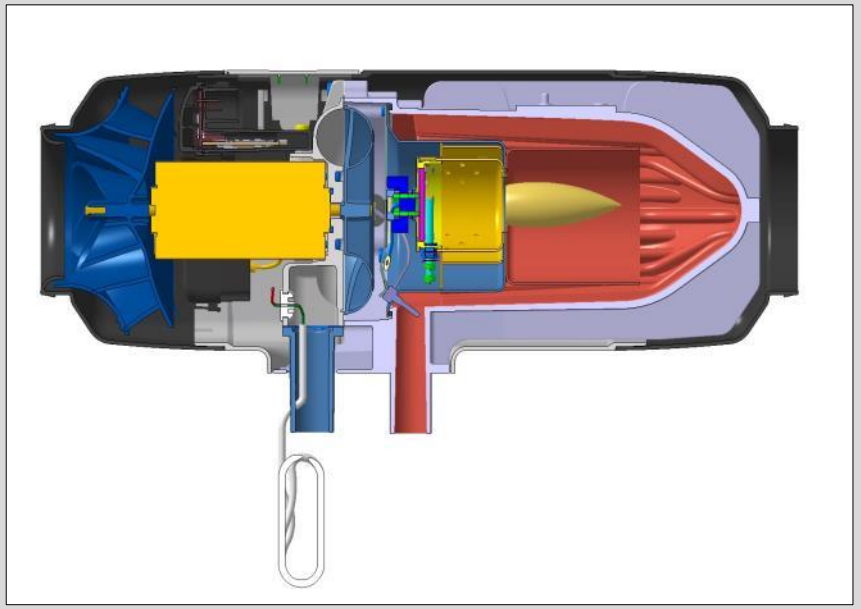
Comparison of components
Innovative Flame Detection Concept

Air Top Evo 3900/5500



Glow Plug Functions
- Ignition of the fuel / air mixture
- Flame recognition due to heat input

Air Top Evo 40/55

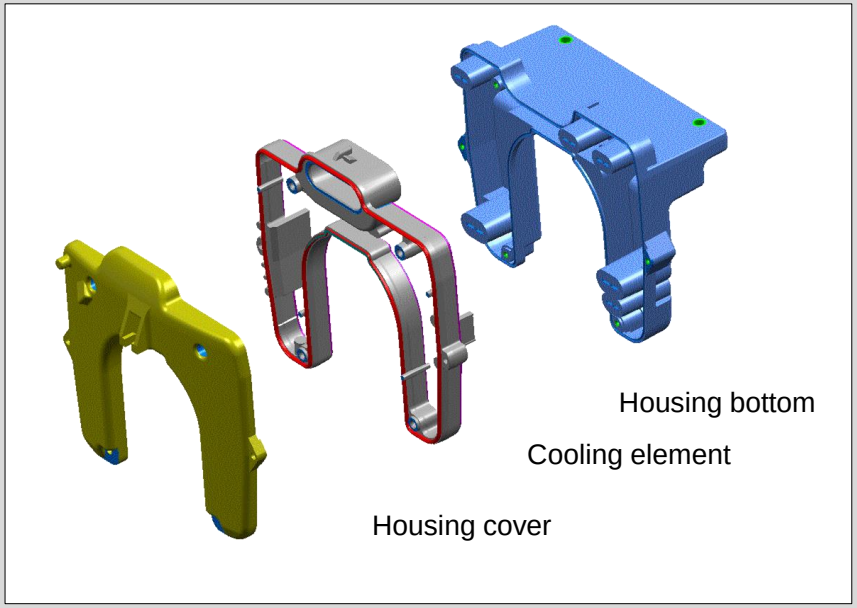


Glow Plug Function
- Ignition of the fuel / air mixture

Exhaust Temperature Sensor Function
- Flame detection via exhaust gas temperature

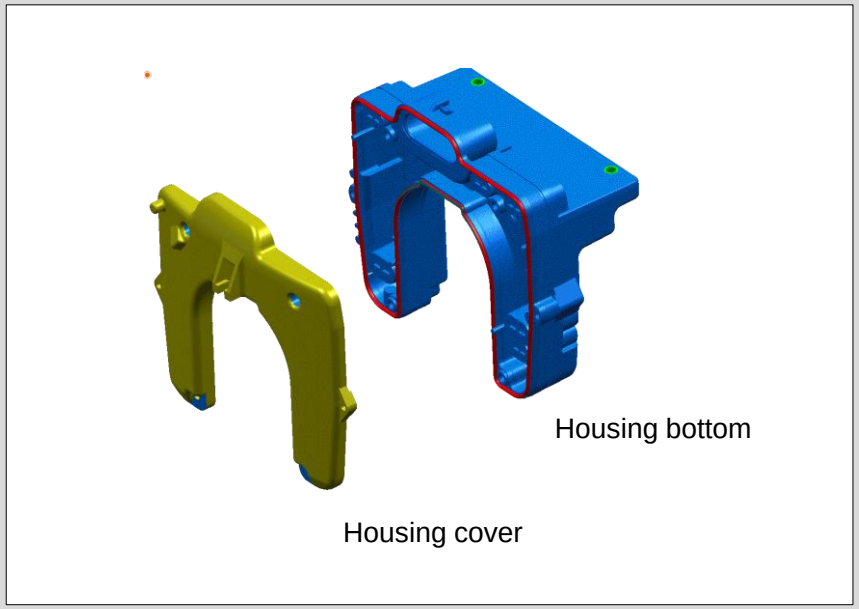
Comparison of components
Electronic Control Unit - ECU

Air Top Evo 3900/5500



- Control unit in 3 parts,
  inclusive aluminum cooling element
- Obsolescence of components – processors not available anymore

Air Top Evo 40/55

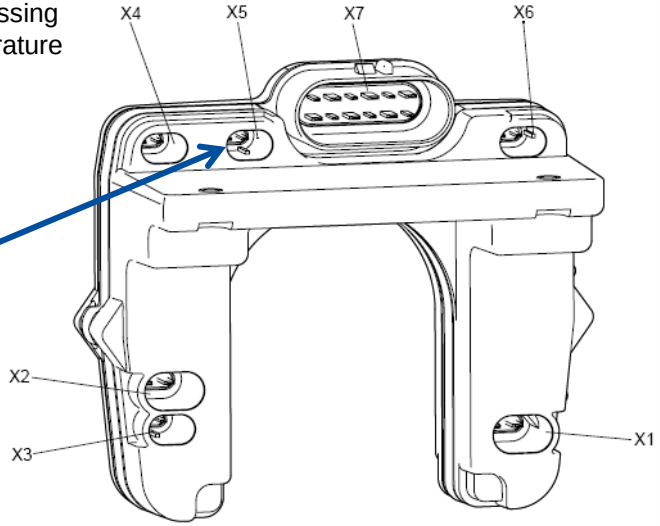


- ECU in 2 parts, better and lighter material
- Better sealing against humidity - IP protection class IP5K3
- EMC improvement
- Lead free solder
- No backwards compatibility to Air Top Evo 3900/5500

Comparison of components
Electronic Control Unit - ECU

Air Top Evo 3900/5500

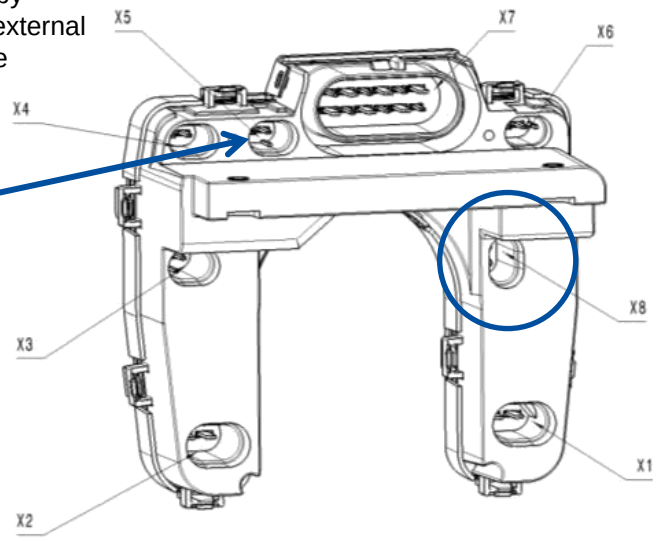
temperature sensor/ resistor by missing extern temperature sensor



X1 = Connector Burner & Air Heater Fan
X2 = Connector Glow Plug
X3 = Connector Overheat Sensor
X4 = Connector Fuel Pump
X5 = Connector External Temperature Sensor (resistor if there is no sensor)
X6 = Connector D+ and Secondary Drive
X7 = Connector Air Heater Cable Harness

Air Top Evo 40/55

Blank plug by missing of external temperature sensor



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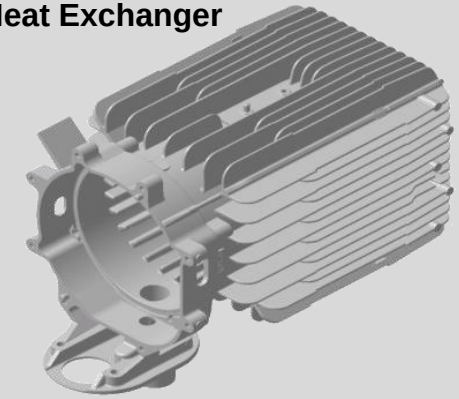
X6 = Connector D+ and Secondary/Auxiliary Drive
X7 = Connector Air Heater Cable Harness
X8 = Connector Exhaust Air Temperature Sensor

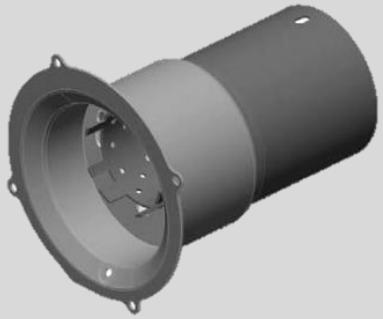
Comparison of components
Modified Components

Heat Exchanger



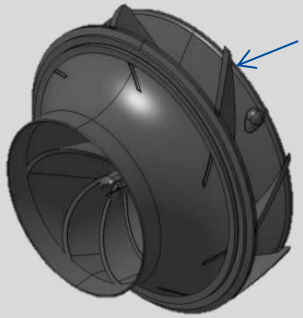
Additional hole for Exhaust Temperature Sensor cable routing

Burner Flange



Additional hole for Exhaust Temperature Sensor cable routing

Fan

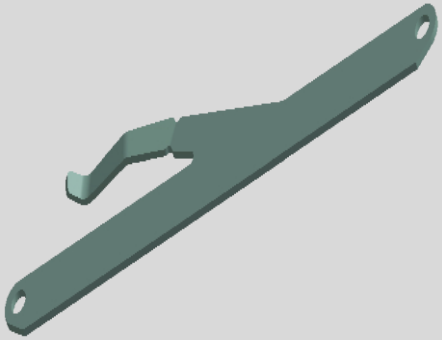


- Small adaption on bottom surface to avoide scratching on ECU
- Backwards compatible

Exhaust Air Temperature Sensor

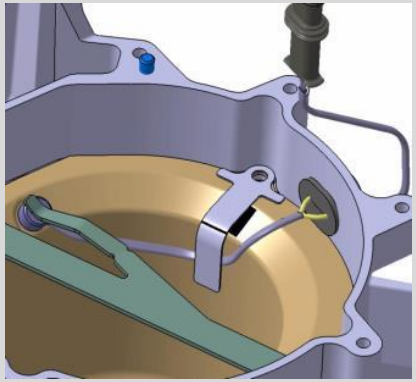
- exhaust air temperature sensor
- Flame detection sensor

ATS Spring Clamp



Fixation of Exhaust Air Temperature Sensor

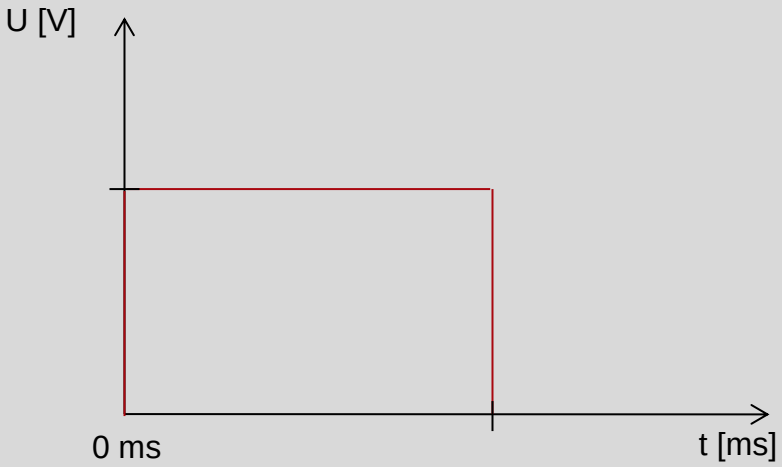
Holding Plate ATS Cable



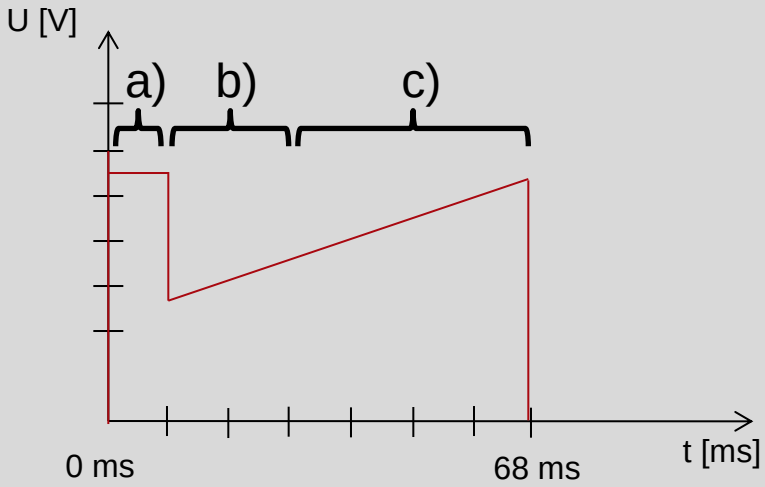
Fixation of Exhaust Air Temperature Sensor cable

Comparison of functionality
DP 42: new activation logic of fuel pump

Up to now: only one single impulse



New: intelligent multistage control



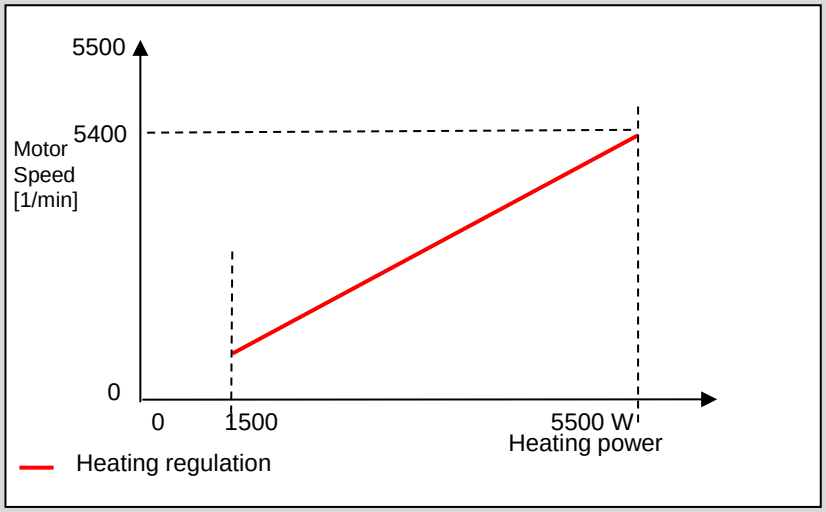
Simplified Schematic picture: Voltage-range within one fuel pump pulse (without overlap of 500 Hz PWM)

With Air Top EVO 40/55 not only DP42 is standard but also fuel pump activation has improved:

- Intelligent multistage control:
  a) Short impulse of full voltage to get piston going
  b) reduction of voltage to move piston slowly. Piston will softly touch the end stop at slow speed
  → reduced ticking noise!
  c) Voltage is increasing to full level. In case of high pressure situation piston is now moving the very last bit until the end stop.

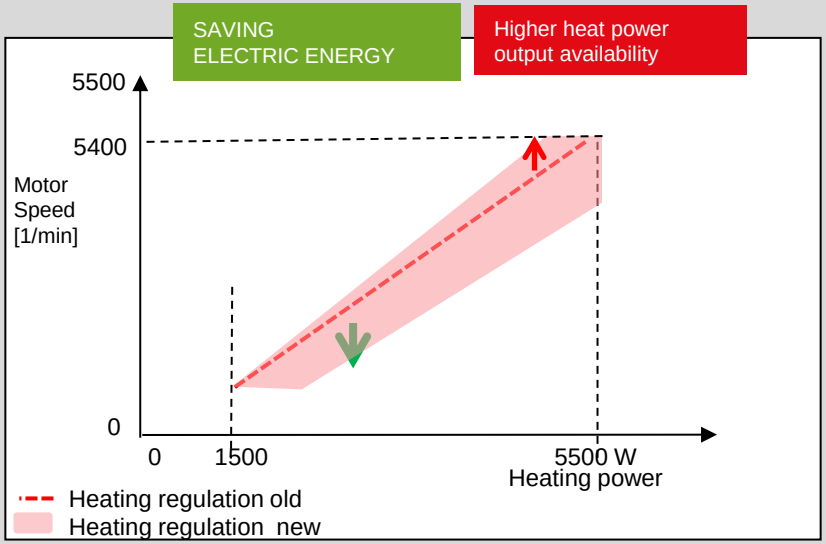
Comparison of functionality
Intelligent blower control

Air Top Evo 3900/5500
linear Air Blower- Characteristic Control Line



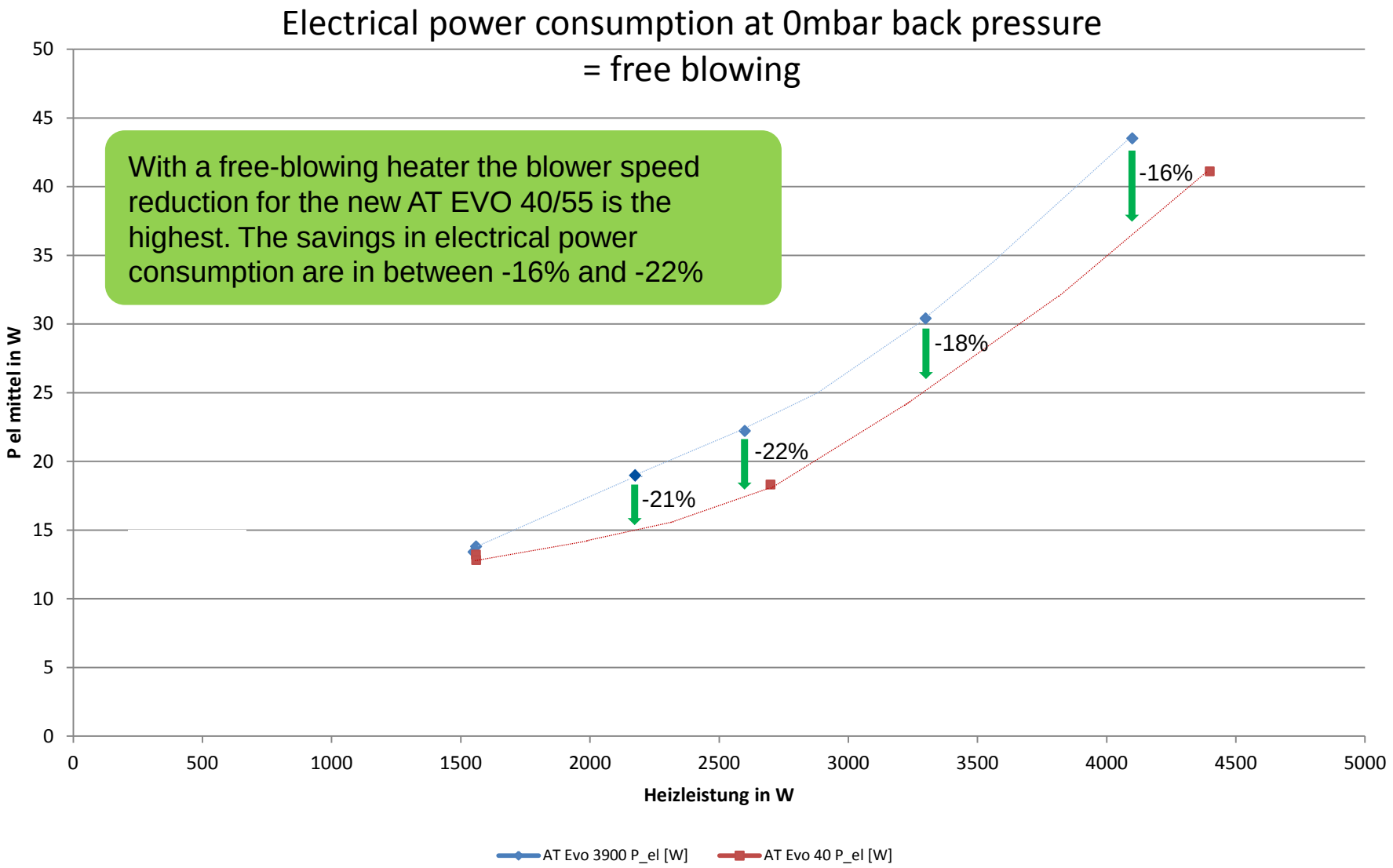
- Step less regulation, fixed blower speed depending on heat output

Air Top Evo 40/55
Intelligent blower control logic

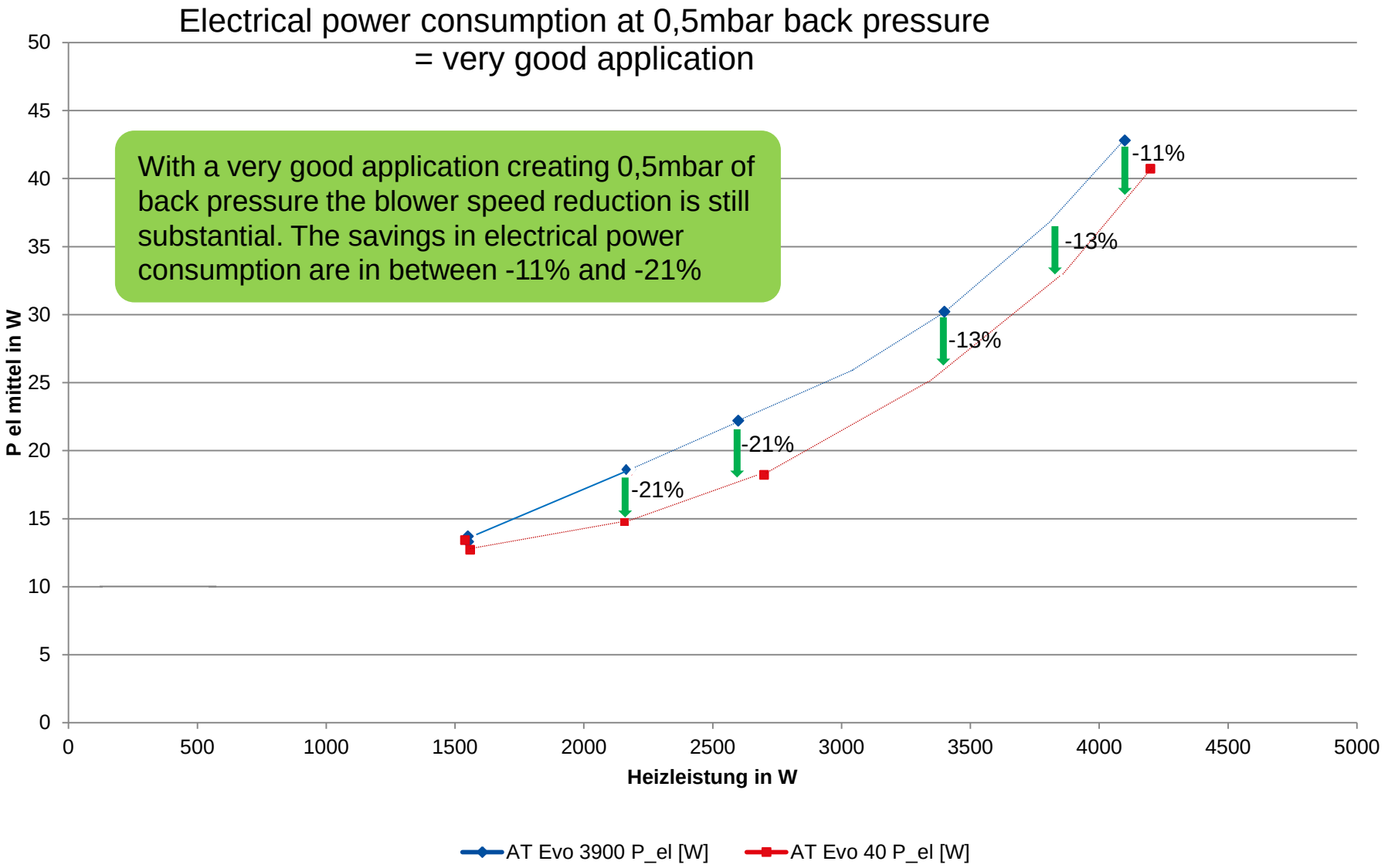


- Lower electrical power consumption for applications with low to medium back pressure (lower motor speed at same output power)
- Lower noise at regular operation due to lower motor speed
- **Improved back pressure resistance for applications with high back pressure level. Motor speed will increase keeping heat output constant.**
  → Higher availability of the heating power. Heater will reduce output much later than before

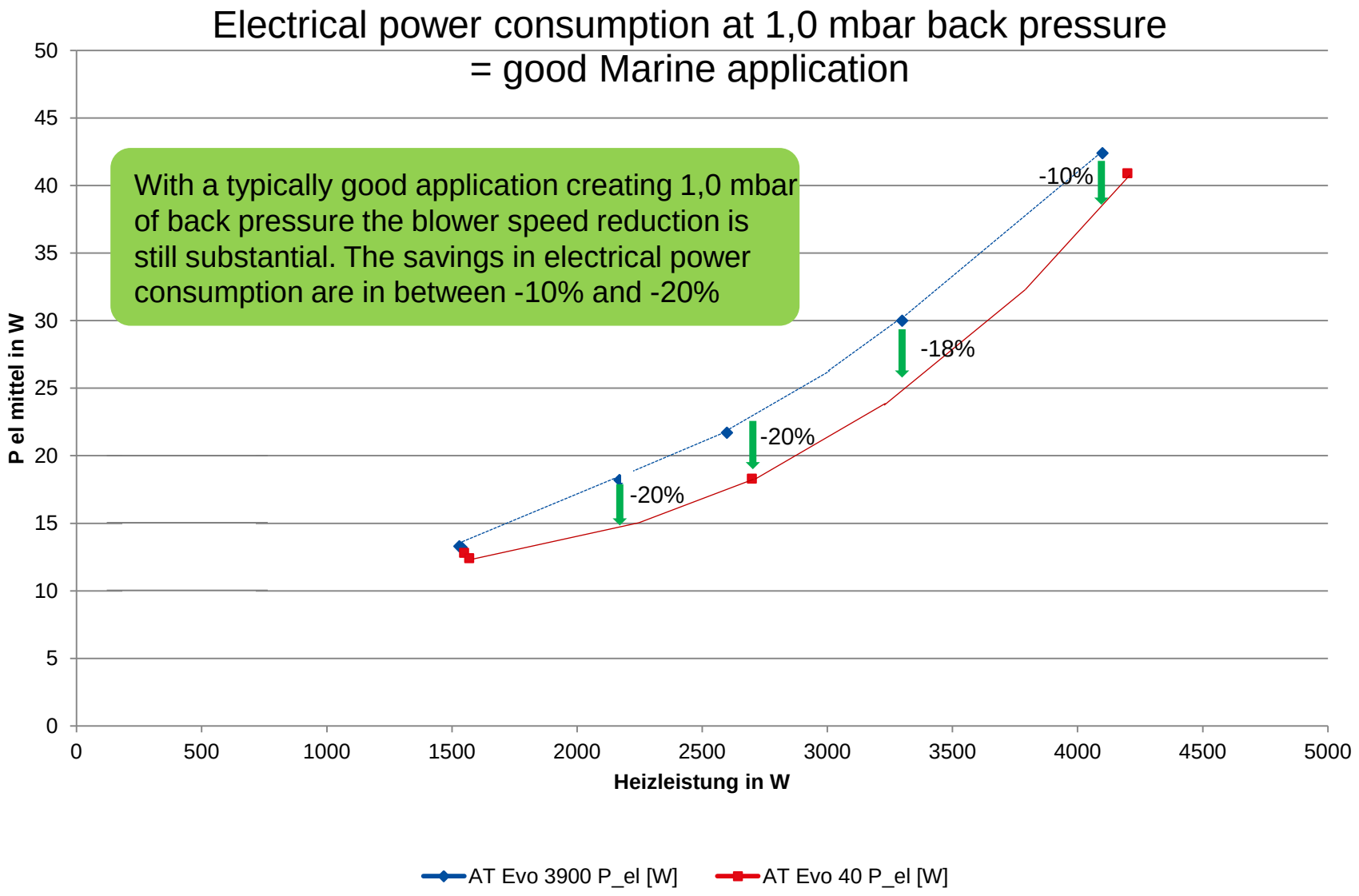
Comparison of functionality
Intelligent blower control



Comparison of functionality
Intelligent blower control



Comparison of functionality
Intelligent blower control



Rembering the past..

- Absolute more tricky case is when restrictions in flow are present but limited, allowing the heater to start but not running in full operation mode

- In the a.m. case the overheating sensor is ‘’managing the heater’’ by reducing power avoiding serious troubles to the heater an piping system

- This operating function is instructed to deal with current norms and temporary restriction flow at the outlets

- This particular operation mode is feasible to be detected with the use of the Webasto diagnose only, making very difficult to perceive it

- ***The heater is operating but is not heating enough..***

- ***That is the customer claim you may get, with no error messages displayed..***

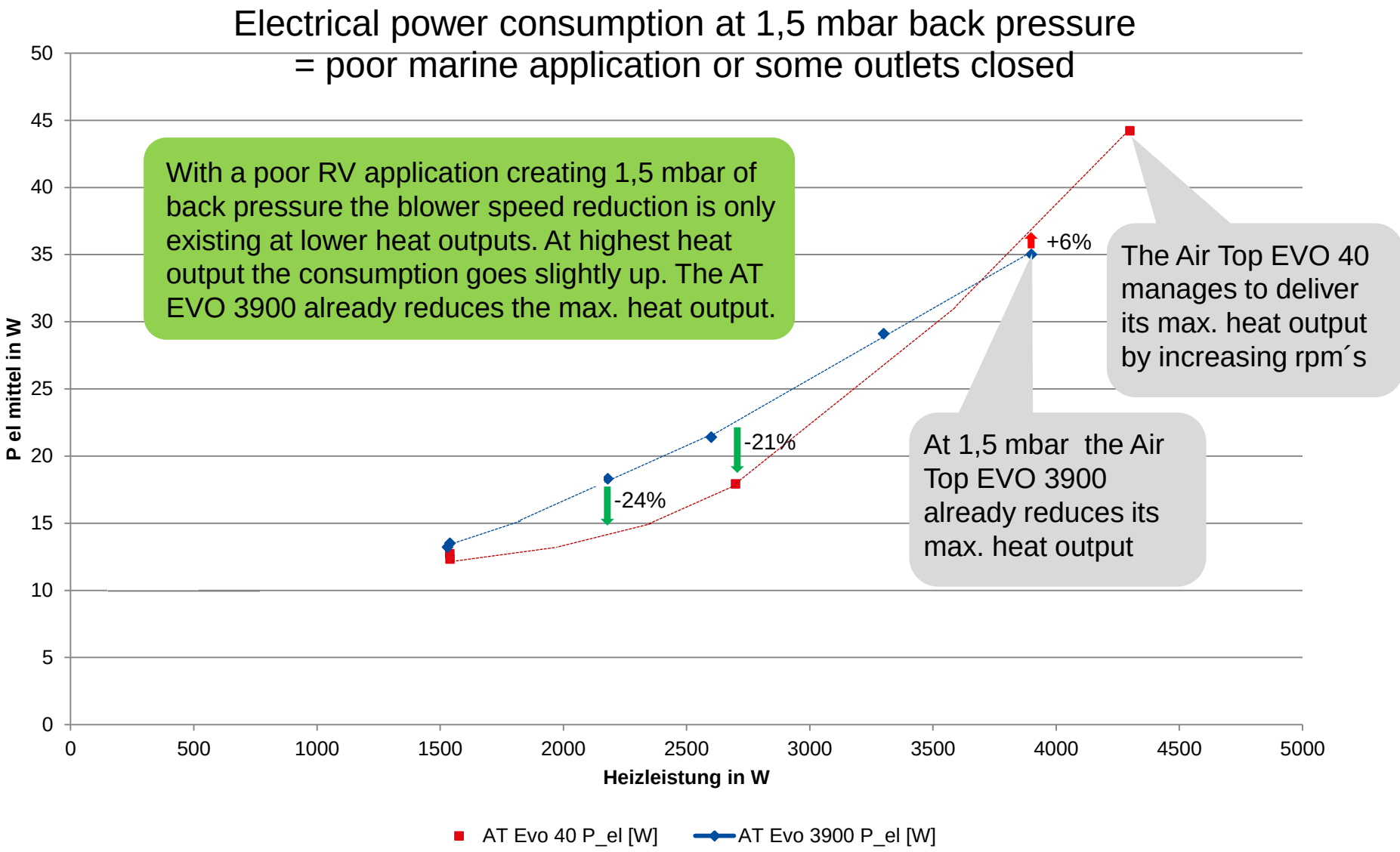
Rembering the past..

- As a reference value for the maximum permissible air ducting, air ducting components have so-called "resistance points" that represent a flow resistance value
- *The greater is the resistance point of an air ducting component, more poorly the air flows through it*

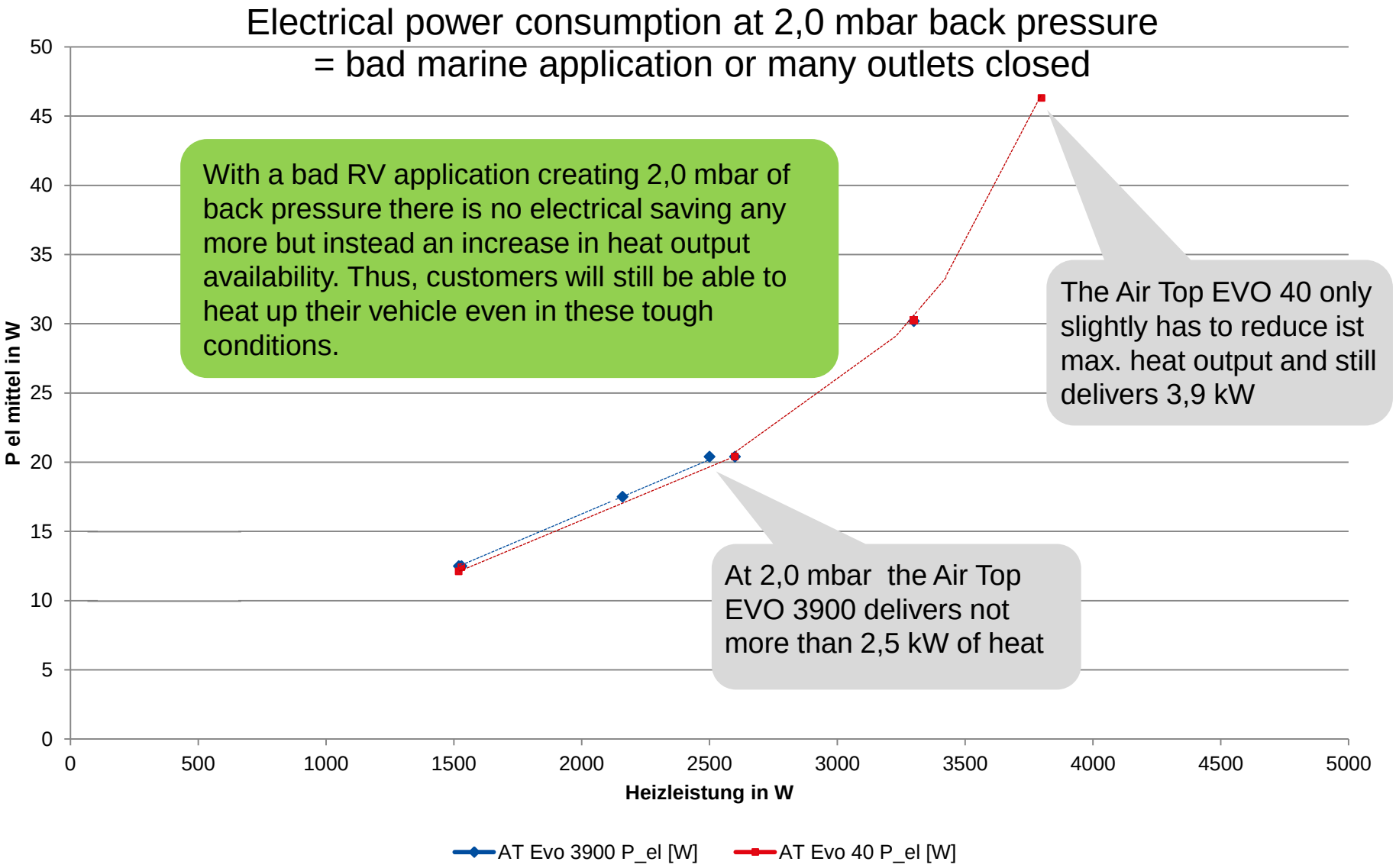
- Before installing the air ducting system, make sure that the allowed total sum of the resistance points in the main branch is not exceeded (otherwise there is the risk of the heater unit overheating or premature reduction of the heating capacity while the interior has not yet been warmed up)

- *Air Top 2000 ST: max. 325 points*
- *Air Top Evo 3900: max. 550 points*
- *Air Top Evo 5500: max. 375 points.*

Comparison of functionality
Intelligent blower control



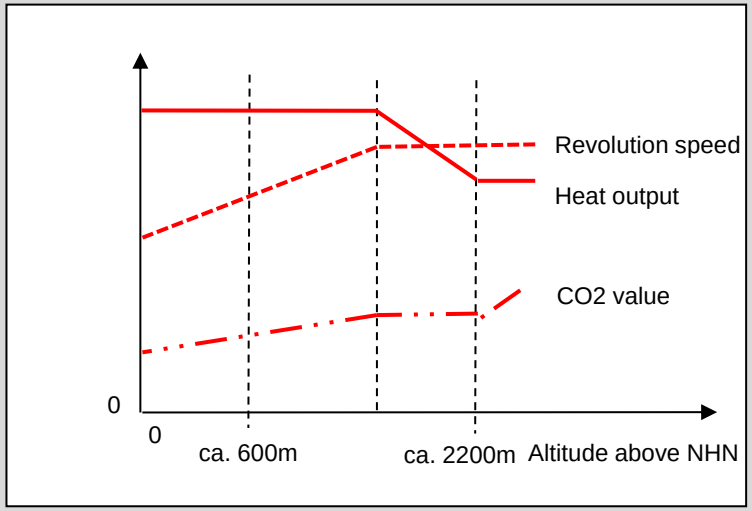
Comparison of functionality
Intelligent blower control



Comparison of functionality
Intelligent altitude adjustment

Air Top Evo 3900/5500

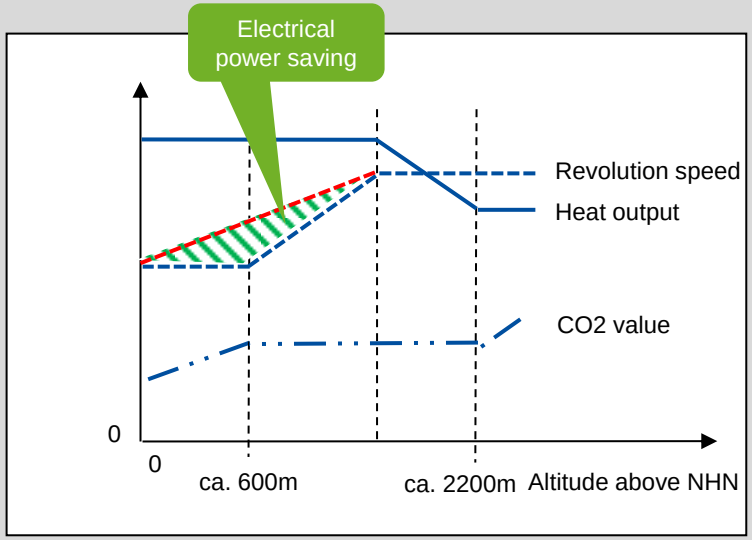
Standard Altitude adjustment



- Pressure sensor was integrated in selected number of heater variants
- Compensation of thinner air achieved by increasing rpm's of combustion blower motor. This compensation was starting just above sea level going up to 2200m altitude
- This resulted in increased electrical power consumption right above sea level.

Air Top Evo 40/55

Intelligent altitude adjustment

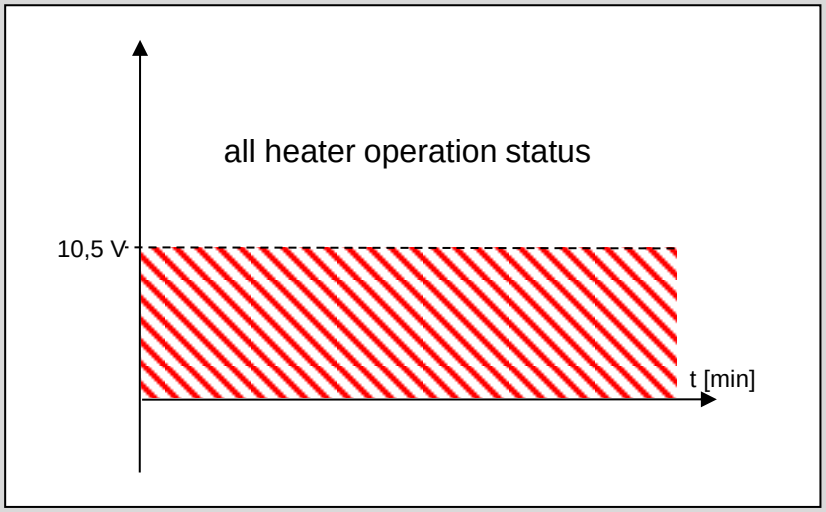


- Pressure sensor integrated in all heaters now
- Compensation of thinner air is also achieved by increasing rpm's but it now starts only above 600m altitude. Below this level there is no compensation and thus no increased electrical power demand.
  → reduced electrical power consumption particularly at altitude levels below 600m

Comparison of functionality
Start Guarantee – Undervoltage threshold

Air Top Evo 3900/5500

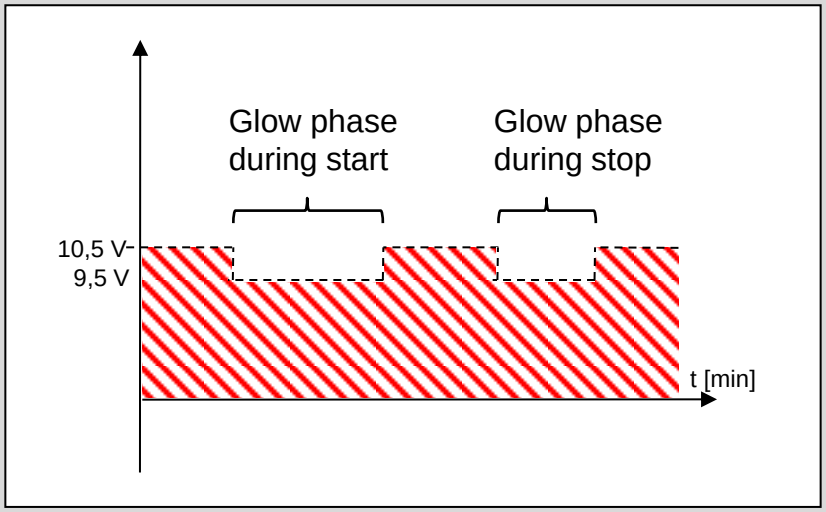
Constant undervoltage threshold



- Undervoltage threshold is independent from operating mode
- Undervoltage failure detected if voltage falls below threshold for > 20 sec.
  24 V heater = 20,5 V; 12 V heater = 10,5 V
- Overvoltage failure if threshold is higher for > 6 sec.
  24 V heater = 31,0 V; 12 V heater = 16,0 V
- In Marine's a "half full" battery sometimes could not start the heater any more (low voltage failure)
  → customer complaint!

Air Top Evo 40/55

Lower undervoltage during glow phases

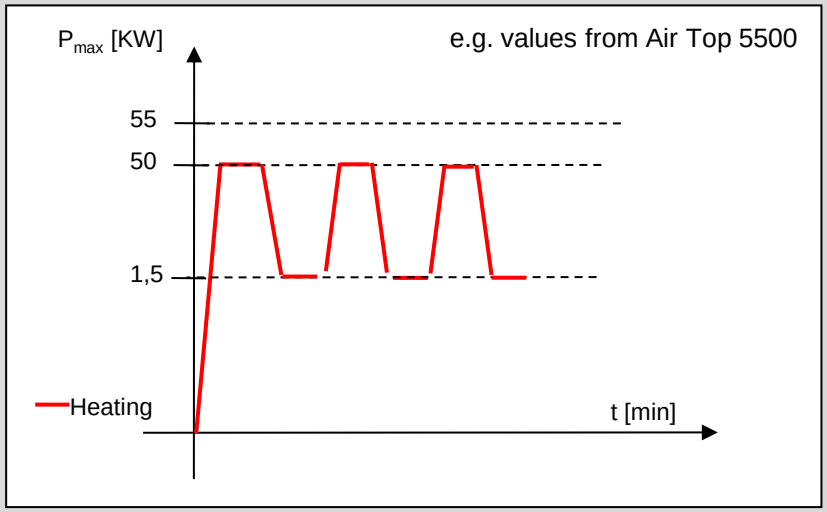


- Undervoltage depends on operating status
- During glow phase amperage is quite high and a voltage loss occurs in supply cables. Measured voltage at control unit is reduced
- During glow phase a second lower voltage threshold at 9,5V (19,5V for 24V heaters) is applied → heater is able to start with "half full" battery. Failure trigger time >6 sec.
- If heater is not glowing the "normal" threshold applies like before in order to protect battery. Failure trigger time > 20 sec.

Comparison of functionality
Extended heating performance, Autoboost

Air Top Evo 3900/5500

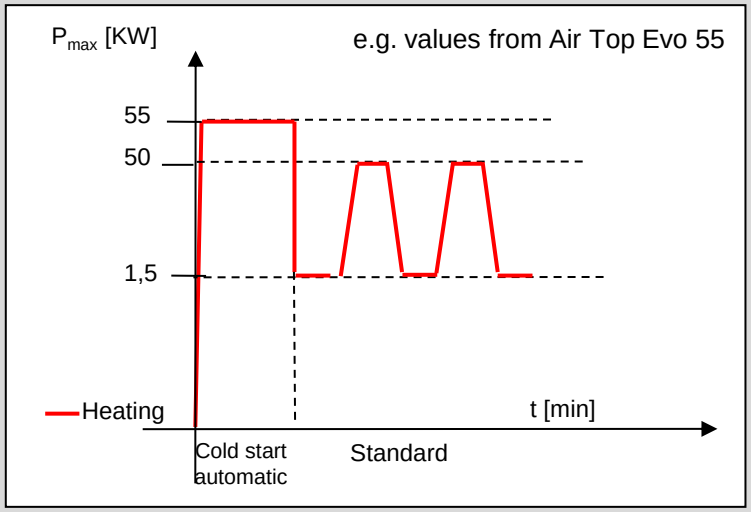
Manuelly extended heating „Plus“



- Manual activation of the extended heating "Plus" only by operating panel model MC04/05
- Duration: until the desired room temperature is reached or time limit:
  60 minutes at Air Top Evo 3900
  30 minutes at Air Top Evo 5500

Air Top Evo 40/55

Cold start automatic, manually extended heating „plus“, Autoboost



- **Cold start automatic: heater always starts in boost mode for quick heating of the cabin also with simple knob user interface**
- Duration: until the desired room temperature is reached or time limit:
  6 hours at the Air Top Evo 40
  30 minutes at the Air Top Evo 55
- ECO mode still possible with operating panel MC04

Summary

New Heater Air Top Evo 40/55
Key facts

- **More Comfort**
  - More silent operation mode (intelligent blower control reduces air flow if possible & half-stroke pump DP42)
  - Auto boost during cold start to 4000/5500 W
  - Quicker start of the heater ⇨ Very rapid availability of warm air
  - Intelligent altitude adjustment for operation up to 2200m a.s.l

- **More Efficiency**
  - Robust and powerful with 1,5 to 4 kW / 5,5 kW
  - Boost time of the EVO 40 has been increased from 30 min to 6 hrs. This will help us in reaching heat up targets of EN 1646
  - High product quality with high life time (4000 operating hours)
  - Lower electrical energy consumption: up to 30% energy saving due to intelligent blower speed control and intelligent altitude adjustment compared to Air Top EVO 3900

- **More safety and reliability**
  - Exhaust air temperature sensor for flame detection
  - New low voltage protections ensures a longer usage of the battery capacity

Benchmark with Eberspächer Airtronic D4

Benchmark Eberspächer Airtronic D4
Overview results, 24V

	Airtronic D4	Air Top Evo 40
Size & weight	(Length x width x height): 371 x 140 x 150 [mm] (Weight): 4.7 [kg]	(Length x width x height): 423 x 148 x 162 [mm] (Weight): 5.9 [kg]
Heating power control behaviour	In 4 steps	Without steps, sliding output control with intelligent automatic function for low power consumption
Heating power control range	In the range from 0.9 – 3.9 kW	In the range from 1.5 to 4 kW
Heating at high altitudes	Height adjustment over 1500m only with additional air pressure sensor possible	Height adjustment up to 2200m automatically ensured with integrated air pressure sensor
Variability of mounting positions	Horizontal, tilted forward 30°, rotated 90° to the right No vertical installation possible	Horizontal, tilted forward 90°(vertical installation), rotated 90 ° to the right and left
Heating flame detection / monitoring	Flame detection by combined sensor (flame sensor/overheating sensor)	Flame detection by exhaust gas temperature sensor. Stable operation and improved continuous heating behavior
Compliance with legal requirements	Short-term exceeding of the outlet temperature of 150° C.	Limits according to Directive 2001/56/EC are met.