

Natural Refrigerant Training Summit

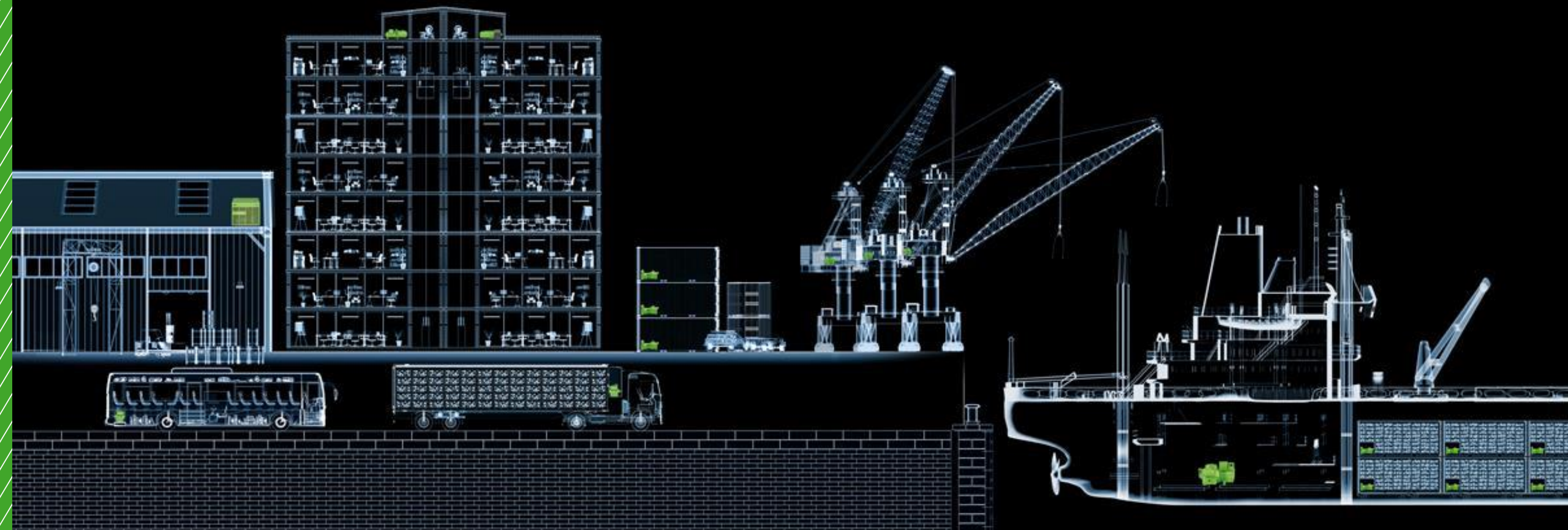
Building a Sustainable Workforce

Using BITZER BEST w/ CO2

Greg Krause

Commercial Ref. Mgr. / BITZER US Inc.



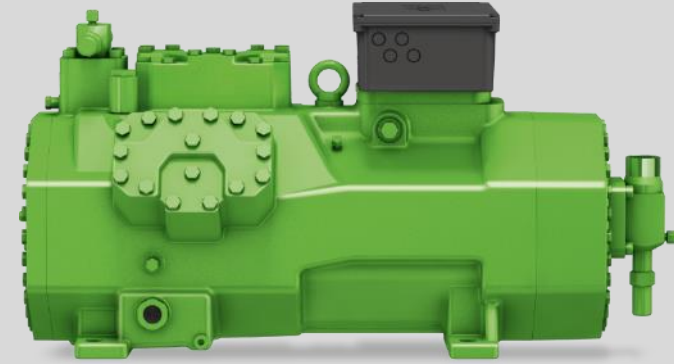
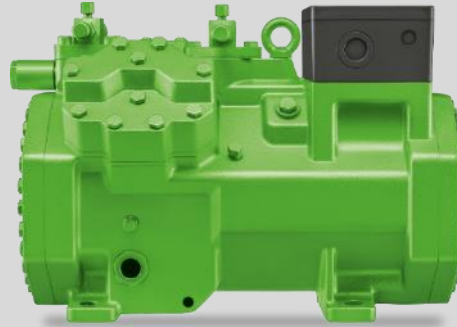
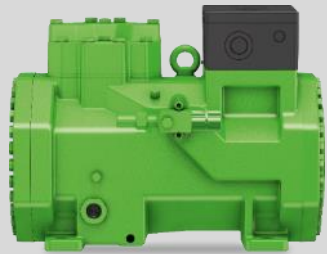


NASRC NATURAL REFRIGERATION TRAINING SUMMIT

November 2023
BITZER US



DAS HERZ DER FRISCHE



BITZER CO₂ COMPRESSORS

// General Overview

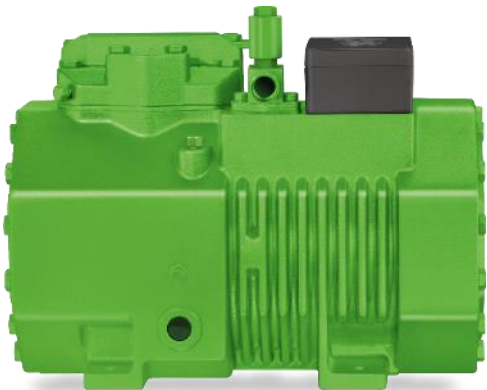
- BITZER Subcritical and Transcritical
- CM-RC / VARISTEP CO₂
- Using the BITZER Software
- Using the BEST Software

SUBCRITICAL CO₂ COMPRESSORS

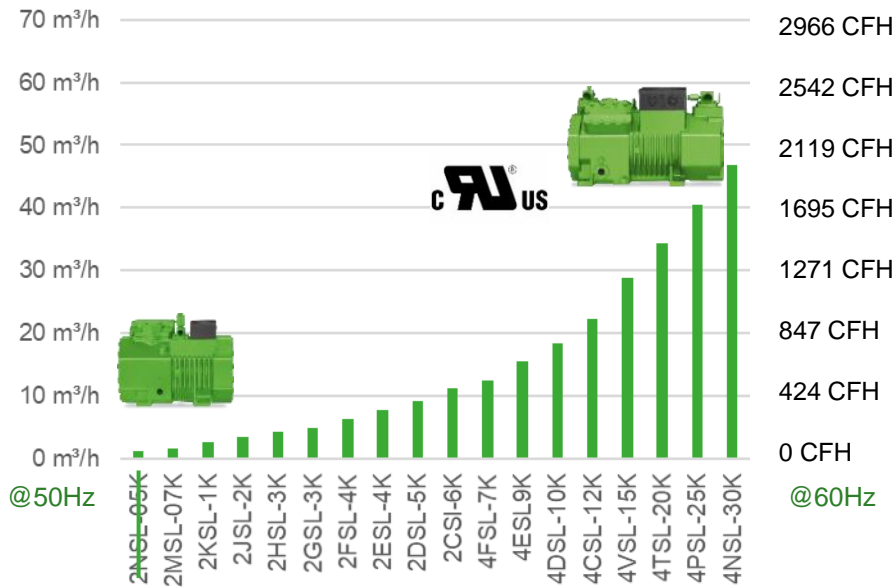


RECIPROCATING
COMPRESSORS

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

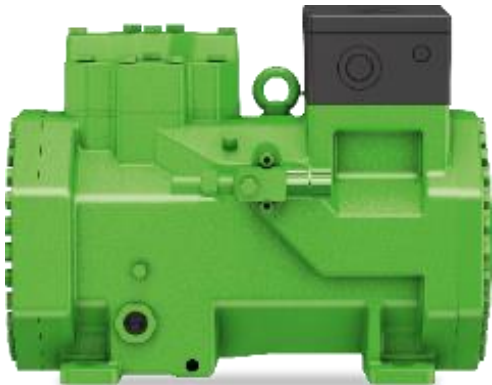
Motor Size:
30: Nominal HP

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

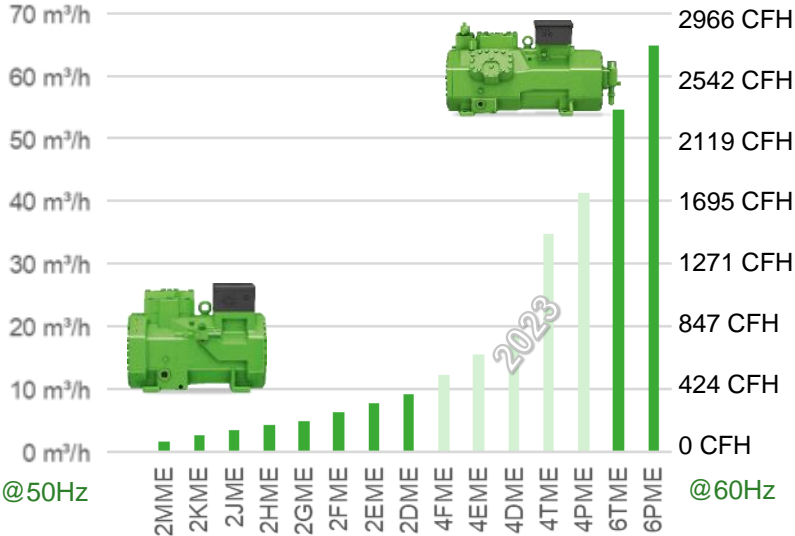
SUBCRITICAL CO₂ COMPRESSORS



- 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	CO2			Nominal HP		Voltage
6	P	M	E	-	40	-	2NU

No. of Cylinders
2,4,6

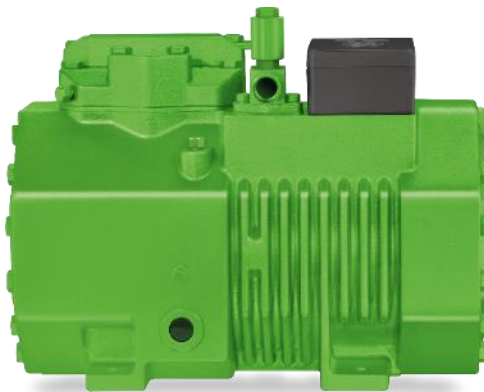
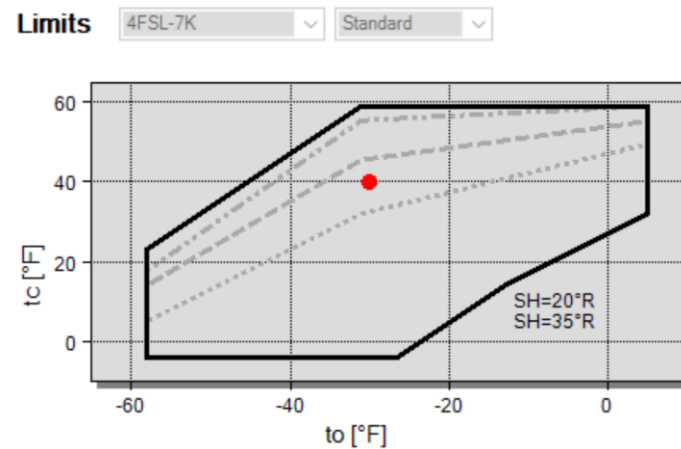
Displacement:
Bore and Stroke

CO2 Series:
ME: Subcritical

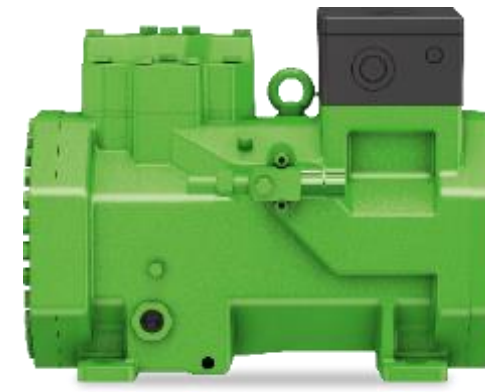
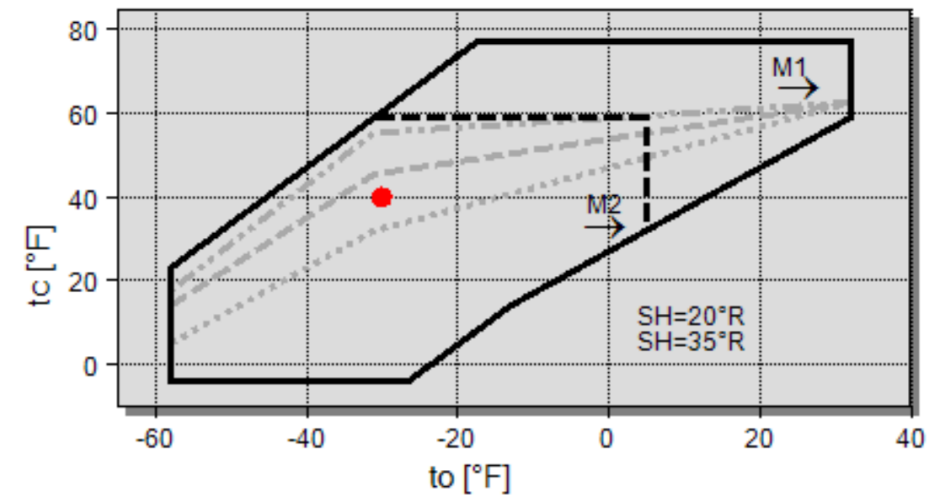
Motor Size:
40: Nominal HP

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

SL Series



ME Series



TRANSCRITICAL ECOLINE CO₂ COMPRESSORS

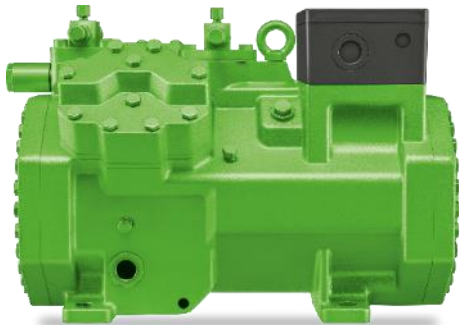


IQ MODULE

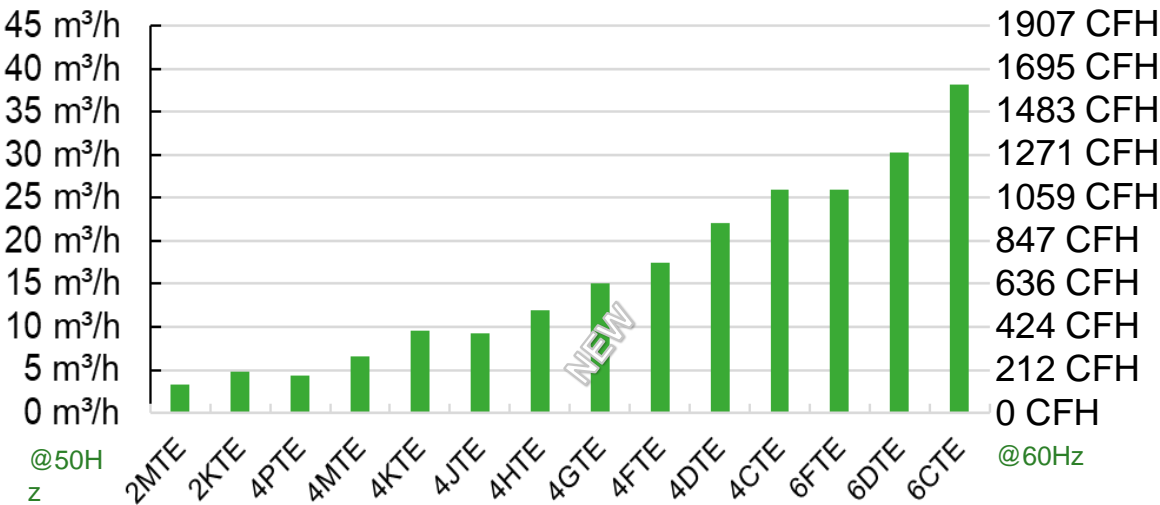
RECIPROCATING COMPRESSORS

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	CO2			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

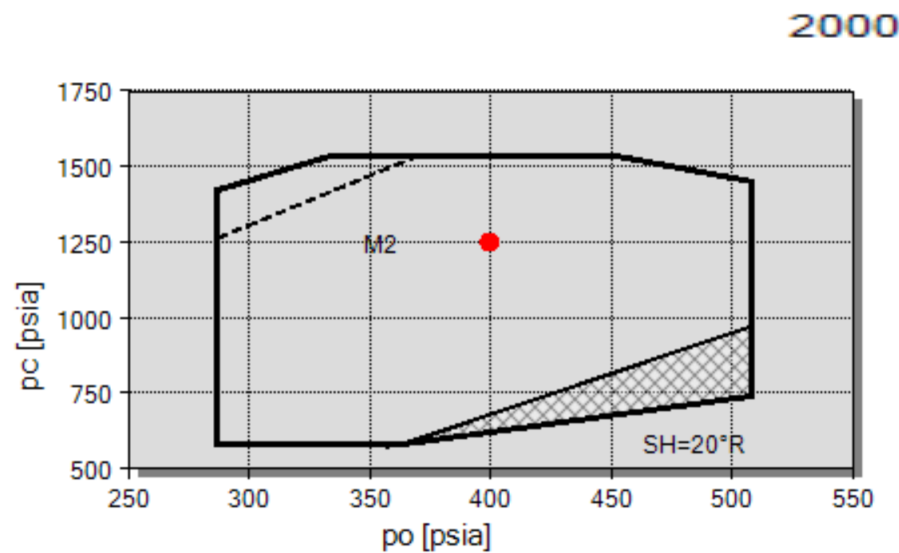
Oil:
D: Dry

Unloaders:
1: Step of CR

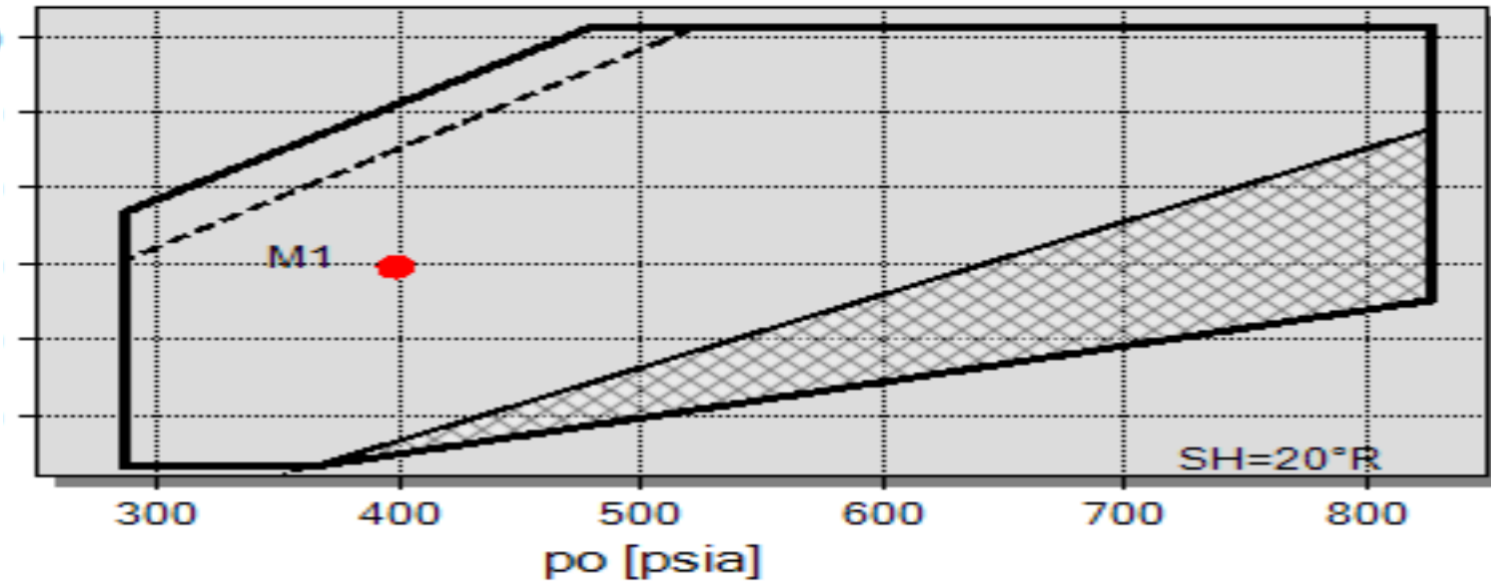
ECOLINE SUBCRITICAL APPLICATION WINDOWS

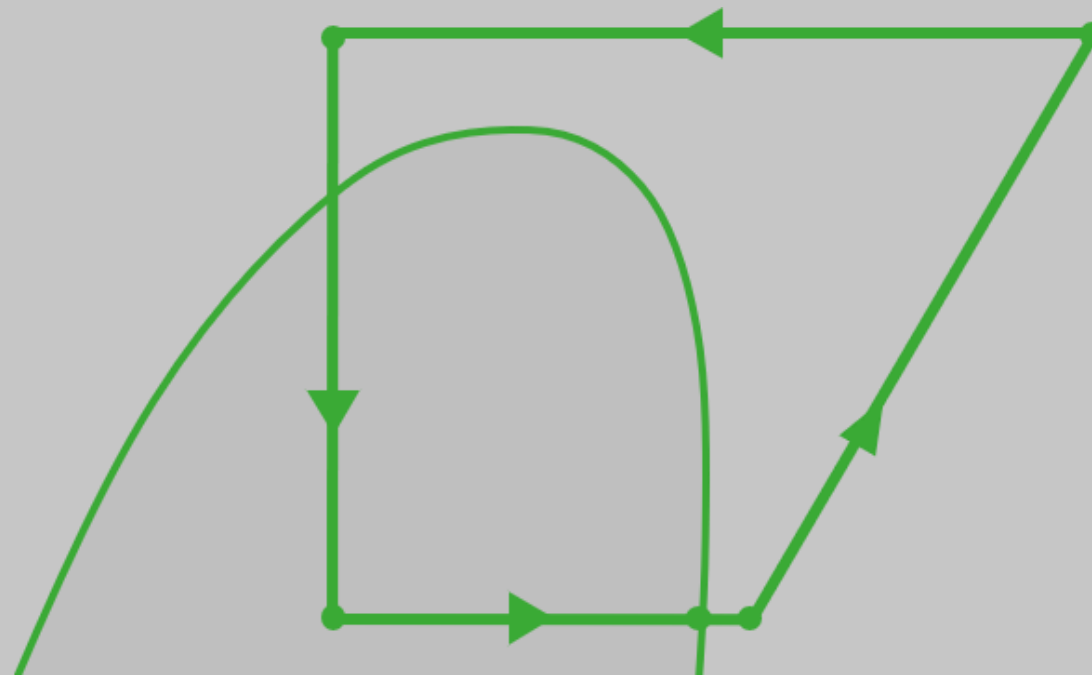


TE Series (M2)



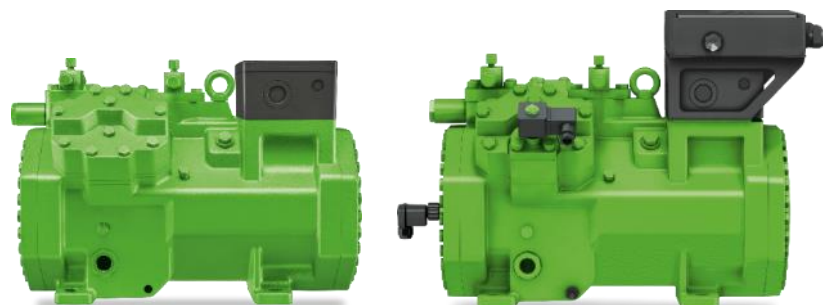
TE Series (M1)





COMPRESSOR FOR TRANSCRITICAL APPLICATIONS

ECOLINE CO₂





VARISTEP / CMRC FOR CO₂

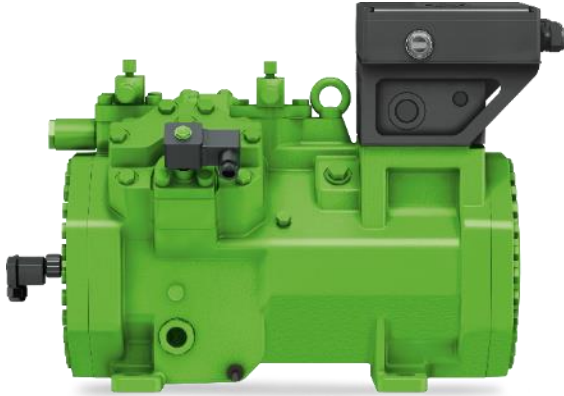
VARISTEP for CO₂

CMRC

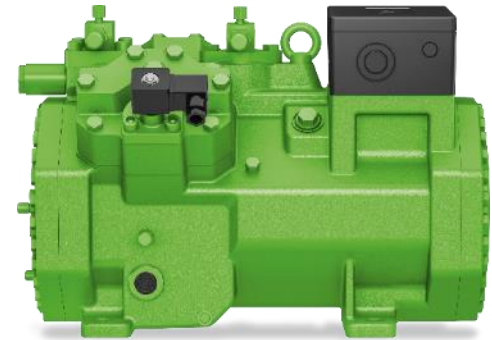


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VARISTEP POSSIBILITIES



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

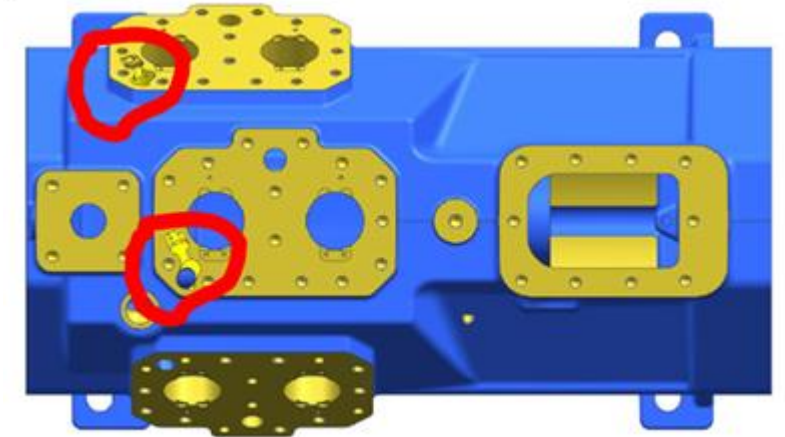
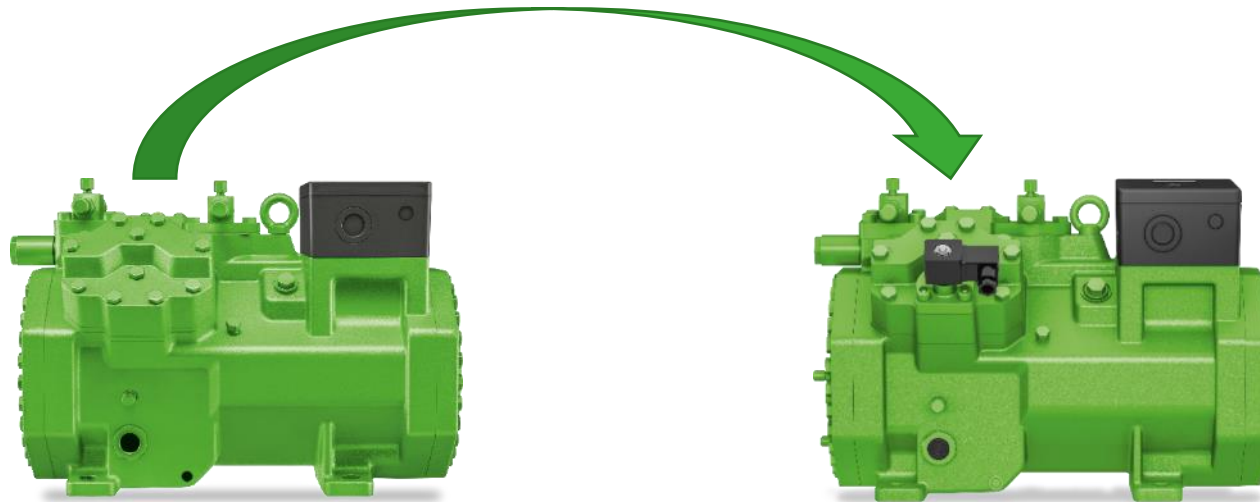


Without IQ MODULE
Stepped capacity control
/ 4 Cylinder 50 or 100%
/ 6 Cylinder 33%, 66% or 100%

IMPORTANT !!!!

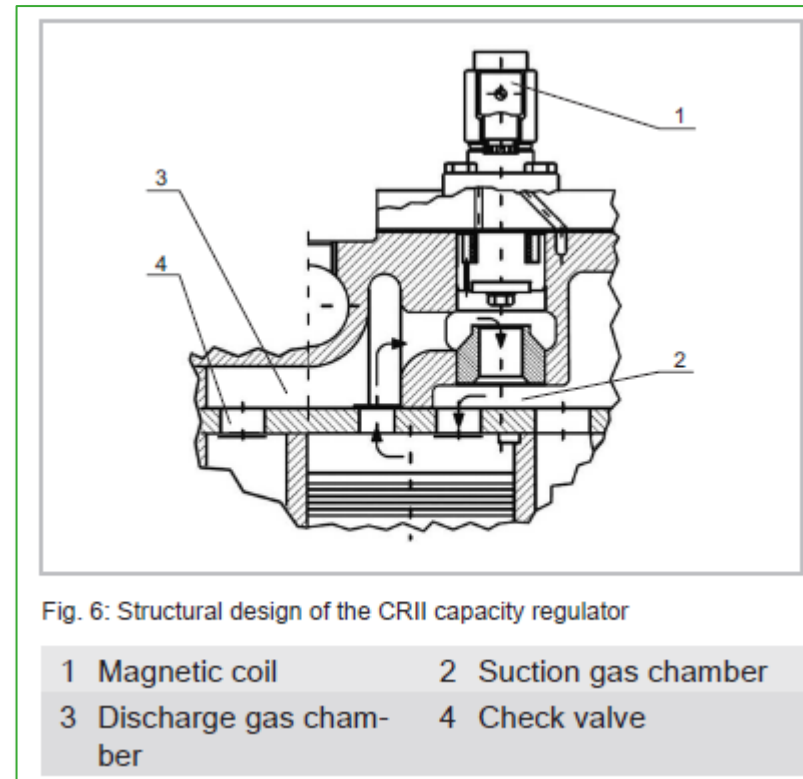


- // Field retrofits are possible for BITZER US TE models
- Additional machining in the casting is required for VARISTEP
 - This is not possible for compressors build in Germany
 - VARISTEP is **not** possible on TC models



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 CMRC 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

Crankcase Heater*

H: Heater Pre-wired

Refrigerant Injection (Pre-wired)* / CO2:

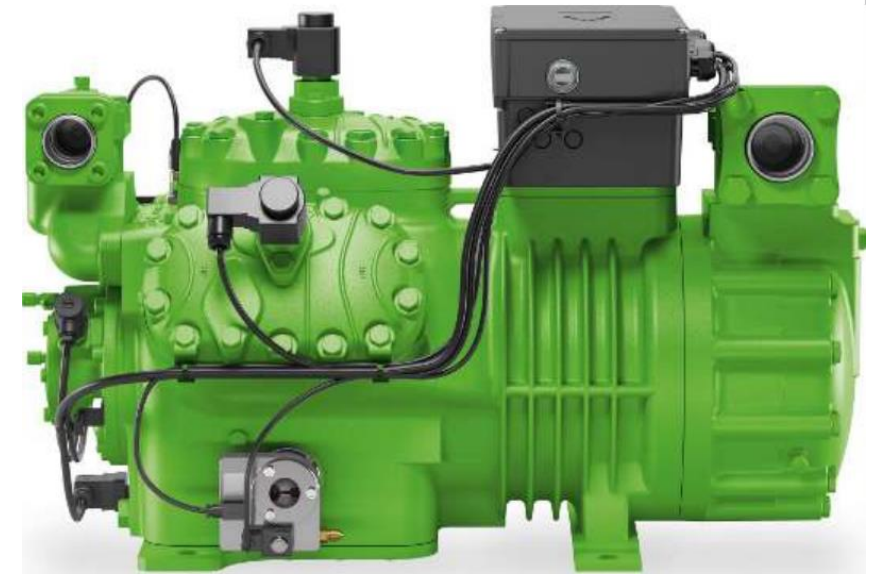
CO2: Unloader Coil and DGTS

Number of Unloader (Pre-Wired)*:

1: (1) Cable / Coil

2: (2) Cable / Coil

3: (3) Cable / Coil



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

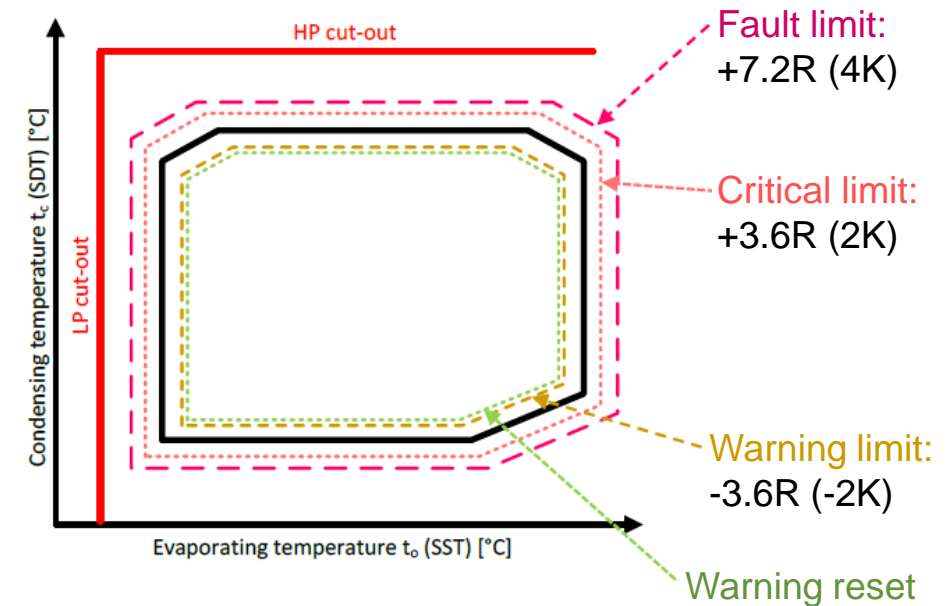


Standard Compressor Protection

- // 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

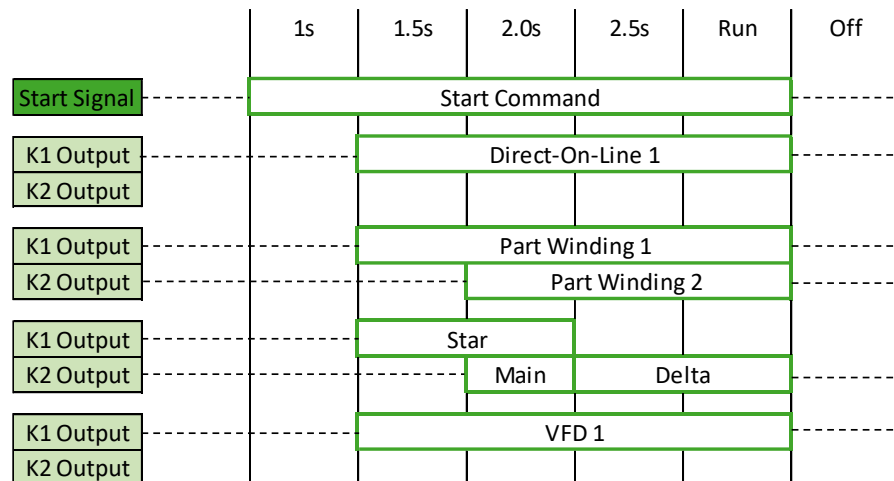
- Adjustable
- Not a safety cut-out

IQ MODULE FOR RECIPROCATING COMPRESSORS CONTROL DEVICE



Motor Contactor

// Internal time delays



// No external time delays required

Crankcase Heater

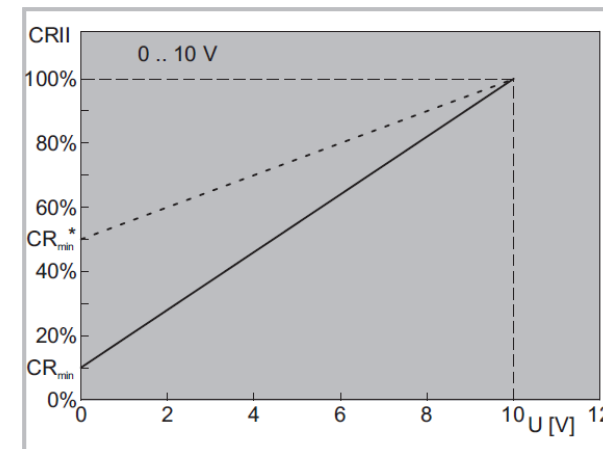
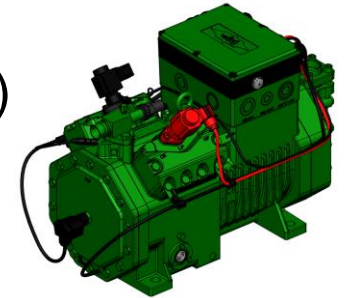
// Compressor on → Heater off

// Compressor off → Heater on

CRII & Start Unloading

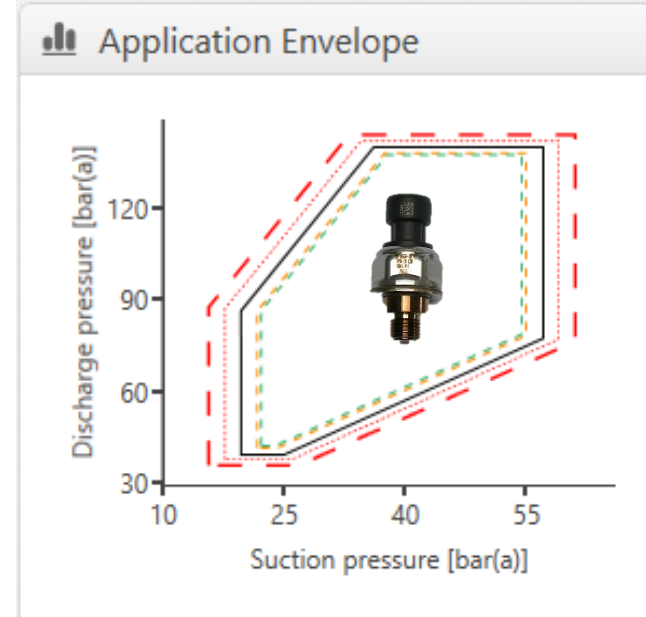
// Min – Max linear control (std)

- 0 - 10V input
 - 4-20mA possible
- CR between 10-100%



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

- // Standard CMRC v. CO2 CMRC
 - 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.)



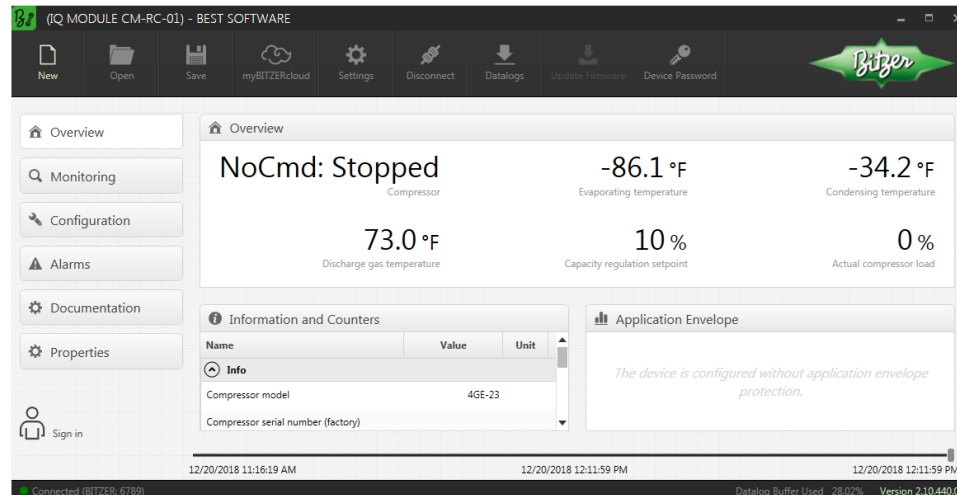
BEST Software / App

// 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**

Configuration

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	

User Settings

Connected / Disconnected

Four LED's are visible through the sight glass

POWER Warning Fault COM

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

Code	Severity	Time Stamp	Description
35-02	Warning	9/7/2018 12:19:22	Oil Pressure Low
10-00	Fault	9/7/2018 11:10:40	Too many identical timed reset faults in 24 hours
10-01	Fault	9/7/2018 11:10:40	Too many timed reset faults in 1 hour
34-31	Fault	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	Fault	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	Fault	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	Fault	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	Fault	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

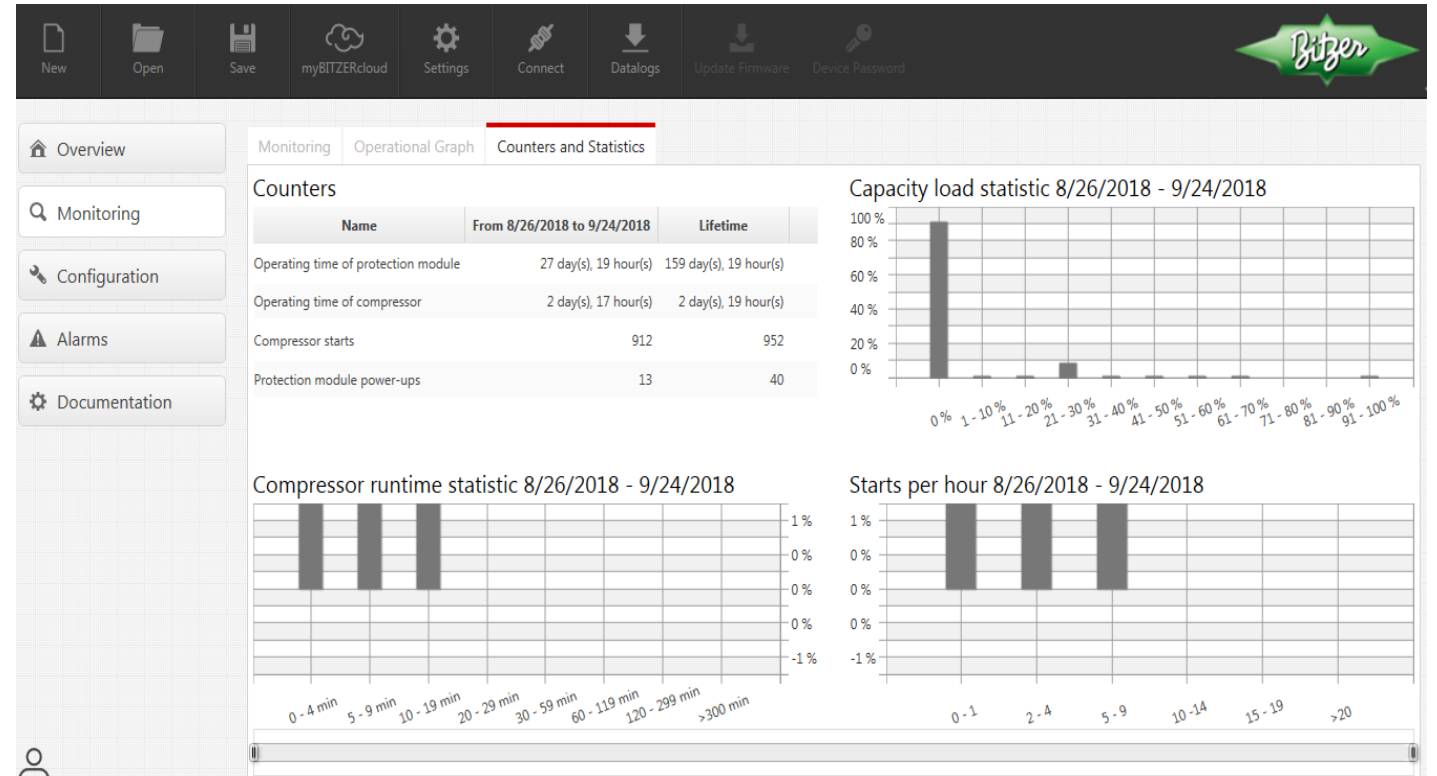
- Compressor on – 10s
- Compressor off – 60s
- Fault traces – 3s
- Lifetime: 1-3 weeks

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





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

Bitzer

Overview

Monitoring

Configuration

Alarms

Documentation

Sign in

Overview

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		

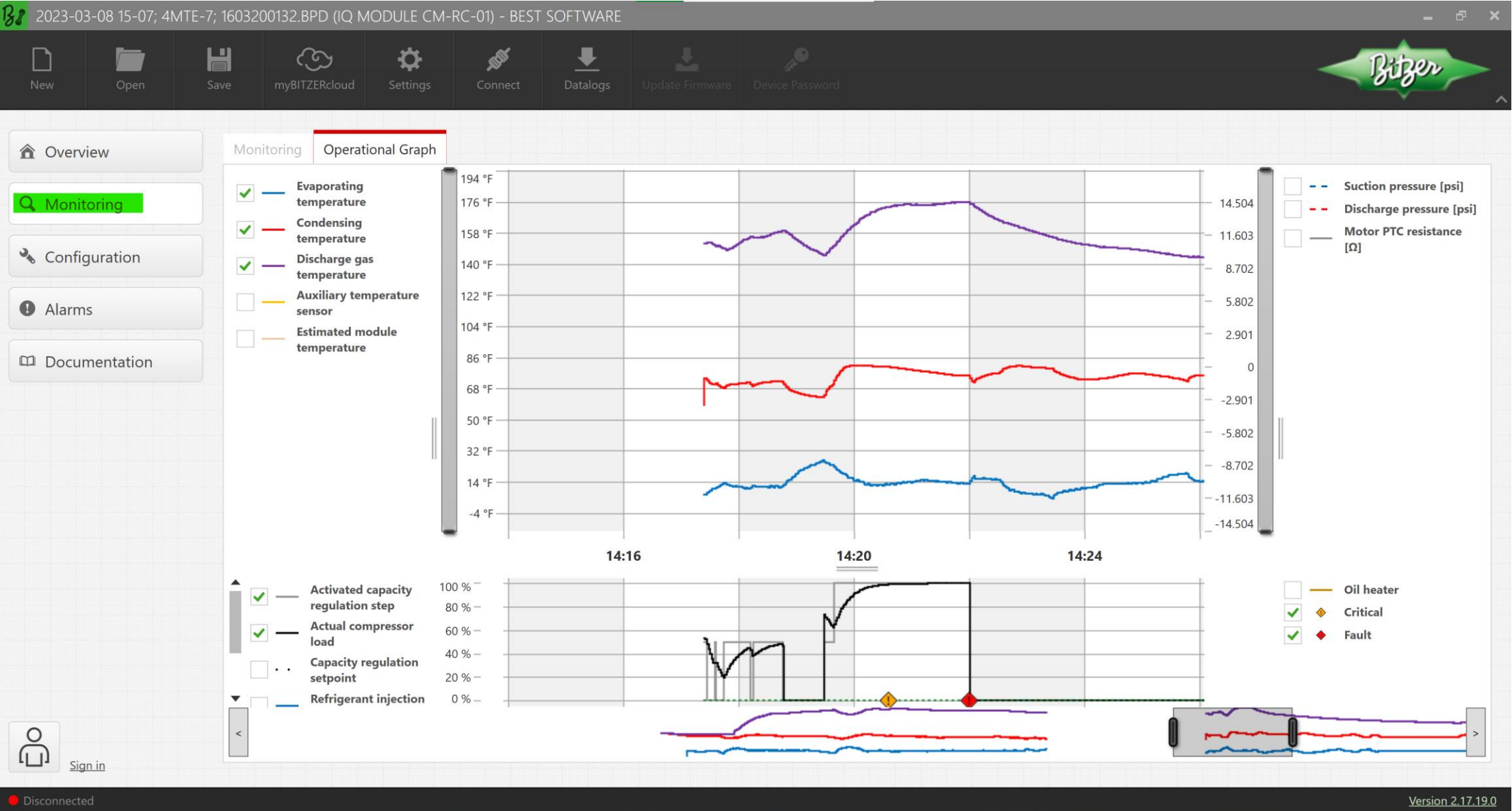
Application Envelope

The device is configured without application envelope protection.

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

Bitzer

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...

Sign in

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



New

Open

Save

myBITZERcloud

Settings

Connect

Datalogs

Update Firmware

Reset...

Device Password

Overview

Monitoring

Configuration

Alarms

Documentation

Sign in

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

Alarms

Datalog Alarms

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

Disconnected

Version 2.17.19.0

32 NORTH AMERICAN SUSTAINABLE REFRIGERATION COUNCIL (NASRC)

© BITZER M.BOSCAN 04.2023

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...

Bitzer

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

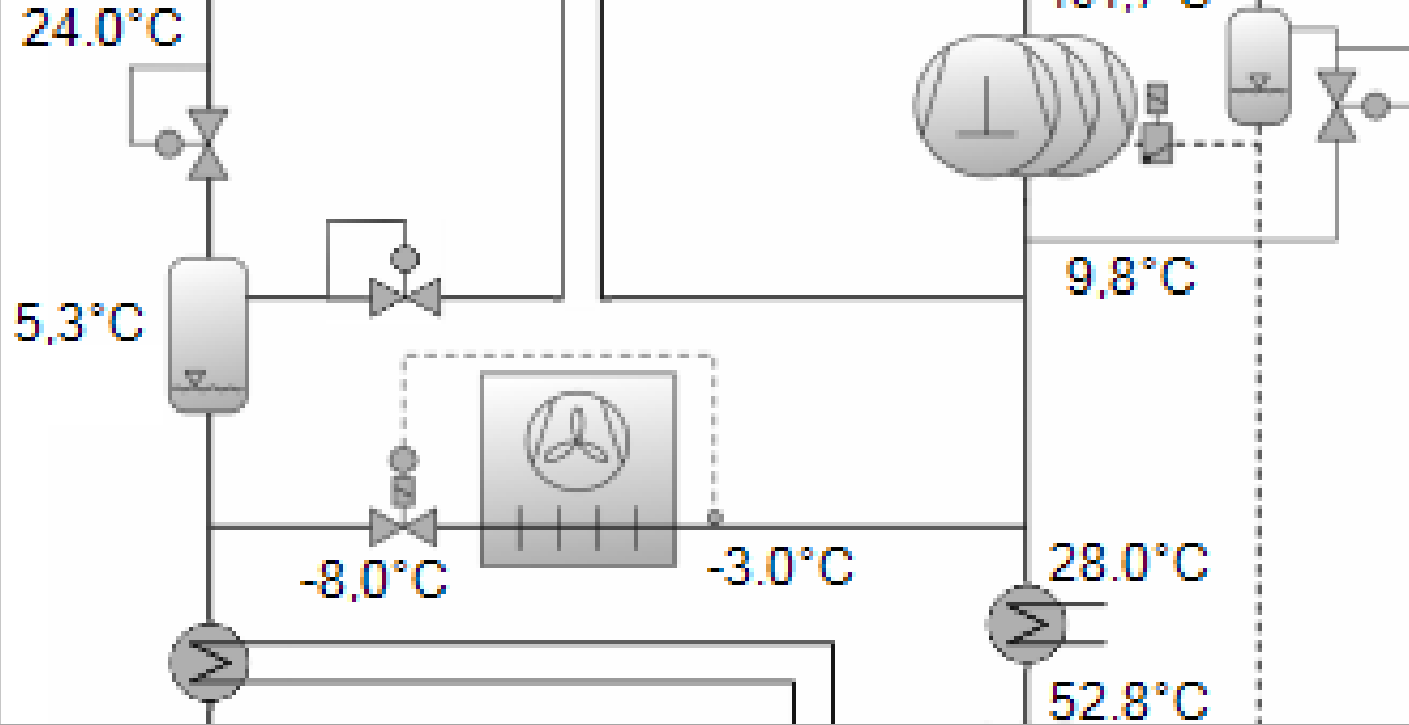
3/8/2023 2:43:38 PM

Disconnected

Version 2.17.19.0

// 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

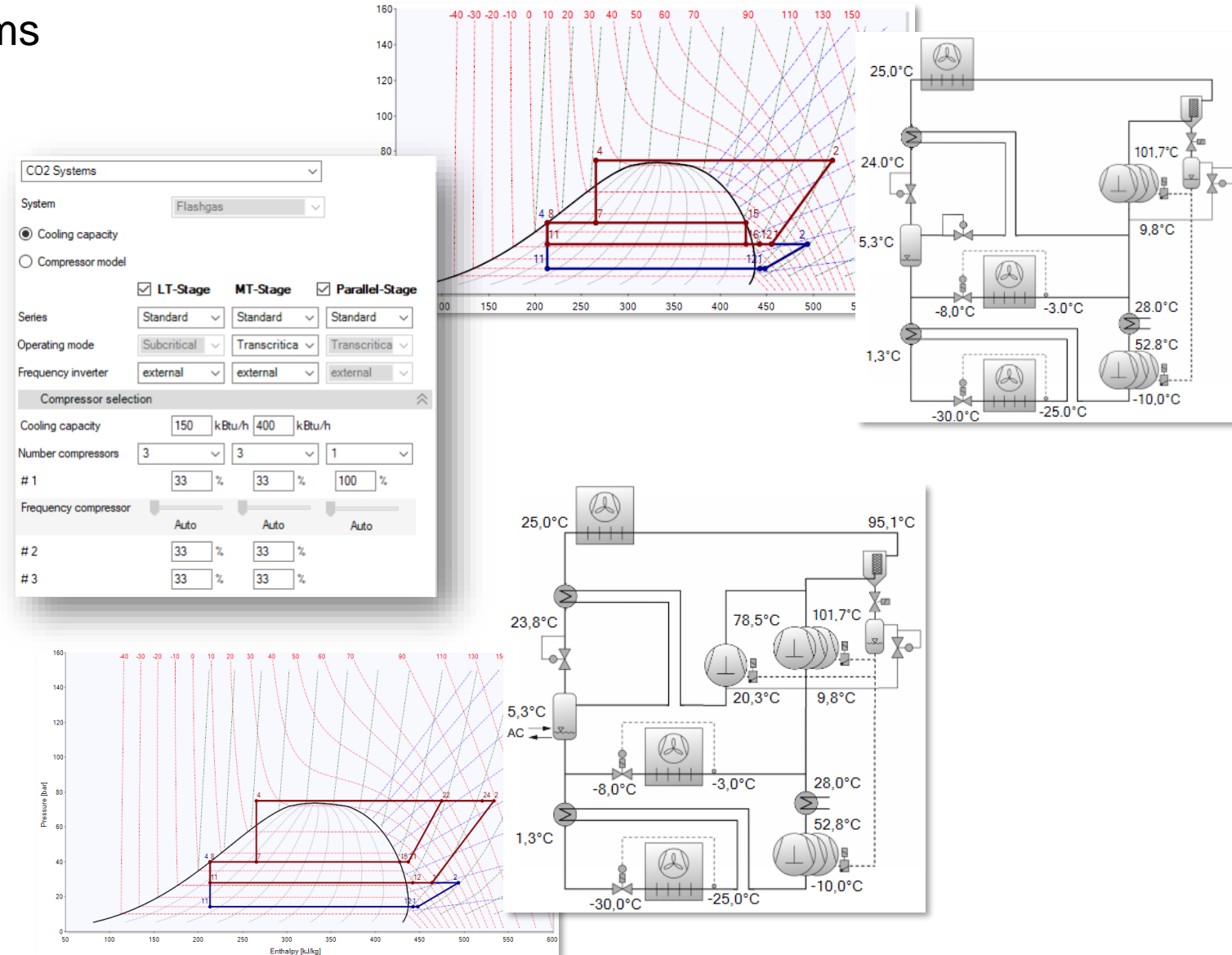
- IHX – FG to Gas Cooler
- Desuperheater (LT comps)
- IHX – LT
- AC Load (w/Parallel)

/ Compressor Selection

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

/ Heat Recovery option

- Up to 3 HXs



// Live demonstration of BITZER Software

- Required inputs
- Individual compressor data v. system data
- Troubleshooting using performance data



DAS HERZ DER FRISCHE

Share Your Feedback!



To receive an electronic training certificate:

1. Scan or visit nasrc.org/session-surveys
2. Provide your name and email at the end of the survey

Please Note: You will not receive a certificate unless you share your name on the survey form.

Using BITZER BEST w/CO2

Greg Krause

Commercial Ref. Mgr. /BITZER US Inc.