VARIABLE SPEED ON SCREW COMPRESSORS

Current and future trends

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Dorian Vlaeminck
Export & Business development

TRANE
Cooling and Heating Systems and Services

Atic
for HVAC professionals

AGENDA

I. **The interest behind variable speed compressors**

II. **Available options in a particular range (500-1500 kW Air Cooled)**

   a. Standard

   b. Variable Frequency drive

   c. AFD with Permanent magnet motors

   d. New trends…

III. **Illustrative Case**

I. The interest behind variable speed compressors

- Comfort application runs most of the time at part load*

	ESEER parameters		
Part Load Ratio	Air temperature (°C)	Water temperature (°C)	Weighting coefficients
100	35	30	3 %
75	30	26	33 %
50	25	22	41 %
25	20	18	23 %

&

ESEER is calculated as follows:
ESEER = A.EER100% + B.EER75% + C.EER50% + D.EER25%
With the following weighting coefficients:
A = 0.03 ; B = 0.33 ; C = 0.41 ; D = 0.23

Importance of part load efficiency

- Better capacity modulation
- Start/stop's reduced considerably
- Lower inrush current

Up to 45% reduction

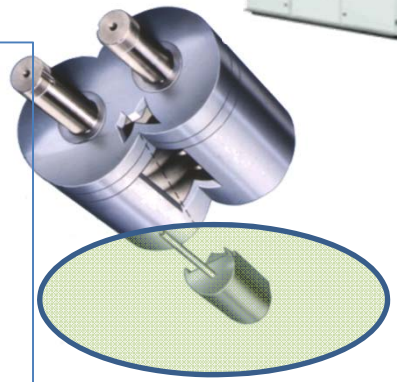
Starting current reduced by 5

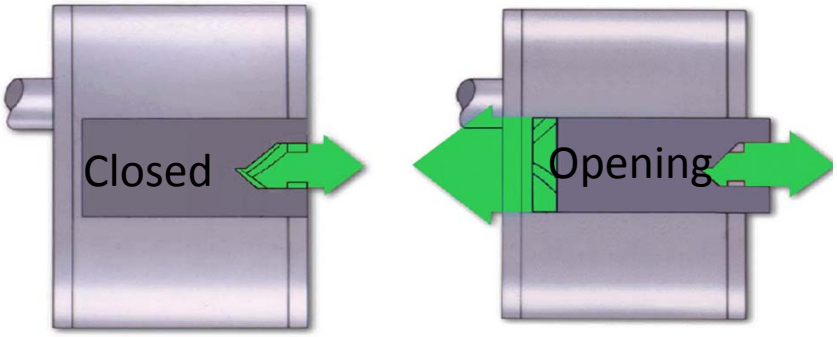
Source: www.eurovent-certification.com

II. Available options

a. Standard screw compressors

Compressor	Screw type (GP2)
Unloading method	Slide Valve
Minimum load	15% (chiller)
Application	- Data centers - Process cooling - High load profile
Refrigerant	R134a

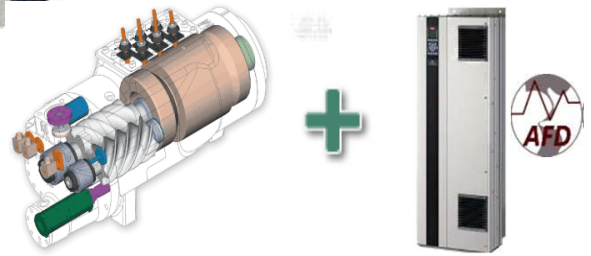


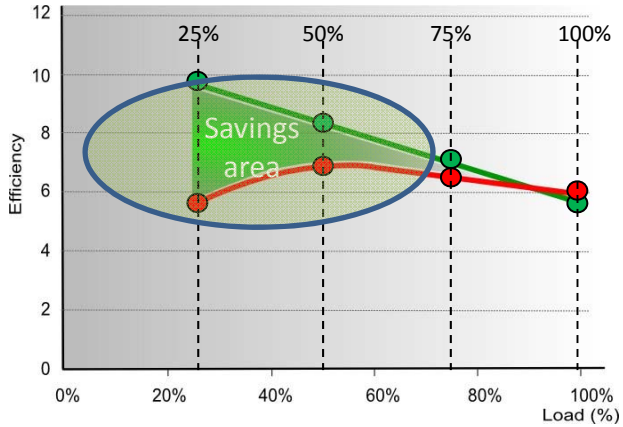


II. Available options

b. Standard AFD compressors

Compressor	Screw type (GP2)
Unloading method	AFD
Minimum load	20% (chiller)
Application	- Comfort Cooling - Part-load operation
Refrigerant	R134a/R513

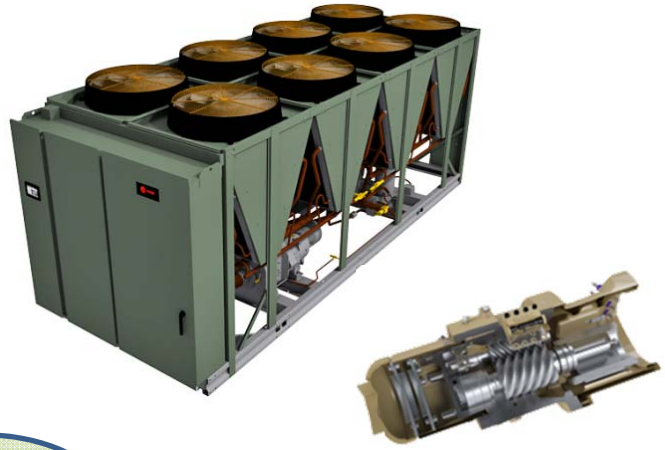


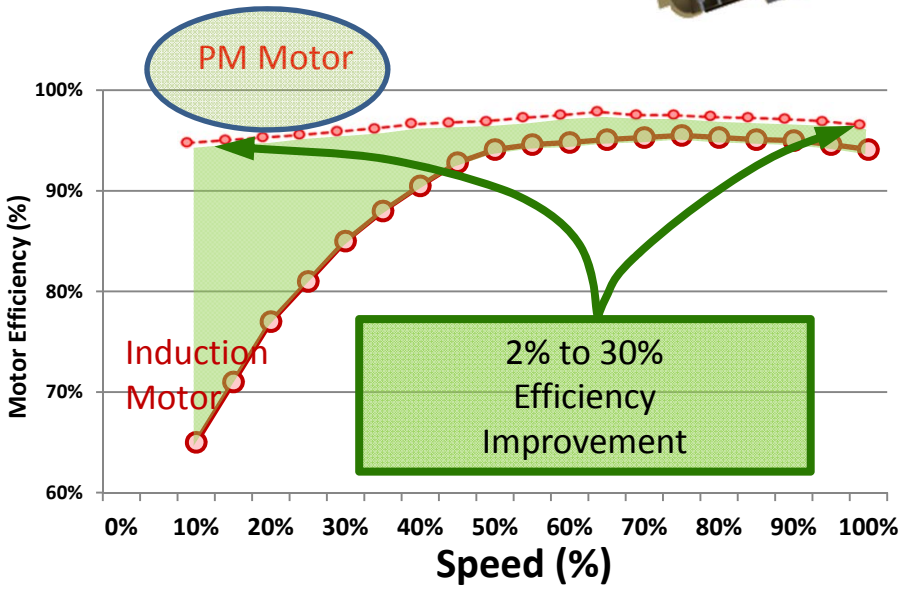


II. Available options

c. Permanent magnet motor Screw

Compressor	Screw type (GP4)
Unloading method	**AFD3 ™**
Minimum load	15% (chiller)
Application	- Comfort Cooling - Part-load - **High** part and full load **efficiency** std
Refrigerant	R134a





II. Available options

d. New trends…

- Best of market Full & Part Load Efficiency
- EUROVENT certified
- Low GWP **R1234ZE, Safe: Non-toxic, R1234ze is A1 in Europe and cannot be ignited at room temperature.** (acc. CLP reg. EC 1272/2008)
- High Speed Centrifugal compressors (Turbocor)
- Integrated within Trane's latest innovations
  - Microchannel condenser
  - EC Fans standard
  - CHIL* Evaporator (reduced charge)
  - Trane UC800 Integrated Controls
  - Free Cooling Option
- 450 – 1250kW (R1234ZE) / 1600kW (R134a)

SINTESIS EXCELLENT

III. Illustrative case

Typical 850kW cooling AC chiller

	Model	Refrigerant	Capacity (kW)	EER	ESEER	Investment
	RTAC SE	R134a	+/-850	2,89	3,85	100$
	RTAF HSE	R134a (Optional R513)	+/-850	+6%	+20%	115$
	RTAE	R134a	+/-850	+17%	+32%	140$
	GVAF	R1234ze (Optional R134a)	+/-850	+22%	+50%	160$

III. Illustrative case

Typical 850kW cooling AC chiller

Case 1

- Process application
- Working most of the time over 80% of total load

	Model	Refrigerant	Capacity (kW)	EER	ESEER	Investment
	RTAC SE	R134a	+/-850	2,89	3,85	100$

Reduced investment cost and maximize EER **(HE, XE application)**

III. Illustrative case

Typical 850kW cooling AC chiller

Case 2

- Comfort application
- Importance of part load performances

	Model	Refrigerant	Capacity (kW)	EER	ESEER	Investment
	RTAF HSE	R134a (Optional R513)	+/-850	+6%	+20%	115$
	RTAE	R134a	+/-850	+17%	+32%	140$

Higher investment costs but mostly recovered through **reduced operating costs**

III. Illustrative case

Typical 850kW cooling AC chiller

Case 3

- Comfort application
- Importance of part load performances
- Environmental impact is central (BREEAM, LEED,…)

	Model	Refrigerant	Capacity (kW)	EER	ESEER	Investment
	GVAF	R1234ze (Optional R134a)	+/-850	+22%	+50%	160$

Higher investment cost recovered through reduced operating cost and **environmental impact optimisation**