



CARBON DIOXIDE REFRIGERATION SYSTEMS FOR SUPERMARKETS APPLICATIONS

GIACOMO PISANO

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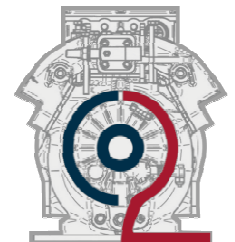
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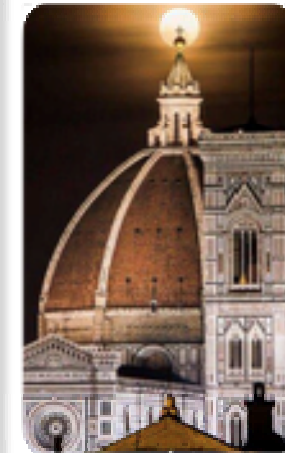
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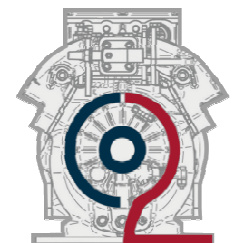
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1. INTRODUCTION



- WORKING ON CO₂ TRANS-CRITICAL COMPRESSORS SINCE 1995
- APRIL 2019: DORIN USA



2. CO₂ AS A REFRIGERANT: REASONS WHY IT IS SO GOOD

- FABOLOUS 4 REASONS:

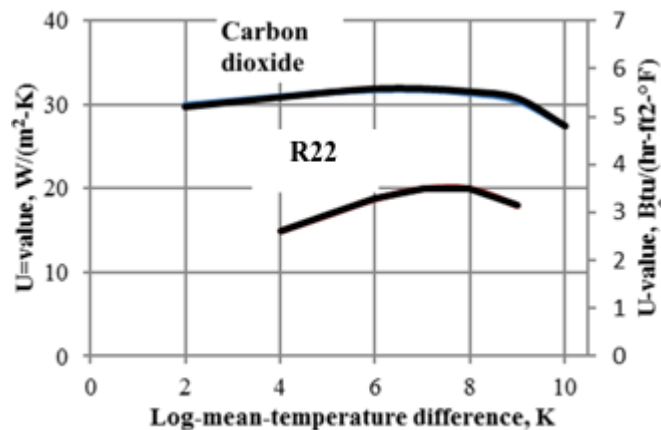
- NO TOXIC – NO FLAMMABLE – NO GWP – NO ODP

- BESIDE THE FABOLOUS 4 REASONS

- CO₂ IS SIMPLY A GREAT REFRIGERANT – IN A NUT SHELL:





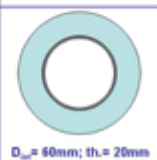

- HIGH WORKING PRESSURES

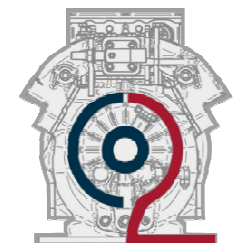
- BETTER HEAT TRANSFER



- LARGER SPECIFIC CAPACITY

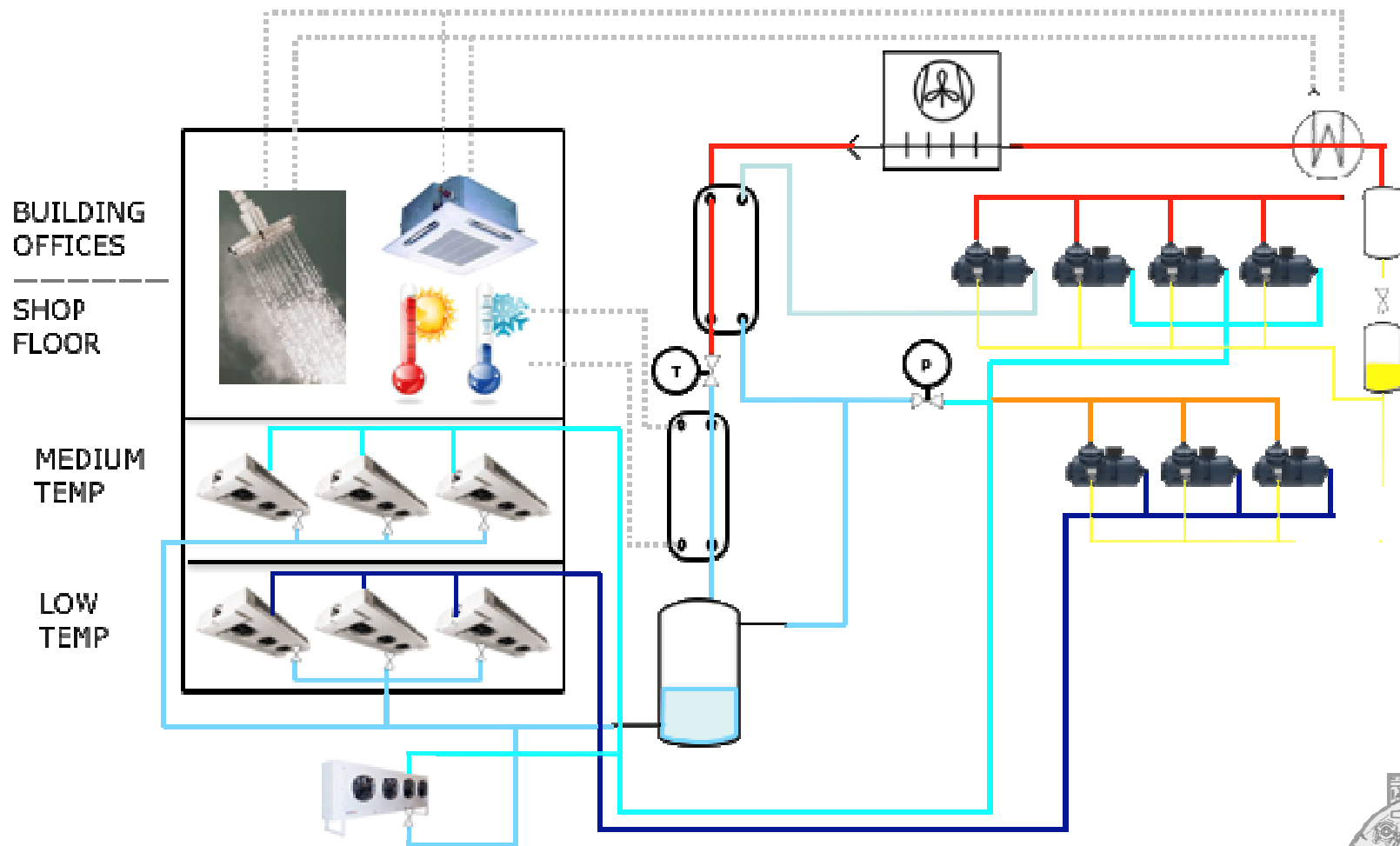
- SMALLER PIPE DIAMETERS

	FLUID		
	R404A (~ 300 W tot)	Propylene Glycol (~ 600 W tot)	CO ₂ (~ 300 W tot)
LIQUID	 D _{int} = 25 mm	 D _{int} = 40mm; th. = 20mm	 D _{int} = 17mm; th. = 10mm
SUCTION LINE	 D _{int} = 50mm; th. = 15mm	 D _{int} = 60mm; th. = 20mm	 D _{int} = 20mm; th. = 10mm

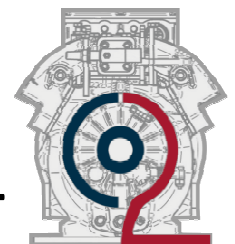


2. CO₂ AS A REFRIGERANT: REASONS WHY IT IS SO GOOD

- LARGE ENTHALPIES IN HP LINE
- EFFICIENT HEAT RECOVERY
- INTERMEDIATE PRESSURE LEVELS
- HVAC INTEGRATION

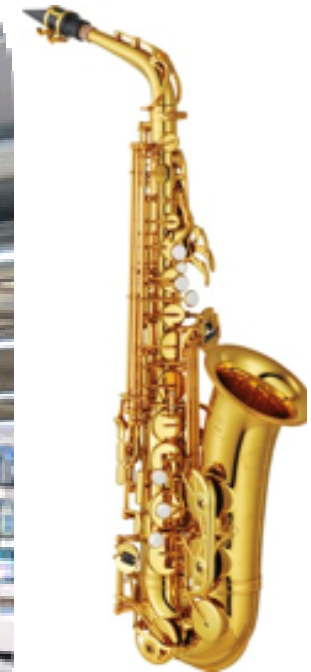


- ONE CONTRACTOR ONLY DOES IT ALL WITH CO₂
- THE POINT OF SALES BECOMES TOTALLY ENERGY SELF SUFFICIENT

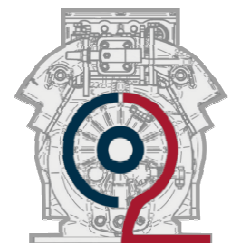


2. CO₂ AS A REFRIGERANT: REASONS WHY IT IS SO GOOD

- ONE CONTRACTOR ONLY DOES IT ALL WITH CO₂
- THE POINT OF SALES BECOMES 100% ENERGY SELF SUFFICIENT

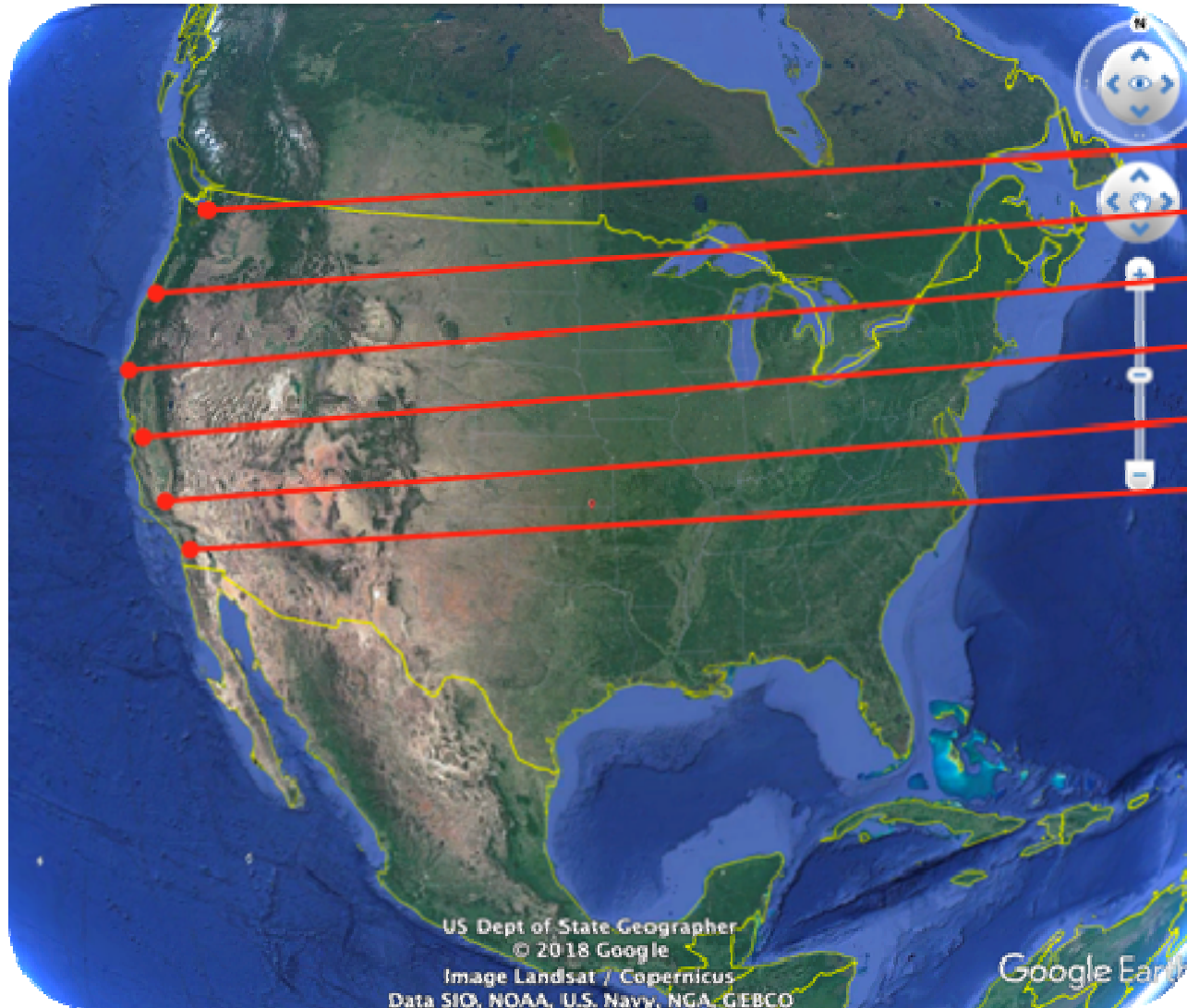


- 200+ CO₂ SUPERMARKETS WORKING WITH THIS PRINCIPLE IN EU
- dorin.com: SOFTWARE IS AVAILABLE FOR TOTAL SYSTEM DESIGN



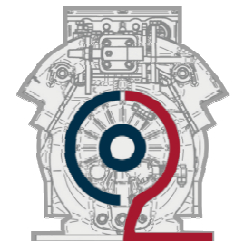
3. SUPERMARKET REFRIGERATION: CO₂ IS GREAT WITH ANY CLIMATE

- ENERGY EFFICIENCY COMPARISON: GROCERY STORE
- R404A DX vs CO₂ EJECTOR: 600 kbtu/h MT – 120 kbtu/h LT – 0.10 \$/kWh



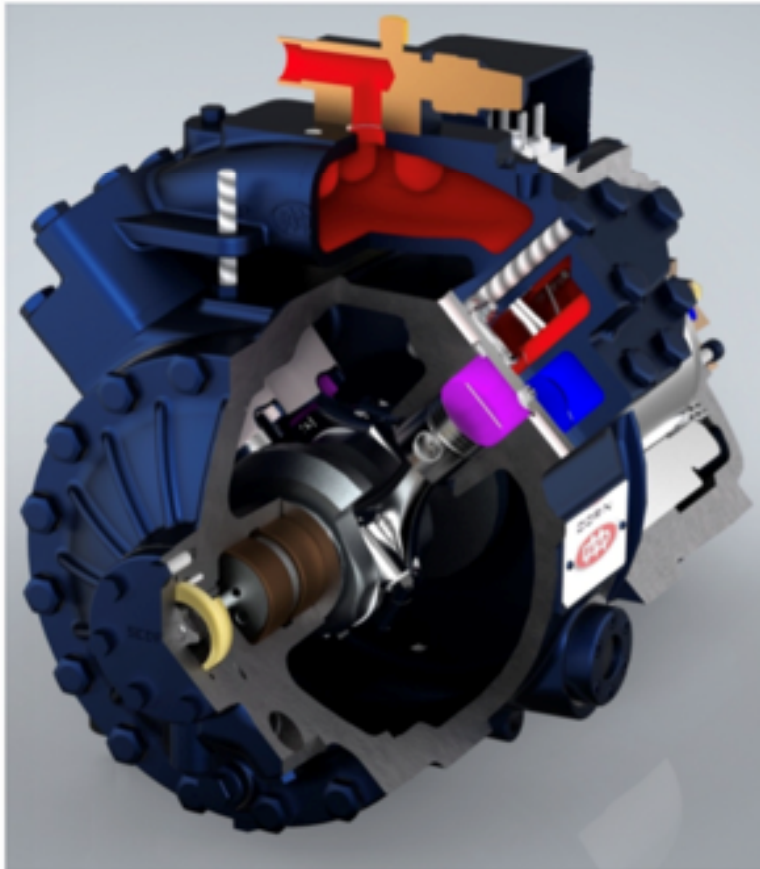
- 15.000 \$ / Y
- 13.500 \$ / Y
- 12.000 \$ / Y
- 9.000 \$ / Y
- 5.000 \$ / Y
- 3.000 \$ / Y

**MODERN CO₂
TECHNOLOGY BRINGS
COST SAVING AT
EVERY LATITUDE**

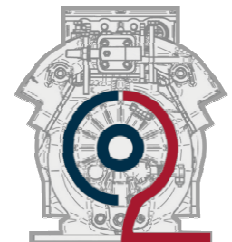


4. DORIN CO₂ COMPRESSORS: BEST FIT FOR HIGH EFFICIENCY APPLICATIONS

- **CO₂ HIGH EFFICIENCY SOLUTIONS CALL FOR**
 - **PARALLEL COMPRESSION: HIGHER SST and LOWER SUPERHEAT**
 - **EJECTOR (OVERFEED) TECHNOLOGY: NO SUPERHEAT AT ALL**
- **SEVERE COMPRESSORS CHALLENGES**
- **DORIN IMPLEMENTED AUTOMOTIVE SOLUTIONS (COMBUSTION ENGINES)**



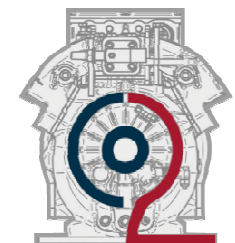
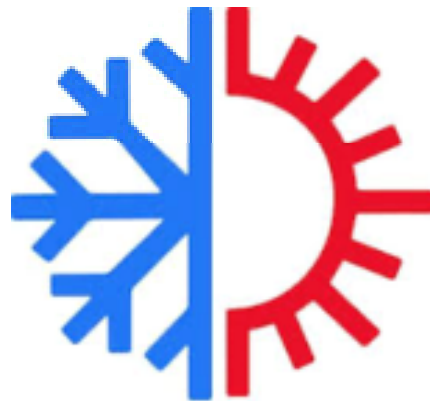
- **EXTERNAL DISCHARGE MANIFOLD**
- **PERFECT HP / LP THERMAL INSULATION**
- **LOWER OIL TEMPERATURES**
- **VERY SMOOTH OPERATION**
- **VERY LIMITED VIBRATIONS**
- **COATING / SUPERFINISHING**
 - **SHAFT NECKS**
 - **WRIST PINS**
 - **BEARINGS**
 - **PISTON SKIRTS**



5. CONCLUSIONS

*... CO₂ IS AS CLOSE TO THE IDEAL
REFRIGERANT AS IT IS POSSIBLE TO COME ...*

Prof. GUSTAV LORENTZEN - 1993



THANK YOU !

