

Applications with Natural Refrigerants

Spain & Portugal. Situation and Experiences.

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Chillventa, October 2018

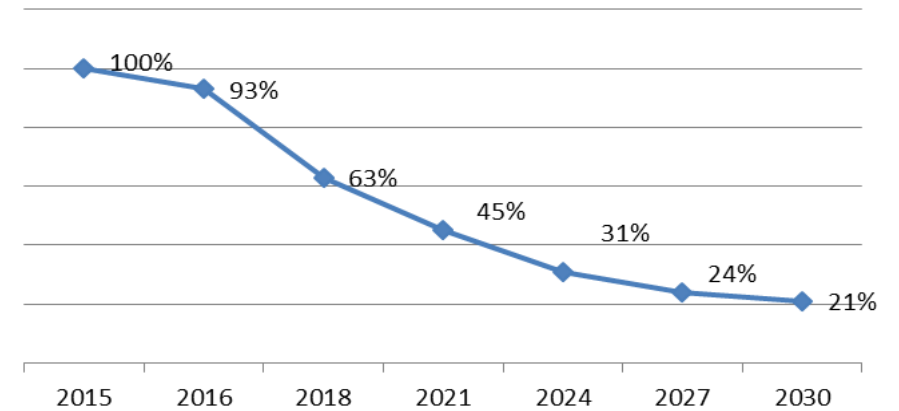


Impact of F-Gas in Spain

- Minimal reduction in allocations in 2016. Significant impacts in 2017 and 2018, which will lead to high price increases
- Spain also started Climate Protection actions by implementing **Special Tax**.

Gas	GWP	Total Price per Kg Sept 18 (€)	Breakdown of prices (€)	
			Cost of Gas	Cost of Taxes
R134a	1.430	60,52	44,02	16,50
R404A	3.921	116,49	57,67	58,82
R407F	1.824	57,69	30,32	27,37
R422A	3.142	102,44	55,30	47,14
R434A	3.245	123,21	74,53	48,68
R507A	3.985	123,08	63,3	59,78
R513A	629	44,84	35,4	9,44

Phase Down Target



Price of Gas has multiplied by 20 in the last 10 years !!!

Selection Criteria to alternatives to HFC Refrigerants.

**THERE IS NOT A DEFINITIVE ANSWER.
IT DEPENDS ON A COMBINATION OF FACTORS**



- ✓ Energy Efficiency
- ✓ Security (Inflammability, toxicity ...)
- ✓ Compatibility and ease of Retrofitting of the existing installation
- ✓ Size of the installation (small or large)
- ✓ Required Temperature of the services
- ✓ Future of the Refrigerant → Availability, future Cost and Taxes

Natural
Refrigerants

✓ FOR THE END USER

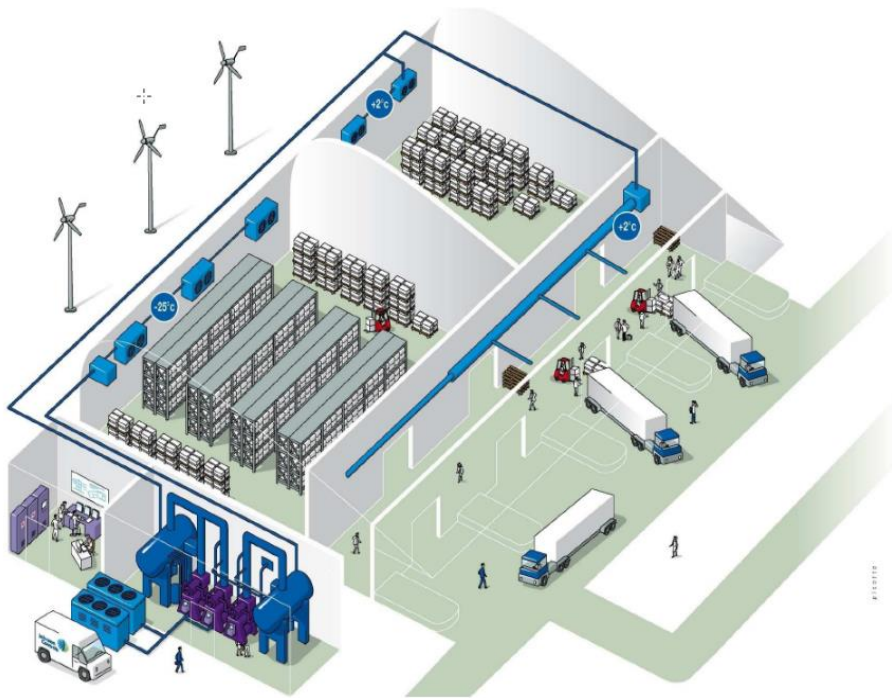
- ✓ Maintenance Contract with a Refrigeration Company.
- ✓ Civil Responsibility Insurance of 900 k€.

✓ FOR THE INSTALLATION

- ✓ Design and execution according to National Regulations (RSF/RD 138-2011) based on EN378 (under revision).
- ✓ No charge limitation. No extra safe requirements.
- ✓ Very few requirements if the charge is under 50 kg.

R717 Applications

Cold store



100% of **Large Industrial Installations** for Food Processing, Storage and Delivering

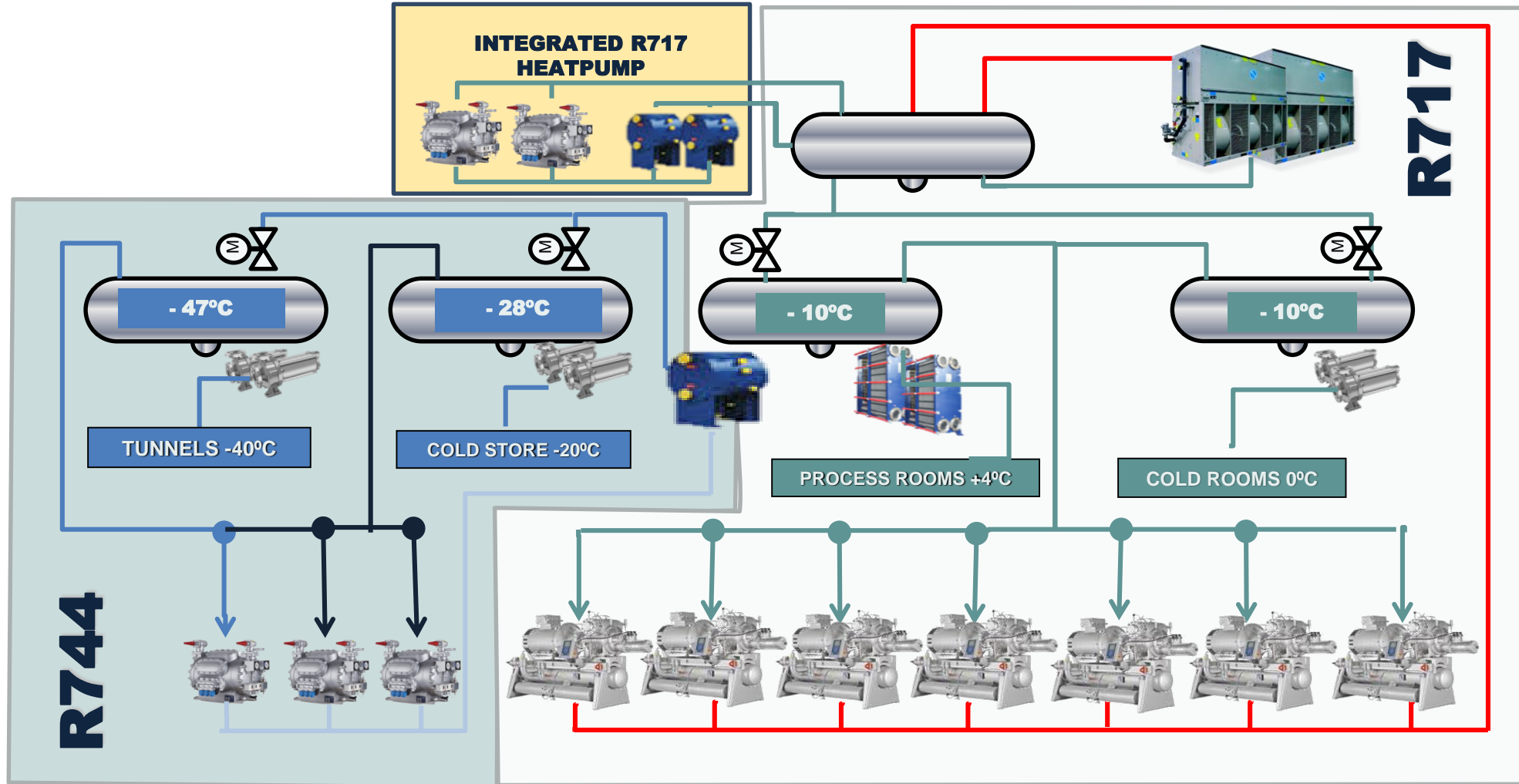
Perfect Combination with **Glycol** for Process Rooms with positive Temp

Perfect Combination with **CO2 subcritical** for Freezing Tunnels or Cold Store

Petrochemical Production and some Pharmaceutical applications

Industrial Heatpumps (from 500 kW to 7.000 kW).

R717 Application Food Factory



R717 Chiller Application

Water chillers (Water: inlet 12°C, outlet 7°C)

Type	Cooling capacity kW	R717 charge kg
ChillPAC 104 S-A	233	14
ChillPAC 104 L-A	294	15
ChillPAC 106 S-A	346	17
ChillPAC 104 E-A	357	17
ChillPAC 106 L-A	440	21
ChillPAC 108 S-A	464	22
ChillPAC 106 E-A	536	24
ChillPAC 108 L-A	588	26
ChillPAC 112 S-A	690	29
ChillPAC 108 E-A	715	30
ChillPAC 112 L-A	878	36
ChillPAC 116 S-A	921	37
ChillPAC 112 E-A	1066	41
ChillPAC 116 L-A	1167	45
ChillPAC 116 E-A	1398	49



$KW/kg = 16.7 \text{ to } 28.6$

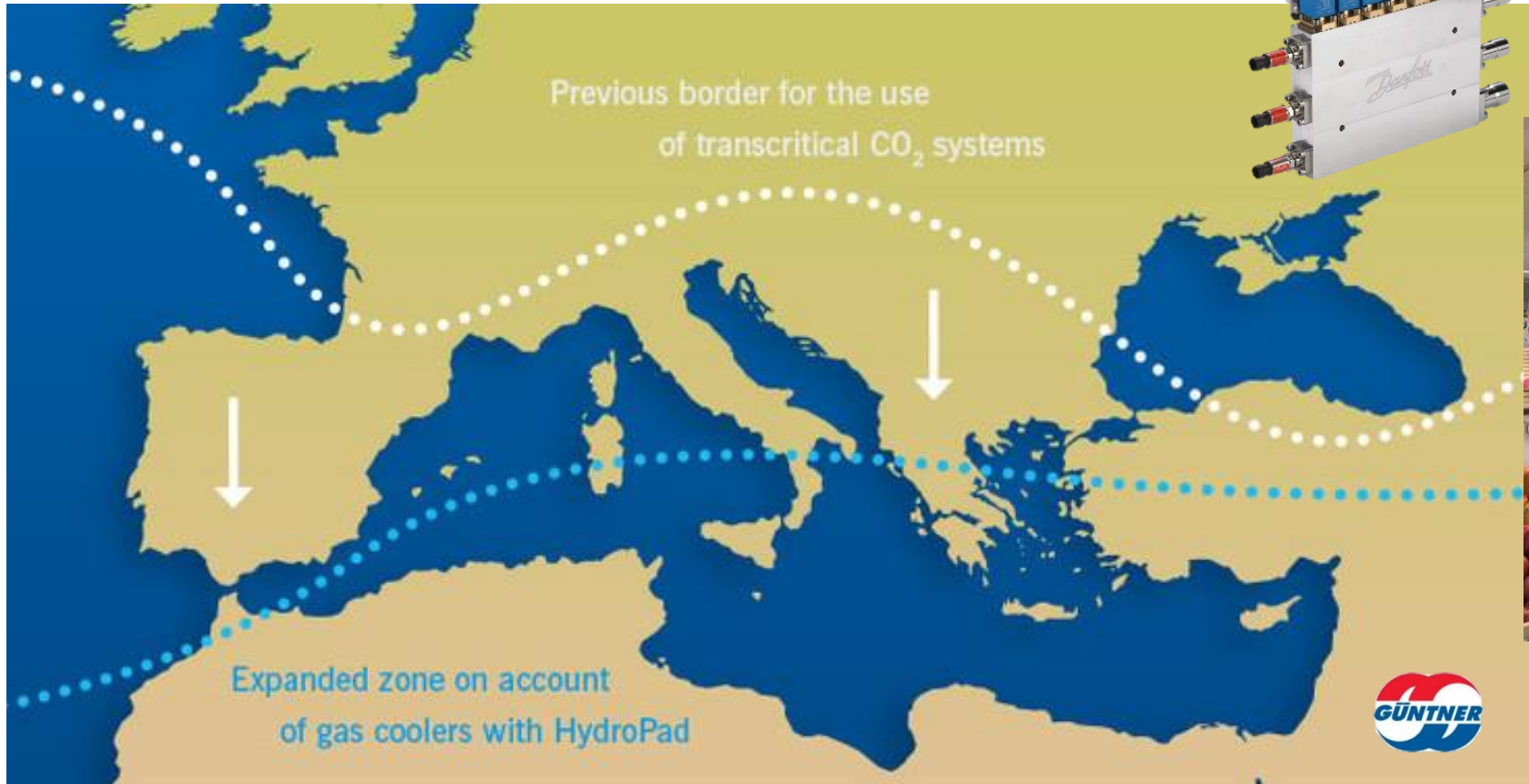


R744 Subcritical

- ✓ Perfect combination with a HP Stage with NH3.
- ✓ Great Performance (COP) at Low Temperatures.
- ✓ First Industrial Installation in 2003 in Spain and in 2009 in Portugal



R744 Transcritical





R170	ETHANE	C₂H₆
R290	PROPANE	C₃H₈
R600	BUTANE	C₄H₁₀
R600a	ISOBUTANE	C₄H₁₀
R1270	PROPYLENE	C₃H₆

R290 / R1270



Technical data			
Type	Cooling capacity kW	COP ESEER	R290 charge kg
SABlight A95-1	129	4.6	20
SABlight A95-2	128	4.6	20
SABlight A140-1	180	5.0	24
SABlight A140-2	188	5.1	32
SABlight A200-1	237	5.0	24
SABlight A200-2	238	4.9	32
SABlight A260-1	297	5.1	32
SABlight A260-2	301	5.2	40
SABlight A340-1	350	5.0	32
SABlight A340-2	346	5.0	48
SABlight A400-1	432	5.3	48
SABlight A400-2	428	5.3	56



KW/kg = 6.5 to 7.7



12 Kg Butane



R290 / R1270

Model with R290:	Power (watt)	Charge gas gr.
MGM10702Y	1281	220
MGM11002Y	1312	220
BGM11002Y	1038	330



Model SB/AS with R1270:		
MSB135N02P	2788	320
MSB135T02P	3631	320
BSB135T02P	2865	240

Watt/gr = 176



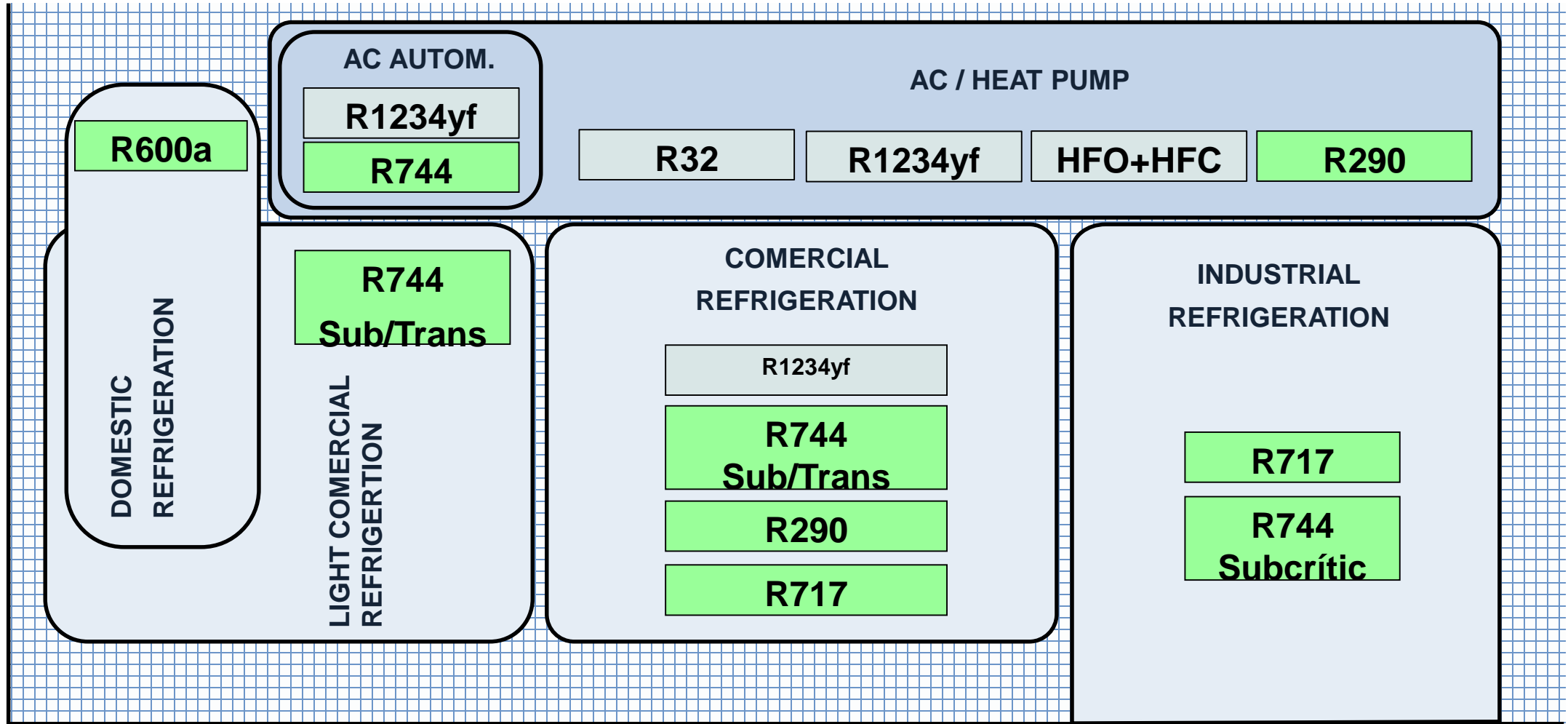
VIC 440 CSV

Plug-in units



Refrigerants Applications

EVAPORATION TEMPERATURE



CAPACITY [kW]

This course allows trainees to learn the characteristics of the ammonia refrigerant from the thermodynamic, safety, regulation and implementation criteria.
The course is performed in a training facility, wearing safety equipment and led by highly qualified instructors.

Instructor-led class

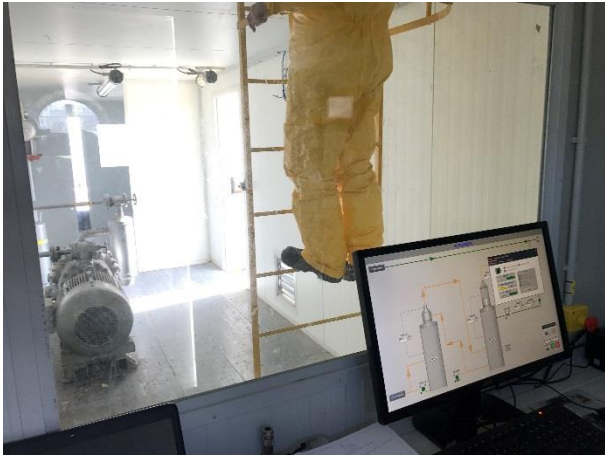
- Ammonia in theory
- Rules for ammonia safe handling
- Prevention and safety rules
- Preventive maintenance operations
(leak detection, oil sample, ...)
- Safety equipment operation
(breathable air autonomy calculation, equipment verification, ...)



So Realistic it Could be True

On Simulation site/platform

- First part is designed to detect people suffering from claustrophobia and to get trainees comfortable by wearing safety equipment with breathing apparatus
- Operations will be done in a simulation area under specific real-life site conditions (cold smoke, low light, low ceiling, noise, ...)



So Realistic it Could be True

On Simulation site/platform

- Second part is aimed to build further confidence and practice when performing certain operations wearing safety equipment
- Repair of real ammonia leak using safety equipment
- Safety suits flushing procedure before removing



eurammon is always available as a sparring partner for questions on refrigeration with natural refrigerants.

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