

Natural Refrigerant Training Summit

Building a Sustainable Workforce

BITZER BEST for CO2

Miguel Boscan & Greg Krause

AE Manager/Commercial Ref. Manager



NORTH AMERICAN
Sustainable
Refrigeration
Council

Natural Refrigerant Training Summit

Thank you to our sponsors!

Premium Sponsors



Basic Sponsors



Who We Are

A 501c3 nonprofit working to create a sustainable future for supermarket refrigeration by removing barriers to natural refrigerant adoption.




160+
member
companies



55K+
food retail
locations



Goals

-  Build a sustainable technician workforce
-  Increase funding for natural refrigerant equipment
-  Improve technology options, education, and awareness

What are Natural Refrigerants?

CO₂

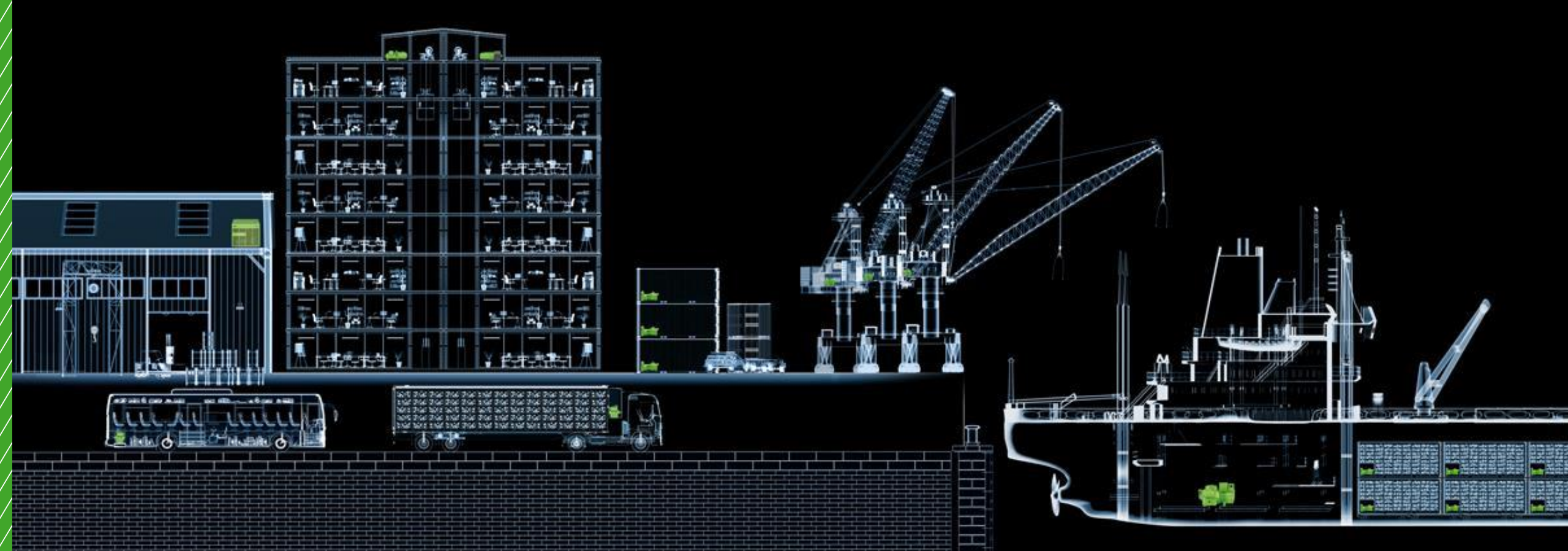
R744
Carbon Dioxide

C₃H₈

R290
Propane

NH₃

R717
Ammonia

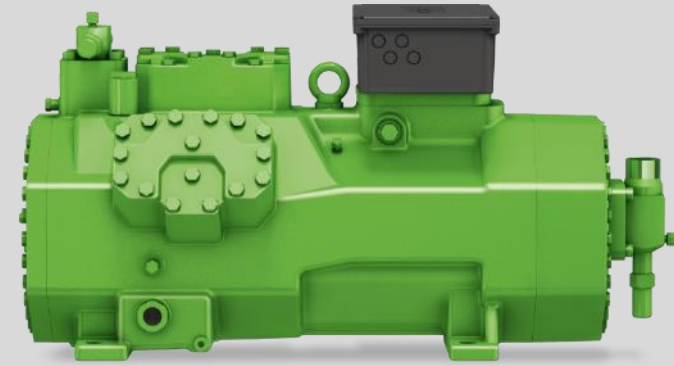
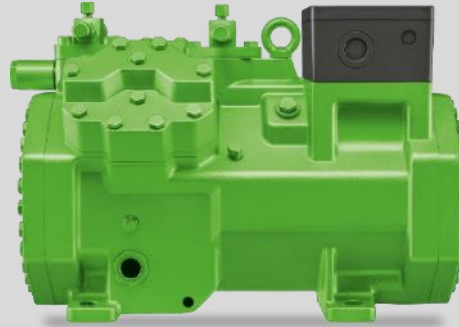
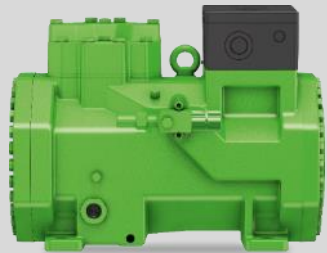


NASRC NATURAL REFRIGERATION TRAINING SUMMIT

March 2024
BITZER US
Miguel Boscan & Greg Krause



DAS HERZ DER FRISCHE



BITZER CO₂ COMPRESSORS

// General Overview

- BITZER Subcritical and Transcritical
- CM-RC / VARISTEP CO₂
- Using the BITZER Software
- Using the BEST Software



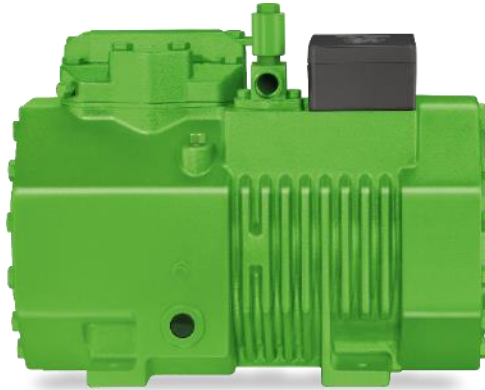
DAS HERZ DER FRISCHE

SUBCRITICAL CO₂ COMPRESSORS

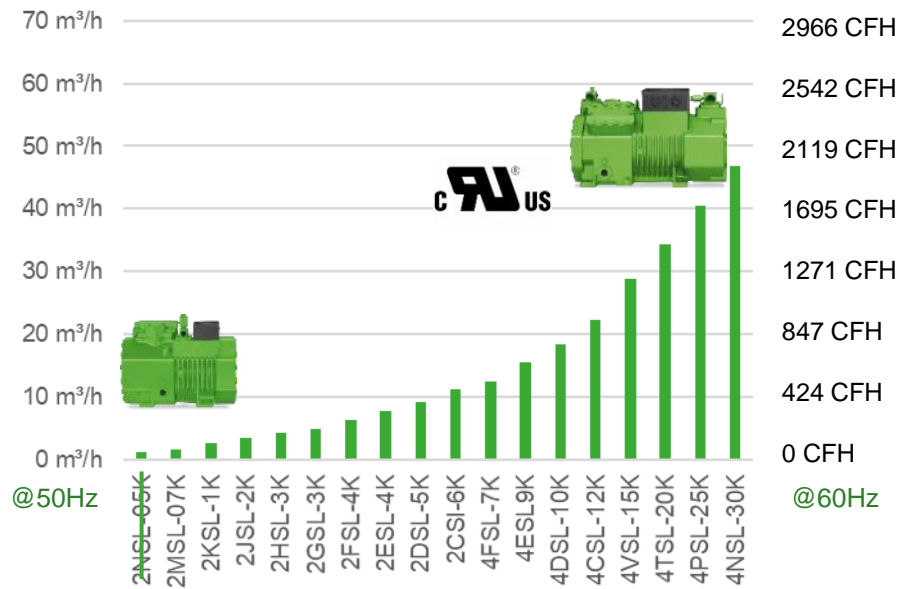


 RECIPROCATING COMPRESSORS

 FREQUENCY INVERTER



Design pressure: LP: 30 bar / 432 psi
HP: 53 bar / 769 psi



1	2	3	4		5,6		7,8,9
Model	ID	CO2			Nominal HP		Voltage
4	N	S	L	-	30	-	2NU

No. of Cylinders
2,4

Displacement:
Bore and Stroke

CO2 Series:
SL: Subcritical

Motor Size:
30: Nominal HP

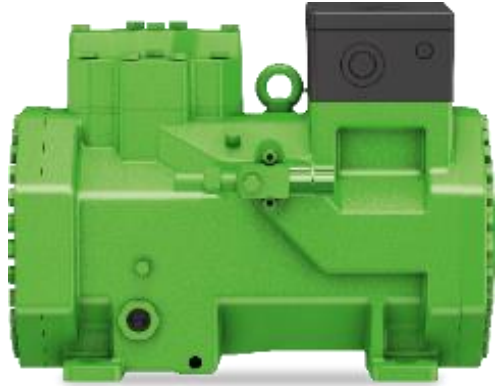
Voltage: (3Ph) UL
2NU: 208/230-460

SUBCRITICAL CO₂ COMPRESSORS

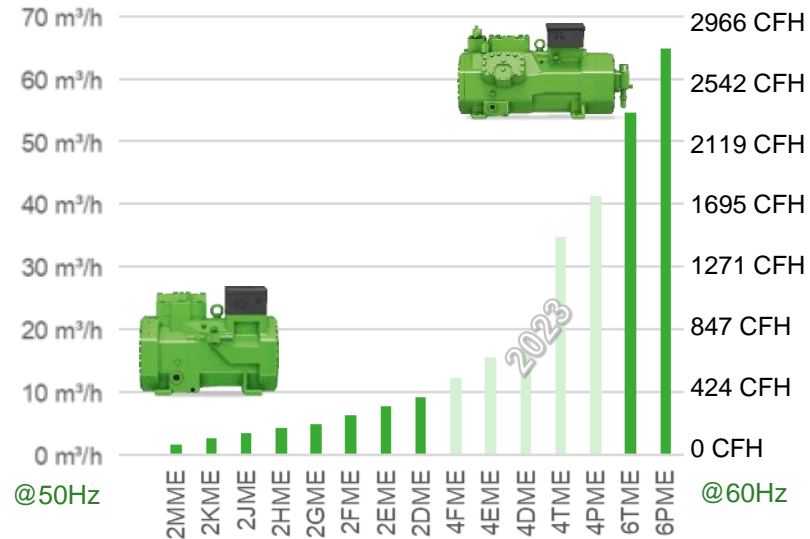


 RECIPROCATING COMPRESSORS

 FREQUENCY INVERTER



Design pressure: LP: 100 bar / 1450 psi
HP: 100 bar / 1450 psi



1	2	3	4		5,6		7,8,9
Model	ID	CO ₂			Nominal HP		Voltage
6	P	M	E	-	40	-	2NU

No. of Cylinders
2,4,6

Displacement:
Bore and Stroke

CO₂ Series:
ME: Subcritical

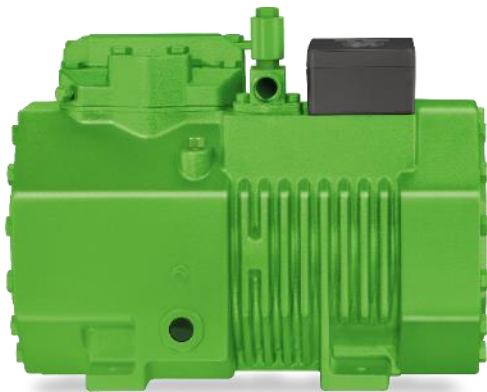
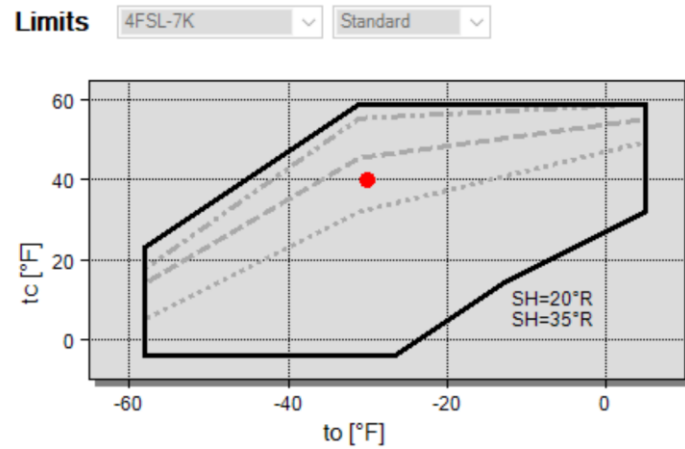
Motor Size:
40: Nominal HP

Voltage: (3Ph) UL
2NU: 208/230-460

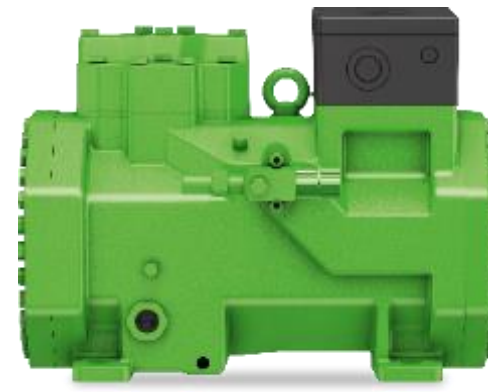
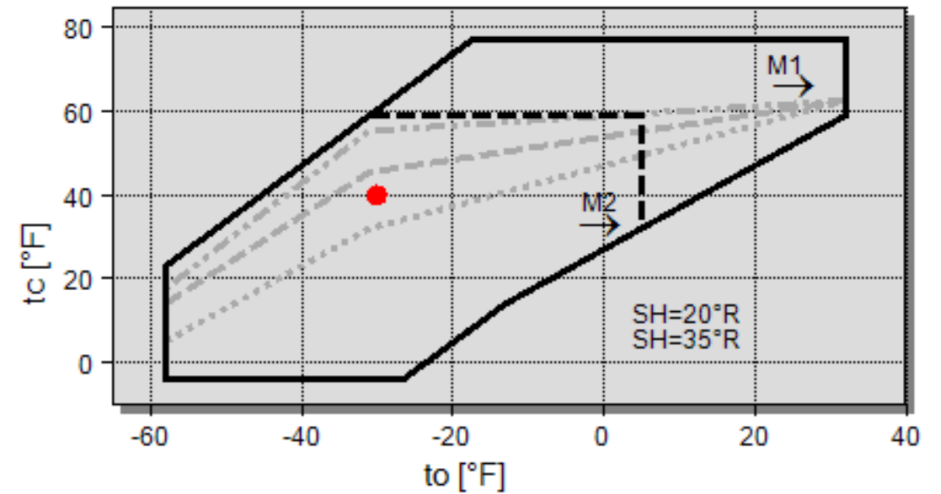
ECOLINE SUBCRITICAL APPLICATION WINDOWS



SL Series



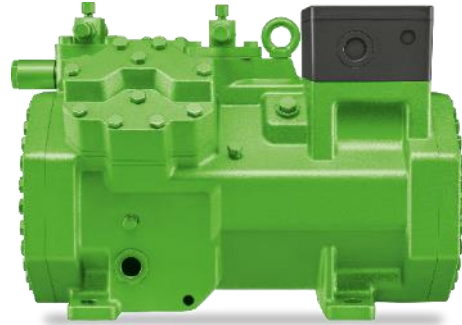
ME Series



TRANSCRITICAL ECOLINE CO₂ COMPRESSORS



IQ MODULE

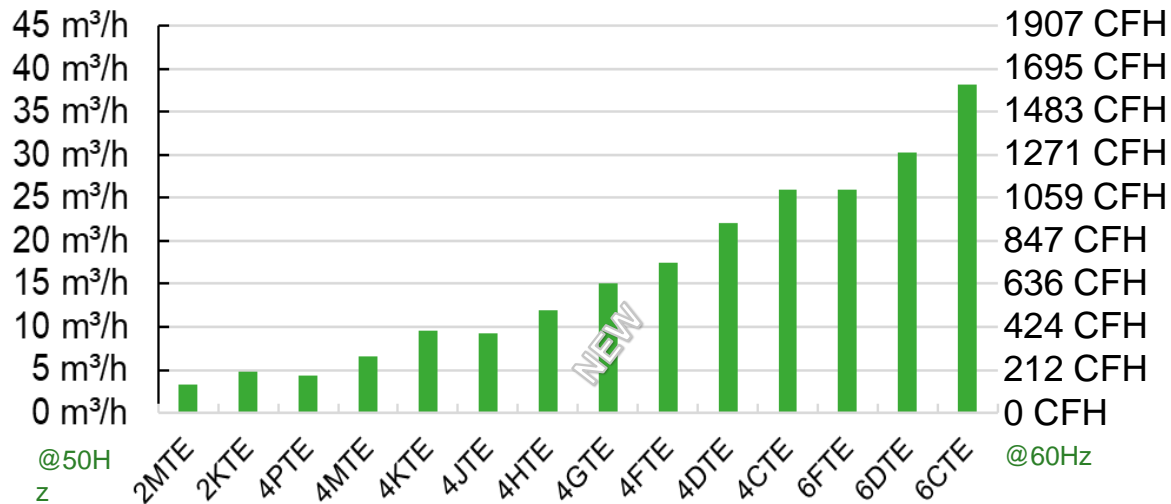


RECIPROCATING COMPRESSORS

IQ INTELLIGENT PRODUCTS

FREQUENCY INVERTER

Design pressure: LP: 100 bar / 1450 psi
HP: 160 bar / 2320 psi



1	2	3	4		5,6		7,8,9	10	11
Model	ID	CO ₂			Nominal HP		Voltage	Unl.	Oil
4	G	T	E	-	30	-	2NU	1*	D*

No. of Cylinders
2,4,6,8

Identification:
Bore and Stroke

CO₂ Series:
T: Transcritical

Series:
E: ECOLINE
C: Octagon (Obsolete)

Motor Size:
30: Horsepower

Voltage: (3Ph) UL
2NU: 208/230-460

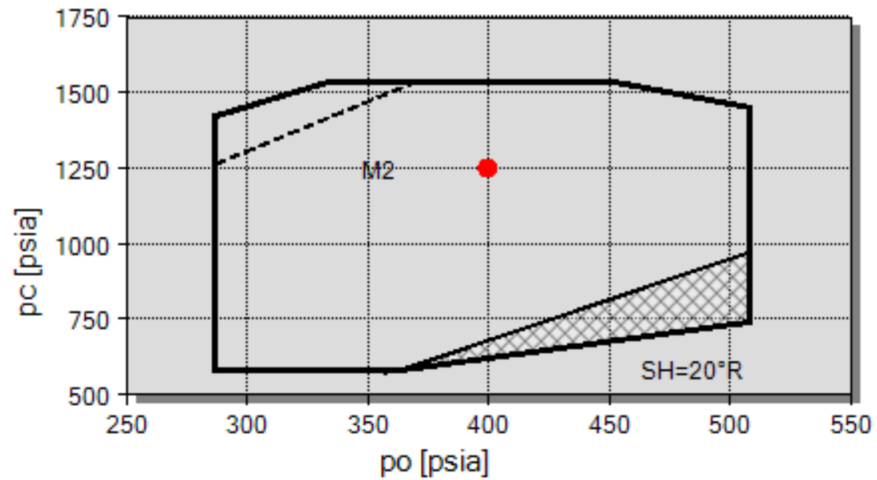
Oil:
D: Dry

Unloaders:
1: Step of CR

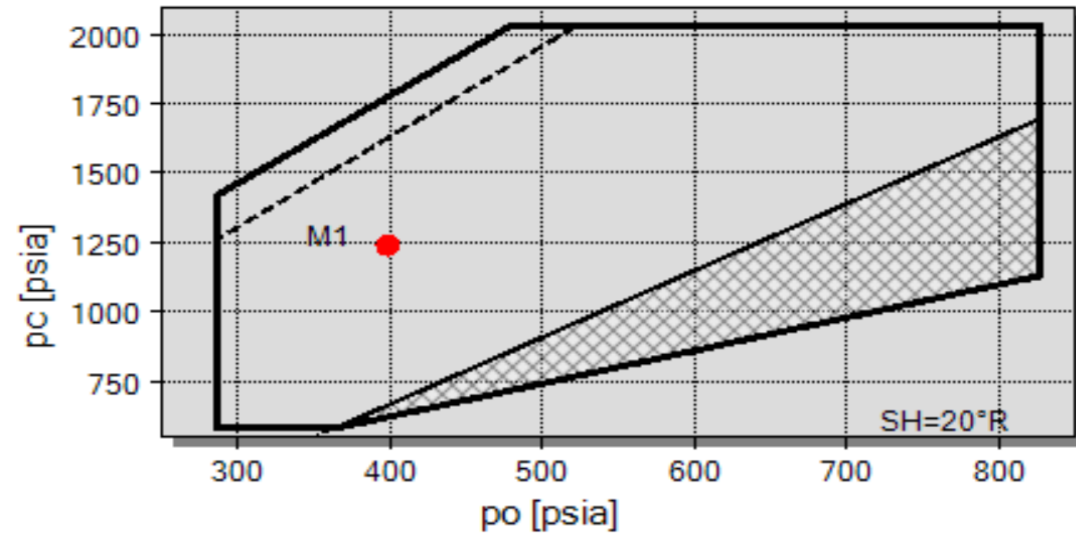
ECOLINE TRANSCRITICAL APPLICATION WINDOWS



TE Series (M2)

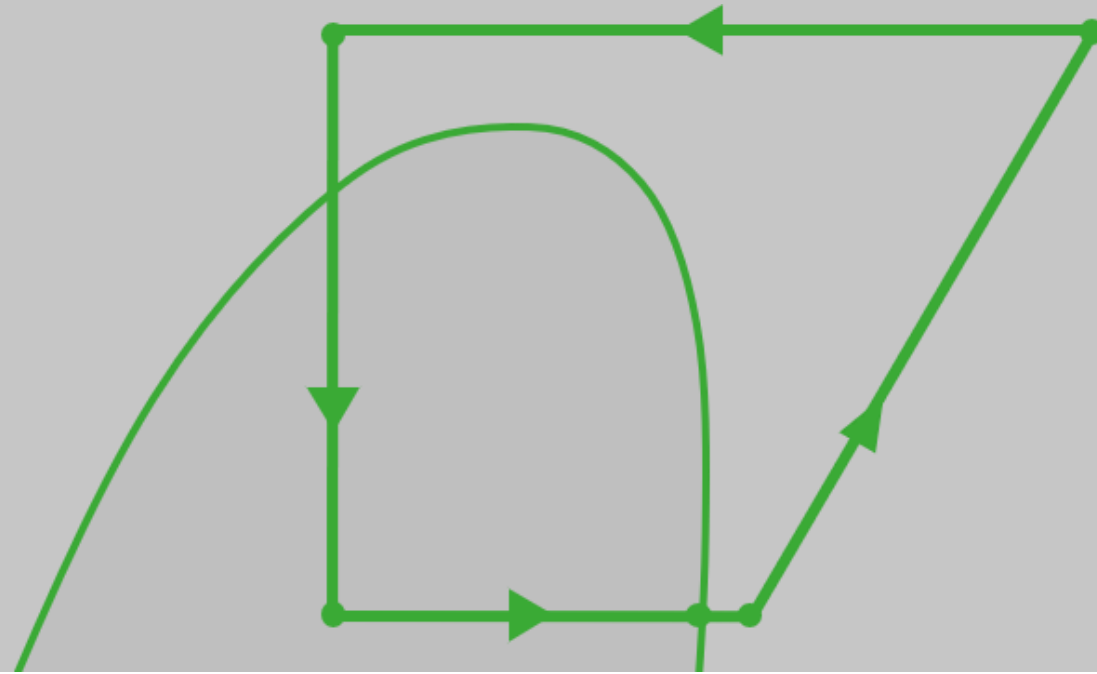


TE Series (M1)



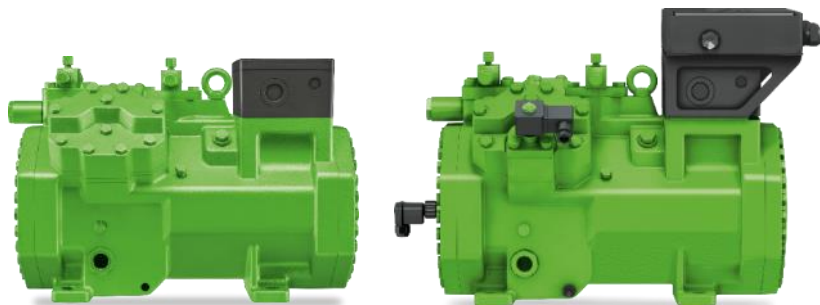


CO₂



COMPRESSOR FOR TRANSCRITICAL APPLICATIONS

ECOLINE CO₂



DAS HERZ DER FRISCHE



VARISTEP / CM-RC FOR CO₂

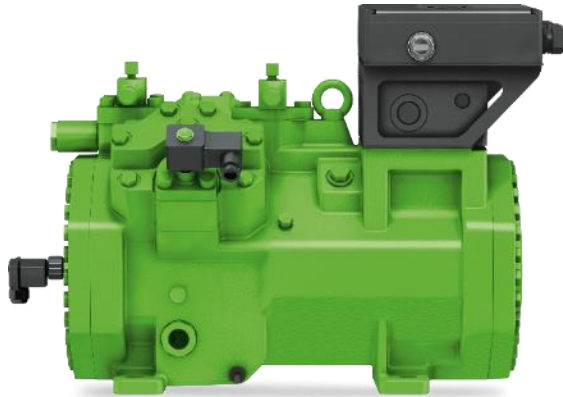
VARISTEP for CO₂

CM-RC

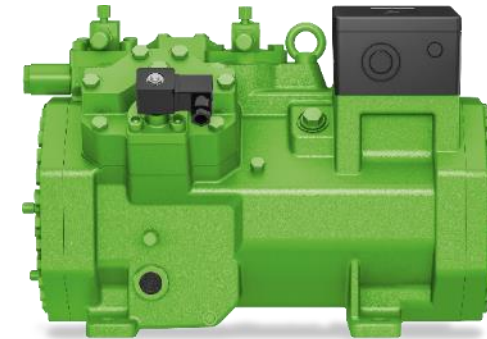


DAS HERZ DER FRISCHE

VARISTEP POSSIBILITIES



With IQ MODULE
Quasi stepless capacity control
/ 4 Cylinder 10-100%
/ 6 Cylinder 10-100%

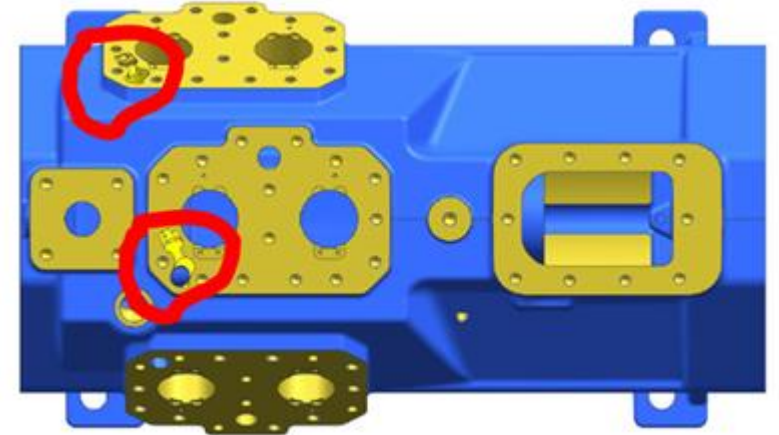
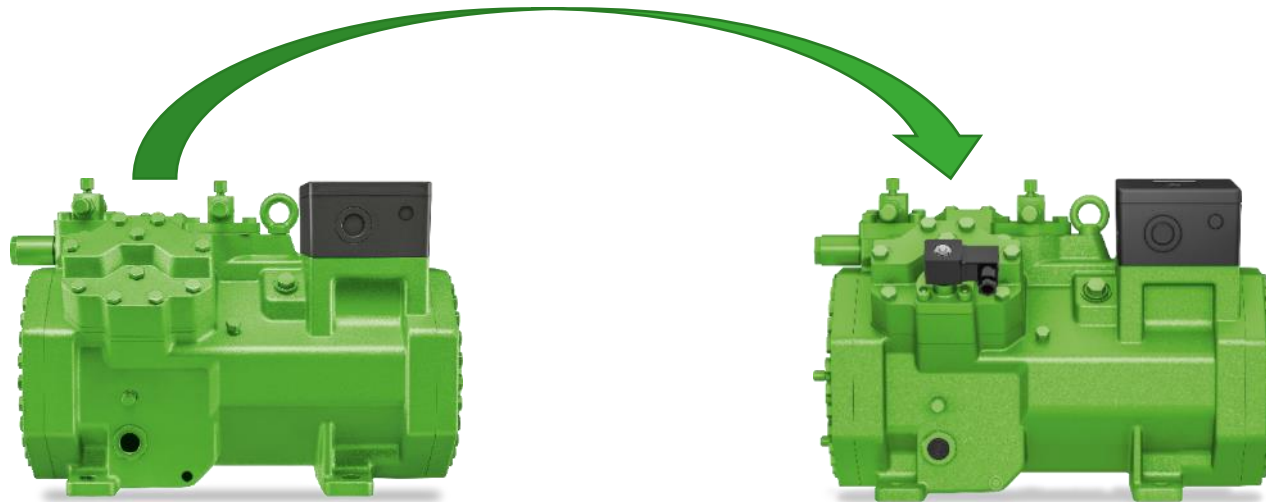


Without IQ MODULE
Stepped capacity control
/ 4 Cylinder 50 or 100%
/ 6 Cylinder 33%, 66% or 100%

IMPORTANT !!!!



- // Field retrofits are possible for BITZER US TE models
 - Additional machining in the casting is required for VARISTEP
 - This is not possible for compressors built in Germany
 - VARISTEP is **not** possible on TC models



WORKING PRINCIPLE OF THE VARISTEP SYSTEM



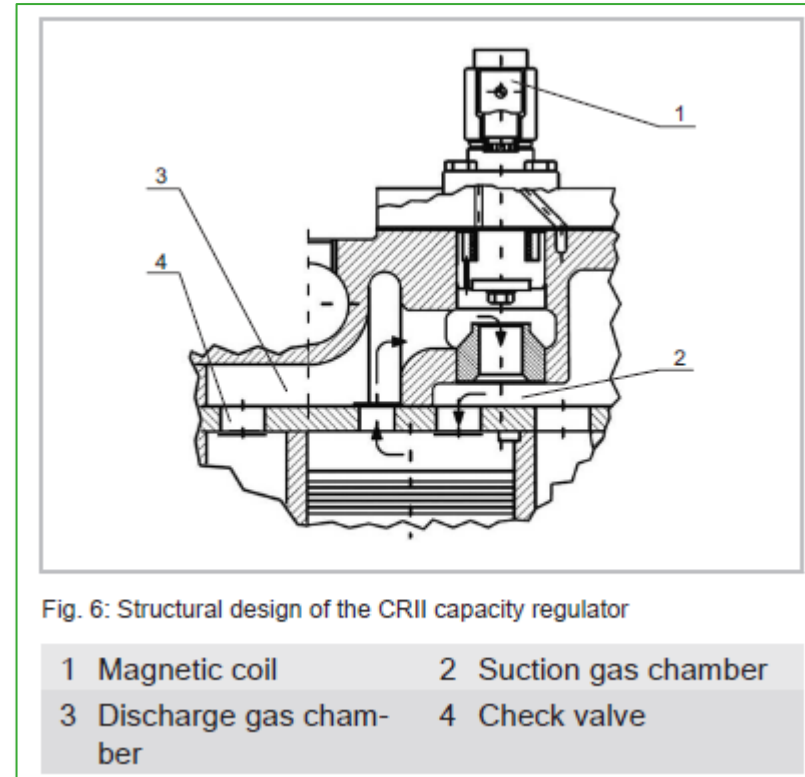
ECOLINE with VARISTEP mechanical capacity regulation

/ The VARISTEP system is based on cylinder cut-off

/ Internal bypass is activated by means of a control piston -> pressure equalization up to the check valve

/ Check valve on the valve plate prevents reverse flow from the system's HP side

/ VARISTEP is energized and de-energized by the IQ MODULE for stepless operation



BITZER Documentation KT-102-1: Technical information on VARISTEP for CO₂

BITZER CM-RC NOMENCLATURE



1,2,3,4	3	4	5,6	7	8	9
Model	Comp Series	Lub. Type*	Control Voltage	CCH*	# Unl*	CO2
CMRC	6	P	1	H	1	CO2

* Cables wired to the CM-RC module.
Additional hardware field installed:

- Unloader Stems
- Heater inserted into compressor



Model:
CMRC: IQ Module

Compressor Series:
3: CKHE3 Series (4FES..4CES / 4PTE..4KTE)
4: CKHE4 Series (4VE..4NE / 4JTE..4CTE)
6: CKHE5 Series (4JE..6FE / 6FTE..6CTE)

Lubrication Type:
P: Oil Pump (DP-1 Pre-wired*)
E: Centrifugal (CO2 Only/No OLC)

Control Voltage:
1: 120v
2: 230v

Number of Unloader (Pre-Wired)*:
1: (1) Cable / Coil
2: (2) Cable / Coil
3: (3) Cable / Coil

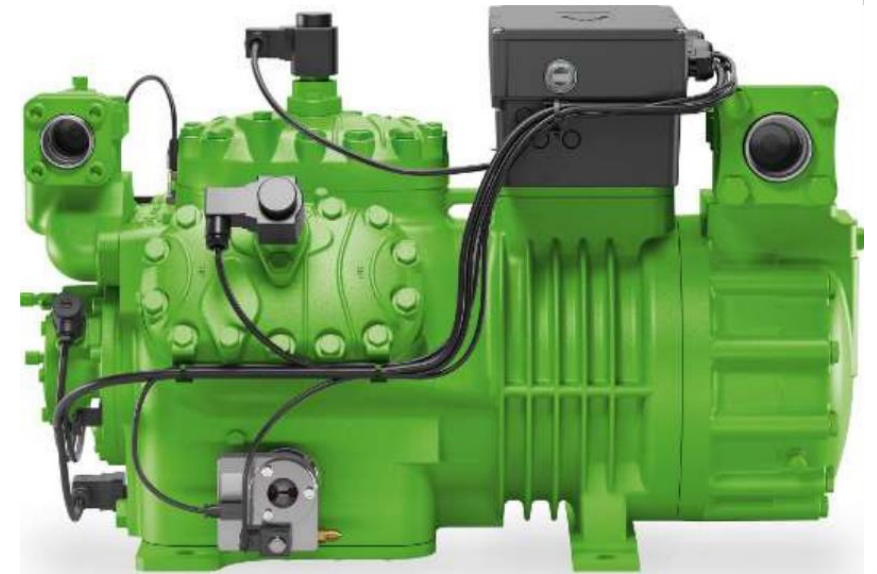
Refrigerant Injection (Pre-wired)* / CO2:
CO2: Unloader Coil and DGTS

Crankcase Heater*:
H: Heater Pre-wired

Extent of Delivery:

CM-RC Kits

Components based on nomenclature plus DGTS (pre-wired), Mounting hardware, Wiring Diagram (sticker), KT-230 Technical Information, KW-23x Installation instructions and Quick Start Card.



IQ MODULE FOR RECIPROCATING COMPRESSORS MONITORING DEVICE

Basic

- // Motor overload
 - Replaces the SE-B* module
- // Oil
 - Oil pressure – Delta PI
- // Discharge gas temperature
 - PTC1000



Advanced

- // Application Monitoring
 - Suction pressure
 - Discharge pressure



IQ MODULE FOR RECIPROCATING COMPRESSORS MONITORING / PROTECTION DEVICE

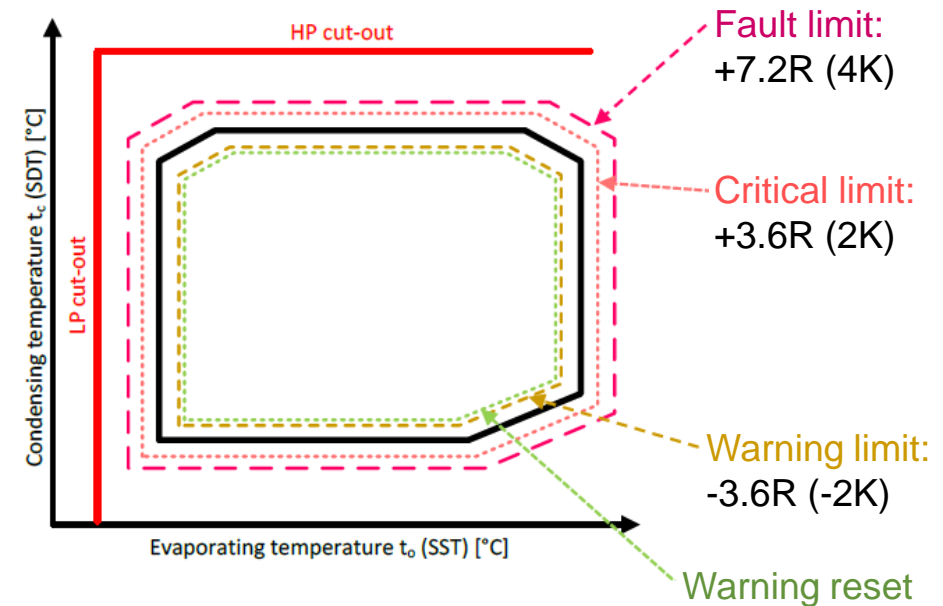


Standard Compressor Protection

- // Motor overload
 - 4500Ω (286°F)
- // Oil
 - Delta PI: $\Delta p < 10\text{psi}$
- // DGT
 - PTC1000: 302°F (150°C)

Advanced Compressor Protection

- // Application limits
 - Active 120s after compressor start



// HP / LP

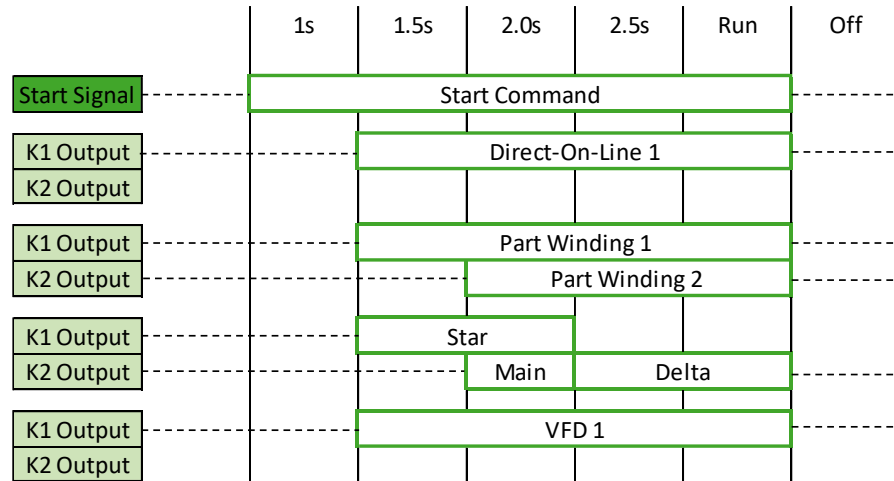
- Adjustable
- Not a safety cut-out

IQ MODULE FOR RECIPROCATING COMPRESSORS CONTROL DEVICE



Motor Contactor

// Internal time delays



// No external time delays required

Crankcase Heater

// Compressor on → Heater off

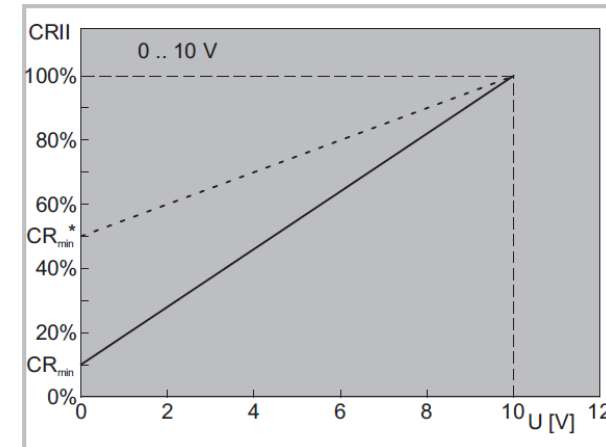
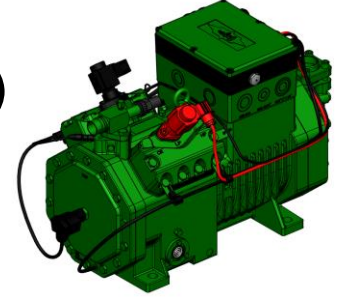
// Compressor off → Heater on

CR II & Start Unloading

// Min – Max linear control (std)

- 0 - 10V input
 - 4-20mA possible

– CR between 10-100%



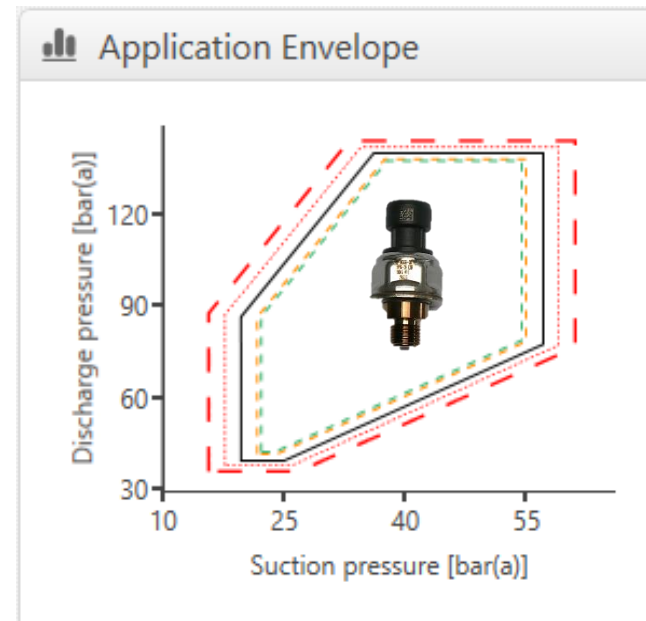
FYI



- // Additional port on CR head
 - Required for leak/burst testing in the factory
 - Plugged at the factory
 - Not intended for field use



- // Standard CM-RC v. CO2 CM-RC
 - Parker Stems and Coils
 - Black instead of blue
 - DGTS is different
 - Shorter
 - Application Monitoring Kit
 - Transducer rated for higher pressure



IQ MODULE FOR RECIPROCATING COMPRESSORS COMMUNICATION (CONT.)



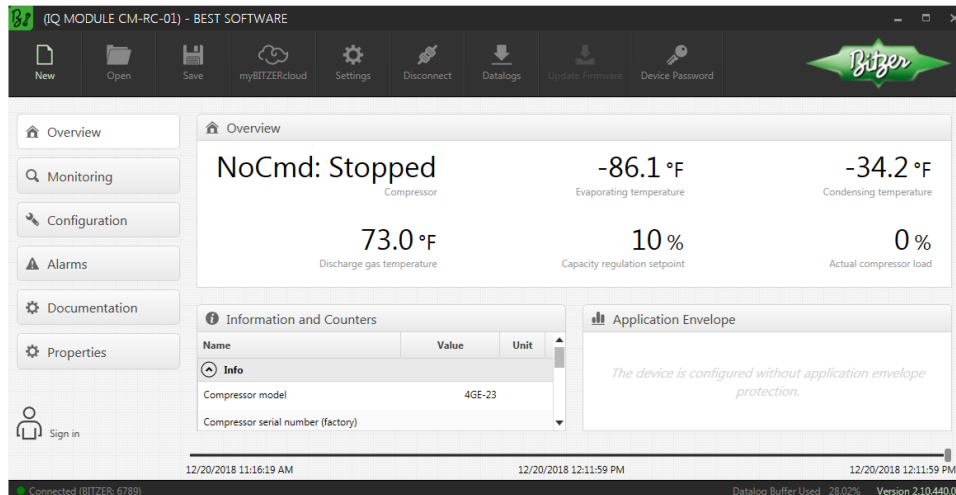
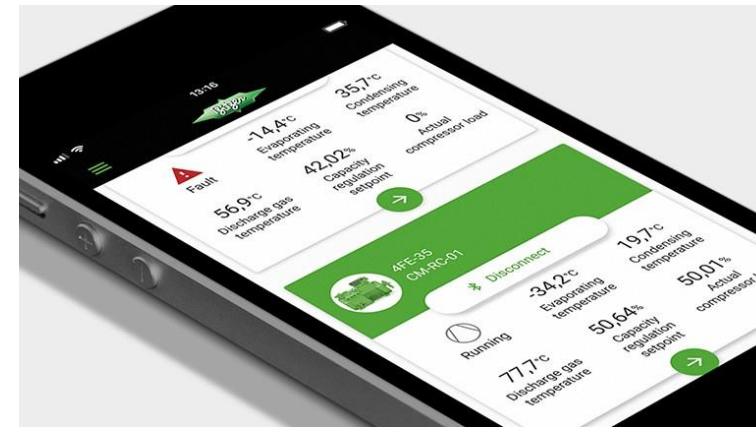
BEST Software / App

// Bluetooth

- Default Password: 8670

// BEST Converter

- p/n 344314-02
- 4 Pole Phoenix 3.81
- No password



IQ CM-RC MODULE



New

Connect / Disconnect

Transfer

User Settings

Parameter	Unit	Default Setting	Actual Setting	User Setting
Main Setup				
Compressor model			4VE5-10	
Motor starter function			Direct On Line (DOL)	
Refrigerant			R407C	
Compressor serial number (actual)			123456789	
Date		3/1/2019	3/1/2019	
Time		3:51:51 PM	3:54:22 PM	
Customer, Location				
System name, Compressor number				
Operating Range				
Minimum compressor capacity limit	%	10	10	
Maximum compressor capacity limit	%	100	100	
Operating functions				
Select start unloading function			None	

Connected (BITZER: 6789)

● Connected
● Disconnected

○ Four LED's are visible through the sight glass



P/N 996-0038-01

IQ MODULE FOR RECIPROCATING COMPRESSORS DATA LOGGER



Entries

// Alarms

- Timestamp
- Alarm code and text
- Severity: warning, critical or fault
- Set or Clear
- Lifetime: 365 days

The screenshot shows the Bitzer Data Logger interface. The top navigation bar includes icons for New, Open, Save, myBITZERcloud, Settings, Connect, Datalogs, Update Firmware, and Reset. The main content area is titled 'Datalog Alarms' and features a 'Severity filter' dropdown set to 'Not filtered...'. Below this is a table with columns for Code, Severity, Time Stamp, and Description. The table contains 13 rows of alarm data. A 'Sign in' button is visible in the bottom left corner of the interface.

Code	Severity	Time Stamp	Description
35-02	Warning	9/7/2018 12:19:22	Oil Pressure Low
10-00	Critical	9/7/2018 11:10:40	Too many identical timed reset faults in 24 hours
10-01	Critical	9/7/2018 11:10:40	Too many timed reset faults in 1 hour
34-31	Critical	9/7/2018 11:10:40	High Pressure Switch
30-26	Warning	9/7/2018 11:10:39	Minimum Compressor Start To Start Time Not Respected
34-31	Critical	9/7/2018 11:09:39	High Pressure Switch
30-26	Warning	9/7/2018 11:09:38	Minimum Compressor Start To Start Time Not Respected
34-31	Critical	9/7/2018 11:08:38	High Pressure Switch
30-26	Warning	9/7/2018 11:08:37	Minimum Compressor Start To Start Time Not Respected
34-31	Critical	9/7/2018 11:07:36	High Pressure Switch
30-26	Warning	9/7/2018 11:07:35	Minimum Compressor Start To Start Time Not Respected
34-31	Critical	9/7/2018 11:06:35	High Pressure Switch

// Events

- Power up/down
- External alarm reset
- Compressor start/stop
- Service tool connect/disconnect
- Lifetime: 30 days

Data

// Intervals

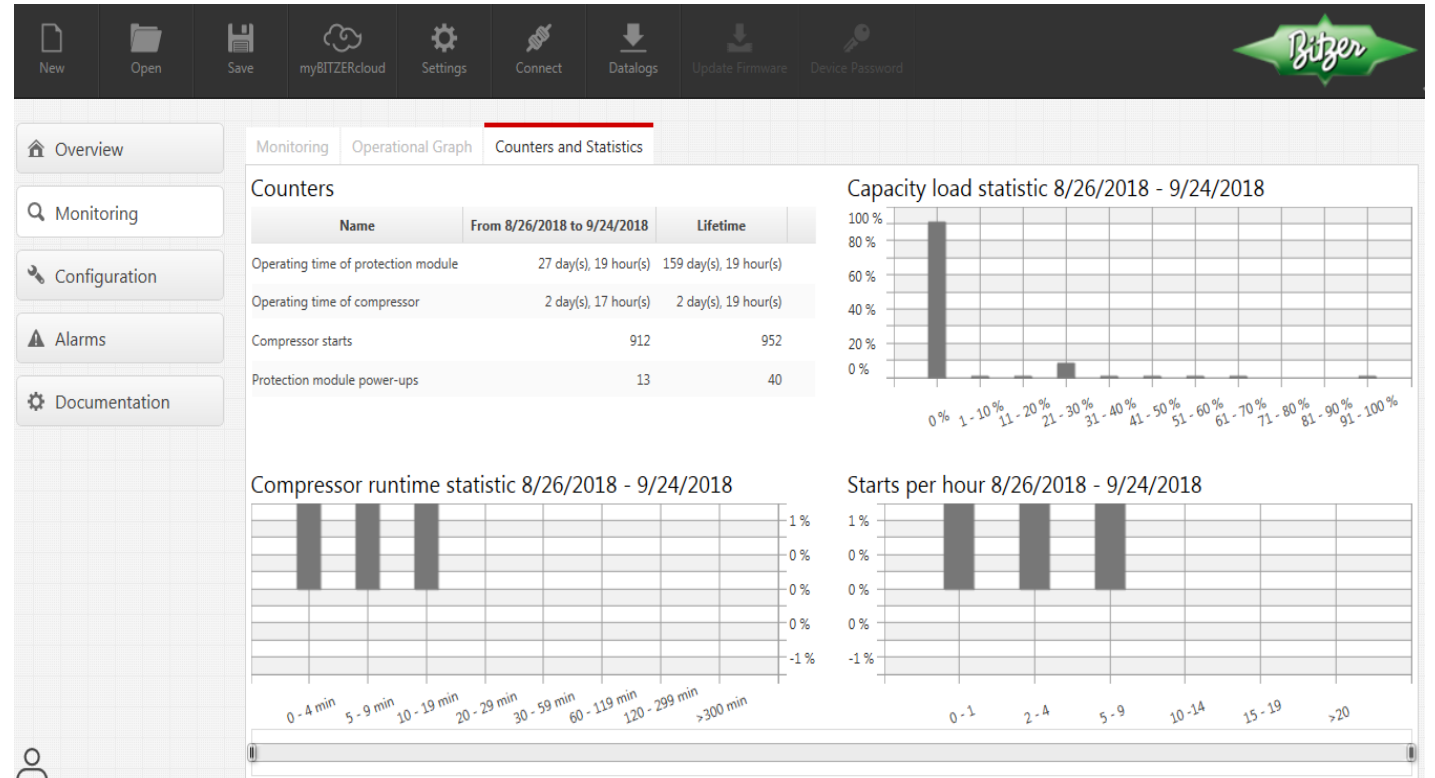
- Compressor on – 10s
- Compressor off – 60s
- Fault traces – 3s
- Lifetime: 1-3 weeks

IQ MODULE FOR RECIPROCATING COMPRESSORS DATA LOGGER



Statistics and counters

- Logged at Midnight and power down
- Timestamp
- Data
 - Accumulated counters
 - Capacity load
 - Daily counters
 - Runtime statistics
 - Compressor start statistics
- Lifetime: 365 days



CM-RC W/ CO2 COMPRESSOR



CM-RC FILE



2023-03-08 15-07; 4MTE-7; 1603200132.BPD (IQ MODULE CM-RC-01) - BEST SOFTWARE

New Open Save myBITZERcloud Settings Connect Datalogs Update Firmware Device Password

Overview

Monitoring Configuration Alarms Documentation

Start: Running
Compressor

382.2 psig
Suction Pressure

936.8 psig
Discharge Pressure

16.3 °F
Evaporating temperature

78.4 °F
Condensing temperature

173.7 °F
Discharge gas temperature

100 %
Capacity regulation setpoint

97 %
Actual compressor load

Information and Counters

Name	Value	Unit
Info		
Compressor model	4MTE-7	
Compressor serial number (factory)	1603200132	
Compressor serial number (actual)	1603200132	
IQ MODULE serial number	030000181901FP212405597	
Firmware version	2.20.282.0	
Customer, Location		
System name, Compressor number		
Bluetooth name	BITZER: 1603200132	
Counters		

Application Envelope

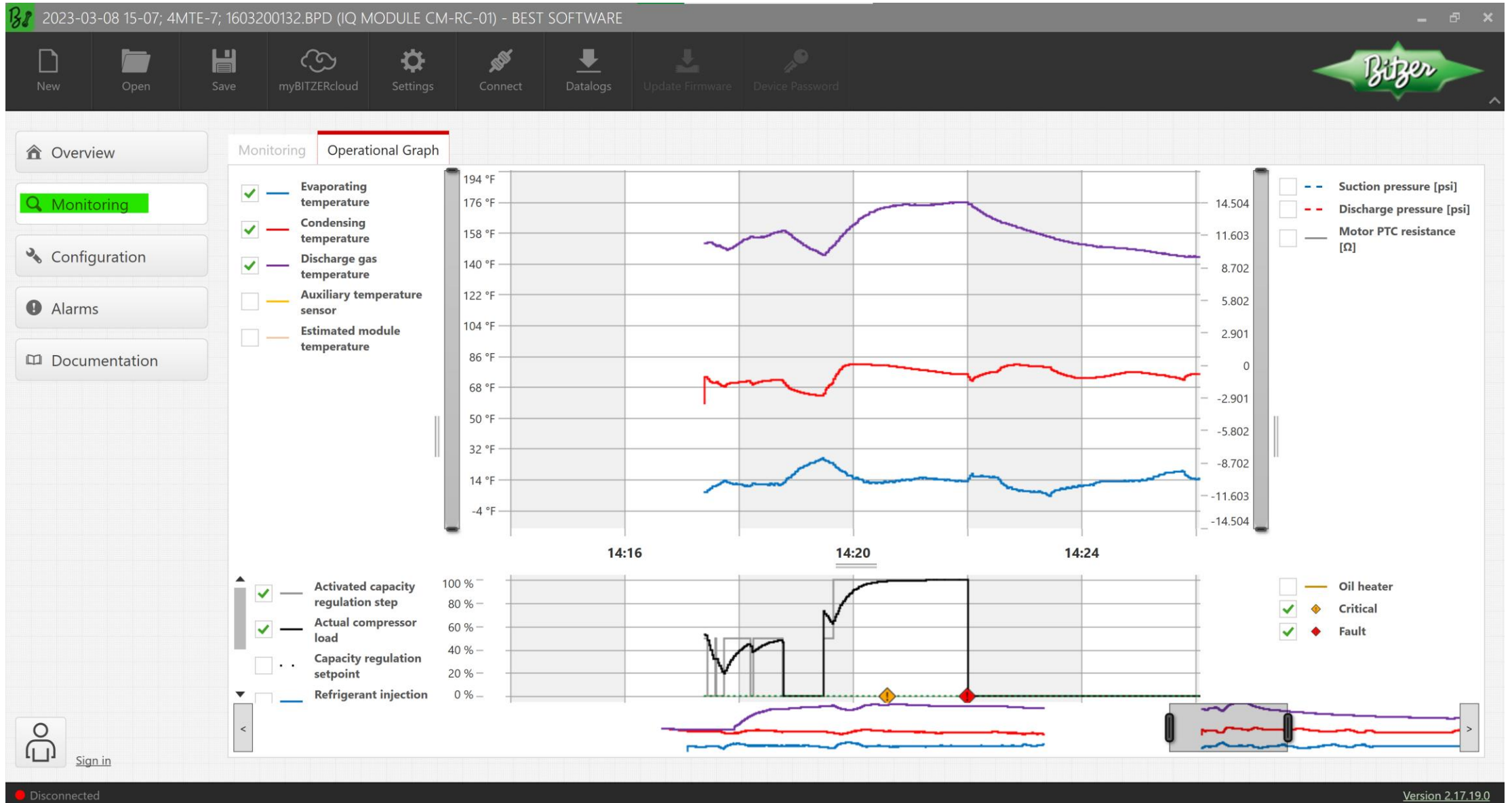
The device is configured without application envelope protection.

Sign in

Disconnected

Version 2.17.19.0

CM-RC FILE



CM-RC FILE



2023-03-08 15-07; 4MTE-7; 1603200132.BPD (IQ MODULE CM-RC-01) - BEST SOFTWARE

New Open Save myBITZERcloud Settings Connect Datalogs Update Firmware Transfer... Device Password

Overview Monitoring Configuration Alarms Documentation

Configuration

Parameter	Unit	Default Setting	Actual Setting	User Setting
Main Setup				
Compressor model			4MTE-7	
Motor starter function	?		Direct on Line (DOL)	
Refrigerant			R744	
Compressor serial number (actual)			1603200132	
Date			3/8/2023	
Time			3:05:38 PM	
Customer, Location				
System name, Compressor number				
Operating Range				
Minimum compressor capacity limit	? %	10	10	
Maximum compressor capacity limit	%	100	100	
Operating functions				
Select start unloading function			None	
Enable oil level regulation (OLM-IQ)	?	No	No	

Hidden parameter values differ [Details...](#)

3/8/2023 12:40:10 PM 3/8/2023 2:43:38 PM 3/8/2023 2:43:38 PM

Disconnected Version 2.17.19.0

CM-RC FILE



2020-06-29; 4KTEU-10L; 1696707531 POST UPDATE.BPD (IQ MODULE CM-RC-01) - BEST SOFTWARE

New Open Save myBITZERcloud Settings Connect Datalogs Update Firmware Reset... Device Password

Overview Monitoring Configuration **Alarms** Documentation

Alarms Datalog Alarms

Code	Description	Categories	Alarm reset types ?
30-25	Minimum Compressor Run Time Not Respected		

Disconnected

Version 2.17.19.0

CM-RC FILE



2023-03-08 15-07; 4MTE-7; 1603200132.BPD (IQ MODULE CM-RC-01) - BEST SOFTWARE

New Open Save myBITZERcloud Settings Connect Datalogs Update Firmware Device Password Export...

Overview Monitoring Configuration Alarms Documentation

Alarms Modbus Firmware Release Notes

Index	Code	Severities	Description	Categories	Alarm reset types
119	10-00	!	Too many identical timed reset faults in 24 hours	?	Severity Fault: External
120	10-01	!	Too many timed reset faults in 1 hour	?	Severity Fault: External
1	11-00	!	Serial Control Timeout	?	Severity Fault: Timed
3	30-01	! ! !	Envelope: Low Evaporation, Low Condensation		Severity Fault: Timed
4	30-02	! ! !	Envelope: Low Evaporation		Severity Fault: Timed
5	30-03	! ! !	Envelope: Low Evaporation, High Condensation / High pre...		Severity Fault: Timed
6	30-04	! ! !	Envelope: High Condensation / High pressure		Severity Fault: Timed
7	30-05	! ! !	Envelope: High Evaporation, High Condensation / High pr...		Severity Fault: Timed
8	30-06	! ! !	Envelope: High Evaporation		Severity Fault: Timed
9	30-07	! ! !	Envelope: High Evaporation, Low Condensation		Severity Fault: Timed
10	30-08	! ! !	Envelope: Low Condensation		Severity Fault: Timed
11	30-10	!	Envelope: Startup Timeout		Severity Fault: Timed
12	30-11	!	Envelope: Configuration Failure		Severity Fault: Restart
74	30-22	!	Too Many Compressor Starts	?	
98	30-24	!	Minimum Compressor Stop Time Not Respected	?	

3/8/2023 12:40:10 PM 3/8/2023 2:43:38 PM 3/8/2023 2:43:38 PM

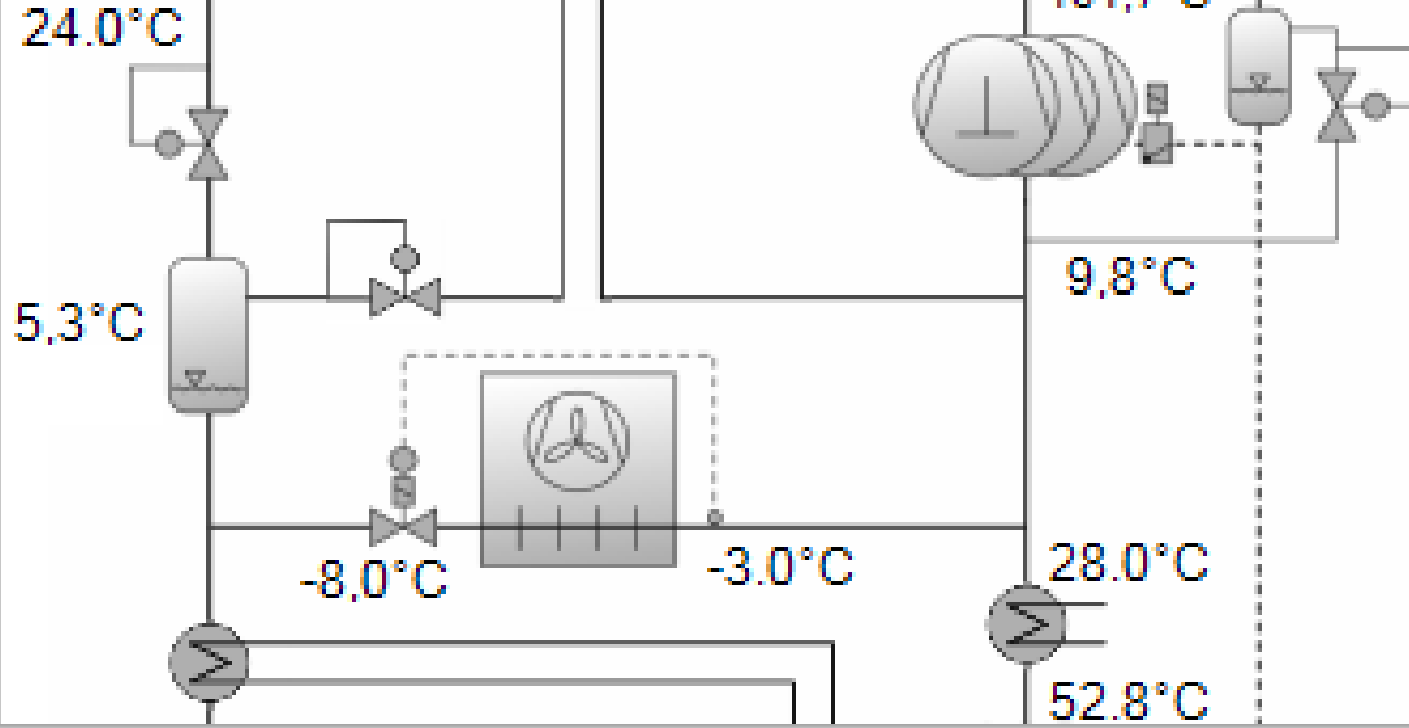
Disconnected Version 2.17.19.0

PLACE HOLDER



// Live interaction with a CM-RC Simulator

- Basic Navigation of HMI
- Parameterization / Diagnostics
- Alarm and troubleshooting
- Operational data / downloading data



BITZER SOFTWARE



STANDARD SOFTWARE



/ Flashgas Bypass & Parallel Systems

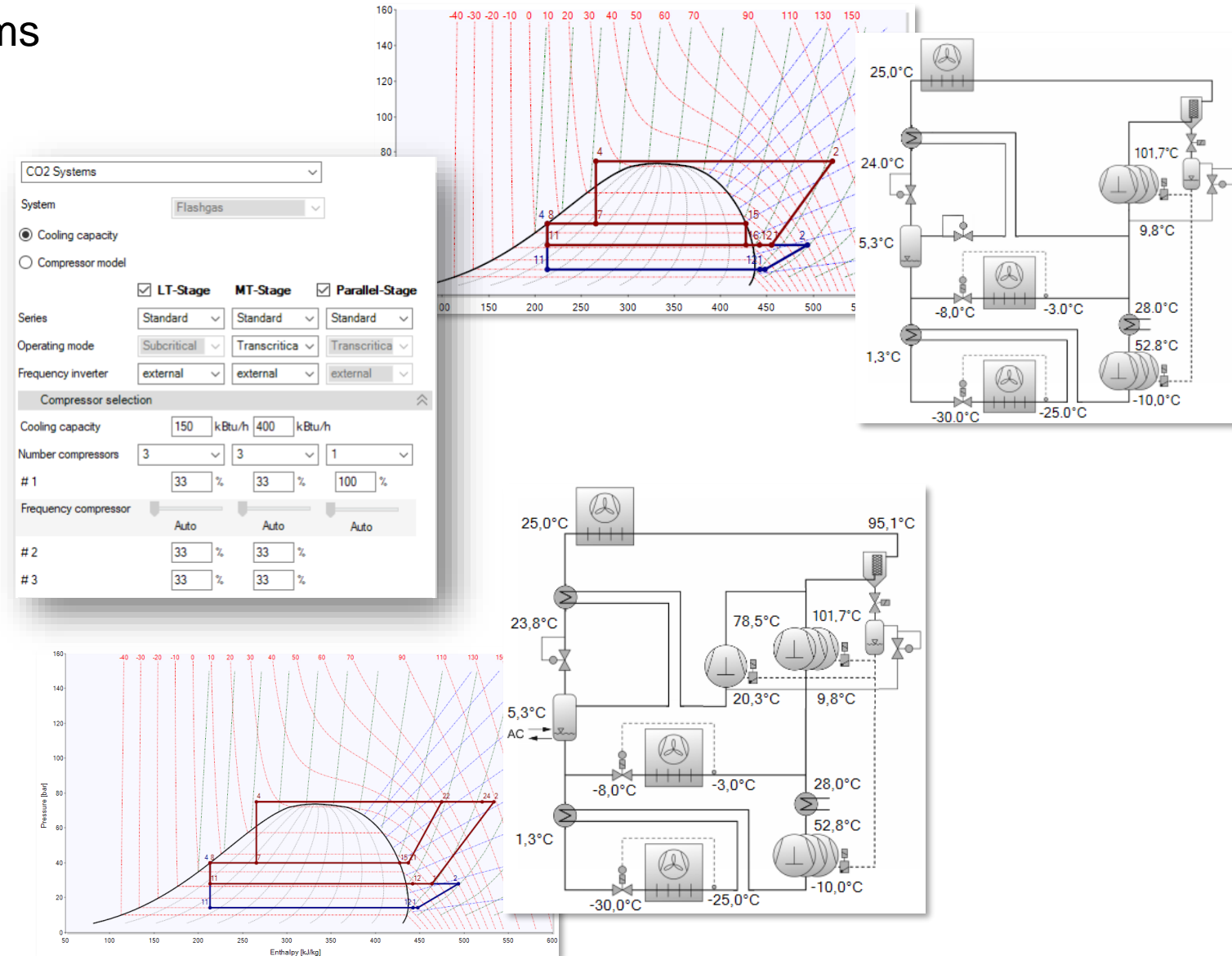
- IHX – FG to Gas Cooler
- Desuperheater (LT comps)
- IHX – LT
- AC Load (w/Parallel)

/ Compressor Selection

- Up to 10 per SG
- VFD option
 - ⇒ External or VARISPEED (TC/TE)

/ Heat Recovery option

- Up to 3 HXs



PLACE HOLDER



- // Live demonstration of BITZER Software
 - Required inputs
 - Individual compressor data v. system data
 - Troubleshooting using performance data



DAS HERZ DER FRISCHE