WITT Refrigeration Day

Separators, units and NH_3 / CO_2 cascade systems

Agenda

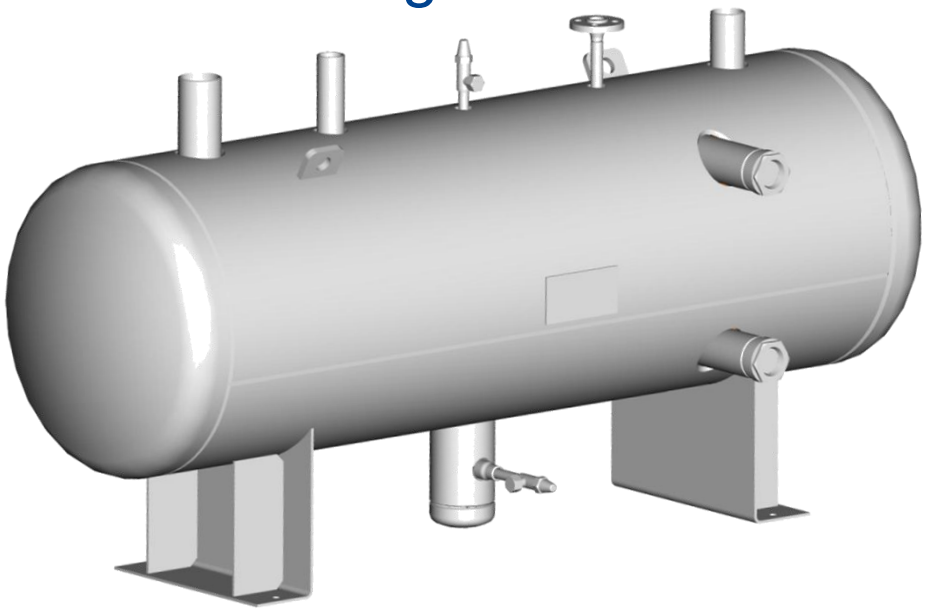
Pressure vessel types / units and their functions

- Receiver / thermosyphon vessel
- Economizer
- Separator and separation versions
- Pumping stations
- Evaporator units: Vahterus / Alfa Laval
- NH_3 / CO_2 cascade systems: Vahterus / Alfa Laval
- Specific data needed for offer preparation

Pressure vessel types

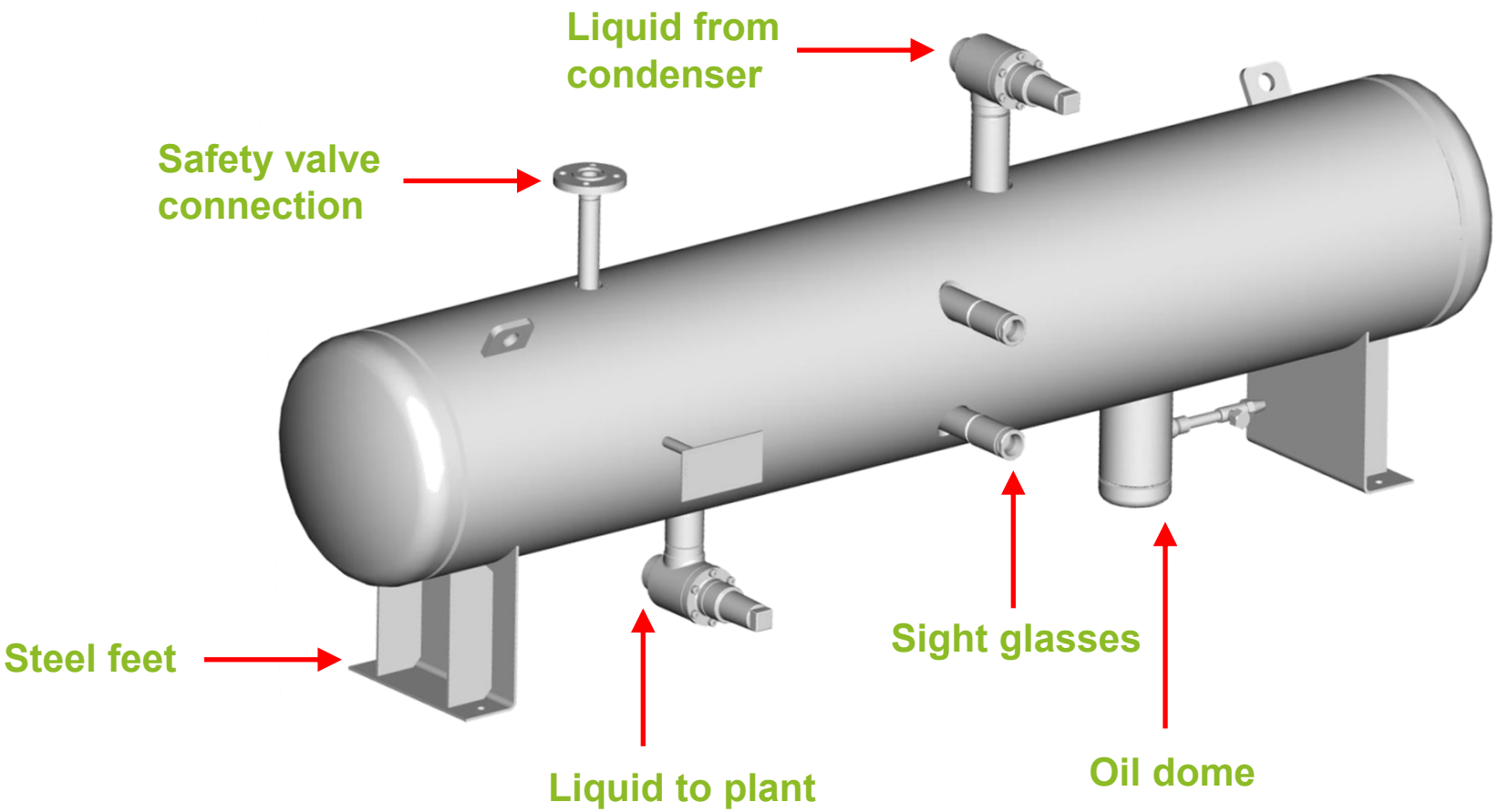
High pressure receiver

- Is installed on the high-pressure side of the refrigeration system
- Usually for NH_3 22 bar pressure rating or higher
- No need to be isolated
- For displacement of the refrigerant in case of a repair at the plant



Pressure vessel types

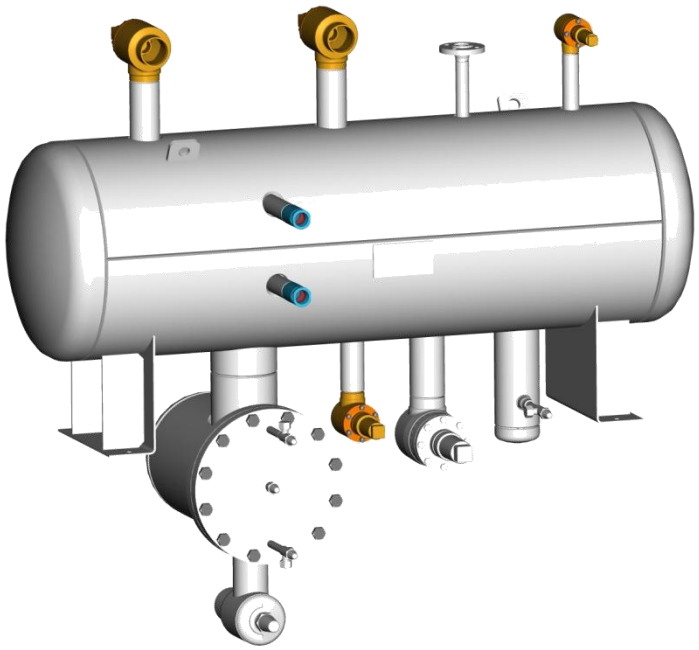
Construction and function of a receiver



Pressure vessel types

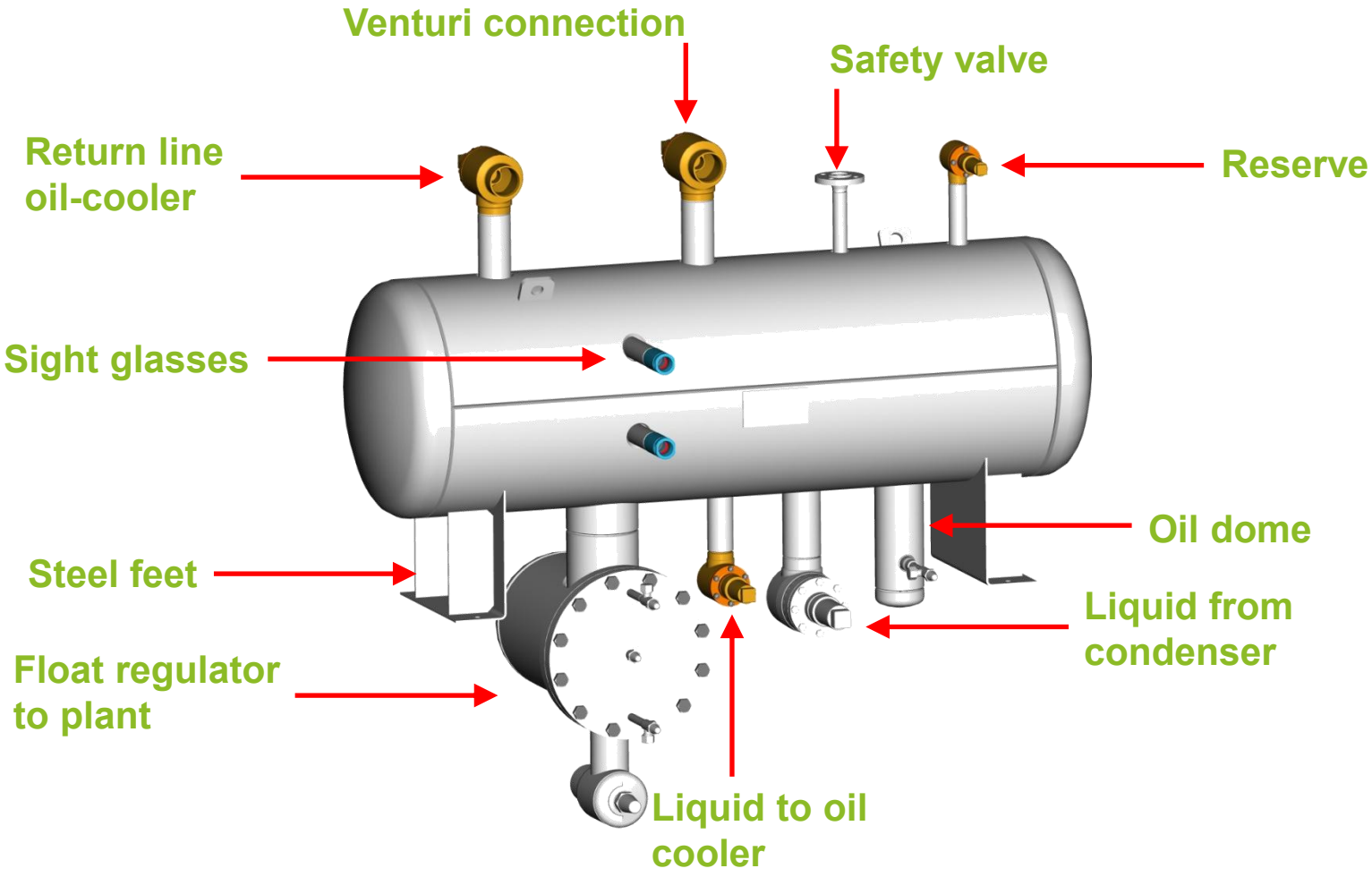
Thermosyphon vessel (prio-vessel)

- Can be installed on the high-pressure side of the refrigeration system
- Usually for NH_3 22 bar pressure rating or higher
- No need of isolation (only from HR/HS exit)
- High pressure float with footprint for the entire plant
- For the supply of the oil cooler from the compressor with ammonia



Pressure vessel types

Construction and function of a thermosyphon vessel (prio-vessel)



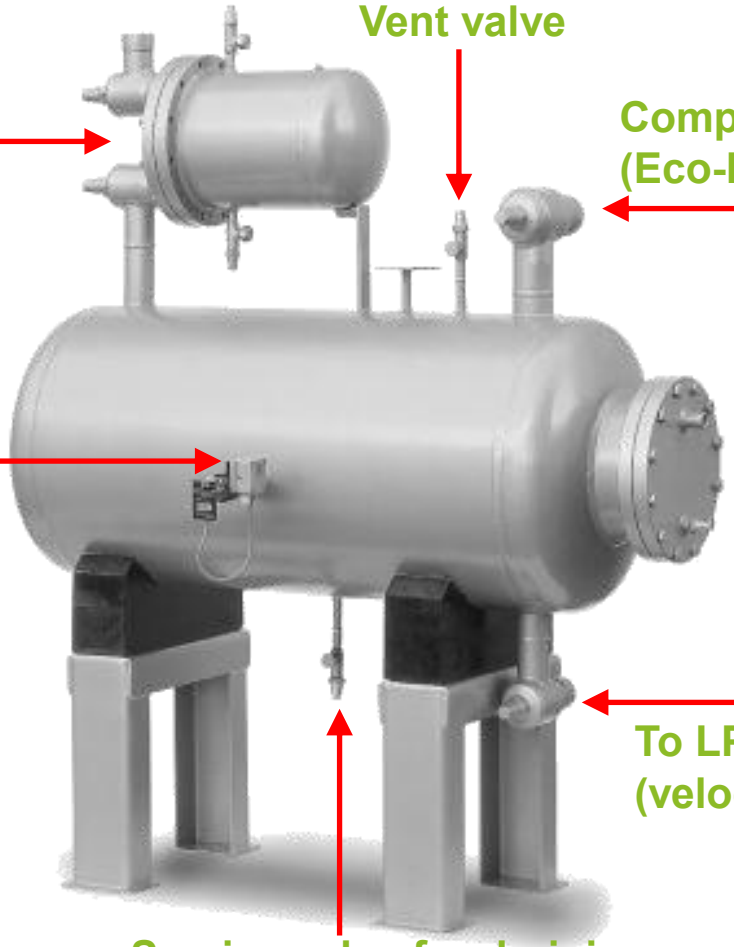
Pressure vessel types

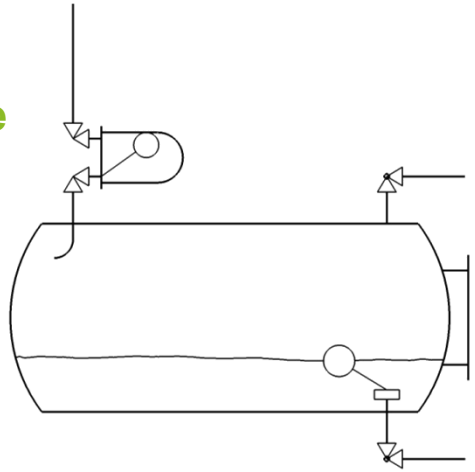
Open flash economizer – ECO

- With mounted float regulator HR / HS
- For screw compressors
- For 2-stage refrigerant expansion
- Improves the COP of the system

Pressure vessel types

Construction and function of an ECO with float regulator

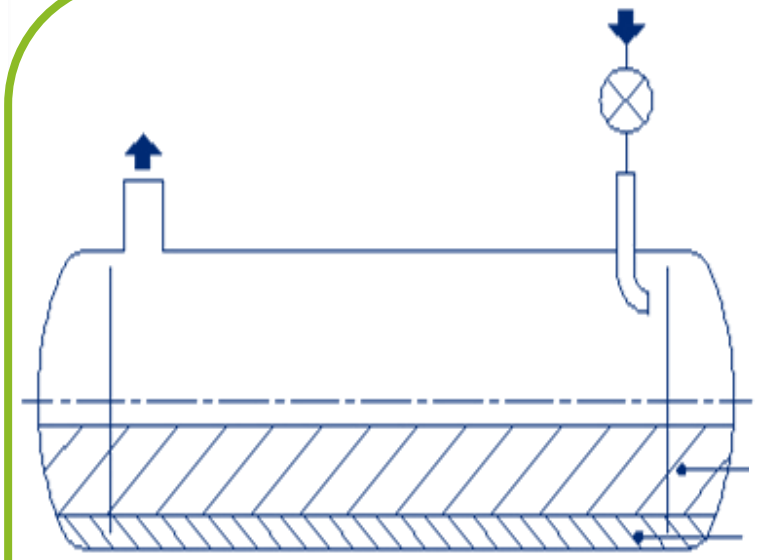




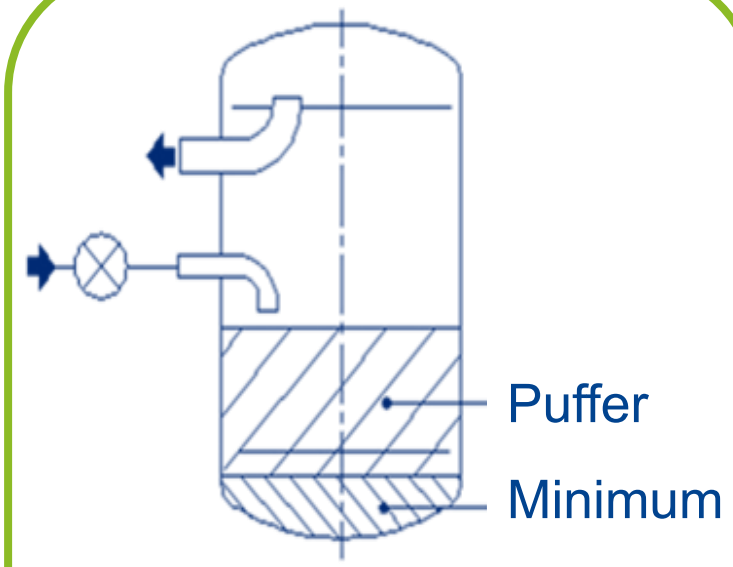
Pressure vessel types

Separator

- Basic types



Horizontal

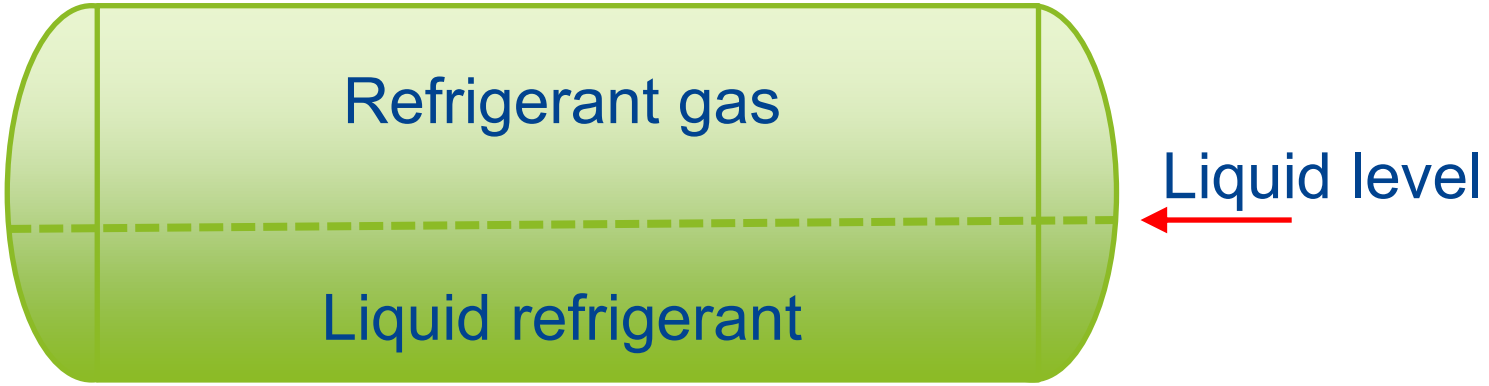


Vertical

Pressure vessel types

Construction and function of a separator

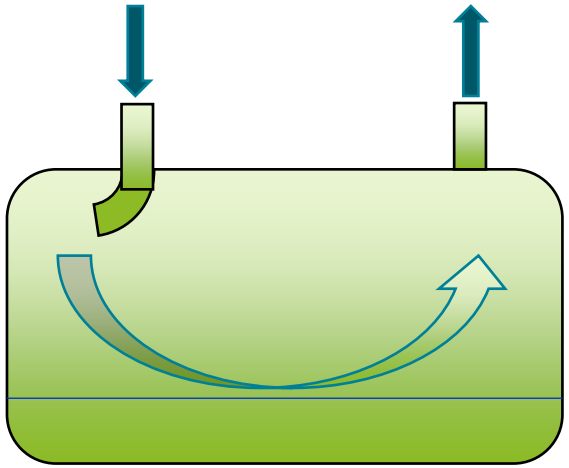
- Separation of gas and liquid in wet return by gravity and low gas velocities
- Provides constant liquid charge for pumps / evaporators
- Collects and holds the refrigerant during plant stand-still



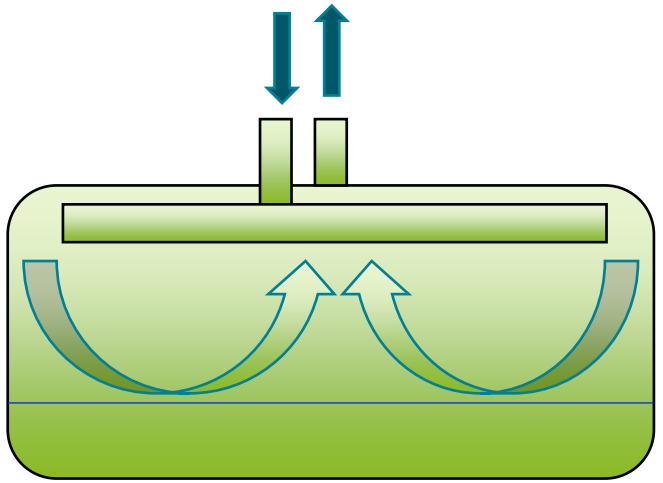
Pressure vessel types

Executions horizontal separators

- Separation design HAE
  - Left side wet return from evaporators
  - Right side suction connection to the compressor



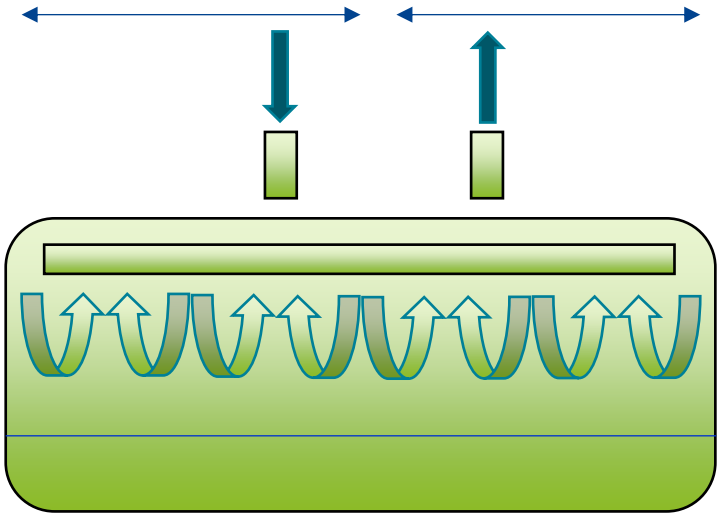
- Separation design HAZ
  - Wet return line and suction connection placed in the middle
  - Wet return is distributed inside to the left and right side



Pressure vessel types

Executions horizontal separators

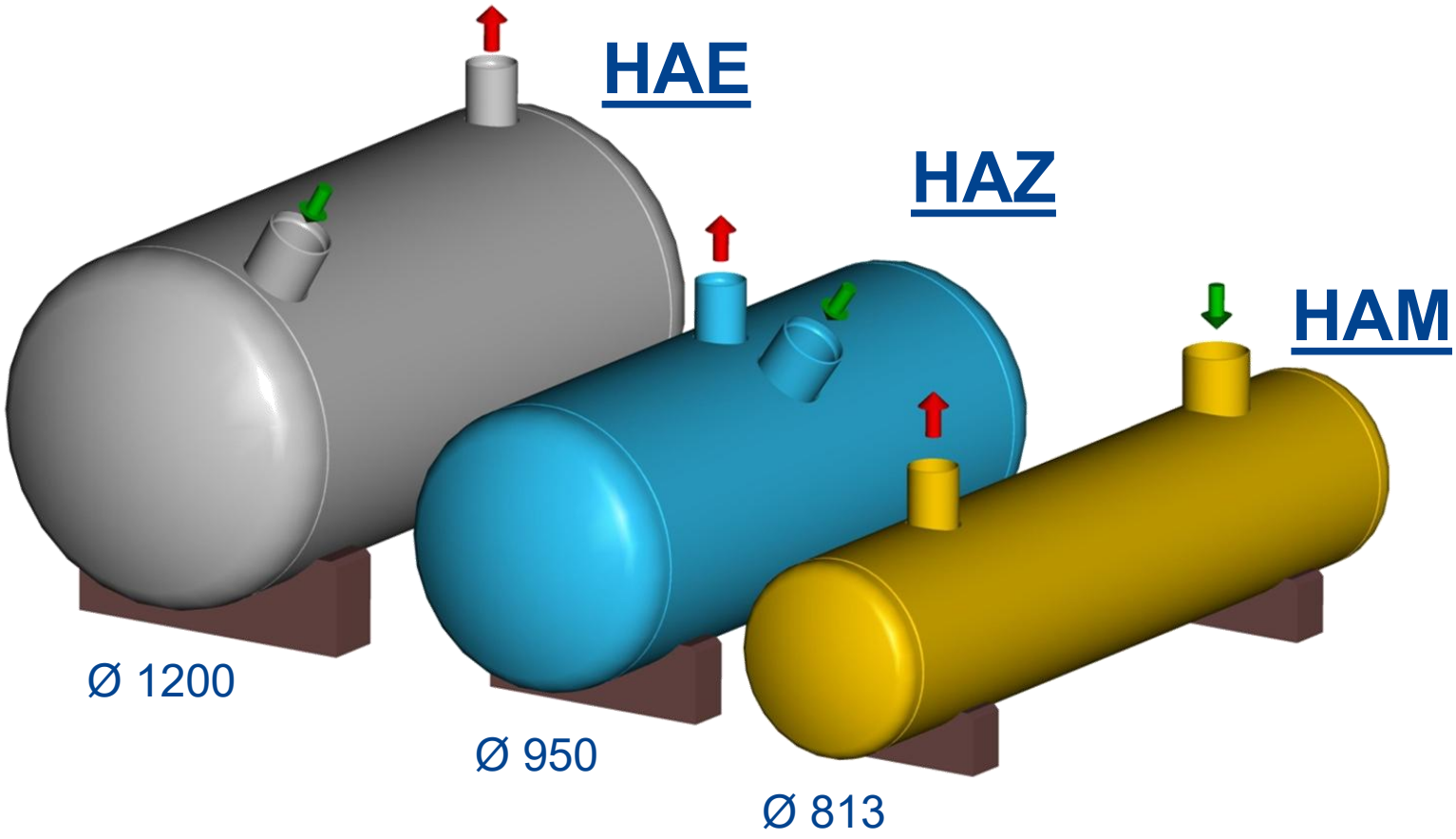
- Separation design HAM
  - Wet return is distributed/separated over the entire length of the vessel
  - Suction gas is also collected over the entire length of the vessel
  - Connections can be placed anywhere along top of the vessel



Pressure vessel types

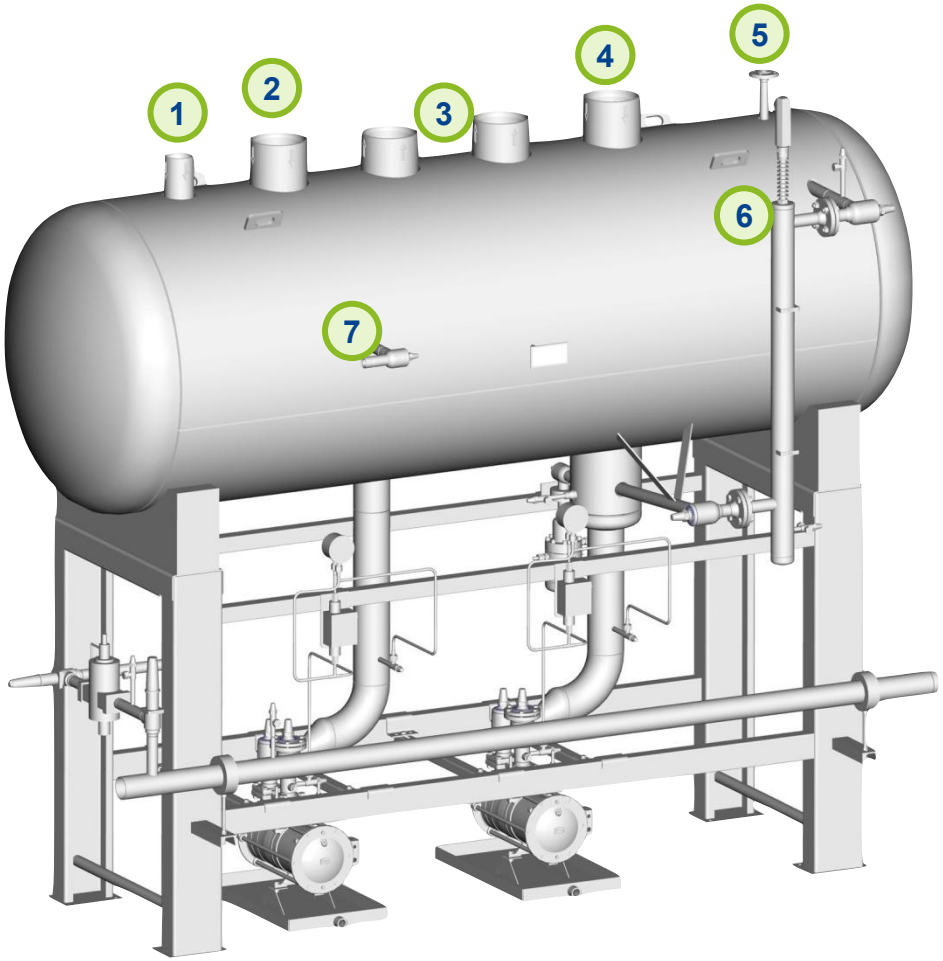
Separators

- Same duty – size comparison



Pressure vessel units

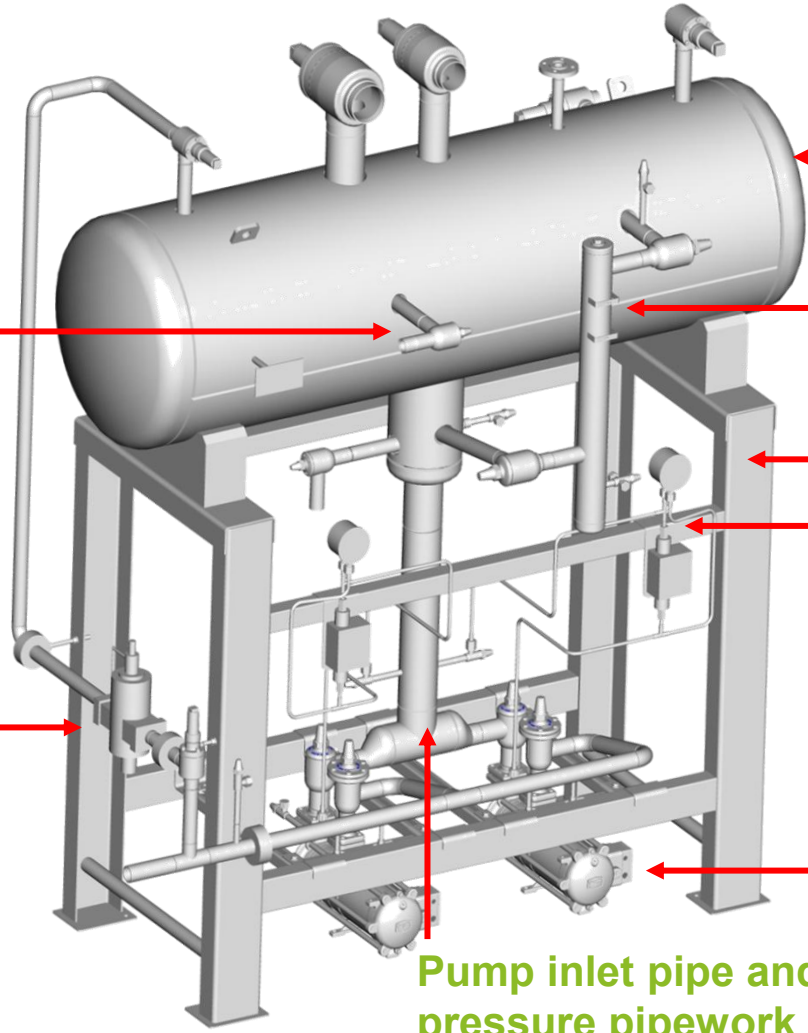
Connections on the vessel



1. Injection HP–side
2. Evaporator return
3. Compressor suction
4. LP–bubble system for 2-stage systems
5. Safety valve (overflow)
6. Standpipe, service valve and level sensor connection
7. Maximum controller

Pressure vessel units

Construction and function of a pumping station with equipment



Separator

Level controlling

NGX maximum controller

Frame construction

Differential pressure controlling with differential pressure manometer and RT260A

Pump-overflow-line with overflow valve

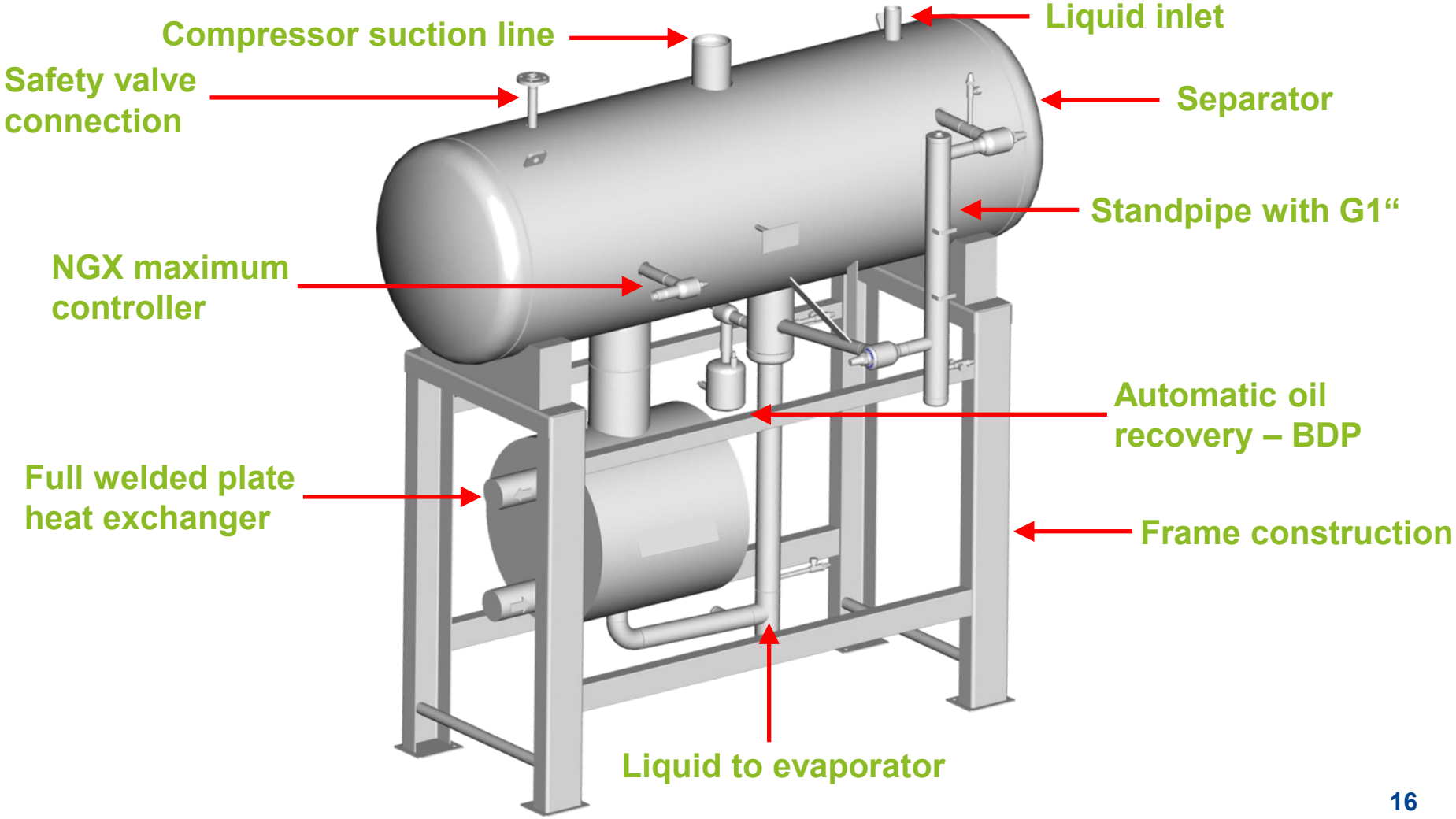
A4AL as example

Pumps

Pump inlet pipe and pressure pipework

Pressure vessel units

Construction and function of a plate heat exchanger unit



Pressure vessel units

Examples – evaporators in natural circulation

PVS

600 kW, MPG/NH_3,
$t_{in/out}$ = -2/-7 °C
$t_{o/c}$ = -10/+35 °C
HAM 660 x 2.500
(Height approx. 2,5 m)

PVE

1.400 kW, MPG/NH_3,
$t_{in/out}$ = -4/-8 °C
$t_{o/c}$ = -12/+35 °C
HAM 950 x 4.040
(Height approx. 3,2 m)

NH_3 / CO_2 cascades

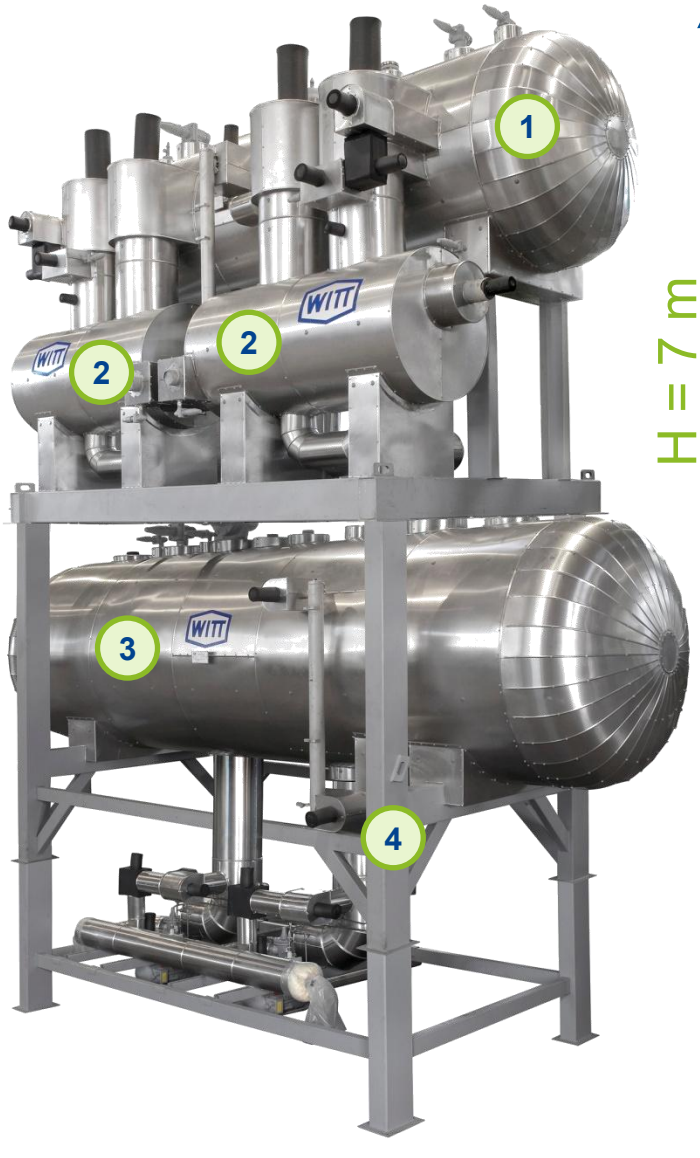
Why NH_3 / CO_2 cascade systems?

- NH_3- only in the plant room
- NH_3- volume will be reduced
- Smaller sizes of CO_2 pipes
- Smaller evaporators and very good heat transfer
- CO_2 will be used as brine
- No compressor (one stage) for CO_2

NH_3 / CO_2 cascades

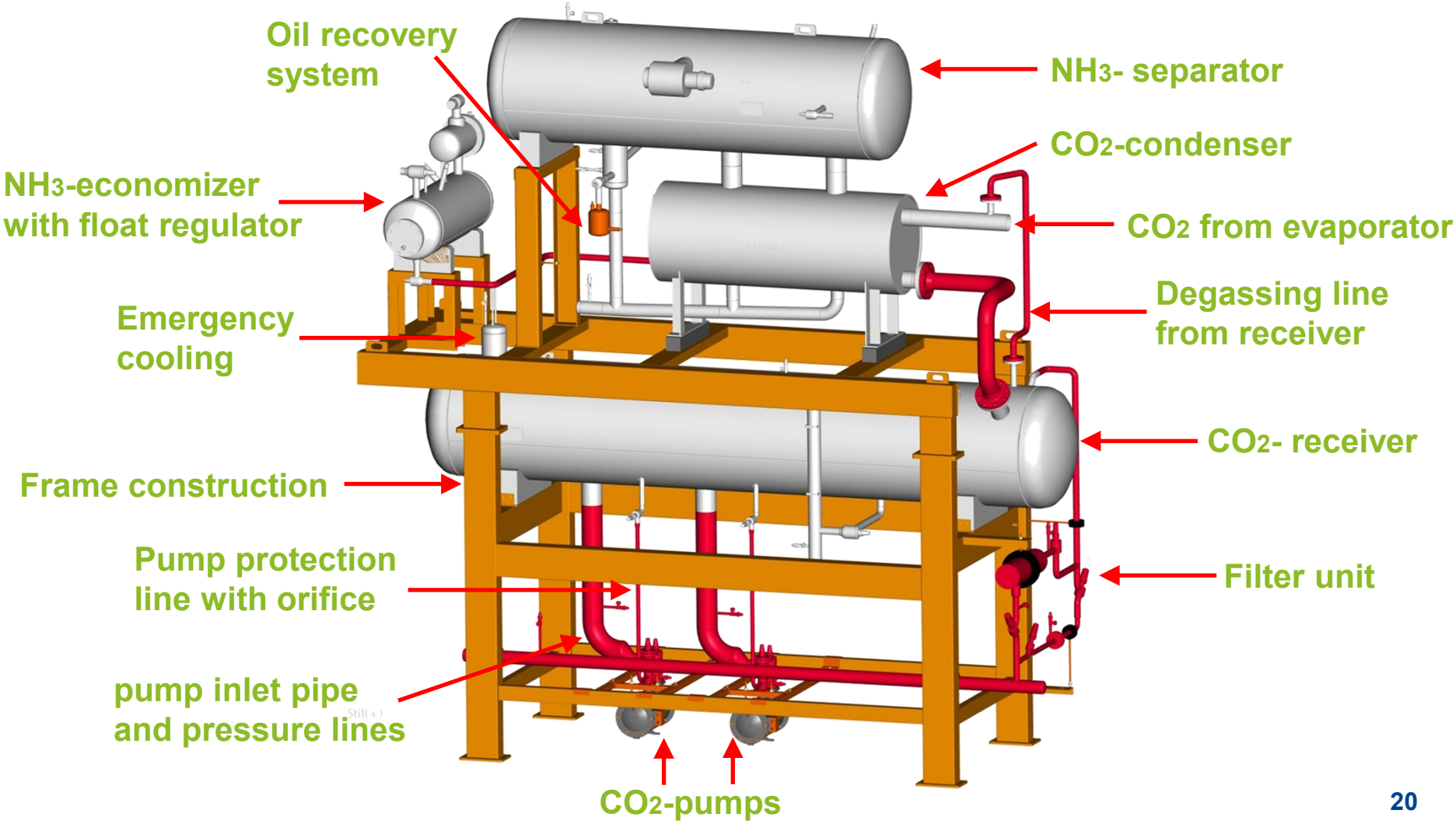
With Vahterus condenser

1. NH_3-separator
2. 2 x NH_3 / CO_2 condenser
3. CO_2-separator with pumps
4. Frame in three parts



NH_3 / CO_2 cascades

Construction and function



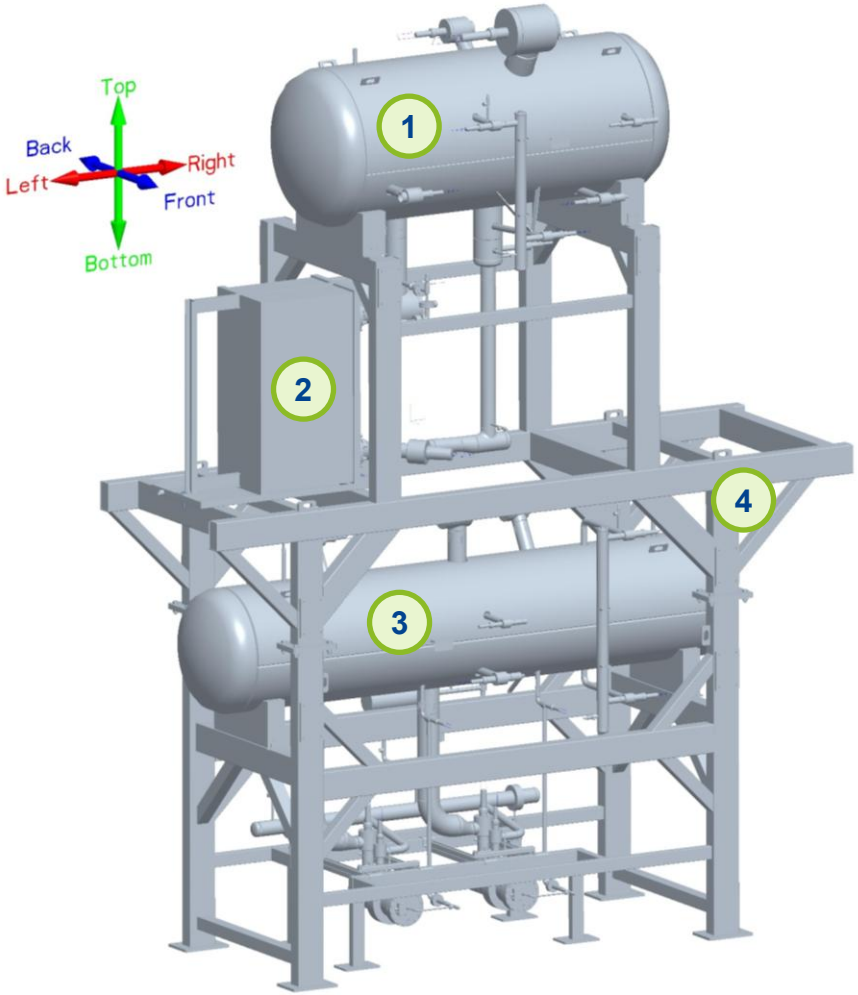
NH_3 / CO_2 cascades

CO_2 as refrigerant in DX-systems

1. NH_3-open flash ECO
2. NH_3-separator
3. NH_3 / glycol-plate heat exchanger
4. NH_3 / CO_2 condenser
5. CO_2-receiver for DX-system

NH_3 / CO_2 cascades

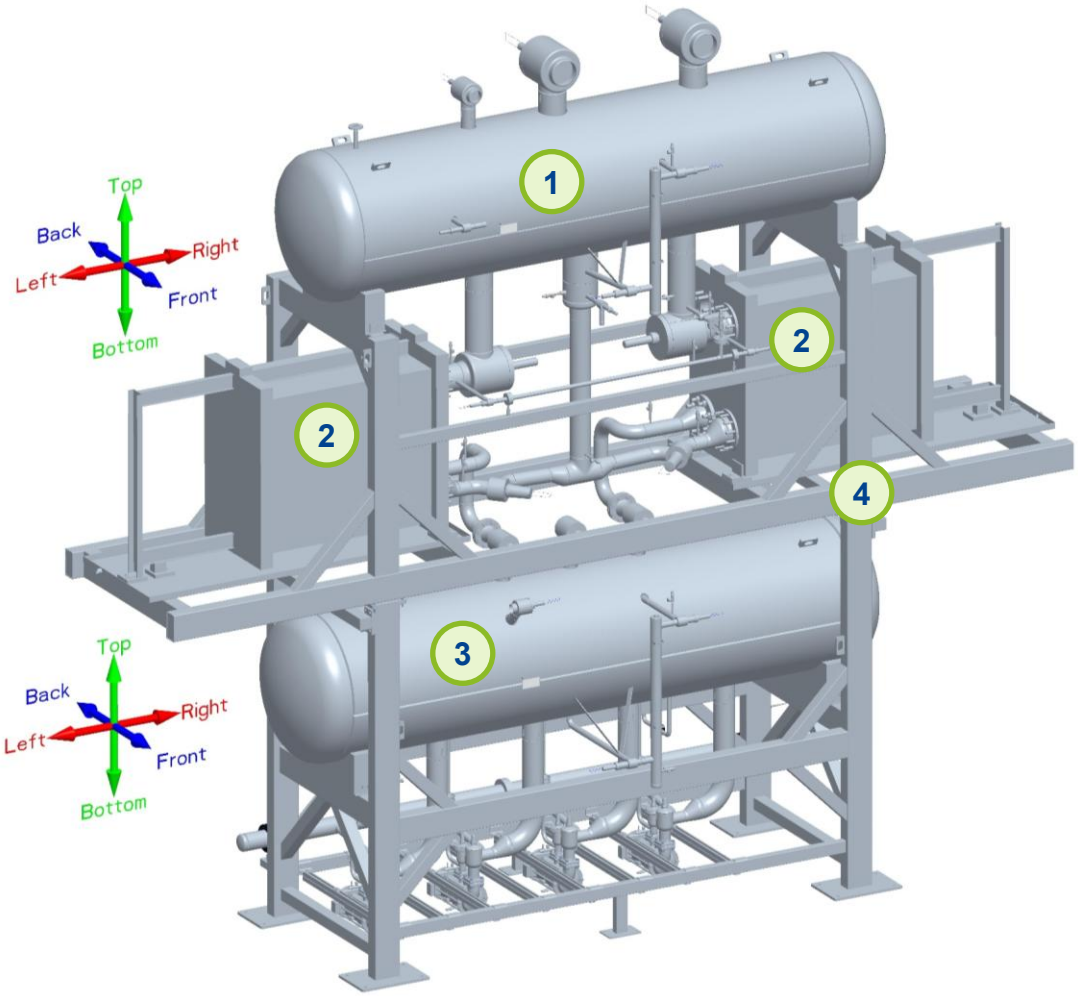
CO_2 / NH_3 system with one Alfa Laval condenser



1. NH_3-separator
2. 1 x NH_3 / CO_2 condenser
3. CO_2-separator with pumps
4. Frame in two parts

NH_3 / CO_2 cascades

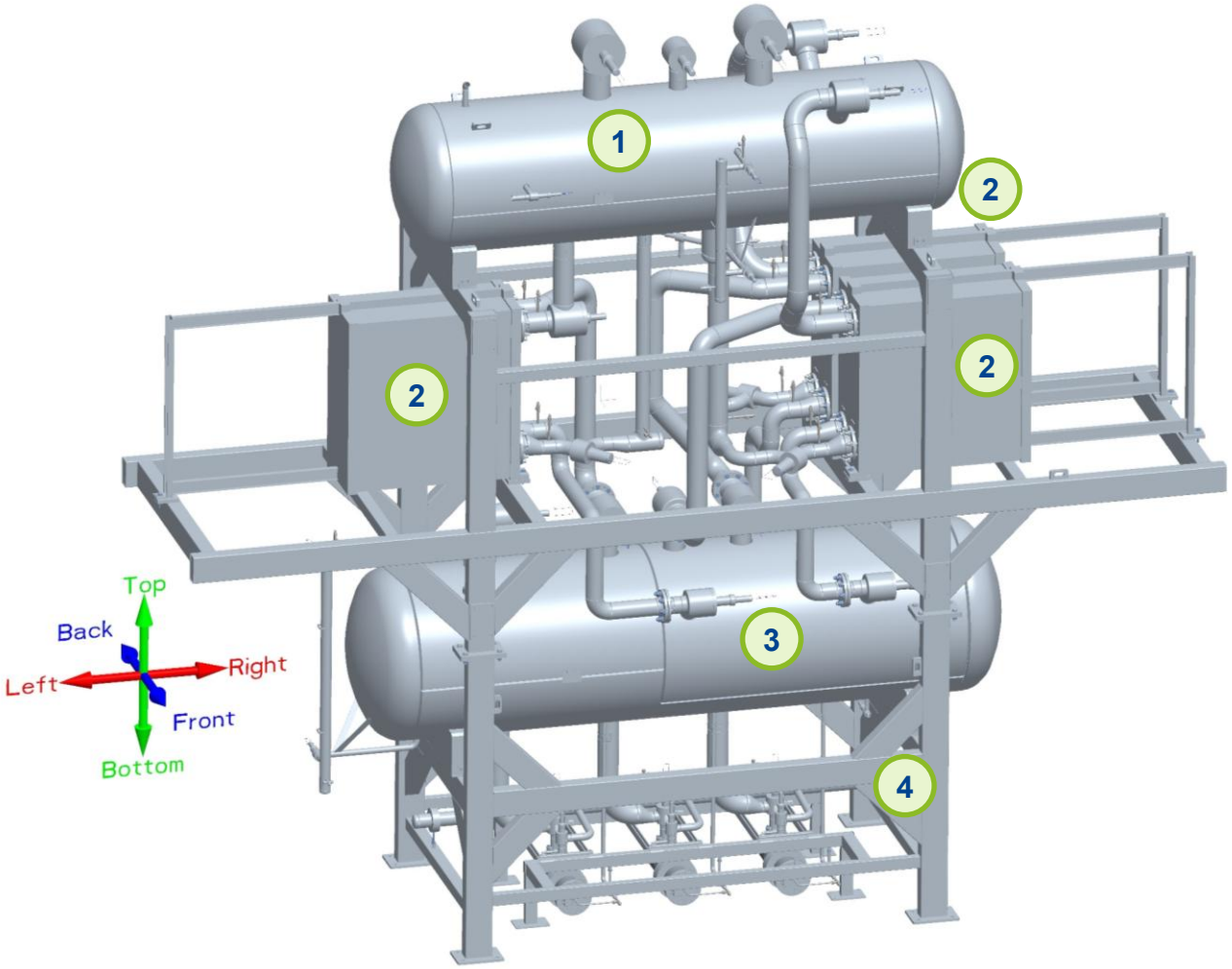
CO_2 / NH_3 system with two Alfa Laval condensers



1. NH_3-separator
2. 2 x NH_3 / CO_2 condenser
3. CO_2-separator with pumps
4. Frame in two parts

NH_3 / CO_2 cascades

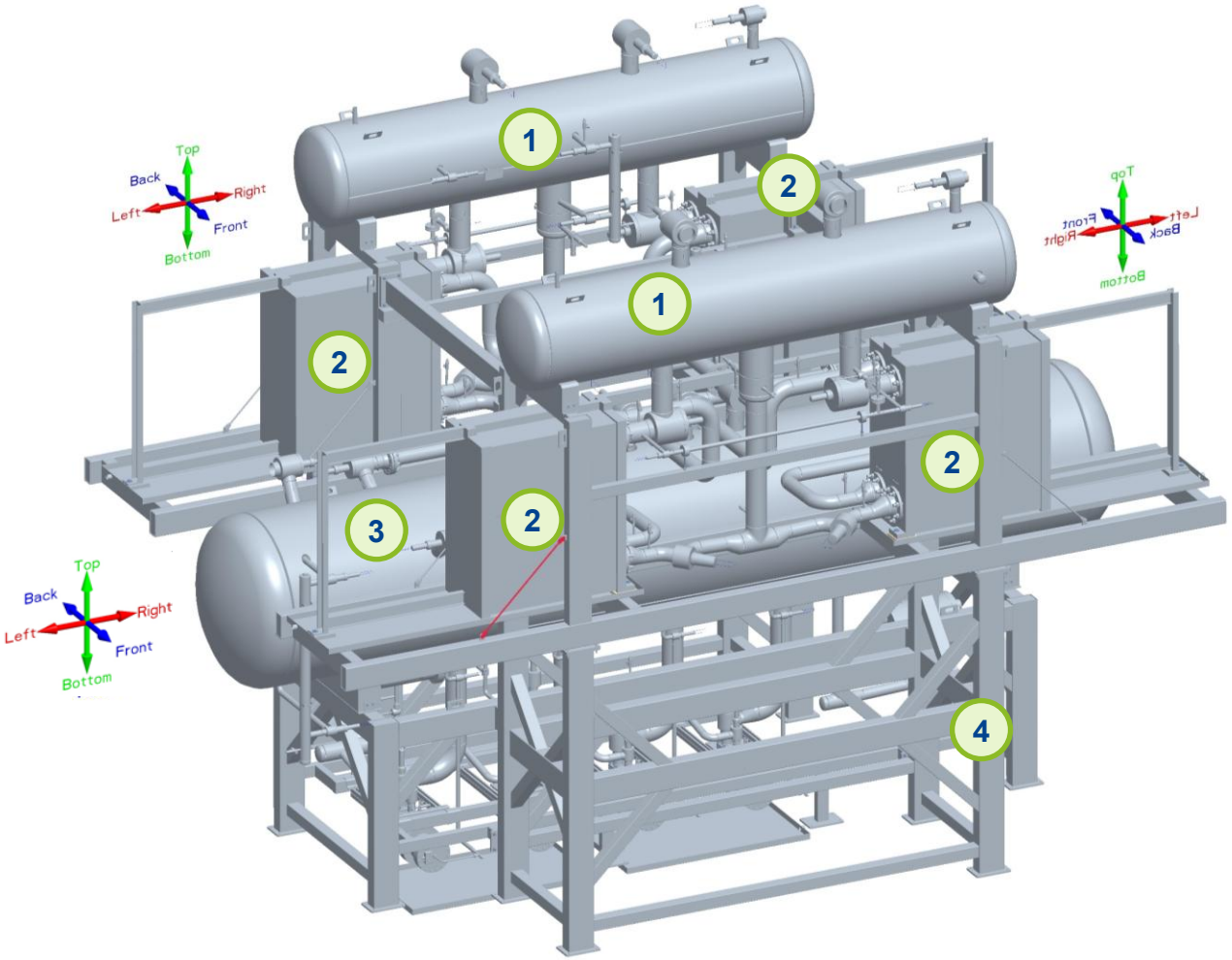
CO_2 / NH_3 system with three and more Alfa Laval condensers



1. NH_3-separator
2. 3 x NH_3 / CO_2 condenser
3. CO_2-separator with pumps
4. Frame in two parts

NH_3 / CO_2 cascades

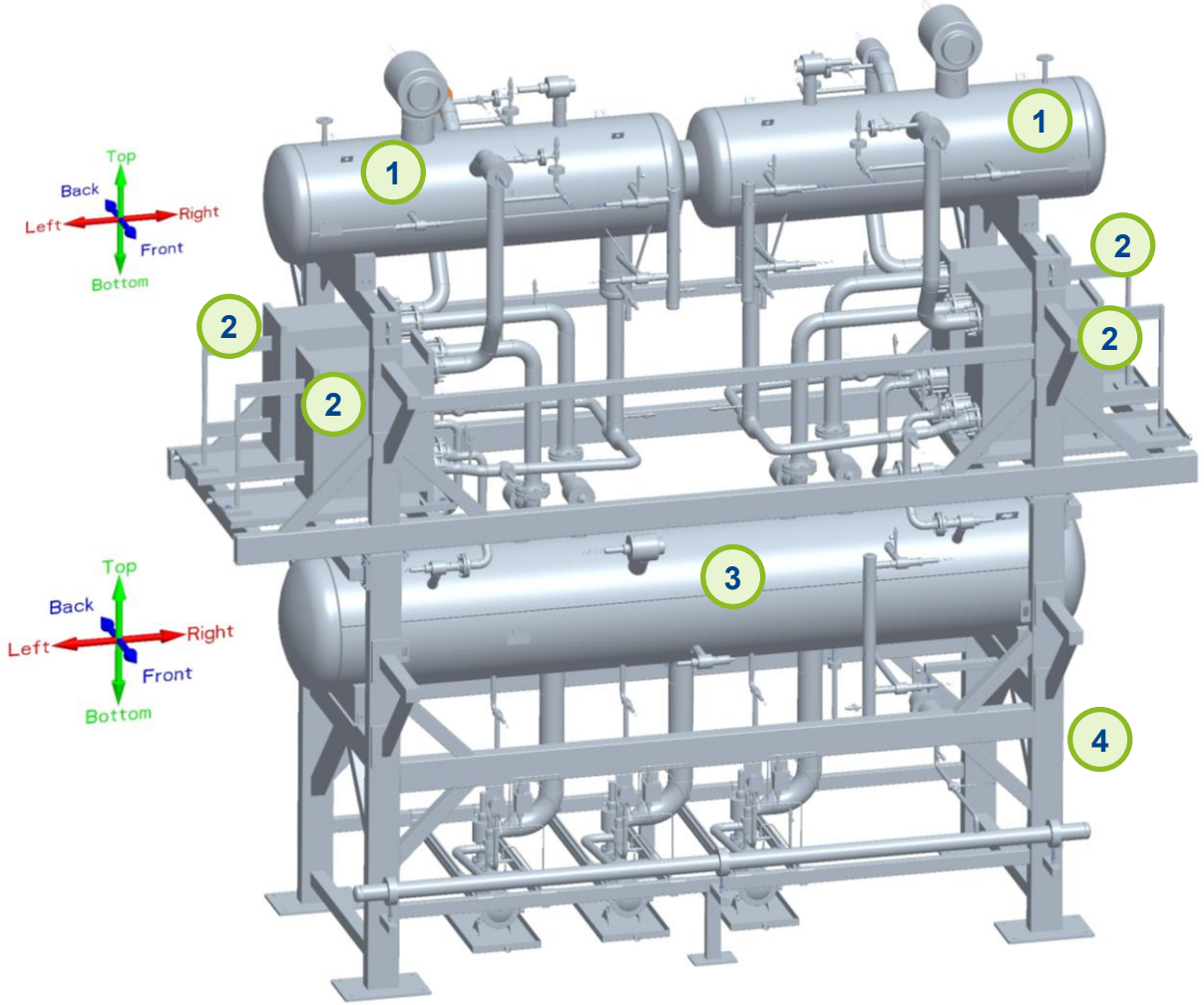
CO_2 / NH_3 system with three and more Alfa Laval condensers



1. 2 x NH_3-separator
2. 4 x NH_3 / CO_2 condenser
3. CO_2-separator with pumps
4. Frame in five parts

NH_3 / CO_2 cascades

CO_2 / NH_3 system with three and more Alfa Laval condensers



1. 2 x NH_3-separator
2. 4 x NH_3 / CO_2 condenser
3. CO_2-separator with pumps
4. Frame in two parts

Specific data for offer preparation

For cascade systems:

- Height and dimensions of the plant room
- Design pressure for NH_3 / CO_2 part
- Storage volume of the CO_2 vessel
- Number of pumps working and stand-by
- Delivery height and pumprate for the pumps
- Number of PHX you need/want
- Capacity for the condensers
- Inlet and outlet temperature CO_2
- Evaporating temperature for NH_3

Further questions

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