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Compressor Technology Options Supporting R744 System Design for Diverse End-User Needs

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End User Needs Are Diverse In The Commercial Refrigeration Industry

End User Needs

Food Safety	Cost	Eco-Compliance	Solutions for Smaller Stores
Reliability	Investment	Regulations	Compactness
Preventive Maintenance	Operational	Environment Friendly	Sound

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Different R744 System Architecture Types Serving Diverse End User Needs

Cascade System (Scroll / Scroll)

1

RIVACOLD MASTERING COLD

- Fully Natural R290/R744
- Cold & Warm Climates
- Compact Design

Investment & Operational Cost
Cold Room
Convenience Stores

Booster System (Semi / Scroll)

2

EDEKA

- Booster Semi / Scroll
- Digital Modulation
- System Efficiency

Residential Areas
Small & Big Stores
Investment & Operational Cost

Booster System (Semi / Semi)

3

alepa

- Booster Semi / Semi
- High Design Pressure
- CoreSense Technology

Resilience
Preventive Maintenance
Faster Concept to Production

Natural Refrigerant Cascade System for a Cold Room Application in a Supermarket

End User Need:

- Natural solution for low-temperature cold rooms
- Centralized booster system is not an option, as Integrals are used for medium-temperature cases
- Installation accross Europe - both in cold and warmer regions
- Solution needs to be cost effective, compact & efficient

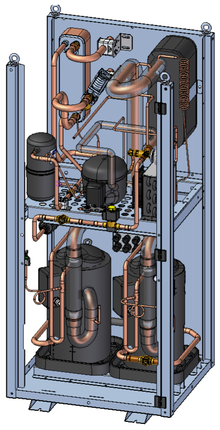
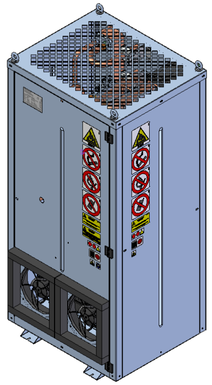
Potential Solutions:

- R744 transcritical condensing unit with 2-stage compressors OR
- R290 / R744 cascade system

R290/R744 Cascade System – Innovative System Design for Cold Rooms

System Design

- The application demands a compact system and natural refrigerant for both high / low side
- R290 on high side condenses R744 on low side
- Split system design concept to isolate R290 module
- Auxiliary unit integrated in the R290 main refrigerant circuit
- New system concept for the cold room application (patent pending)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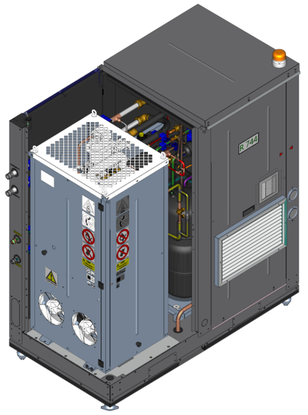
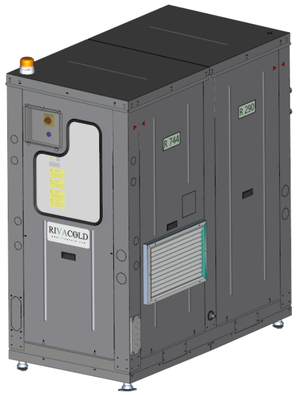
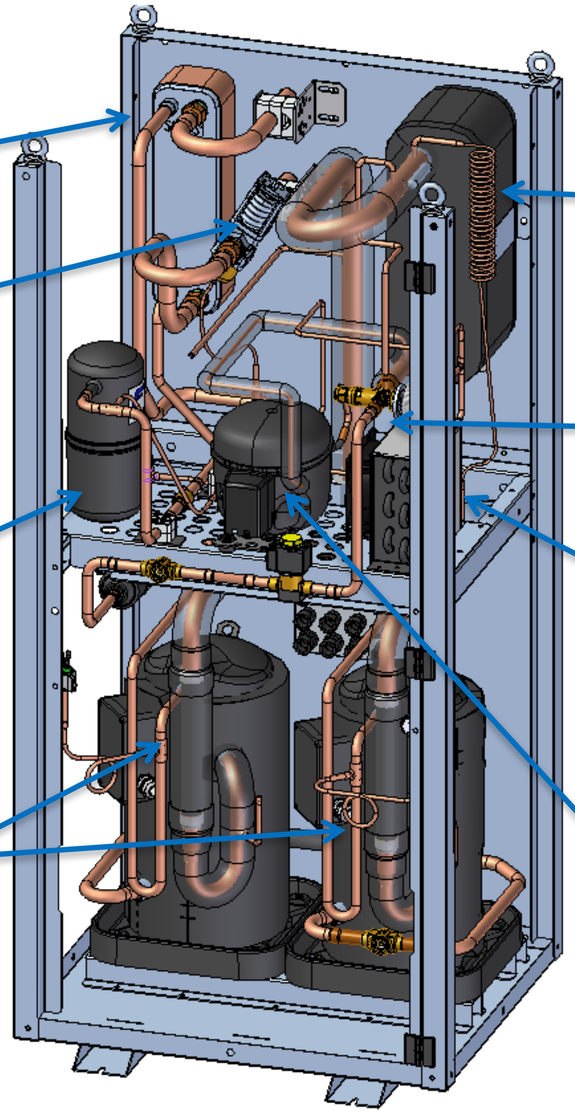




Isolated R290 Module - Flexibility Production, Installation and Maintenance



Condenser

Water valve

Receiver

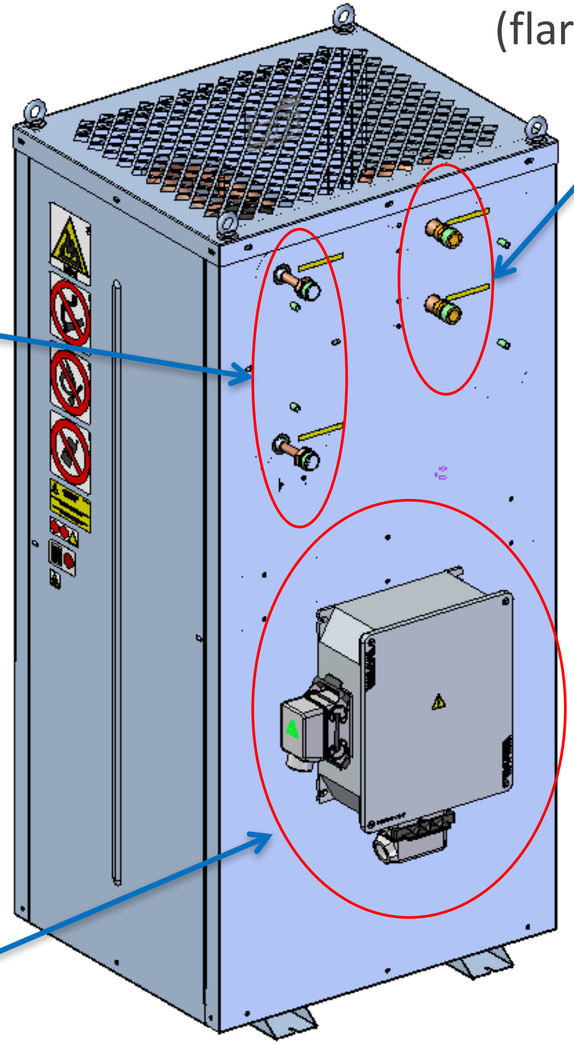
R290 Scroll Compressors

Evaporator (intermediate exchanger)

Mech. TXV

Air condenser for emergency compressor

Emergency compressor

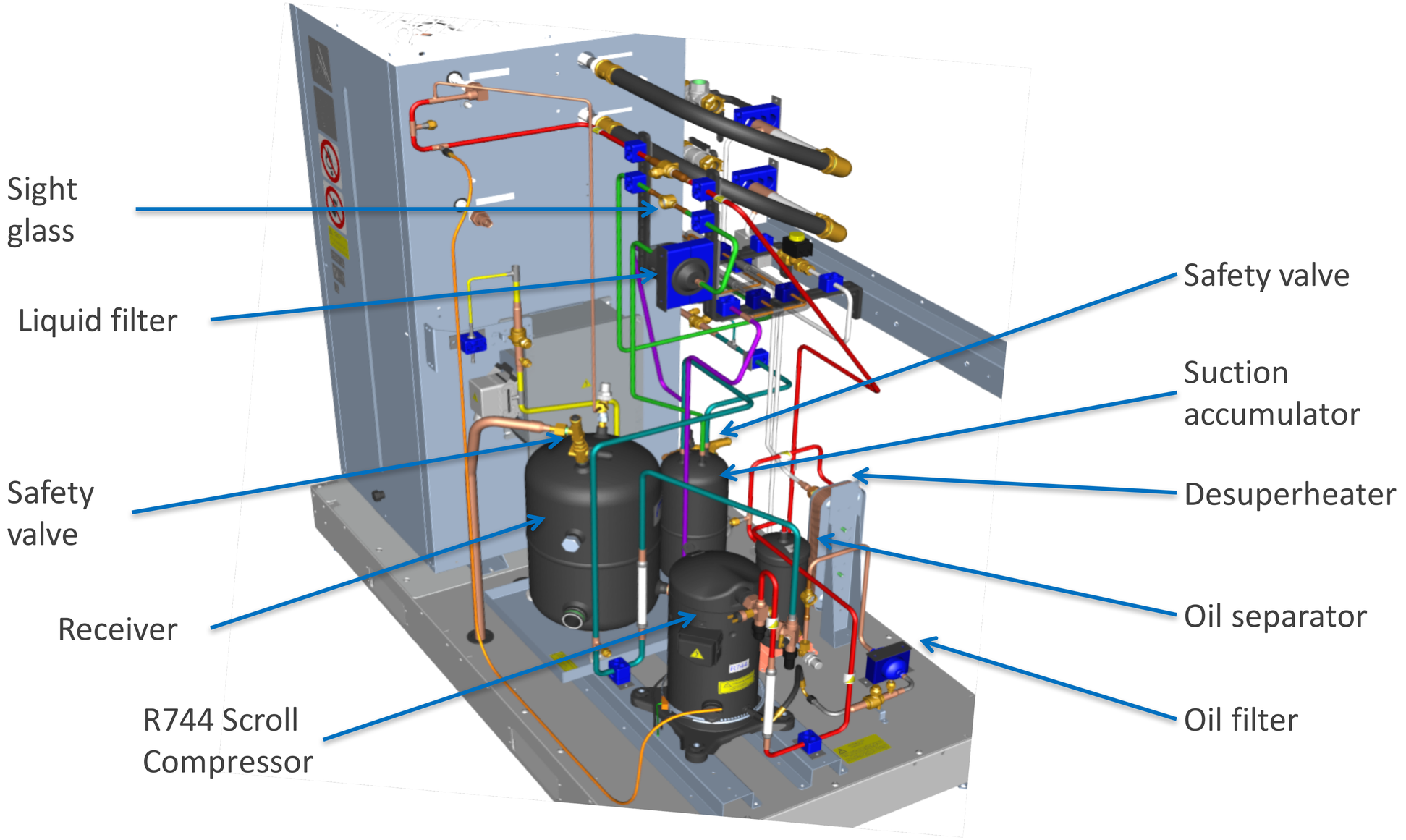


Water connections (flare)

R744 connections (RTLK)

Electrical connection box (industrial plugs)

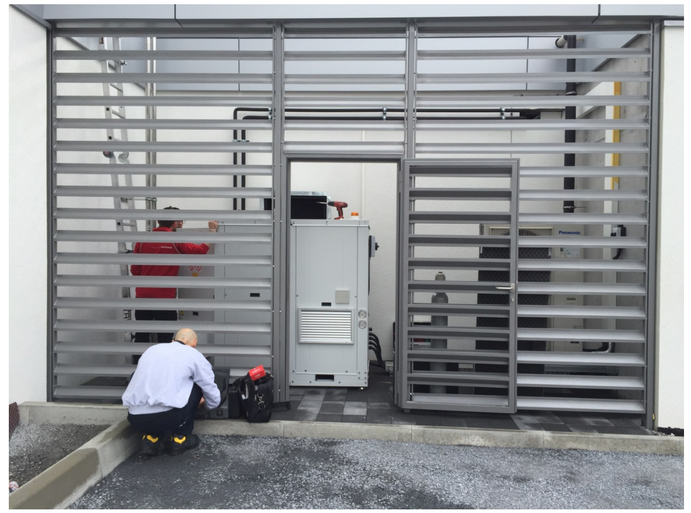
R744 Module Design In The Cascade System



Installation, Benefits & Next Steps

Installation

- Installations in countries such as Germany and Switzerland
- First installation in June 2015
- R290 refrigerant stays outside cold room



Benefits

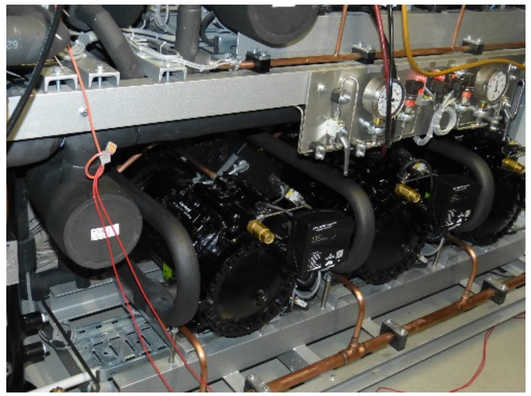
- Reduced investement costs in comparison to transcritical R744 condensing unit
- The system can be used in both cold and warmer regions
- Improved performance even in warmer regions as the R744 circuit always runs in subcritical mode

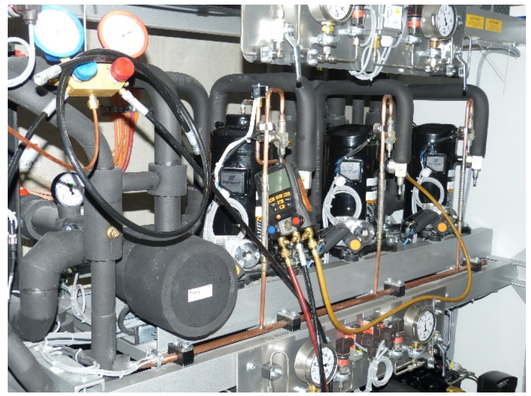
Next Steps

- Realize a system for medium-temperature cold room (evaluation phase)

R744 Booster System with Semi-Hermetic Stream and Scroll Compressors

- **Refrigeration System:**
  - CO2 Booster for Edeka supermarket in Germany
  - OEM: KKE System GmbH
  - Installer: Marenbach Kälte-Klima-Technik
  - Installation: Feb 16
- **Used Technology:**
  - Semi-hermetic „Stream“ for medium temperature
  - Scroll for low temperature
  - Digital scroll for 0-100% capacity modulation
  - Applied cost savings using OM5 oil management system





Applied Cost Savings

Digital Modulation

Compactness

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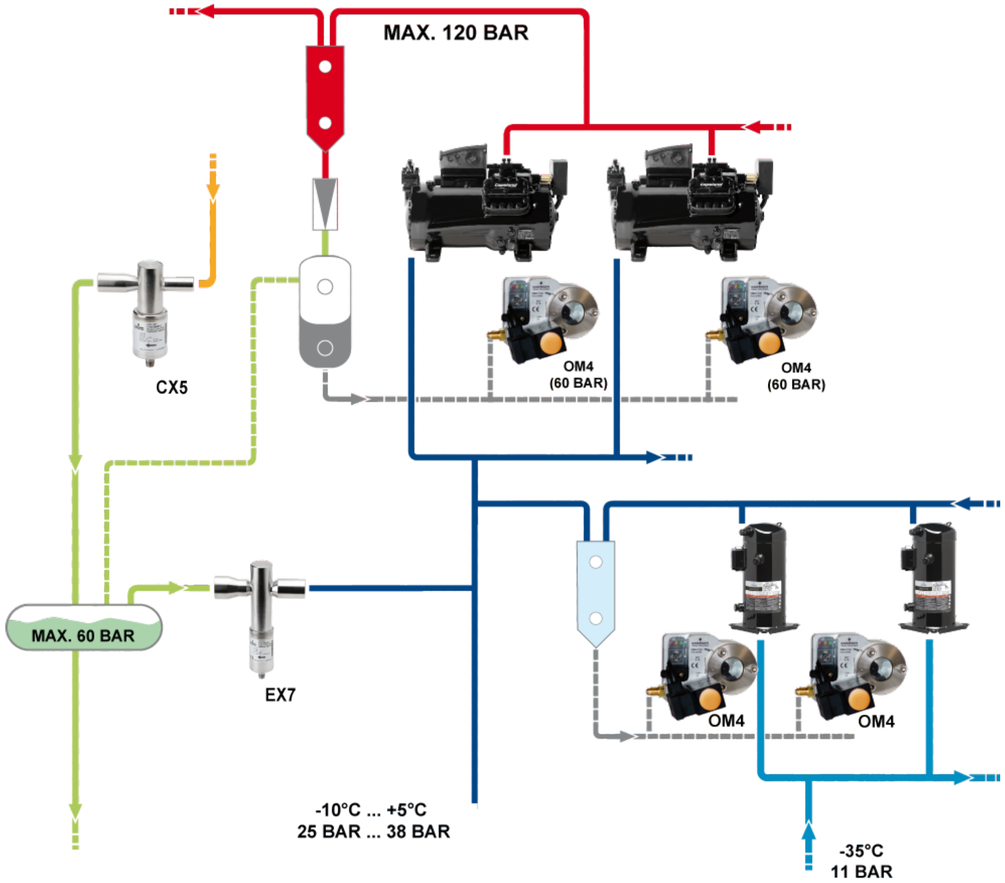
EDEKA

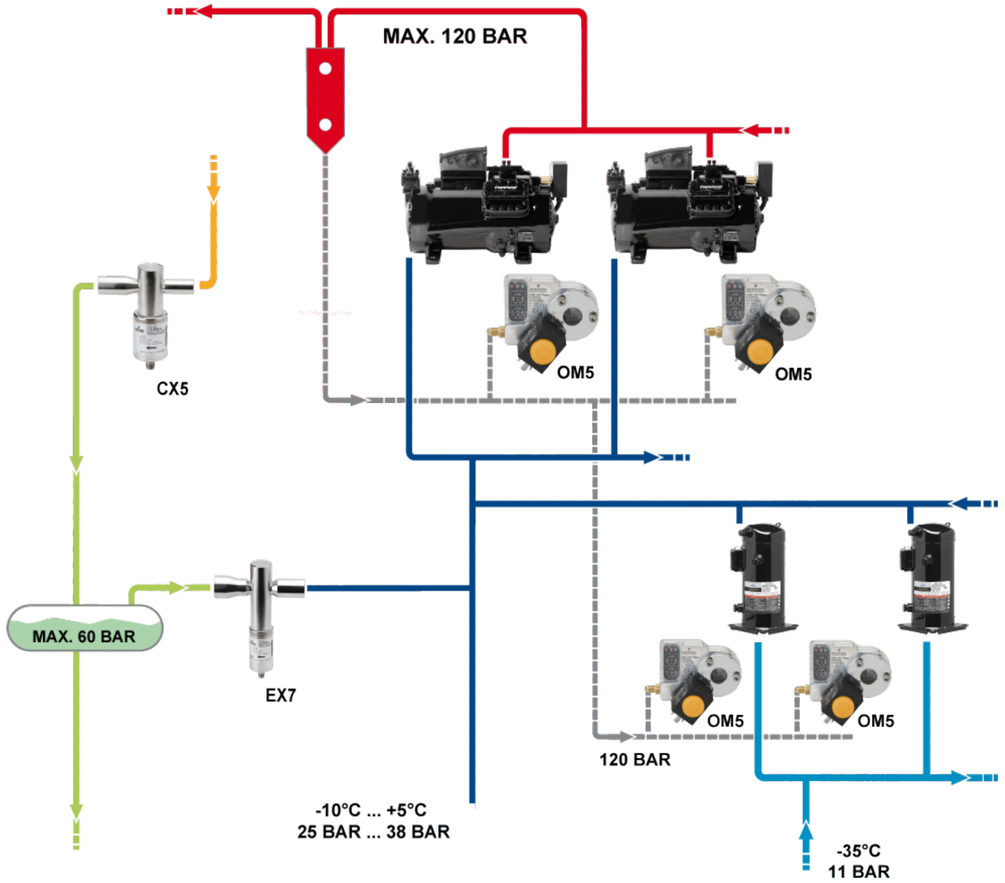
Applied Cost Savings Using Simple and Cost Effective Oil Distribution Method

Traditional



Booster System with Oil Receiver Applied OM4

Simple and Cost Effective

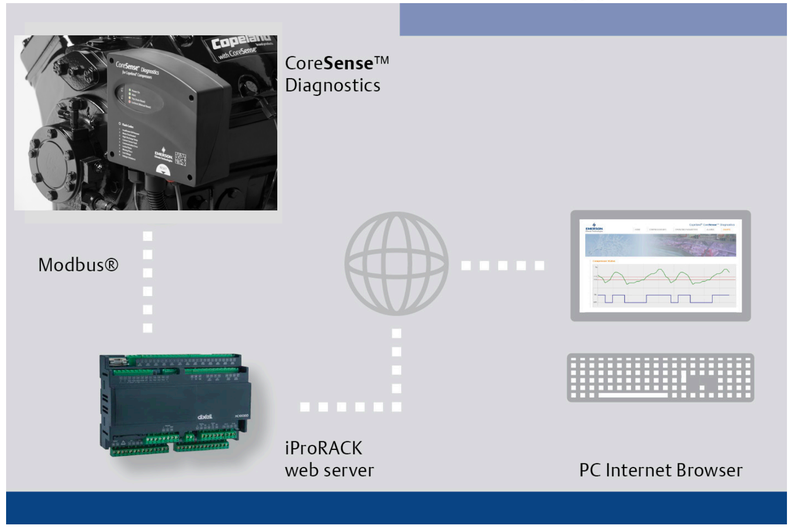


Booster System without Oil Receiver Applied OM5

R744 Booster System with High Standstill Pressure & Compressor Remote Monitoring

- Alepa supermarket in Finland, New installation 650m2
- Total Solution Synergy from Emerson >> IPRO Rack Controller, XWEB, XEV20D and XM679K, Flow Controls (OM5,PT5,LW5,CX6,CX7) and Compressors (Semi-hermetic Stream / Semi-hermetic Stream)
- High standstill pressure with 60 bar system design

CoreSense Technology



Power & Discharge Temperature Monitoring

Resilience

Preventive Maintenance

Fast Concept to Production

Summary & Recommendations

Different Compressor Technology Options Gives Flexiblity In R744 System Design To Satisfy Diverse End User Needs

System Types	Cascade System (Scroll / Scroll)	Booster System (Semi / Scroll)	Booster System (Semi / Semi)
References	Rivacold	Edeka / KKE	Alepa
Technology Options			
Medium Temperature	 Scroll R290  Scroll R290 VSS	 Stream R744  VSS  OM5	 Stream R744  VSS  iProRACK
Low Temperature	 Scroll R744  Scroll R744 Digital  Sound shell	 Scroll R744  Scroll R744 Digital  OM5	 Stream R744  VSS
Benefits	Compactness Investment Cost Operational Cost	Applied Cost Savings Residential Areas Compact & Quiet	High Design Pressure Preventive Maintenance Total Emerson Solution

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Thank you very much!