

Refrigeration Compressor News

Stream

**New Emerson 4 and 6 Cylinders Semi-
Hermetic Reciprocating Compressor
Early Product Information**



EMERSON[™]
Climate Technologies

Emerson Climate Technologies ***Introducing “Stream”***

Agenda

- **For HFC Refrigerants**
 - Product Range Information
 - Product Performance
 - Summary
- **For CO2 Transcritical**
 - Product Range Information
- **Advanced Protection & Diagnostic Module**
- **Release Schedule**



« Stream » Compressors

Built To Last In Today's Changing World

1



New 4 & 6 Cylinders Range

- Multi-Refrigerant Compressor For R404A, R407A/C, R134a
→ HFO1234yf or Blends
 - Best In Class Performance - 10% More Efficient Than Next Best
 - One Model For Medium/Low Temperature Applications
-

2



New Range For CO2 Transcritical

- Designed For CO₂ Applications (Medium Temperature)
 - Best In Class Performance (Efficiency & Sound)
 - Inverter Release 25...75Hz
-


3



New Range With CoreSense™ Diagnostics

- Advanced Protection & Diagnostics Electronic Module With Modbus Communication
- Increased Equipment Life Time
- All New Range Compressors Including CO2 Transcritical

« Stream » Compressors Main Product Features (And Benefit)



New Product Range
Stretch Models (Ratio €/kW, Compactness)
3 Additional models (OEM flexibility)

Modulation
Blocked Suction
Inverter 25...75Hz
(COP, Control Accuracy)

Small Head
(Compactness)

Nameplate Location
(Ease Of Application)

Intelligent Crankcase Heater (COP)

Quiet Compressor
(2...6dBA Quieter)

Min 10% COP Advantage to Competition
New Valve Plate & Body Bow For Larger Gas Passageways
5...8% More Under Investigation

No Head Fan (LT) At 0°C
SGRT (Applied Cost)

CoreSense Diagnostics
(Advanced Protection/Diagnostics)

Plastic Terminal Box
(Sound)

Minor Changes in Connection Points
(Replacement Ease)

Modern Look
Paint & Surface Finishing Quality

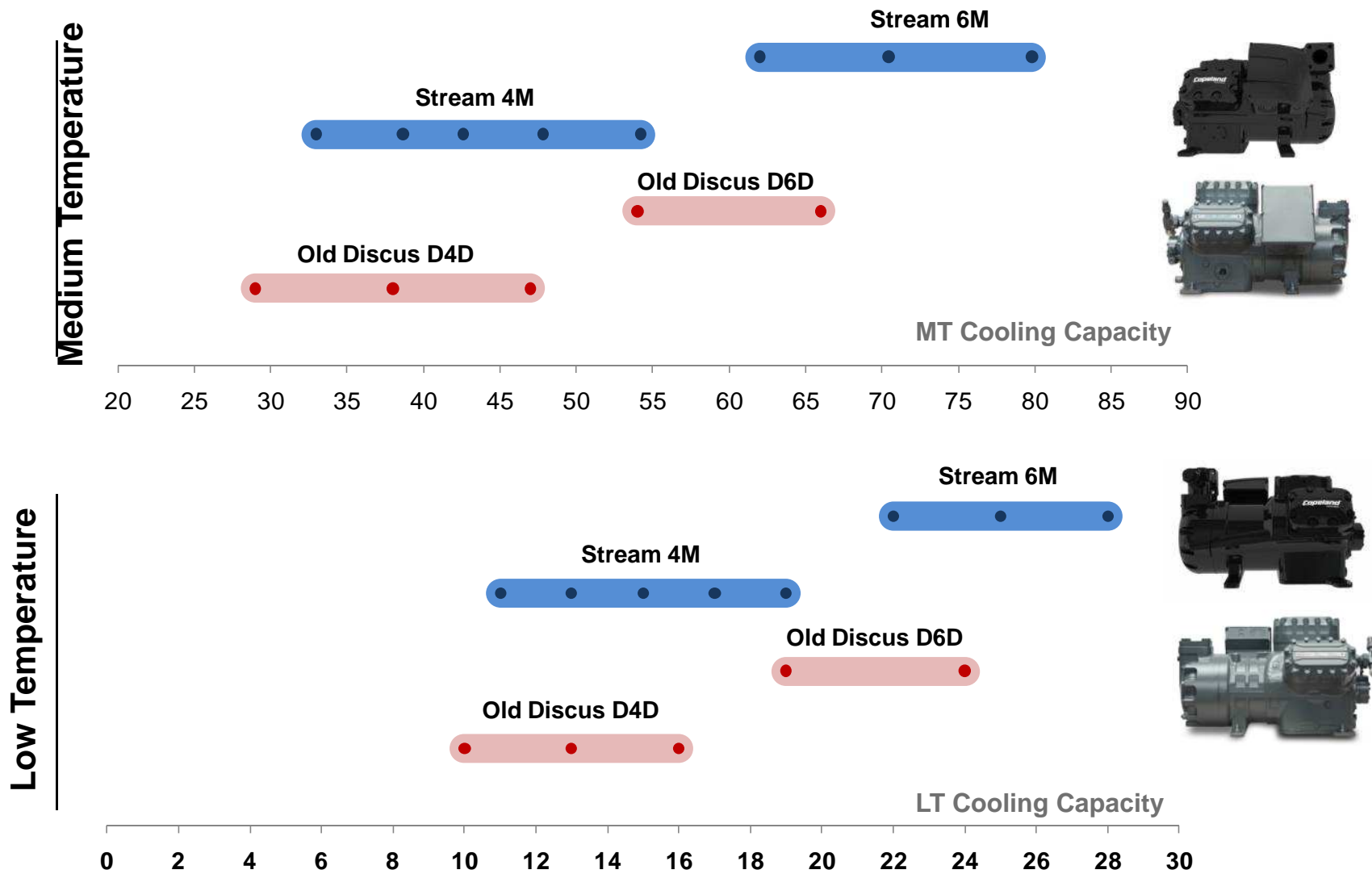
Light Weight & Small Dim -
Up to 40kg Less
(Compactness)

Same Footprint
(Replacement Ease)

Multi-Refrigerants
Compatible with R404A, R134a, R407A/C
→ Ready For HFO1234yf Or Blends
CO2 Medium Temp (Transcritical)

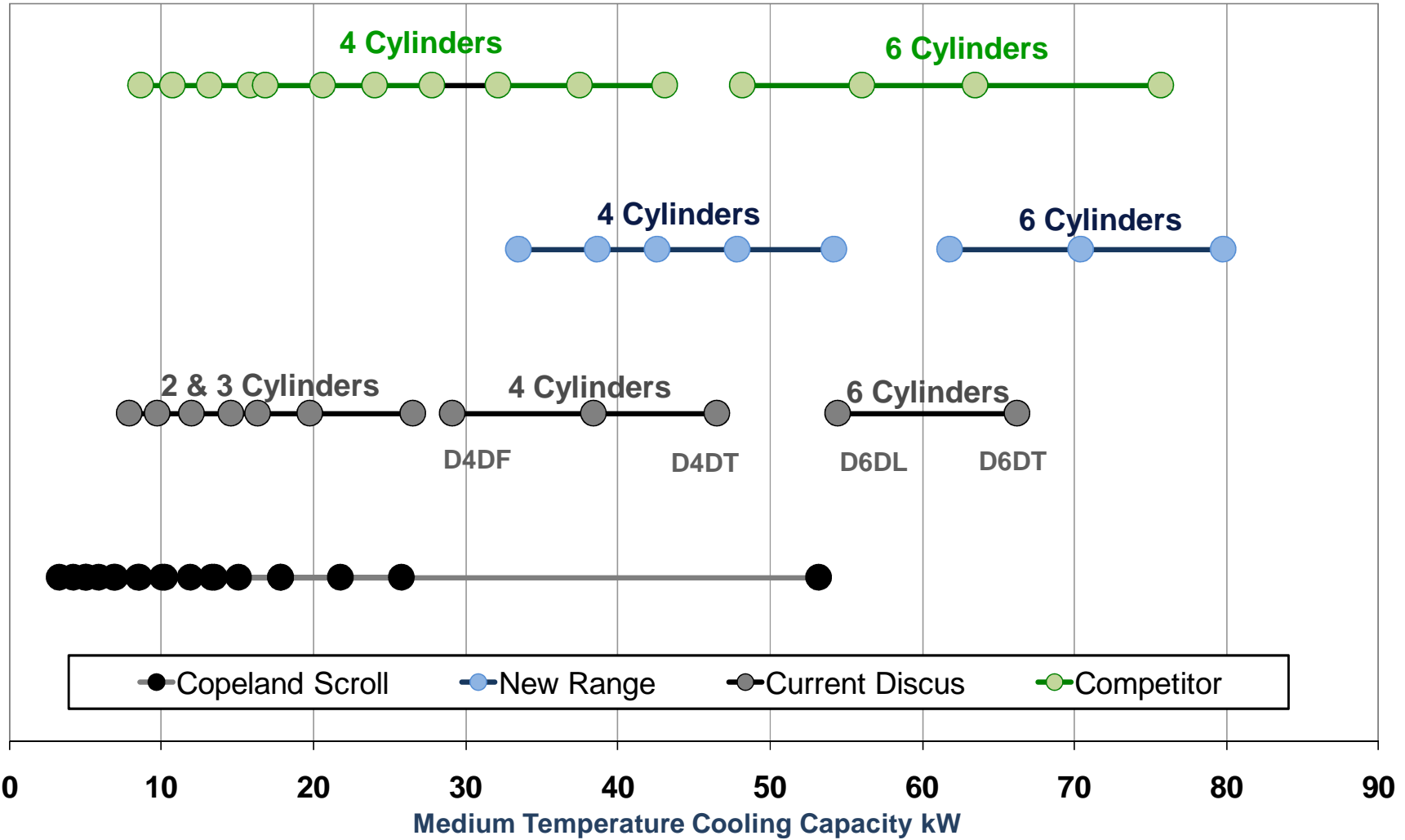
Under Evaluation

Stream Comparison With Existing Discus 4/6 Cylinders



Stream

8 Models With Extended Capacity



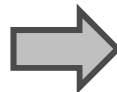
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Stretching Capacity For Improved Competitiveness



Current Discus	
Model	Capacity kW
D4DF-100X / D4DA	29
D4DL-150X / D4DH	38

D4DT-220X / D4DJ	47
D6DL-270X / D6DH	54
D6DT-320X / D6DJ	67



"Stream"	
New Model	Capacity kW
4MA / F	33
4ML / H	39
4MM / I	43
4MT / J	48
4MK / U	54
6MM / I	62
6MT / J	70
6MK / U	80

Comment
Increased Capacity
New Displacement
New Displacement - Stretch 4-Cyl Model
New Displacement
Increased Capacity
New Displacement - Stretch 6-Cyl Model

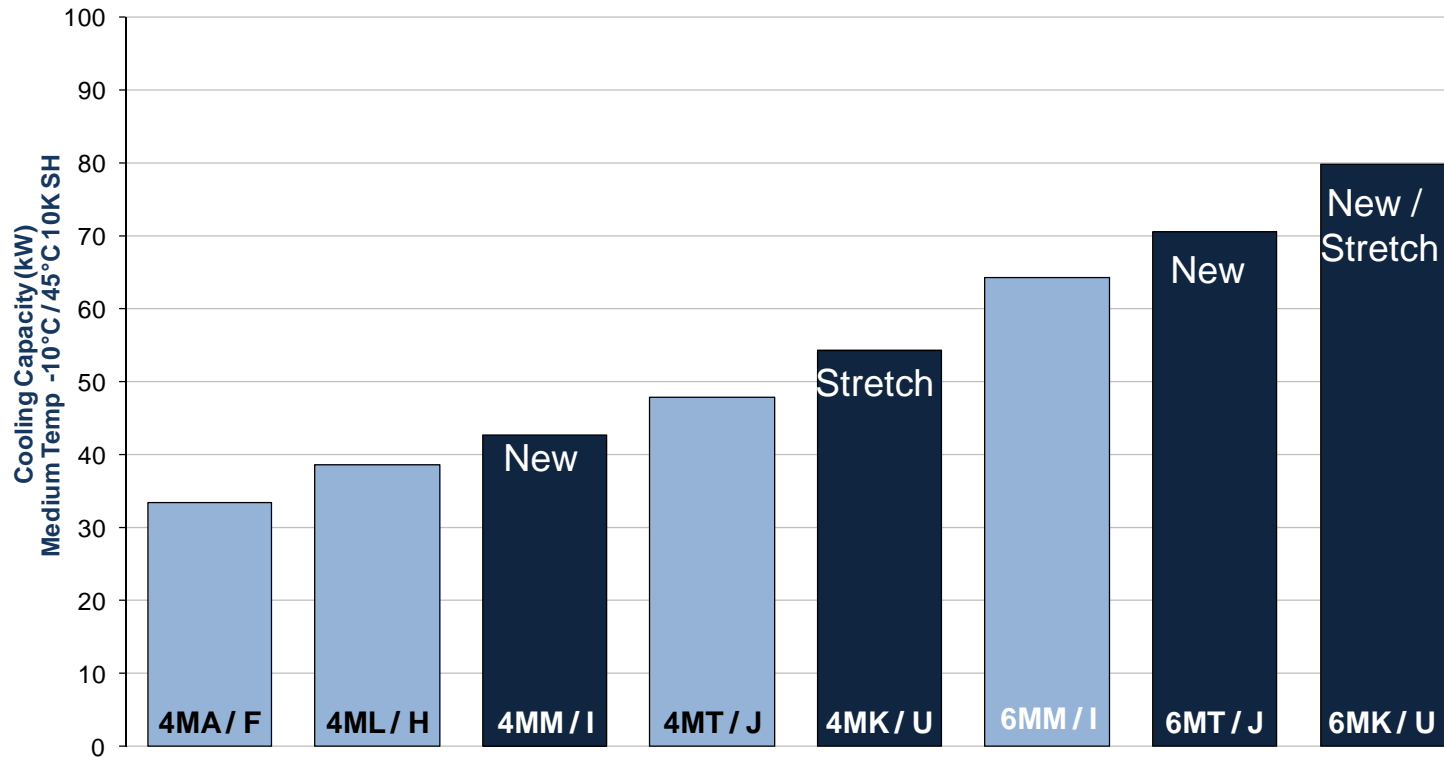
R404A -10/45/20/0

Product Range Includes

- 8 Equally Distributed Capacity Steps
- 2 Versions Per Displacements
 - ➔ Small Motor Version For Ref Applications (R404A MT/LT, R407A/C, – R134a MT)
 - ➔ Large Motor Version For HT/AC Applications (R404A/R407A/C, R134a w/ Heat Recovery)

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New Models/Stretch For Better Selection Flexibility



Product Range Includes

- 3 New Models – 2 x 4 Cylinder & 1 x 6 Cylinder for Better Selection Flexibility
- 2 Stretch Models with The Following Benefits
 - Better €/kW Ratio
 - More Compact & Lighter Compressors Vs Equivalent Competitive Models

Stream

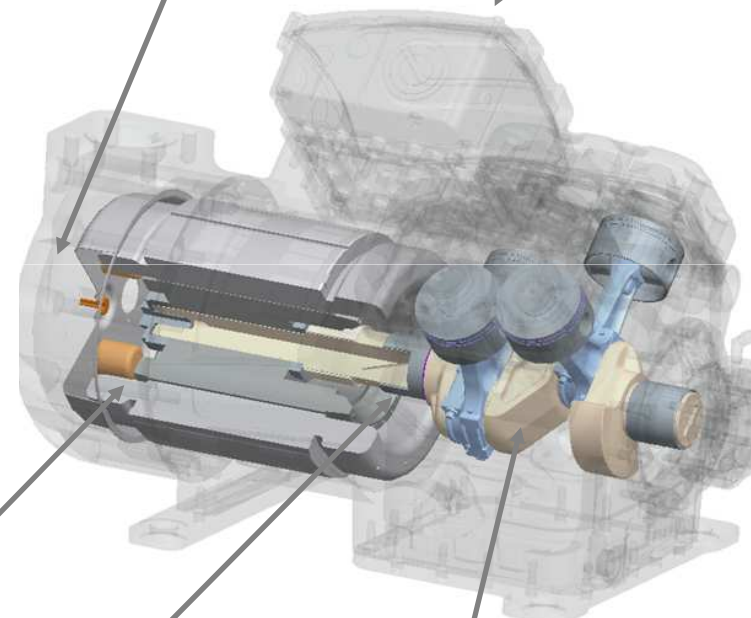
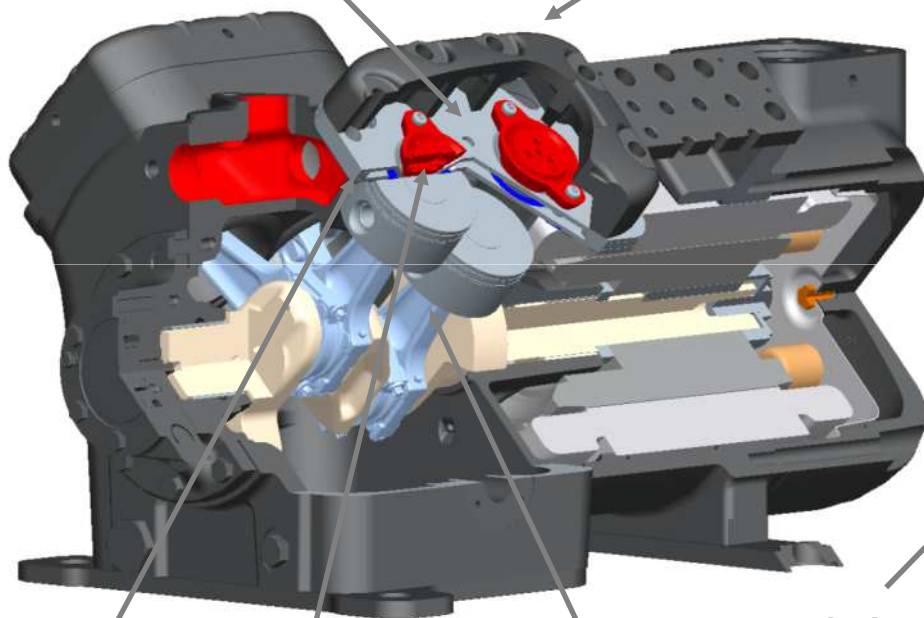
Designed To Deliver Best In Class Performance

« Puck » Valve Plate
Additional / Larger Suction &
Discharge Gas Passageways
(Efficiency, Pulsation)

Small Cylinder Heads
(Compactness)

Larger Gas Passage
Ways Around Motor
(Fan Elimination)

Robust Plastic
Terminal Box (Sound)



Overall Discharge
Volume Balancing
For Reduced
Pulsation

Compact Cylinder
Bank (Efficiency,
Compactness)

Cylinder Bores &
Stroke For Maximum
Cooling Capacity

Optimized Motor
Sized

Larger Bearings
(Reliability)

Reduced Crankshaft
Length (Reliability &
Compactness)

Developed In Europe For Europe

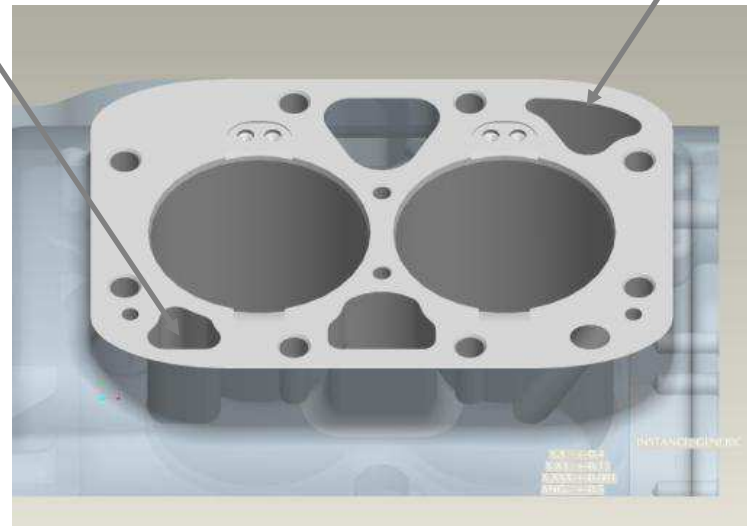
Stream Efficiency and Pulsation

Additional Suction Hole

Larger Discharge Hole



Discus



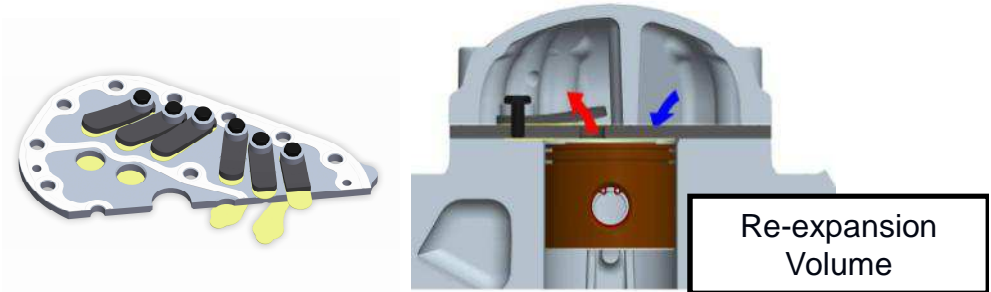
New Range

- Additional Suction & Larger Discharge Gas Passageways → Efficiency
- Combination of Cylinder Head Volume/ Valve Plate Discharge Orifice / Body Discharge Channel → Pulsation Reduction to 6...7psi peak to peak

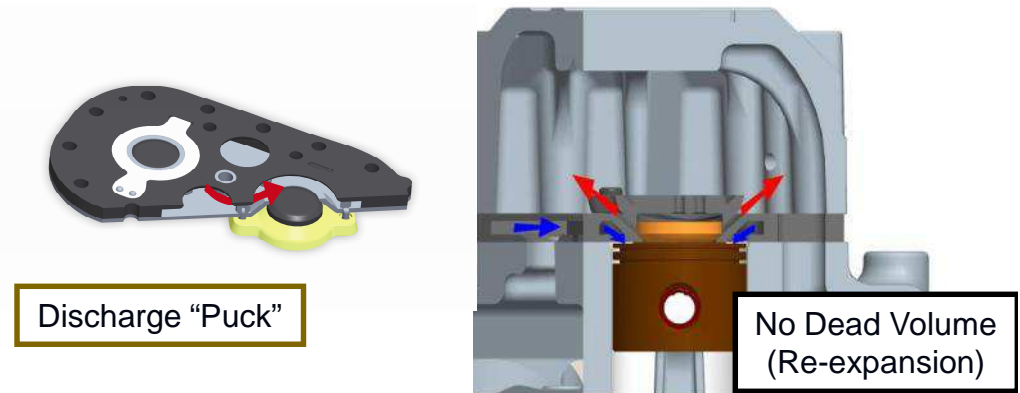
Stream Technology, Leading On Efficiency By Up To 15%

- Discharge “Puck” Retained Flush With Valve Plate
 - Reduces Clearance Volume To minimum When Piston Top Dead Center Of Cylinder
- Valve Plate Allows Gas To Flow Into Cylinders With Minimum Heat Gain
 - Suction Cavities Designed To Smoothly Route The Gas To Minimize Losses
- Technology Leading To Superior Capacity And Efficiency Compared To Conventional Compressors

Standard Reed Technology



Stream Technology



Sound Levels

Working To Go Beyond Sound Reduction Expectations

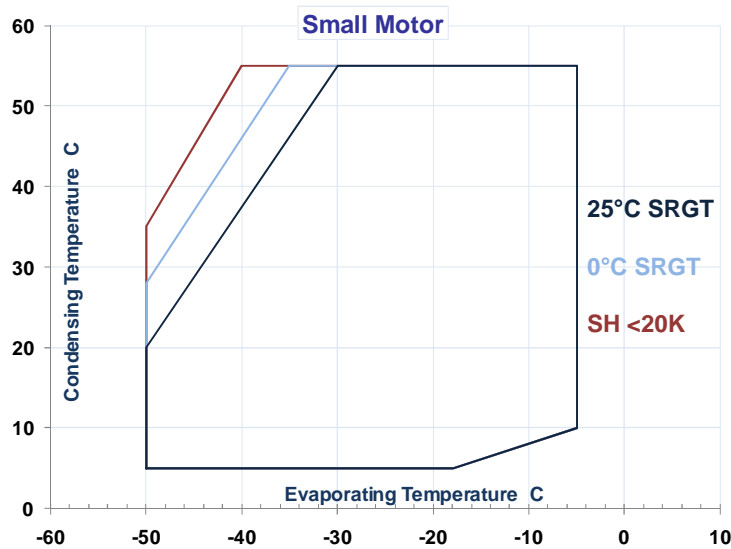
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- Dedicated „Stream“ Sound Shell
- Sound Critical Applications
- 15 to 20 dBA Sound Attenuation
- Design Made Of 3 Main Parts
 - Compressor Base
 - Cylinder Head Side Shell
 - Motor Side Shell
- Makes „Stream“ The Quietest Compressor Available



Wide Operating Envelope For Maximum Flexibility and System Efficiency

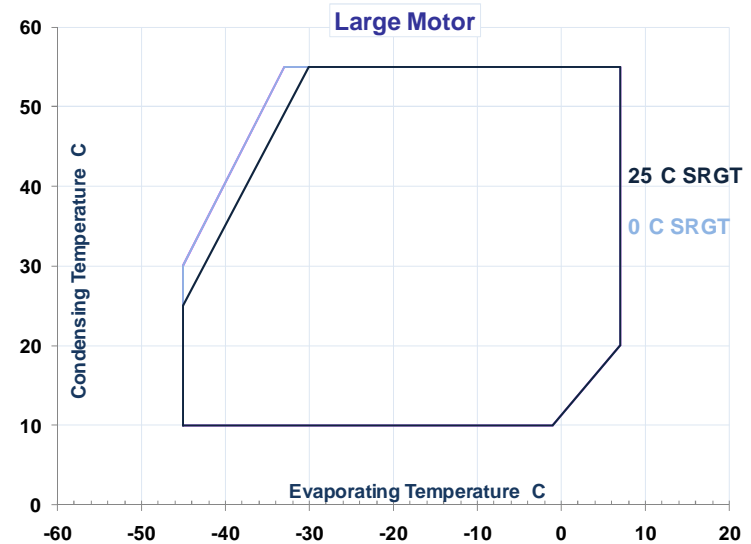
Refrigeration Low/Medium Temperature



Small Motor Version

- Dedicated To Refrigeration
- No Need For Head Fan In Low Temp
- Advantage Of 5°C Low Condensing Limit For Energy Efficiency

Medium/High Temperature



Large Motor Version

- Ideal For Higher Evaporating Temp
- Ideal For inverter Applications Whatever the Application
- Advantage Of 10°C Low Condensing Limit For Energy Efficiency

Machine Room Space Is Precious, The New Range Becomes Compact and Light

1



Reduction Compared To Discus				
Models	Width * (mm)	Length * (mm)	Height * (mm)	Weight * (kg)
4 Cylinder	45	30	5	15
6 Cylinder	45	30	12	25
Stretch	90	90	0	40

→ Compressor Footprint Same As Old Discus / Competition Of Ease Of Replacement

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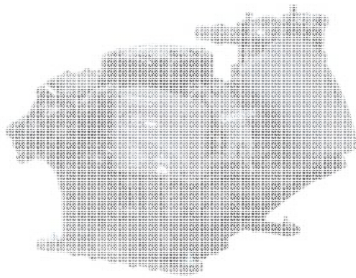
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New Range For CO2 Transcritical

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New Range With CoreSense Diagnostics

- Advanced Protection & Diagnostics Electronic Module With Modbus Communication
- Increased Equipment Life Time
- All New Range Compressors Including CO2 Transcritical

„Stream“ For Transcritical CO₂ Application Part Of The Same Family

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Stream 4...6 Cylinder



- **Standard HFC Refrigerants & Ready For Future Low-GWP Refrigerants)**
- **CoreSense Diagnostic Availability**
- **Inverter Release**

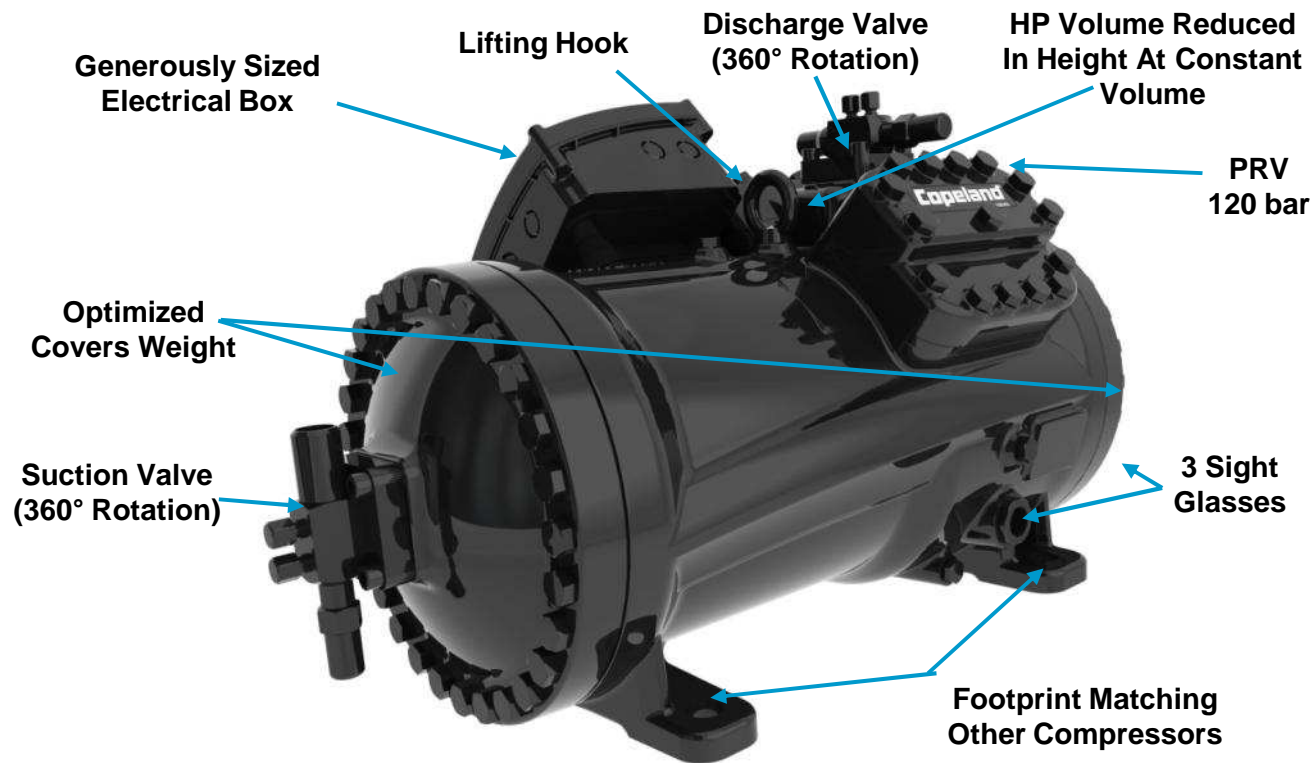
Stream CO₂ T/C Range



- **CO₂-Transcritical**
- **CoreSense Diagnostic Availability**
- **Inverter Release**

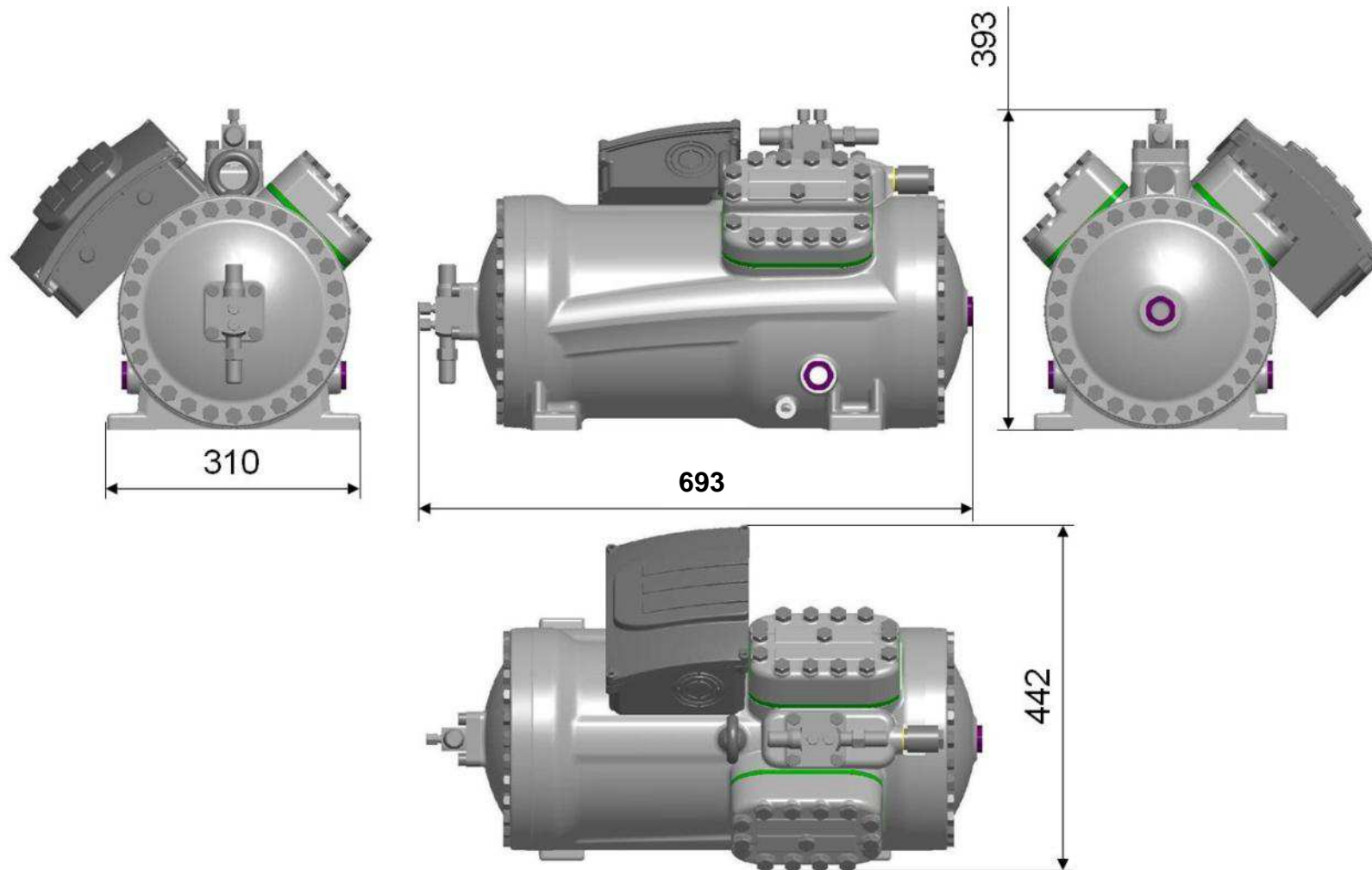
Stream For CO₂-Transcritical Latest Prototype Design

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Stream For CO₂-Transcritical 4MTL Dimensional Drawings

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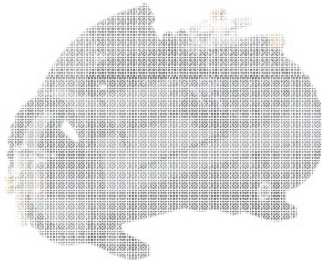
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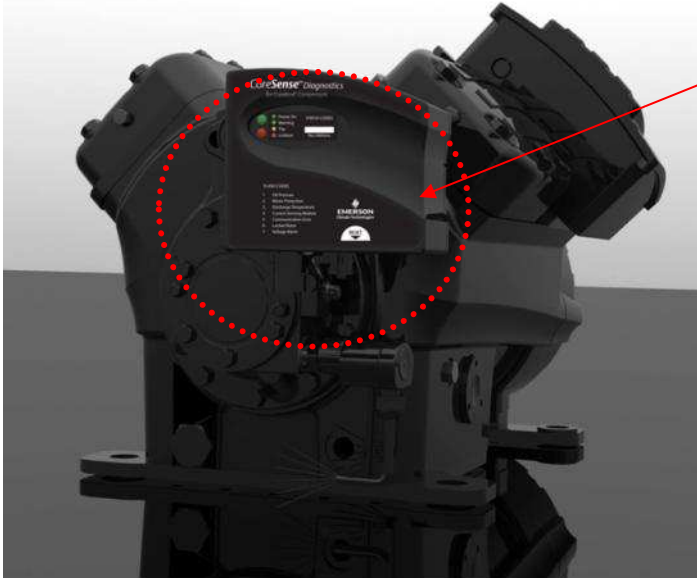


New Range With CoreSense Diagnostics

- Advanced Protection & Diagnostics Electronic Module With Modbus Communication
- Increased Equipment Life Time
- All New Range Compressors Including CO2 Transcritical

CoreSense™ Diagnostics

Advanced Protection and Diagnostics Module



Functions




- Basic Motor And Oil Pressure Protection
- Storage Of Compressor Asset And Advanced Runtime Information
- Runtime/Alarm Signalling Using Multi-Colour LED Flash-Codes
- Communication To System Controller Via Modbus
- Individual Compressor Power Monitoring
- Available On New Semi-Hermetic Range Including For CO2 Transcritical

Benefits

• Reduce Applied System Costs	Manufacturer
• Manage On-Site Compressor Data	Service
• Facilitate Predictive Maintenance & Advanced Diagnostics	
• Reduce Maintenance Costs	End-User
• Increase System Uptime / Reduce Food Loss	

CoreSense Diagnostics

Advanced Protection and Diagnostics Module

Product	Description	Features
Module 	Base Protection Module For Oil And Motor Temperature Communication Provide (6) Diagnostic Alarm Codes In Standard Version	Oil Protection Motor Protection Motor Trip Notification Open Modbus Communication Manual & Remote Reset Low Voltage Protection
Thermistor 	DLT (Discharge Line Thermistor) Provide (3) Additional Alarms	Protection From High Discharge Temperature
Sensor Module 	Sensor Module Provides Additional Diagnostics & Monitoring Capabilities Provides 9 Additional Advanced Diagnostic Alarm Codes Located in The T-Box	Advanced Motor Protection Current, Voltage, Power Monitoring Crank Case Heater Control

CoreSense Diagnostics

Functional Details

Basic Components



Base Module



Sensor Module



Thermistor

Compressor Mounted Front End
Sensor Module In E-Box
Thermistor On Discharge Line

Basic Motor Protection
And Oil Pressure
Monitoring



Replaces



INT69TM



OPS1/2

Thermal Motor Protection
Oil Pressure Monitoring

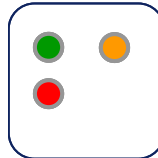
Storage Of
Compressor Asset And
Advanced Runtime
Information



EEPROM Inside
Base Module

Model & Serial Number
Compressor Status & Alarm
History
Voltage, Current, Power

Runtime/Alarm
Signalling Using Multi-
Colour LED Flash-
Codes



1 LED bi-colour red/orange
1 LED red

Status/Warning/Alarm Indication
Coding: Solid / Flash 1...6

Communication To
System Controller Via
Modbus



Open Protocol
Modbus RTU
RS485, 2-wire

Read/Write Communication With
System Controller
Alarm Reset From System
Controller
Additional Functionality W/ Dixell
Ipro System Controller

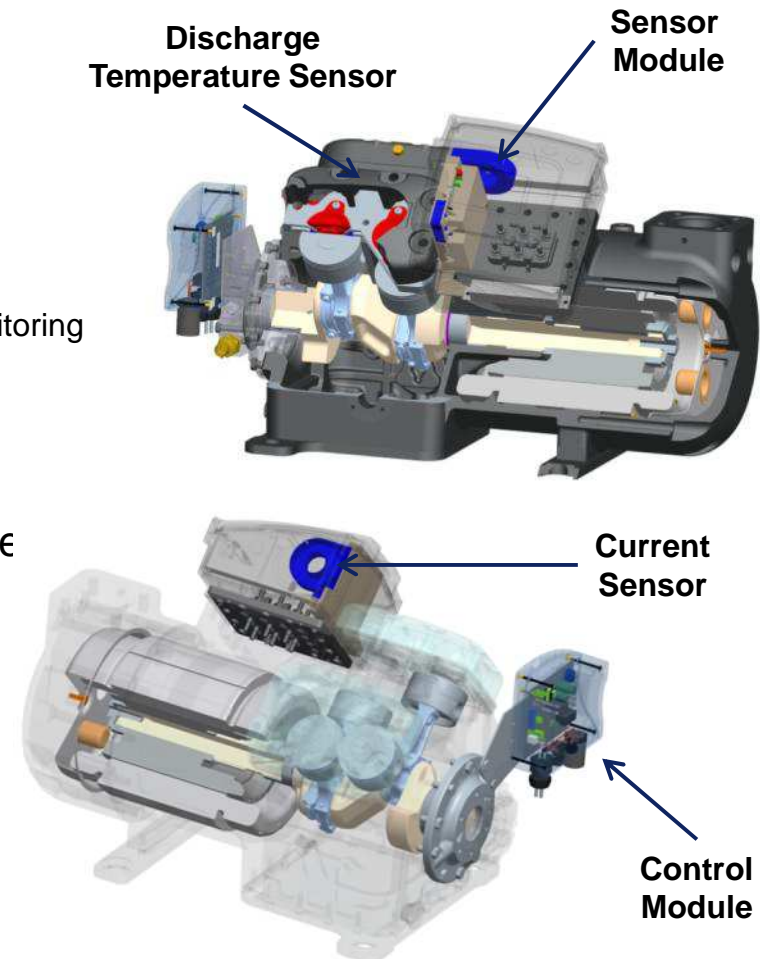
CoreSense Diagnostics

Local Alarm Codes Summary

Fault Event Description	Module LED Status	# Of LED Flash's	iPRO Alarm Display	Type	Alarm Priority
P470 module failure	Solid <small>New!</small>	NA	P470 Module Failure Lockout	Lockout	1
Low Oil Pressure lockout	Flashing	1	Low Oil Pressure Lockout	Lockout	7
PTC Trip	Flashing	2	Motor Temp Trip	Trip	12
Compressor low voltage trip	Flashing	4	Compressor Low Voltage Trip	Trip	23
Loss of Comm (Control Module - E2)	Flashing	6	No Communication (Control Mod - E2)	Warning	26
Low oil pressure warning	Flashing	1	Low Oil Pressure	Warning	31
Normal Run	Solid	NA	Normal Running	Normal	44
Normal Off	Solid	NA	Normal Off	Normal	45
Discharge temperature lockout	Flashing	3	Discharge Temp Lockout	Lockout	5
Discharge temperature trip	Flashing	3	Discharge Temp trip	Trip	25
Open Thermistor	Flashing	3	Fault Temp Probe	Warning	37
Repeated Phase loss for 10 times	Flashing	4	Phase Loss Lockout	Lockout	2
Repeated locked rotor for 10 times	Flashing	5	Locked Rotor Lockout	Lockout	3
Protector Trip	Flashing	2	Protector Trip (Voltage w/o Current)	Trip	11
Locked Rotor Trip	Flashing	5	Locked Rotor Trip	Trip	13
Phase loss trip	Flashing	4	Phase Loss Trip	Trip	16
Current Over load trip	Flashing	4	Current Overload Trip	Trip	17
Voltage Imbalance	Flashing	4	Voltage Imbalance Trip	Trip	20
Loss of Comm (Control Module - SM)	Flashing	6	No Communication To Sensor Module	Warning	28
Connection lost (CT- SM)	Flashing	1	Connection Lost (CT To Sensor Module)	Warning	32

CoreSense™ Diagnostics Functionality

- Control Module
 - Motor And Oil Protection
 - Discharge Temperature Protection
 - Manual & Remote Rester
 - Status Leds
- Sensor & Current Module
 - Current Sensing, Voltage Imbalance, Phase Loss Monitoring
 - Compressor Power Consumption Monitoring
- Memory Asset
 - Runtime And Alarm Information
- Modbus® Communication To System Controlle
 - Supported By Dixell Ipro System Controller



Benefit Details

Reduce Applied System Costs

3

Manufacturer

Today	Future W/ CoreSense Diagnostics	Benefit
Motor protection module pre-installed; oil protection to be ordered and installed separately	Motor and oil protection pre-installed	Reduce parts handling & labour Avoid wiring errors
Individual wiring to I/O board; I/O extension board may be required	Compressor proofing via Modbus – no additional wiring, no additional inputs on system controller required	Additional information (if not available today) Reduced parts handling & labour Avoid wiring effort May reduce space requirement in e-panel

Benefit Details

Manage On-Site Compressor Data

Service

Today	Future W/ CoreSense Diagnostics	Benefit
Data imprinted on compressor and printed documentation	Access module data base via system controller or remotely to read-out compressor model, serial number, nominal capacity and further data Update module data base when making changes, e.g. New serial number when replacing compressor	Ease of managing system documentation Availability of data when and where needed Ensure correct parts reference when making replacements/repairs

Benefit Details

Diagnosics & Predictive Maintenance

Service

Today	Future W/ CoreSense Diagnostics	Benefit
Monitor motor and oil protection based on individual parts	Monitor motor and oil protection based on integral parts Monitor additional information: current, voltage, phase loss, current overload, discharge temperature, ...	Accelerate communication of system failures, diagnosis and remedy
Compressor runtime information depending on setup at system/remote level	Essential information stored inside module, including energy consumption of compressor	Analyse data and optimise system
Local alarm information for <i>current</i> alarms only	Alarm and status information stored and indicated locally Current and <i>historical</i> alarm and status memory	Accelerate failure diagnosis Ease identifying root cause of failure
Alarm information wired separately to system controller	Alarm communicated via Modbus to system controller – no individual wiring	Diagnose problem prior to visiting site Avoid visiting site Predict problems before they occur!

Benefit Details

Reduce Maintenance Costs

End-User

Today	Future W/ CoreSense Diagnostics	Benefit
Fault usually only detected if system trips	Diagnostics data allowing prediction of fault prior to its occurrence	Root problem may be fixed before system trips
Service company travelling to site to diagnose and fix problem	Service company may avoid having to travel to site – or diagnose problem prior to travelling to site	Less on-site service calls and faster fixing of problems

Benefit Details

Increase Uptime / Reduce Food Loss

End-User

Today	Future W/ CoreSense Diagnostics	Benefit
System tripping and temperatures in refrigerated area rising after time – food loss in the extreme	Less occurrences of system trips and system down-times	More stable temperatures, less loss in food

Benefit Details

Reduce Energy Costs

End-User

Today	Future W/ CoreSense Diagnostics	Benefit
Individual compressor electrical energy not monitored	Energy consumption measured individually per compressor	Better analysis of consumption forms basis for energy cost reductions