Ammonia NH_3 Chillers

A Zero-GWP Innovative product in refrigeration & air-conditioning

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Engineering Energy Systems

ENGINEERING ENERGY SYSTEMS

Why it was developed a new Ammonia chiller?

Use the potential of ammonia –
high volumetric efficiency

Minimize the „fear“ concerning ammonia –
be as hermetic as possible

Offer a solution for Freon substitution –
minimize size

Use the advantage of a highly standardized product –
short delivery & competitive price

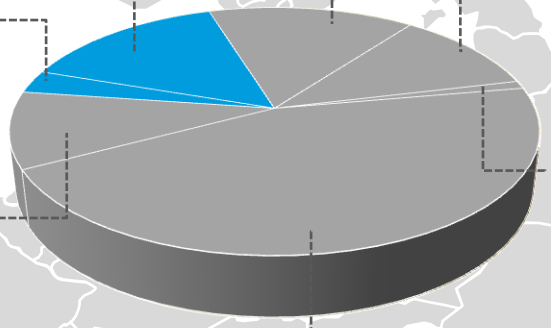
Follow EU directives

HFC Refrigerant consumption in Europe

AC chiller*
15 %

Process cooling
3 %

Household
10 %



Commercial refrigeration
15 %

AC/air handling units
11 %

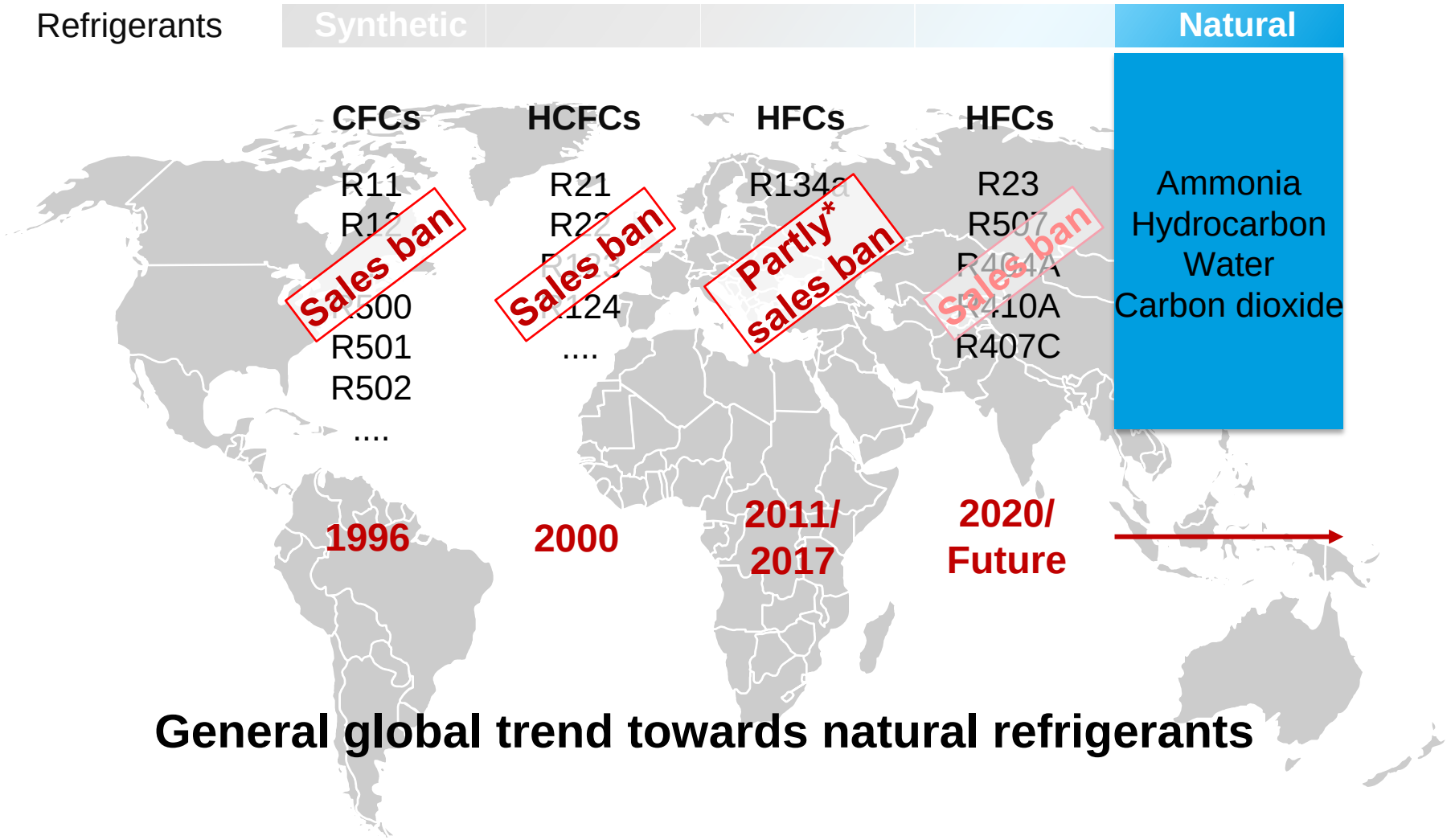
Transportation
1 %

Car AC**
45 %

Ammonia Chillers market potential in AC chiller and process cooling

* AC chiller market size is approx. 40,000 units / 5% within the possible size range
** ban for R134A at new developed cars since 2011

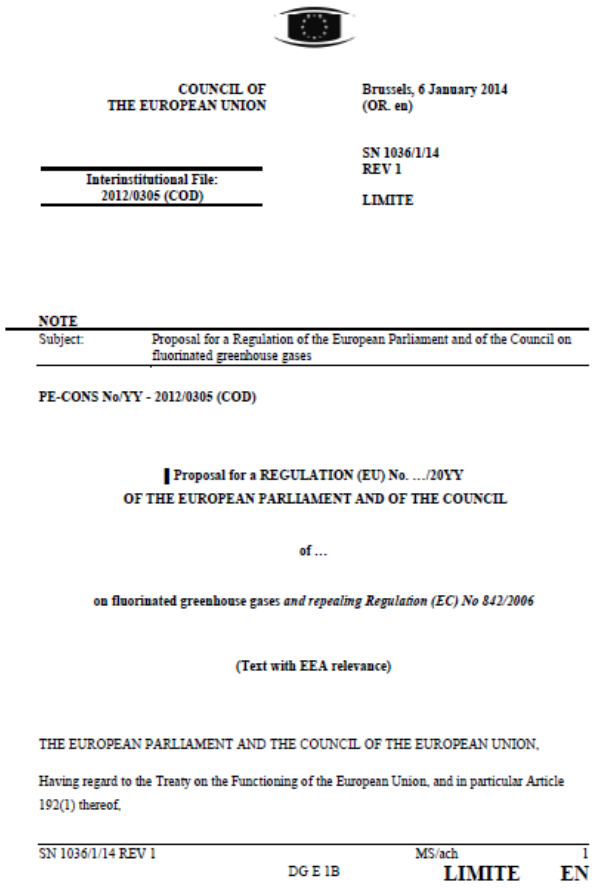
World refrigerant market trends



General global trend towards natural refrigerants

* Air conditioning in cars in EU

New F-GAS Regulation



COUNCIL OF THE EUROPEAN UNION

Brussels, 6 January 2014 (OR. en)

SN 1036/1/14 REV 1

LIMITE

Interinstitutional File: 2012/0305 (COD)

NOTE

Subject: Proposal for a Regulation of the European Parliament and of the Council on fluorinated greenhouse gases

PE-CONS No/YY - 2012/0305 (COD)

Proposal for a REGULATION (EU) No. …/20YY
OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL

of …

on fluorinated greenhouse gases *and repealing Regulation (EC) No 842/2006*

(Text with EEA relevance)

THE EUROPEAN PARLIAMENT AND THE COUNCIL OF THE EUROPEAN UNION,

Having regard to the Treaty on the Functioning of the European Union, and in particular Article 192(1) thereof,

SN 1036/1/14 REV 1 MS/ach 1
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Products & Equipment	Date of Prohibition
Domestic Refrigerators & Freezers that contain HFCs with GWP>150	01-Jan-15
Refrigerators & Freezers for commercial use (hermitically sealed systems) with GWP>2500	01-Jan-20
Refrigerators & Freezers for commercial use (hermitically sealed systems) with GWP>150	01-Jan-22
Centralized Refrigeration Systems for commercial use with capacity >40KW that contain HFCs with GWP>150, except cascade systems with GWP<1500	01-Jan-22
Single Split AC systems containing less than 3Kg of HFCs, that contain HFCs with GWP>750	01-Jan-25

Sustainabillity with Ammonia R717

"The refrigeration and air conditioning industries with their synthetic refrigerants negatively effect the environment all over the world."

- Natural refrigerants are the obvious choice as a sustainable and ecological alternative to HFC's
- All natural refrigerants occur in nature's material cycle.
- They do not contribute to the depletion of the ozone layer and have no significant influence to the greenhouse effect.

Notifications

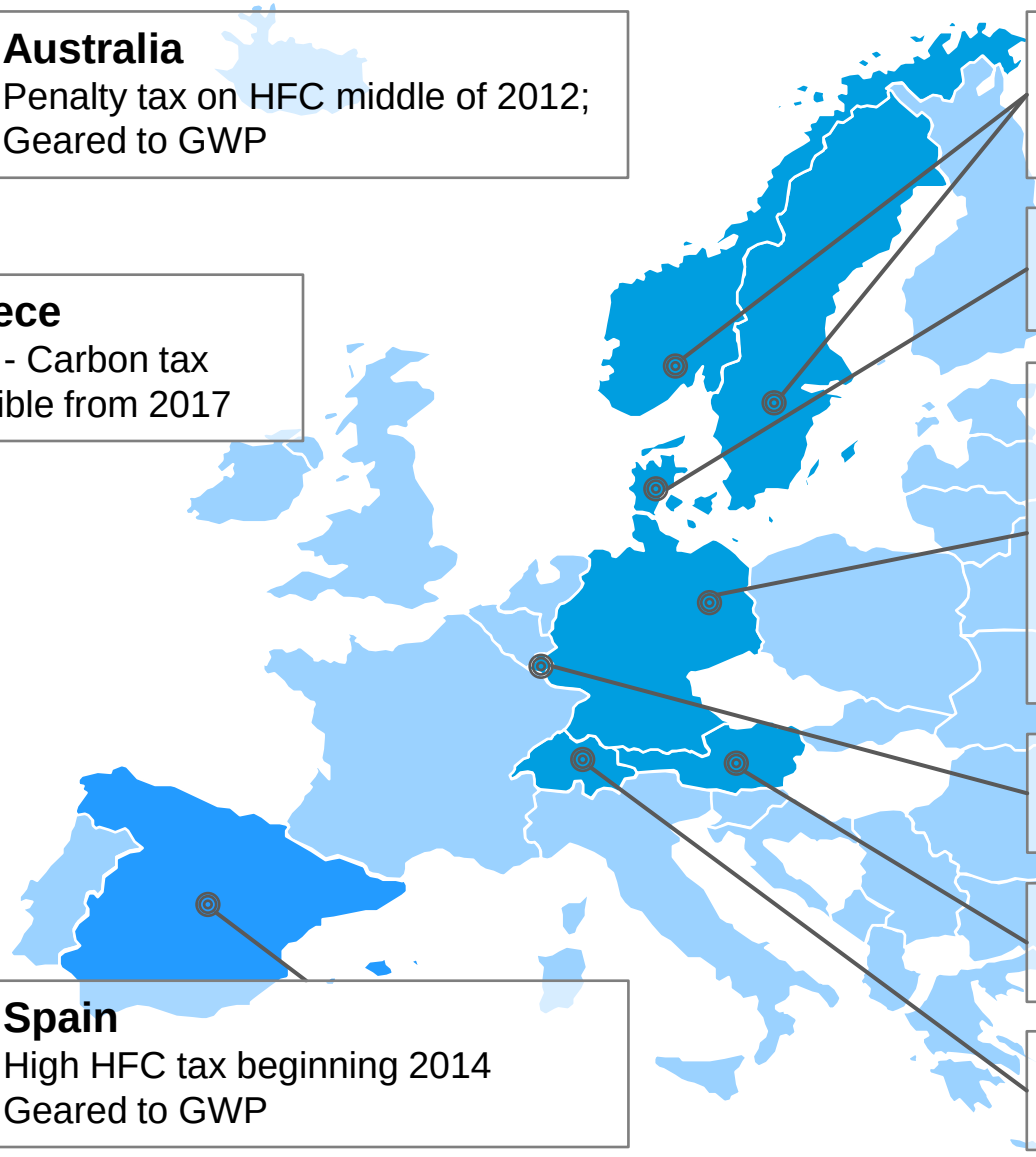
R717 - NH3: Lighter than Air, Characteristic Smell, Critical Handling Procedures

CO2: High Ambient Low Cooling Efficiency – High Pressure

R290: Highly Flammable

Refrigerant	GWP - Global Warming Potential	Indicative Prices €/Kg
R717 - NH_3	0	2
CO_2	1	7
R290	3	20
R134a	1430	4.5
410A	2088	4.8
404A	3922	4.8
407C	1774	5
407F	1705	5

Trends in Europe and Australia regarding HFC



Australia
Penalty tax on HFC middle of 2012;
Geared to GWP

Greece
HFC - Carbon tax
possible from 2017

Spain
High HFC tax beginning 2014
Geared to GWP

Norway & Sweden
Penalty tax on HFC e.g., in Norway
(+272.00 NOK/kg R134a (~ 35 €)

Denmark
Larger than 10kg HFC charge

Germany
Subsidies of up to € 200,000 for commercial refrigeration systems using CO_2, NH_3 or hydrocarbons
Annual inspection with leak test for HFC systems (1-4 times, depending on filling quantity)

Luxembourg
Decision according to TEWI value

Austria
Larger than 20kg HFC charge

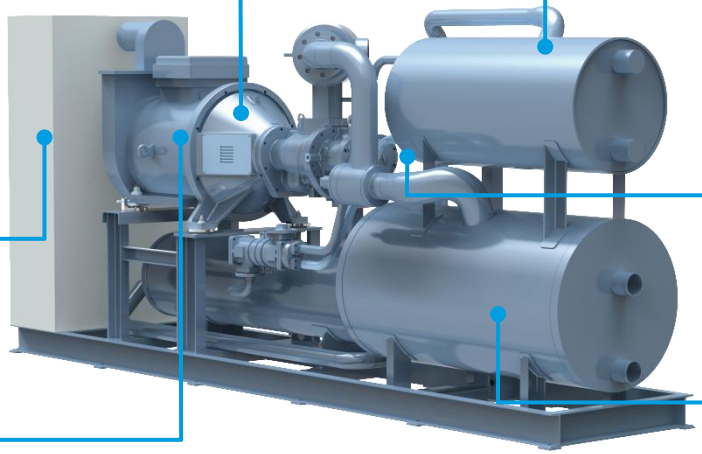
Switzerland
>300 kW Q_0 HFC

Ammonia Chiller design

High efficient screw compressor

Control unit

Electric motor VSD driven



Condenser

Expansion control

Evaporator/liquid receiver

Enclosure (optionally)

Ammonia Chiller Advantages

- Minimizing carbon footprint by using natural refrigerants
- Highest ESEER efficiency by applying newest technologies for all core components
- Small dimensions (door size and minimum footprint) – low required space
- Excellent low noise level and safety in design

Optimized for low TCO (total cost of ownership) and low TEWI (total equivalent of warming impact)

Advantage:
TCO reduction – minimum maintenance costs

Extended maintenance intervals

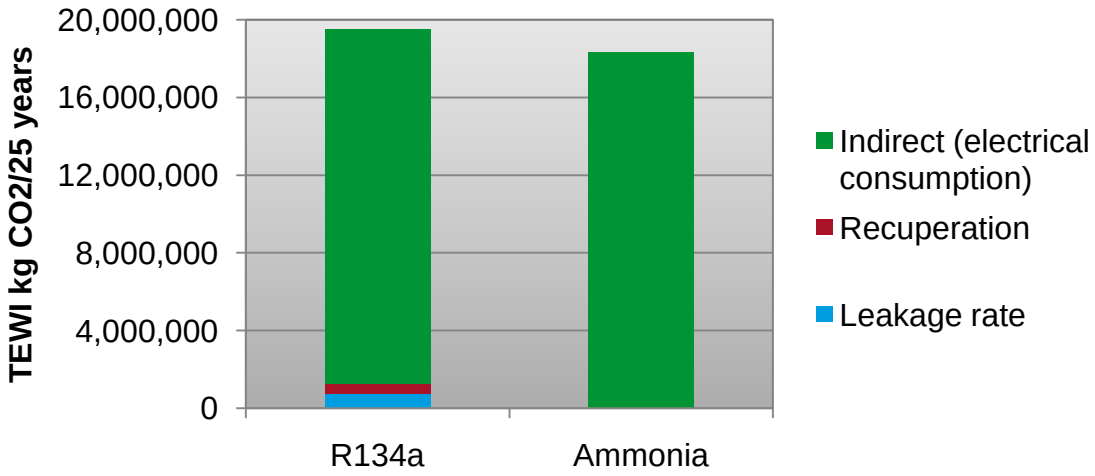
- Best possible “running” parts
- Always optimum speed chosen – VSD driven
- No oil change required if oil quality will be tested (external)
- Nominal services (all 5000 hours) only “Visual check”
- Regular oil services every 25,000h
- “Major Service” (no overhaul) at 50,000h recommended

Advantage:
TEWI reduction

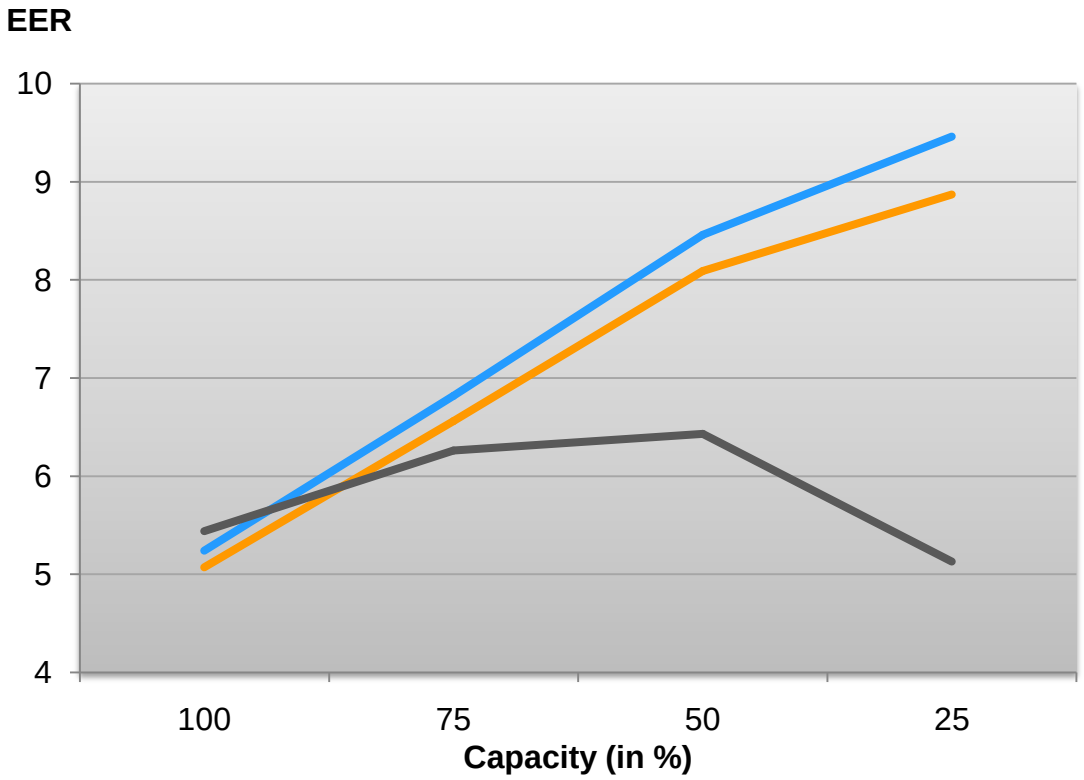
- TEWI judges the consequences of a refrigeration plant
- Life span examination of leakages; recuperation and energy consumption

Ammonia chillers have low TEWI (kg CO_2 equivalent) due to

- Using natural refrigerant ammonia → GWP (global warming impact) = 0
- No refrigerant losses acceptable due to lowest possible detection level (≈3ppm)
- Low refrigerant charge compared to HFCs chiller (1MW Cooling Capacity Chiller: 130Kg NH_3 compared with 200Kg R134a)
- High efficiency leads to minimized energy costs / CO_2 equivalent



Advantage:
Efficiency at part load and full load



Weighting of ESEER at different operating levels

100% = 0.03
75% = 0.33
50% = 0.41
25% = 0.23

Operating Curves

- NH_3 Chiller 6/12C
- NH_3 Chiller 7/12C
- Std R134a Chiller

Ammonia Chillers achieve the highest ESEER values

Advantage:
Door size – easy to install

Ammonia Chillers with door size for a standard door

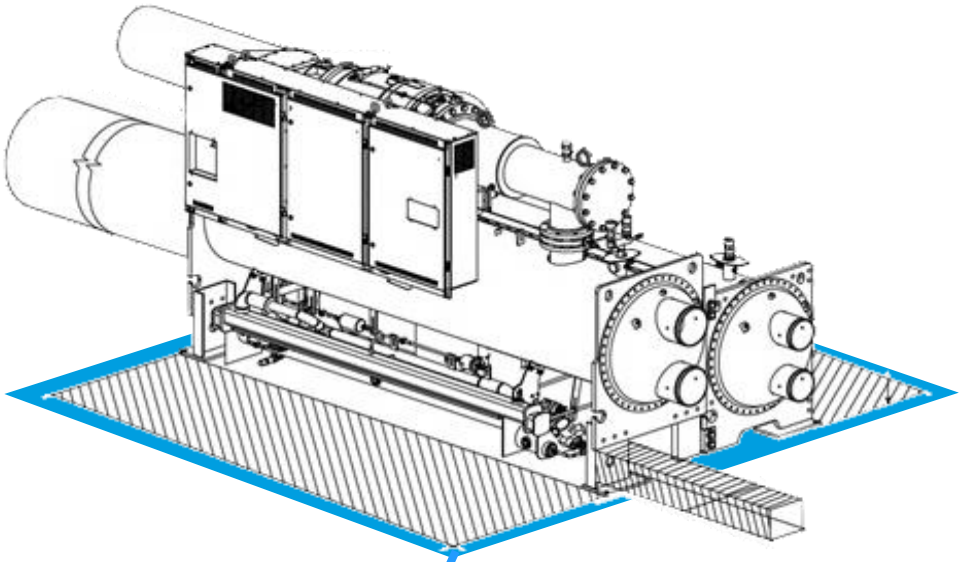
- NH_3 Chiller - 1,1MW Cooling Capacity: 5.0 x 1.0 x 2.1 m (LxWxH)

Std R134a Chillers are far away door size

- Std Chiller 1 5.8 x 1.6 x 2.1m
- Std Chiller 2 5.0 x 2.0 x 2.3m
- Std Chiller 3 4.7 x 1.5 x 2.4 m

Ammonia R717

5 m^2



Commercial products

10 m^2 plus additional service space

Ammonia Chiller range overview

Water Cooled Chillers
Capacity Range:

300KW – 5000KW

Air Cooled Chillers
Capacity Range:

100KW – 1250KW

Σας Ευχαριστώ!

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