CHILLVENTA eSPECIAL

Refrigeration | AC & Ventilation | Heat Pumps

13.–15.10.2020

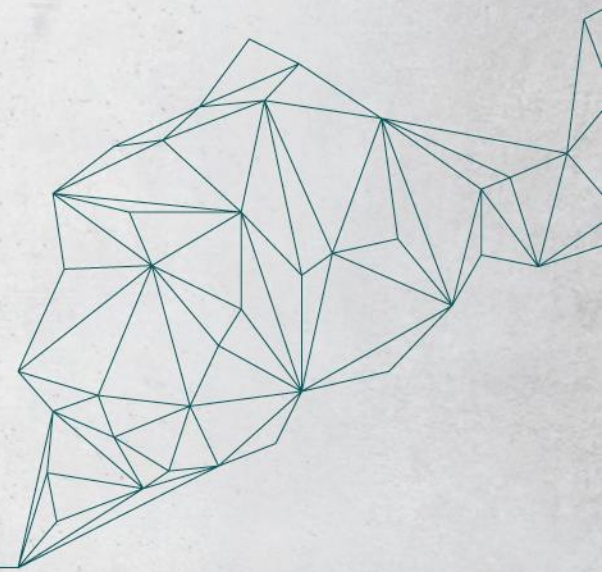
CONNECTING EXPERTS.

NÜRNBERG MESSE

CO_2 Gas Cooler: the keystone for efficiency

Katherina Pesenti – Product Manager

CONNECTING EXPERTS.



The Group

CHILLVENTA eSPECIAL

LU-VE GROUP
leadership with passion

- Over 3.200 skilled employees
- Consolidated Turnover € 420 million
- Listed on the Milan Stock Exchange

LU-VE EXCHANGERS | AIA LU-VE | ALFA LU-VE | LU-VE COILS | TGD ThermoGlassDoor | TECNAIR LV

16 PRODUCTION FACILITIES

15 SALES COMPANIES

Markets

Air conditioning

HVAC for buildings and industry units, Data Centres, Hospitals, Transport, Heat pumps, Telecommunications

Refrigeration (Commercial / Industrial)

Commercial and industrial refrigeration, All fresh conservation, Freezing processes, Foodstuff processes, Storage & Logistics, Seasoning, Display case units, Cabinet units, Dispenser units, Ice makers, OEM

Industrial Cooling - Energy & Power

Power generation, Process cooling, Motor cooling

Rediscovering CO_2

- **CO_2 (R-744)** widely used as refrigerant in the early 20th century.
- **1930-1940** with the advent of the fluorocarbon chemicals its use almost disappeared
- **2000**: Increasing focus on environmental issues created a strong interest in natural refrigerants.

GWP = 1

Thermodynamic properties:

- High evaporation heat
- Low viscosity

High pressures

Low critical point

Not toxic nor flammable

The CO_2 challenge

The real challenge is to design plant with an efficiency level equal or higher than current HFC plants.

TARGETS:

1. Cost effectiveness

2. Avoid indirect pollution

Our answer: research & development

CHILLVENTA eSPECIAL

1st CO_2 private test facility in EUROPE (2010)

Our answer: research & development

CHILLVENTA eSPECIAL

1st **CO_2** private test facility in EUROPE (2010)

- Behaviour of the fluid during trans-critical cooling
- Influence of oil on internal heat exchange
- Calculate reliable product performances

EUROVENT CERTIFIED PERFORMANCE www.eurovent-certification.com

CO_2 Activities

CHILLVENTA eSPECIAL

1st CO_2 worldwide transcritical installation

2004 in EUROPE (Coop, Wettingen)

Gas cooler with water spray system

2015 in LATIN AMERICA (Carrefour, Colombia)

2016 in RUSSIA (Magnit, Voskresensk)

2018 in INDIA (INDEE project, Chennai)

2018 in MIDDLE EAST (Al-Salam, Amman)

2019 in ARABIAN GULF (Masdar City, Abu Dhabi)

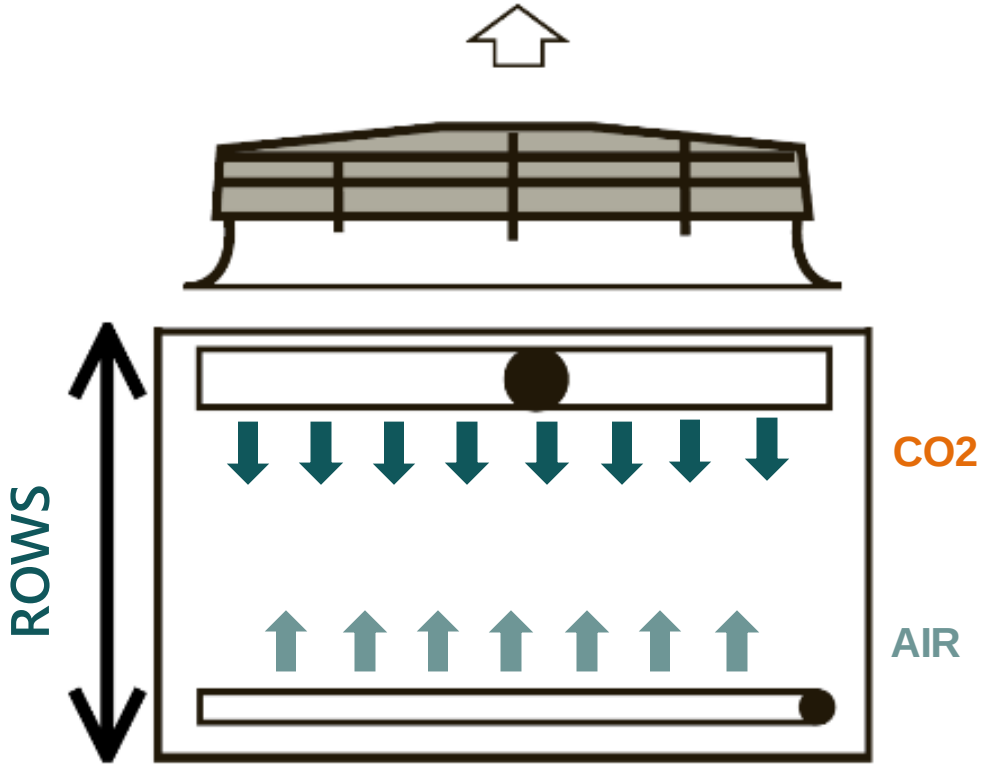
Gas cooler design

TARGETS:

1. High cycle COP → Low CO_2 outlet temperature ↓

2. Energy savings → Energy efficient fan consumption ↓

Heat exchanger design



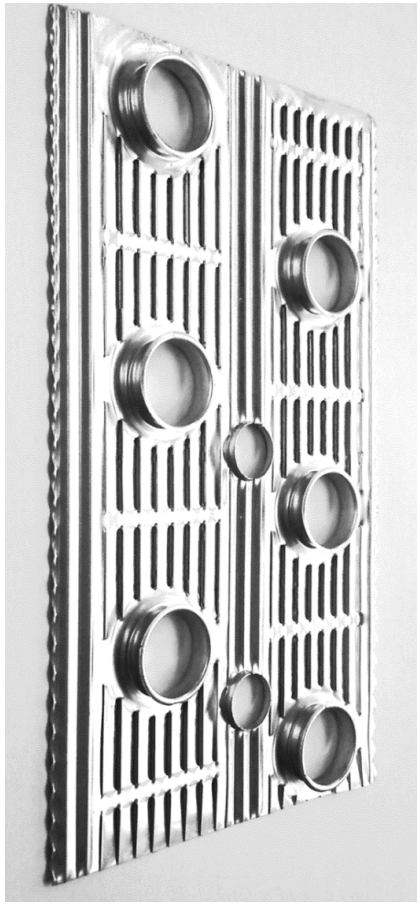
COUNTER-FLOW
High number of **ROWS**

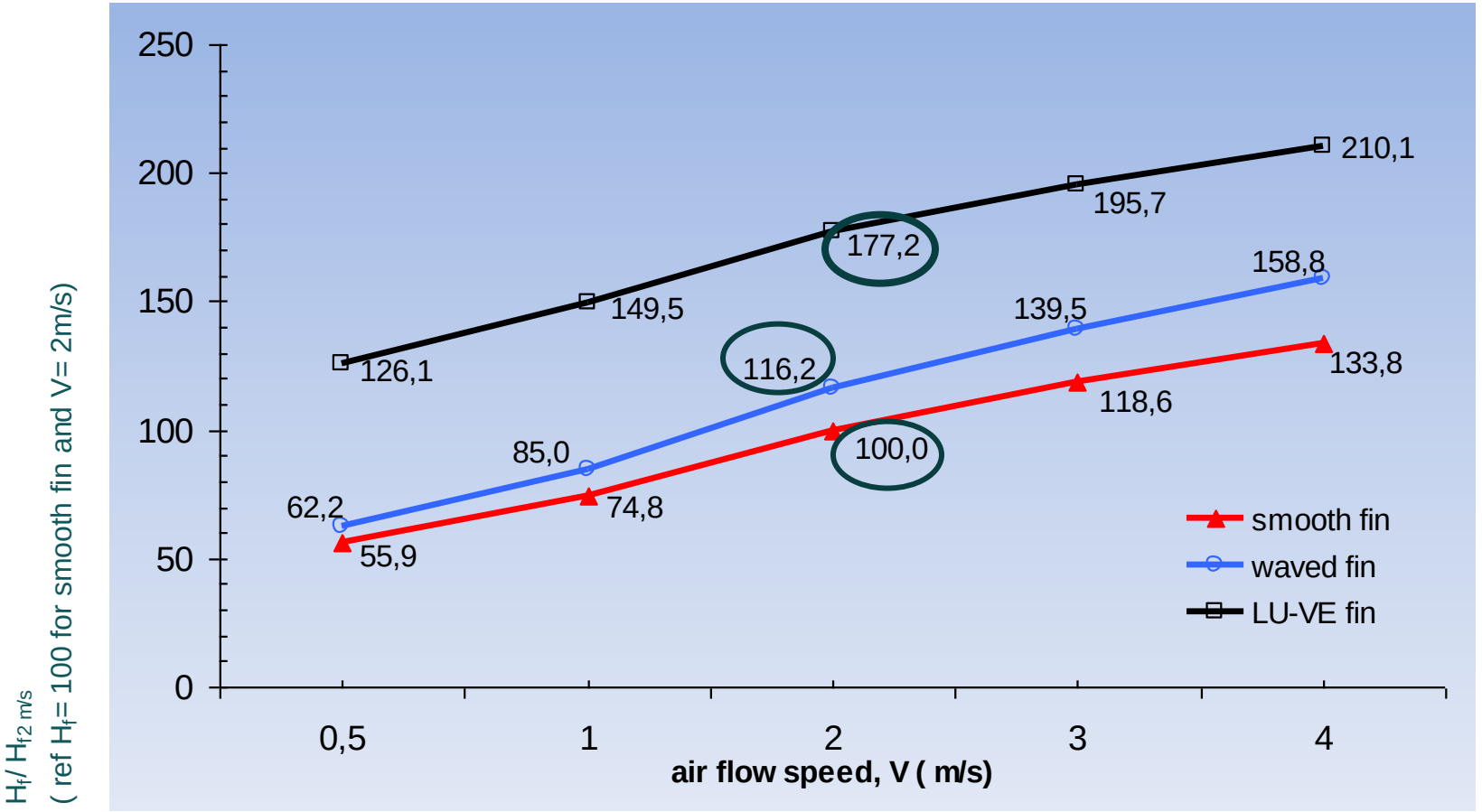
Reduce approach DT
Minimize the CO_2 outlet temperature

HIGHER SYSTEM COP

Louvered fins

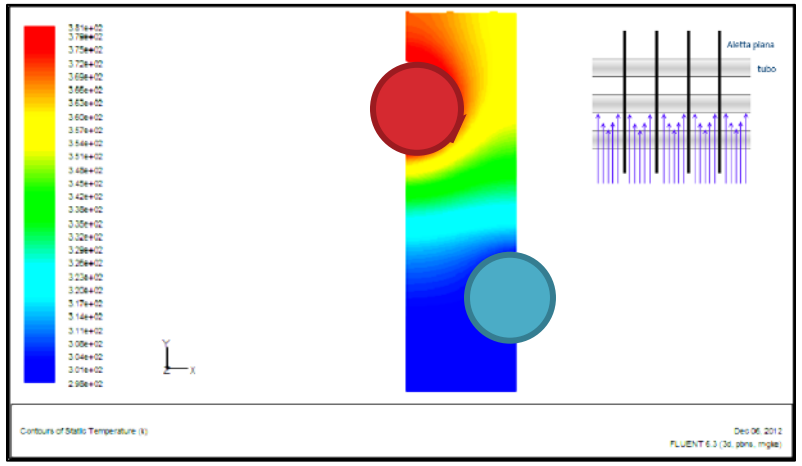
Thanks to the louvered fin is possible to increase the external heat transfer coefficient H_f up to 80%





Louvered fins

FLAT FIN

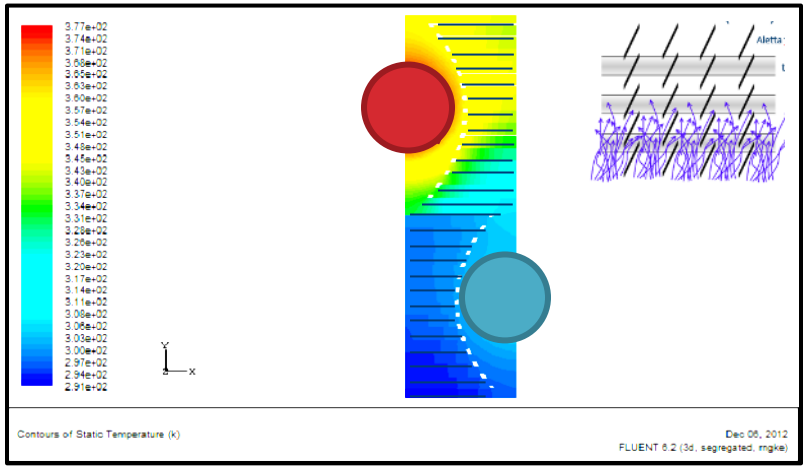


- High DT at the interface:

> 35% parasitic heat transfer

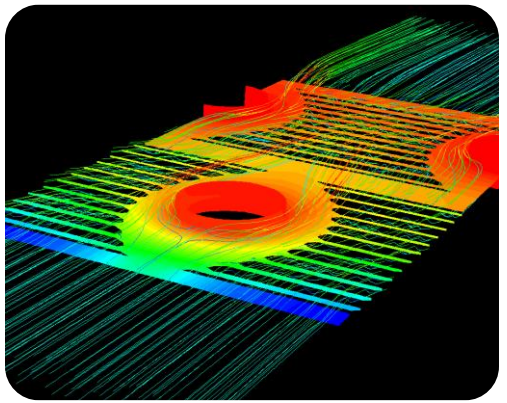
➡ Impact on gas cooler's **capacity 5-10%**

LOUVERED FIN



- DT at the interface negligible:

< 4% parasitic heat transfer



Whisperer PLUS

New **circular silencer** that combines the following features:

Soundproof material

Conical shape → **pressure recovery** through diverging duct

- **Noise level reduction**
- Increase of the air flow @ same rpm
  → **lower energy consumption**

Whisperer PLUS

Model XAV9X 7923 with EC fans

6 x Ø 910 mm fans

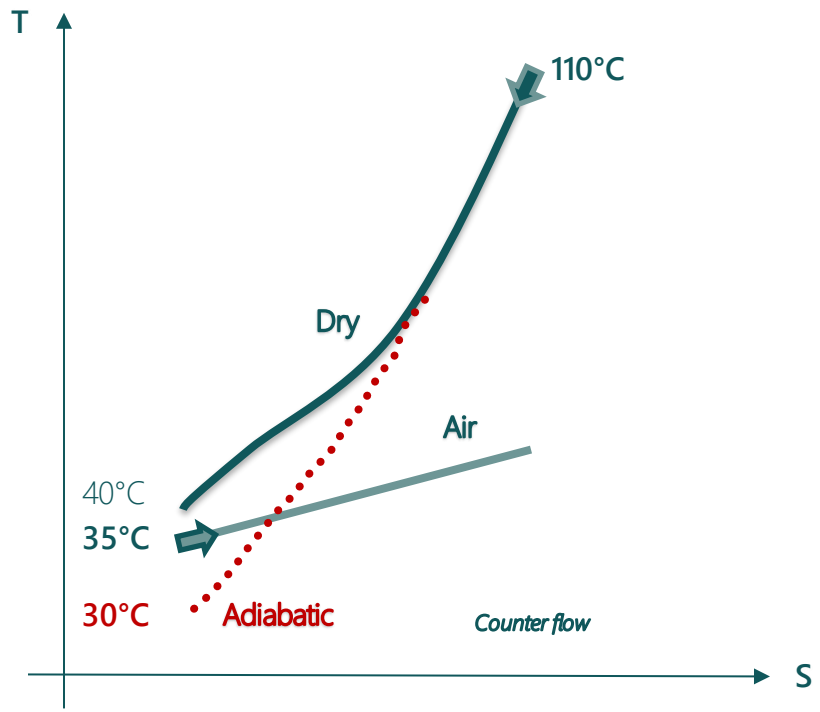
L = ca. 7 m

XAV9X 7923	Capacity [kW]	Rpm	Air quantity [m³/h]	Power consumption [W]	Sound level [dB(A)]
No Whisperer	446	700	119.570	5.465	51
With Whisperer	446	650	119.570	4.340	46

-26% **-5 dB(A)**

Adiabatic pre-cooling

How to reduce CO_2 outlet temperature in a gas cooler during the warmest days?



Transcritical conditions

Adiabatic pre-cooling is a **smart choice**.

The evaporation of the water on the pads cools down the air by humidifying it.

In this way it is possible to keep the CO_2 pressure low and assure a high COP even during summer.

Adiabatic pre-cooling - CASE STUDY

CHILLVENTA eSPECIAL

Application: Supermarket
Location: Gorinchem (NL)
Year: 2018

KONING KOUDETECHNIEK ijskoud de beste!

COOLSULTANCY® ROB JANS

RECUPAIR

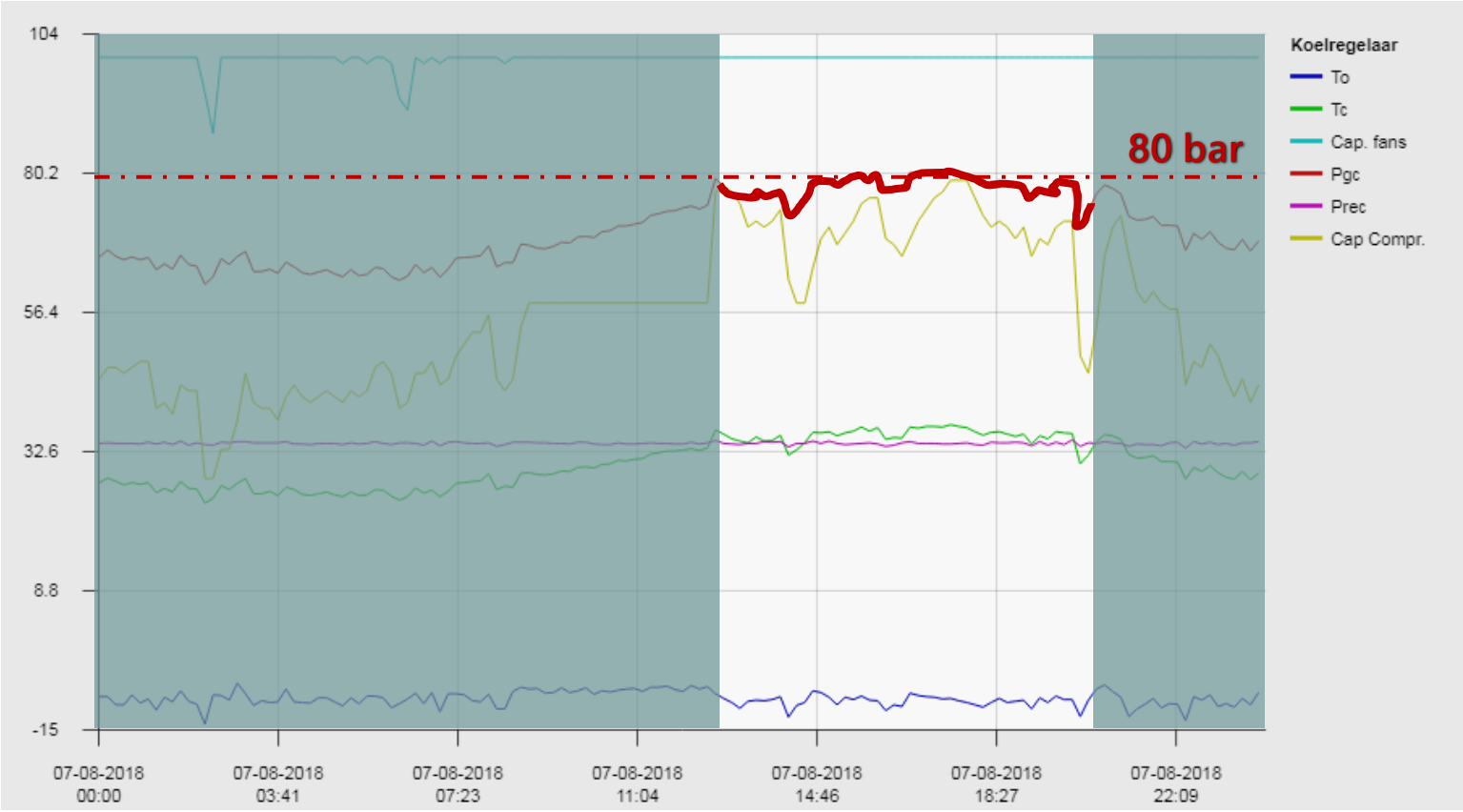
Adiabatic pre-cooling - CASE STUDY

V-Shape gas cooler with adiabatic pads

Adiabatic System

Adiabatic pre-cooling - CASE STUDY

7 August 2018: hottest day of the year



Average temperature: 38°C from 12 AM to 8 PM

Adiabatic pre-cooling - CASE STUDY

CHILLVENTA eSPECIAL

DRY GAS COOLER

CO_2 out temp. = 40°C

CO_2 pressure = 95 bar

COP = 1,5

Adiabatic System

CO_2 out temp. = 32°C

CO_2 pressure = 80 bar

COP = 2

~ 38°C amb. temp.

+ 33%

Conclusions

- **Counter flow** and high **number of rows** increase the heat exchanger efficiency
- **Louvered fins** not only increase the external heat transfer coefficient but also reduce the parasitic heat transfer to the minimum.
- **The Whisperer** decreases noise and energy consumption
- **Adiabatic pre-cooling** make transcritical CO_2 suitable for warmer countries

Thank you for your attention.

CONNECTING EXPERTS.