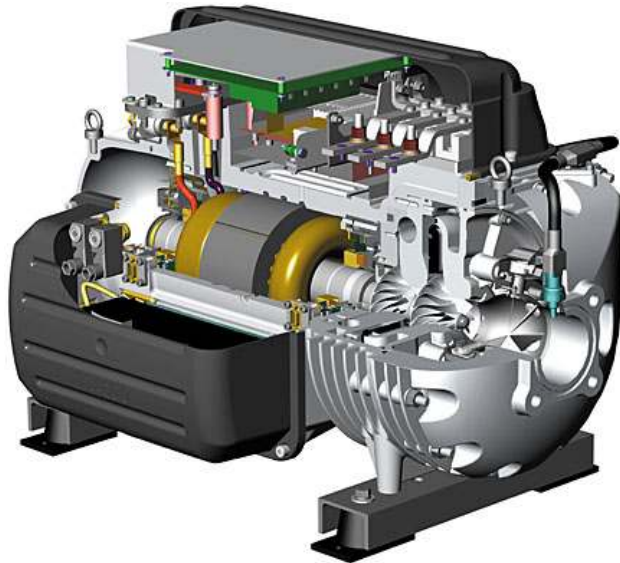

AIRAH New Developments in Variable Capacity



Turbocor



VSH II Scroll

Twin Turbine Centrifugal Compressor.

Totally Oil Free

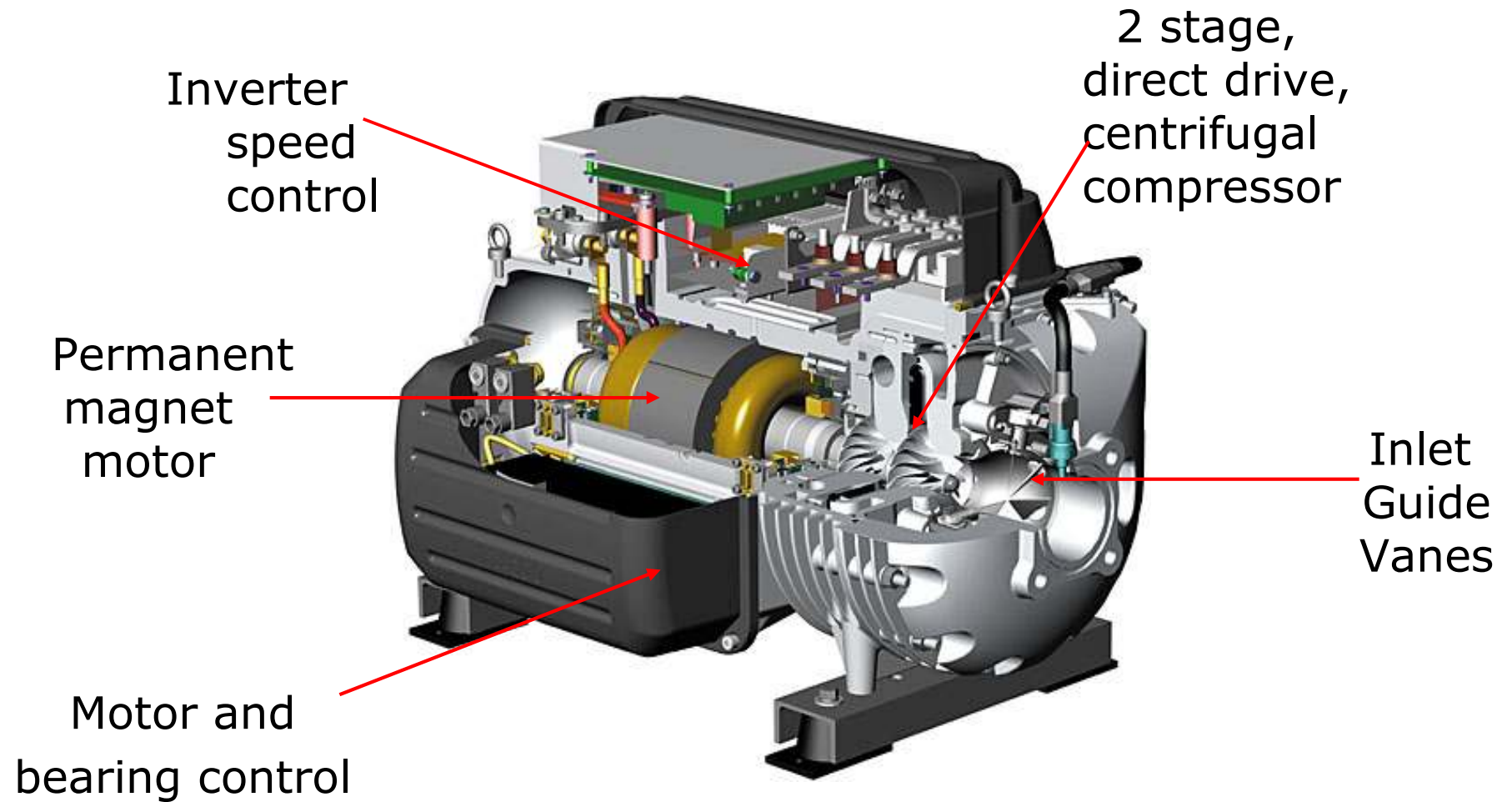
Integrated Variable Speed Drive

Magnetic Bearing

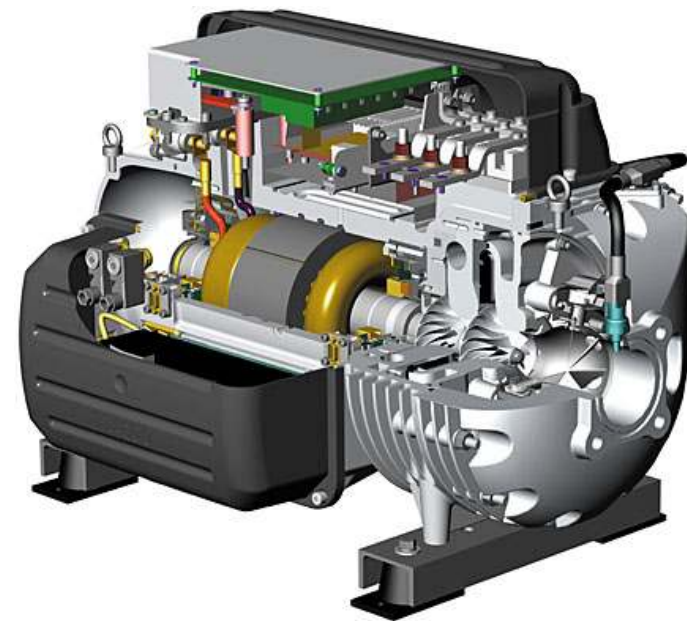
Onboard Digital Electronics

R134a 300 > 700 KW

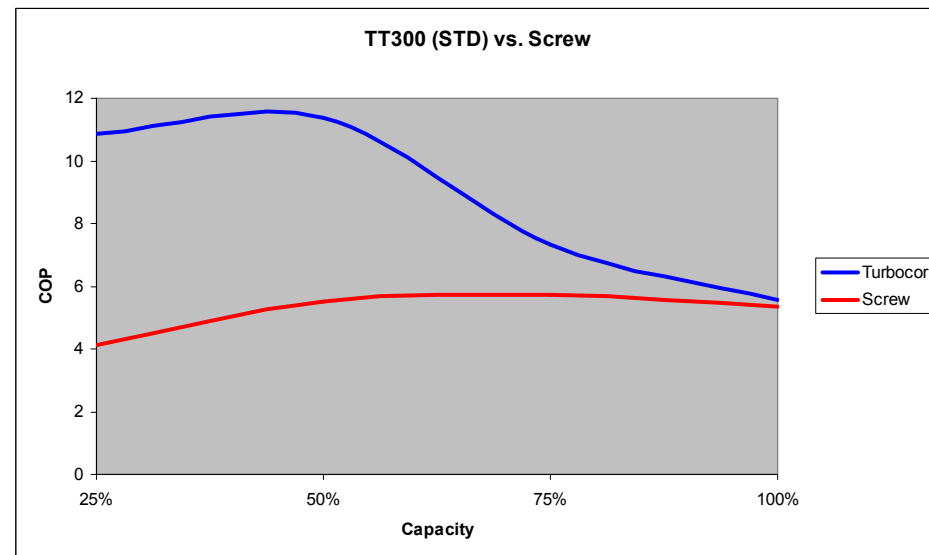




- To provide the extremely high part load efficiencies
- The compressor's speed ranges from 18,000 to 48,000 RPM.
- This compressor only draws 2 amps to start compared to 500 to 600 amps on a typical screw compressor
- No starting equipment required. (contactors / overloads)

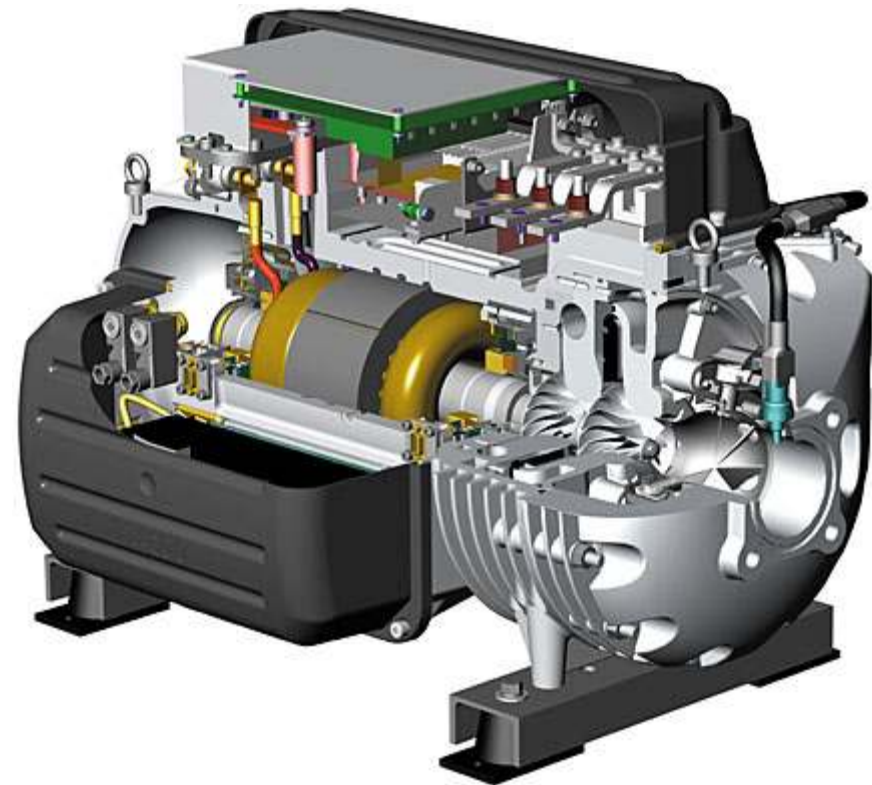


- The Compressor's speed adjusts automatically to match the load and operating conditions for maximum efficiency.
- The slower the compressor's speed, the greater the energy savings.
- World class IPLV



Power Outage

- Motor becomes a generator
- After the compressor comes to a complete stop, the rotor de-levitates normally onto touchdown bearings.
- Touchdown bearings are used as a back up bearing system

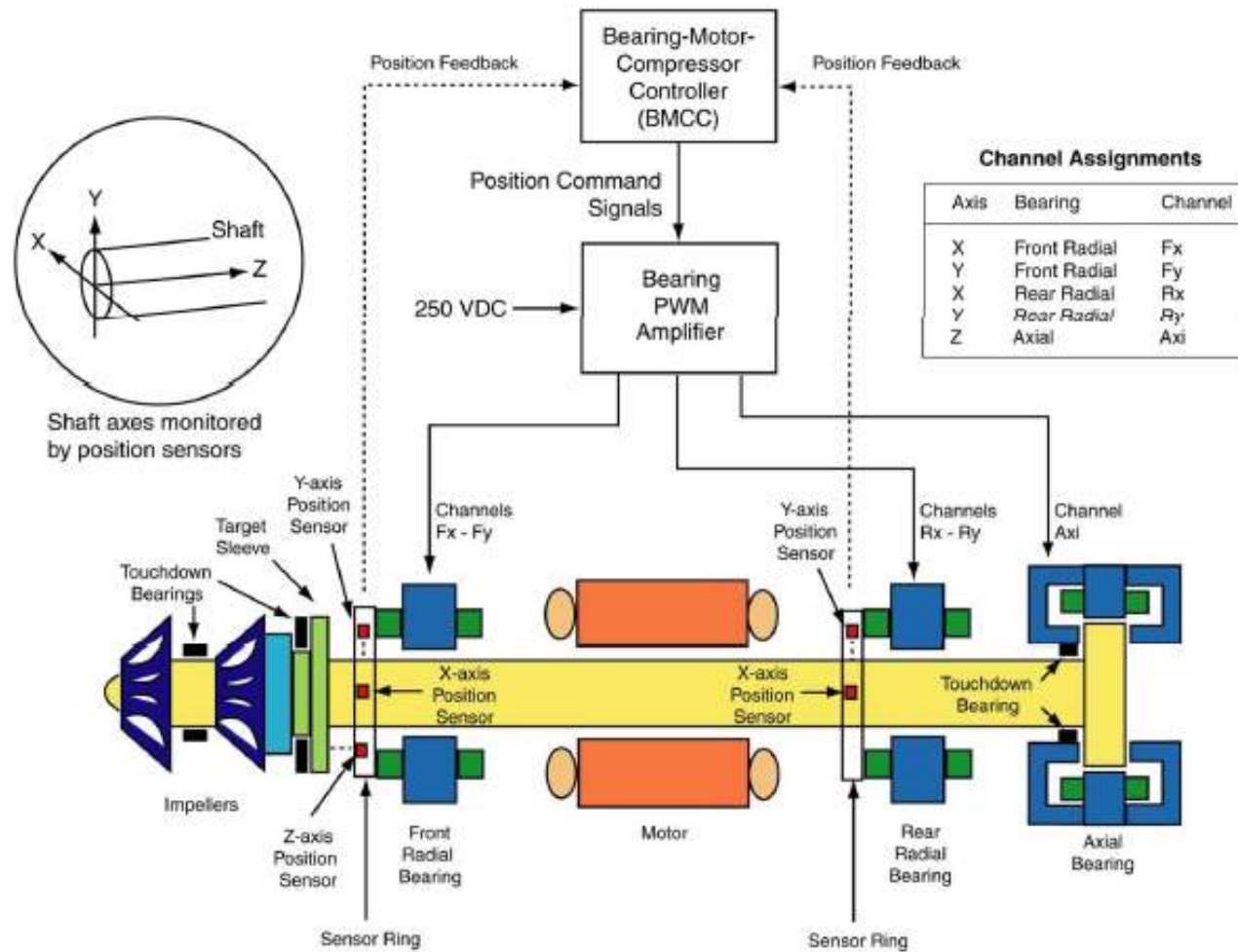


Magnetic Bearings

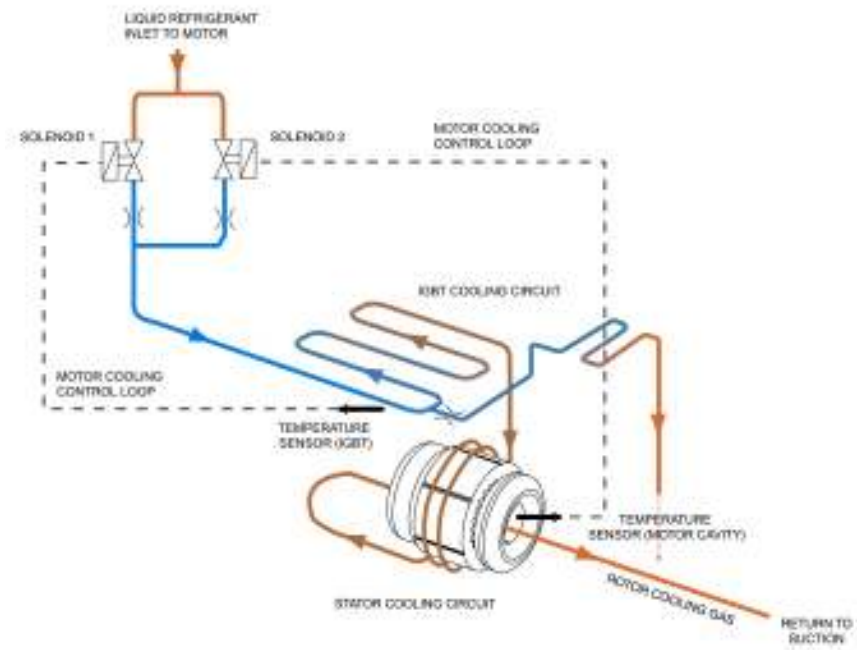
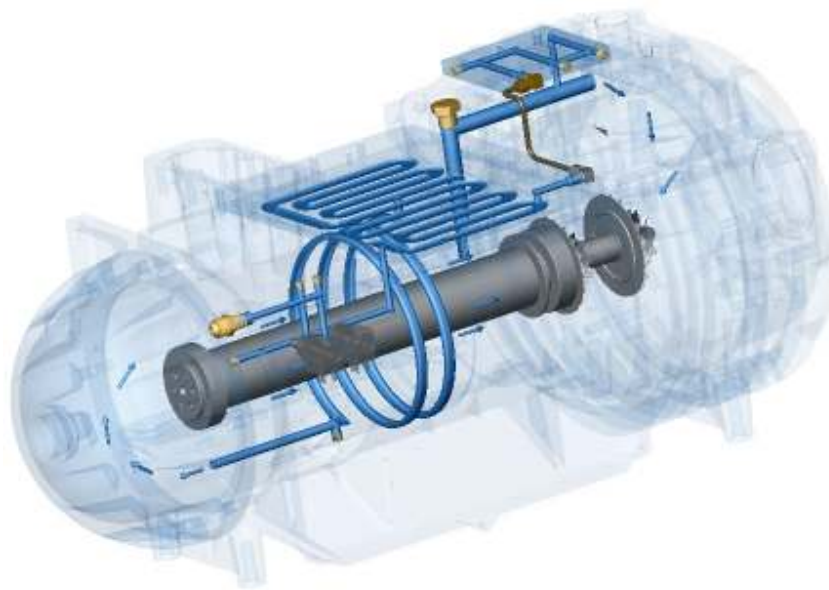
- The magnetic bearings have less friction loss compared to conventional bearings
- The electronics BMC receives information on the shaft position over 1 million times a minute.
- Diameter of human hair: 70 microns, the Shaft Clearance is 76 micron, the bearing control the shaft at 2.54 micron



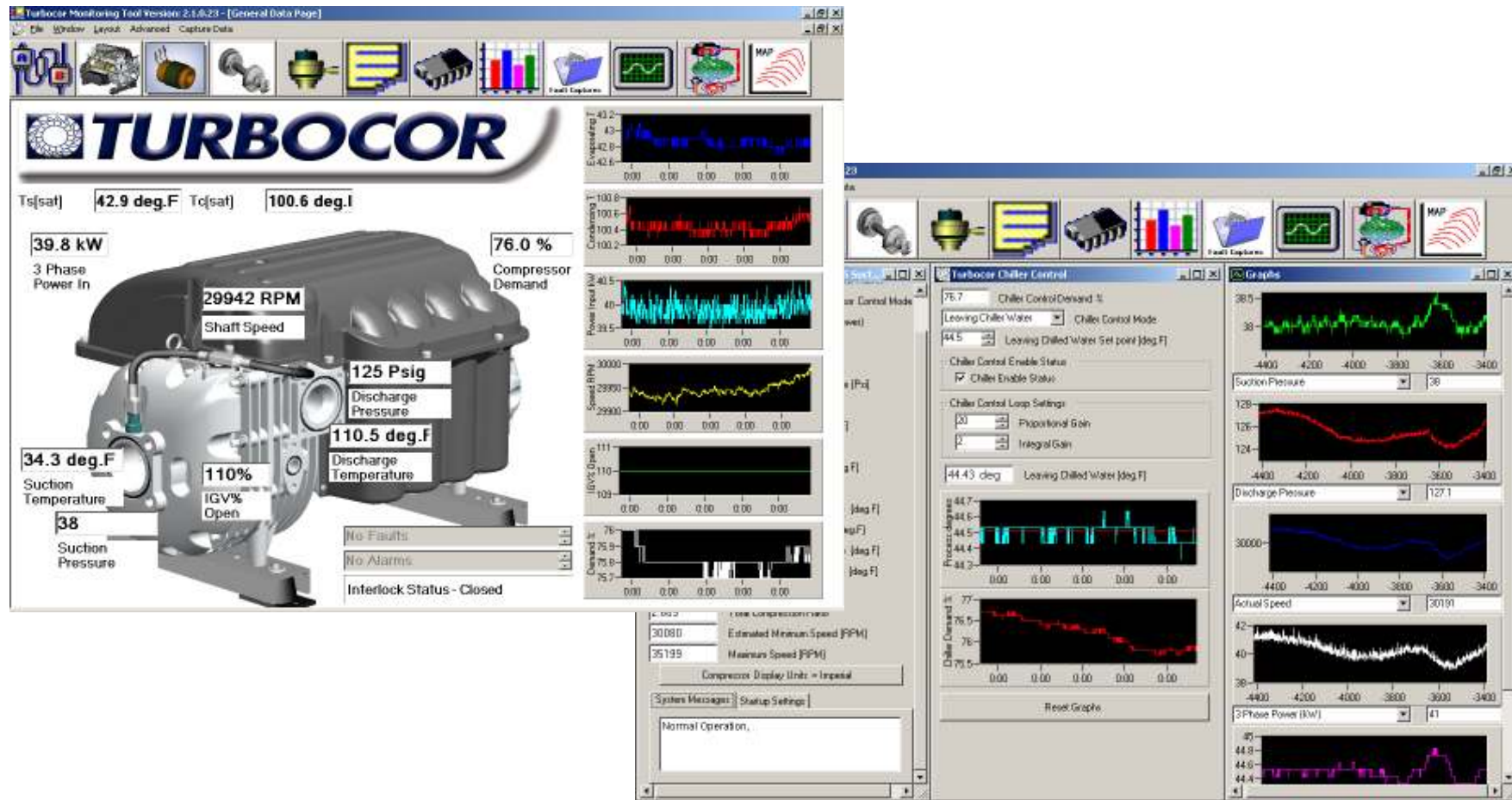
Magnetic Bearing System



IGBT Inverter / Motor Cooling



User Software



Applications



Water Cooled Flooded



Applications



Air Cooled / Evaporative
DX or Flooded



Applications



Applications





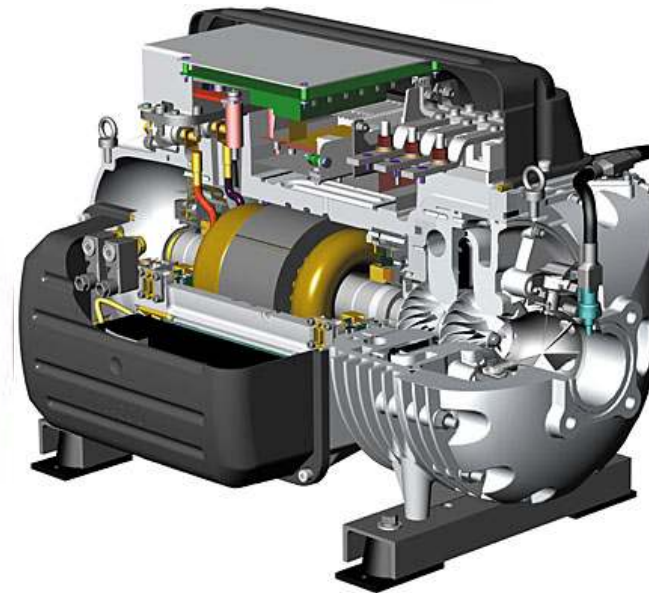
The Future of Compressor Technology!

- **Highest Efficiency***
- **Lowest Emissions**

*Up to 30% more efficient than conventional compressors in its tonnage range.

Plus...

- **Reliable. Only one main rotating part.**
- **Quiet. Sound level less than 70 dBA.**
- **Lightweight. 1/5 the weight of conventional compressors.**
- **Oil-Free!**



An integrated compressor design (ICD) utilizing state-of-the-art frictionless, oil-free magnetic bearings and an integral VFD.

Danfoss

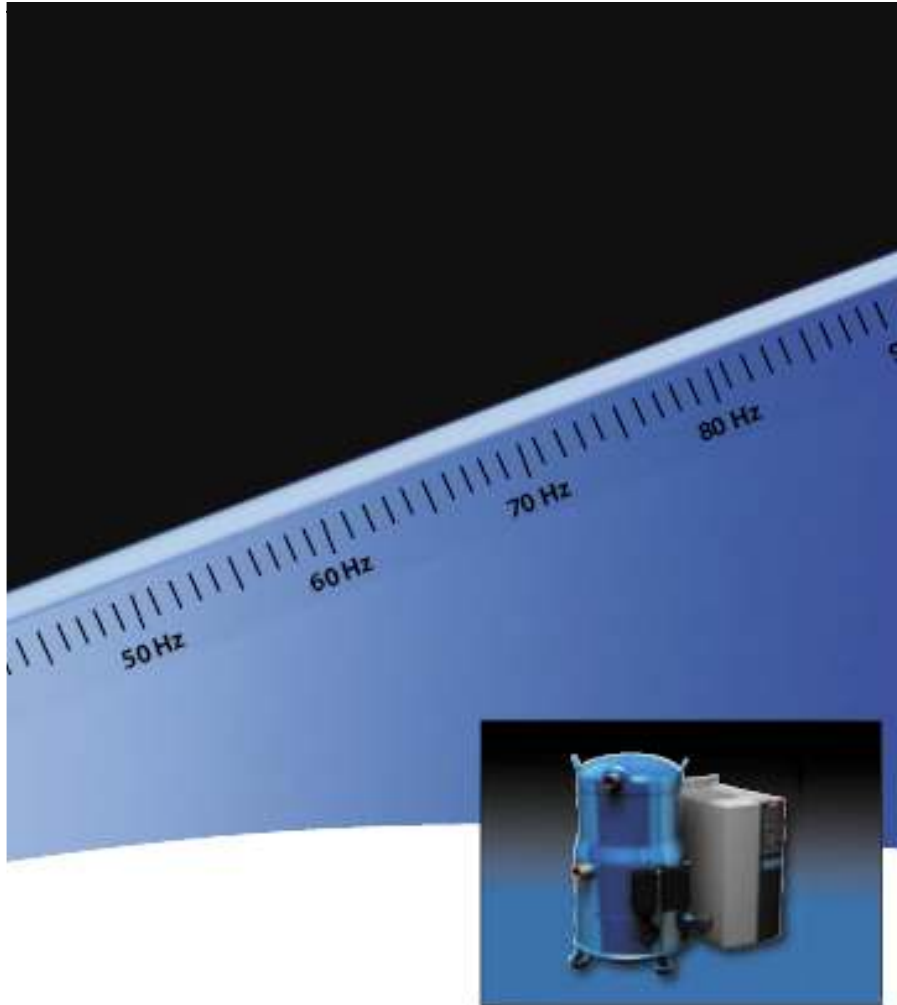


Danfoss® Apexx™

VSH series variable speed scroll compressors for R-410A

Continuous capacity control with VSH

As the frequency varies continuously from 30 Hz to 90 Hz, capacity varies in proportion





The first high-capacity variable speed scroll for air conditioning

Key benefits

- Greater energy efficiency
- Less noise
- Improved comfort
- Reliability



The drive for each VSH package is designed to match the application

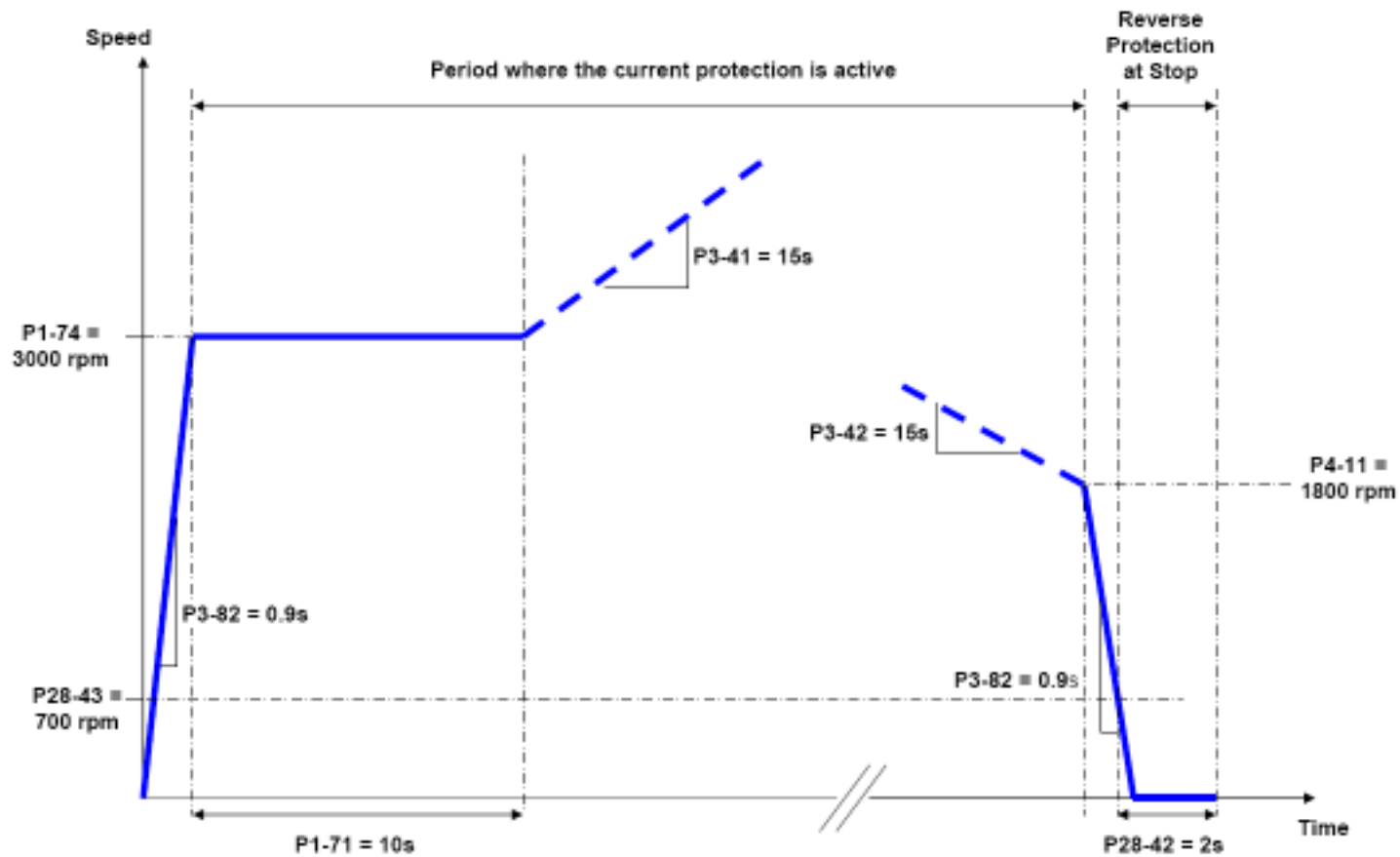
- Pre programmed Software for open or closed loop
- Power factor correction and built-in soft start
- Designed for (50°C) ambient with full current output (no de-rating).
- The drive can be delivered with or without keypad
- IP20 or IP55 protection class
- No need for contactors or overloads



Advanced compressor protection by the drive

- Current monitoring
- Oil management
- Built-in crankcase heater
- Protection from short-cycling
- High tolerance to mains voltage fluctuations
- Protection against short circuits
- High discharge temperature protection option

Ramp up management

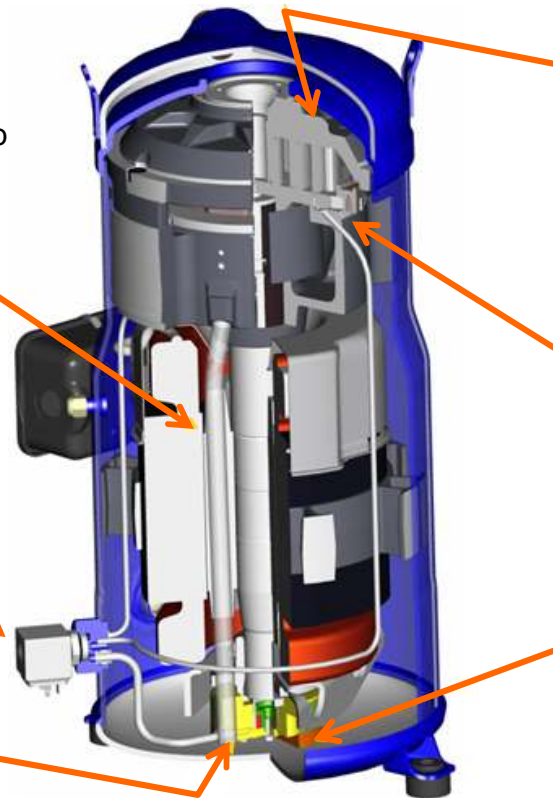


The compressor is designed to match the requirements for variable speed

Oil circulation at high speed is minimized by separating oil and gas flows with an oil return tube to the sump.

Oil injection is controlled by frequency, avoiding increases in oil circulation ratio at higher speeds.

A newly developed gerotor oil pump ensures low speed bearing lubrication.



Reinforced high grade ductile cast iron scroll set.

A patented oil injection system ensures that scrolls and bearings are optimally lubricated at all compressor speeds.

Oil strainer controls the risk of system debris in the oil injection circuit.

Communication interface

Mains supply (L1, L2, L3)	
Supply voltage (motor code J)	200 – 240 V
Supply voltage (motor code G)	380 – 480 V
Supply voltage (motor code H)	525 – 600 V
Analog inputs	
Analog inputs (voltage or current)	2
Analog Output	
Programmable analog output	1

Digital Inputs & Outputs	
Digital inputs	3
Digital outputs	2
Relay outputs	
Programmable relay outputs	2
USB Port	
PC access to drive parameter via MCT10 software	USB port
Serial communication	
Interface	RS-485
Build-in protocol	FC-Protocol



Optional graphic display with on-board memory



MCT10 software provides PC access to drive parameters

Oil return management (P28.1x)

- **Secures that oil stored in the system is returned to the compressor by increasing the speed to 70Hz for a user defined time "Boost duration".**
- **Interval between "oil boost"**
 - **Fixed time oil boost within a user defined time "Fixed boost interval" (Default 24h).**
 - **Adaptive oil boost. If running speed is below 50Hz for a given time it will lead to oil boost. time is set in "Low speed running time" (default 60 min.).**

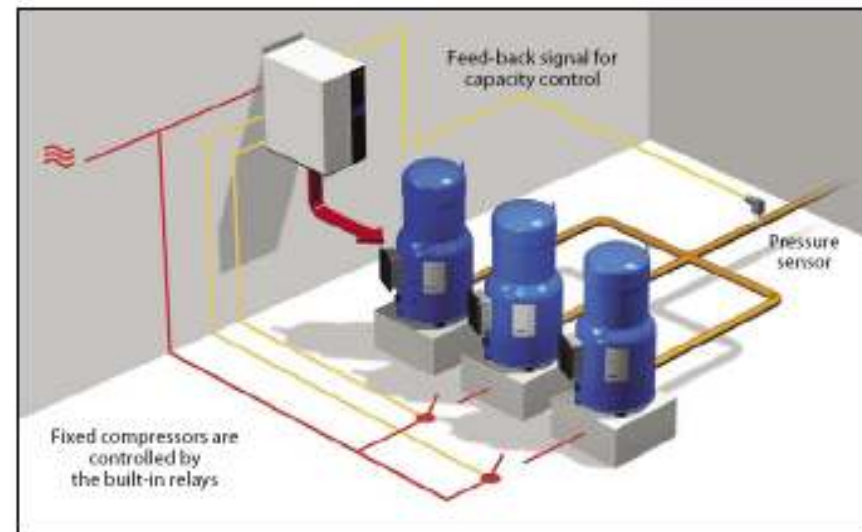
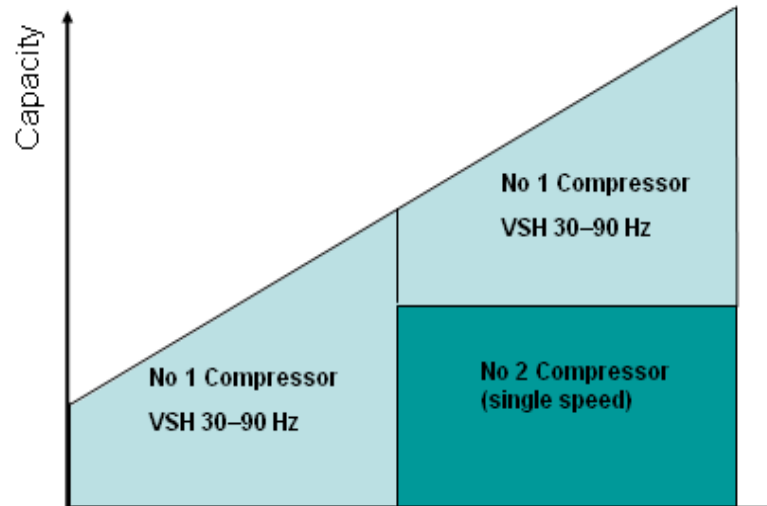
Six VSH packages cover a variable speed capacity range from 3.5 to 44.1 ton

VSH packages	90 Hz design capacity (ARI Ton)	VS capacity range (ARI Ton)	M5
VSH088	11.7	3.5 – 11.7	Feb 09
VSH117	15.6	4.7 – 15.6	Feb 09
VSH170	23.0	7.0 – 23.0	Feb 09
VSH088 + SH120	22.3	3.5 – 22.3	Feb 09
VSH117 + SH161	29.1	4.7 – 29.1	Feb 09
VSH170 + SH240	44.1	7.0 – 44.1	Feb 09

ARI conditions:

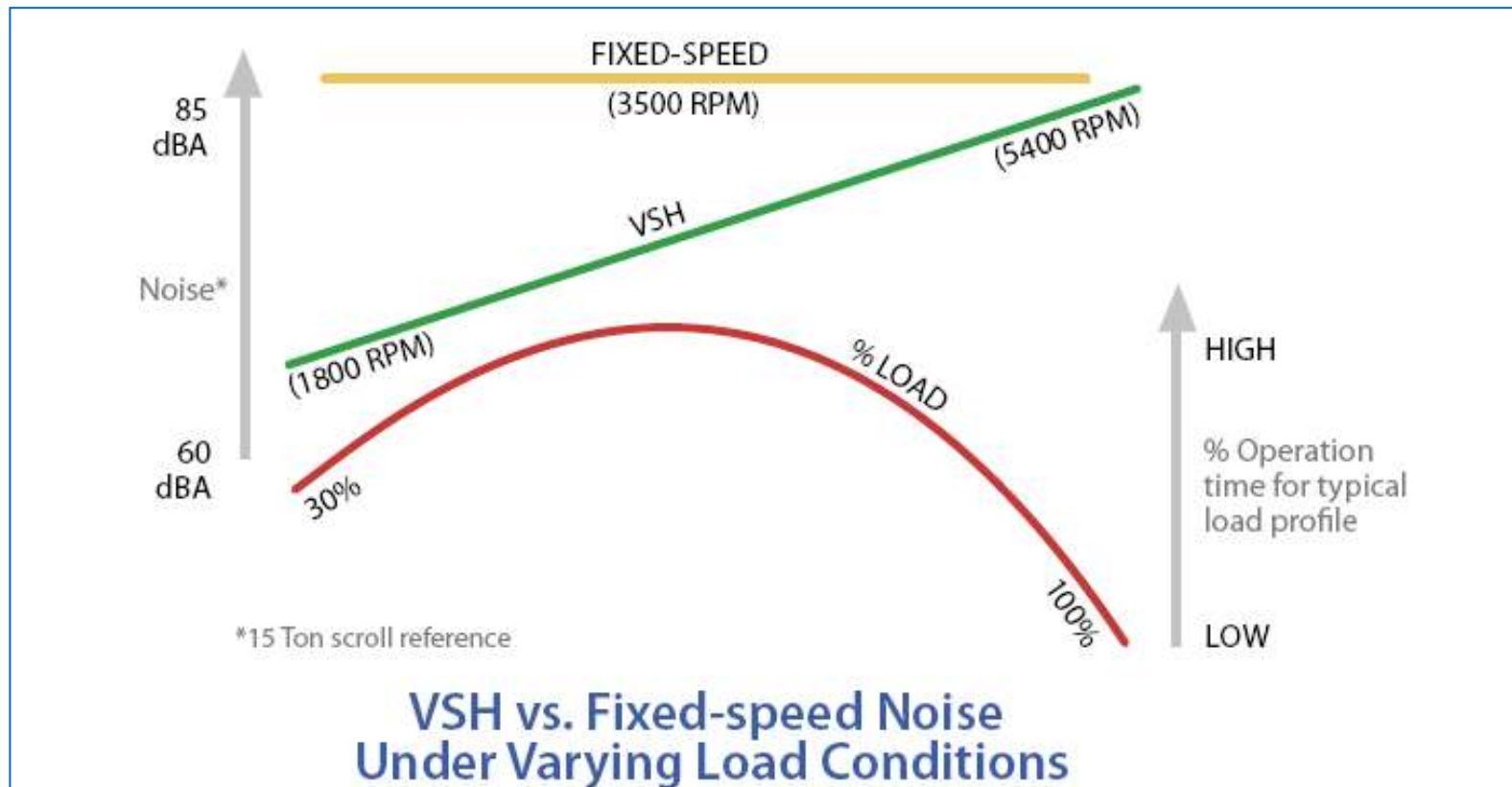
Evaporating Temp: +7.2°C, Condensing Temp: +54.4°C
Superheat Temp.: +11.1°C, Sub cooling Temp.: +8.3°C

Hybrid solutions are a cost efficient method of increasing the variable capacity range

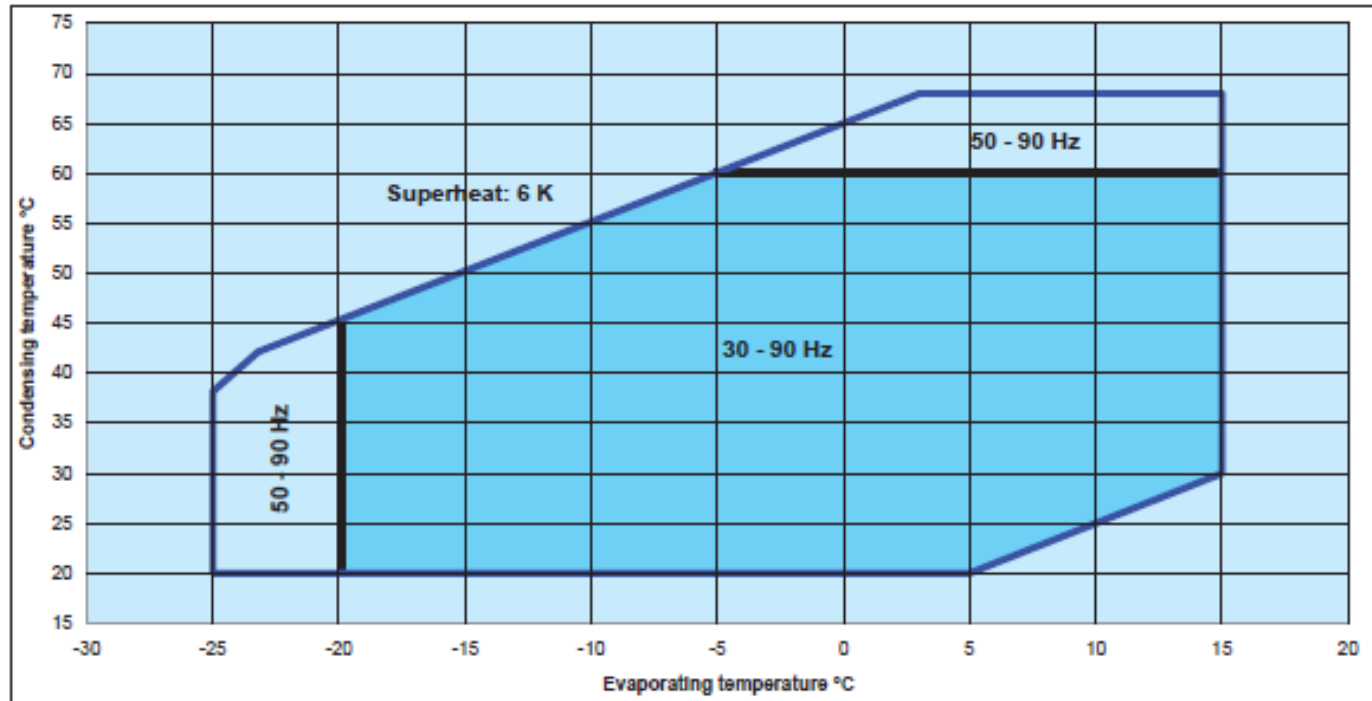


VSH provides a customizable pack controller that allows staging of up to two fixed compressors along with one variable speed compressor.

Creating a quieter environment is another competitive difference



Application envelope





Thank You