

# CAFP CO<sub>2</sub>/Ammonia Freeze Package

The innovative Sabroe CO<sub>2</sub>/Ammonia Freeze Package (CAFP) concept is based on a cascade system that combines the advantages of CO<sub>2</sub> on the low-temperature side and ammonia on the high-temperature side.

This remarkably efficient package is inexpensive, extremely compact and has a very small ammonia charge. It is also both environmentally friendly and future-compatible due to the use of natural refrigerants.

## Compact solution

A compressor that uses CO<sub>2</sub> has a capacity 8–12 times greater than its counterpart using ammonia. This makes the low-temperature compressor much smaller, and the whole unit significantly more compact than a traditional solution.

The CAFP range includes capacities of 80–400 kW at –50°C and 140–650 kW at –40°C. Each package only takes up as much space as a standard 20-foot container. Such compactness makes it easy to move a CAFP system from one site to another.

## Low operating costs at low temperatures

Compared with conventional two-stage or single-stage systems with economisers, a CAFP unit uses significantly less power in the temperature range from –35°C to –55°C.

Depending on configuration, this means that savings of 5–15% are possible, compared with a conventional two-stage system, and of up to 45% compared with single-stage systems with economisers.



CAFP unit controlled and monitored by Unisab III

## Significant advantages

The advantages of the Sabroe CAFP package include

- Extremely low power consumption, even at part load.
- Compact design.
- Very small ammonia charge.
- Entire ammonia charge is located on the unit itself, restricting ammonia use to the machine room.
- Clear separation of ammonia and CO<sub>2</sub>.
- Automatic oil recovery system in both CO<sub>2</sub> and ammonia circuits.

## Customer benefits

For the customer, the benefits of the Sabroe CAFP package include

- ▶ Low operating costs.
- ▶ Saves space, and gives greater flexibility in production.
- ▶ Makes it possible to install large-capacity, low-temperature plants with only limited refrigerant restrictions.
- ▶ No risk of ammonia leaks in production areas, cold stores and working areas. Less risk of product damage.
- ▶ Eliminates risk of panic or damage in production and working area in case of leaks, and can also save on insurance rates.
- ▶ Only minimum maintenance required.

Sabroe product description

## Standard equipment

The standard Sabroe CO<sub>2</sub>/Ammonia Freeze Package includes the following

- CO<sub>2</sub> and ammonia compressors complete with oil separators, motors and Unisab II control panels.
- CO<sub>2</sub> pump separator including two pumps (one standby).
- shell-and-tube type cascade cooler with double-tube sheet to minimise risk of mixing CO<sub>2</sub> and ammonia.
- standstill cooling unit to limit CO<sub>2</sub> pressure, including separate control panel and separate power supply.
- automatic oil recovery system in both circuits.
- water-cooled condenser (plate heat exchanger type) on ammonia side.
- motor control panel with starters and controls for compressors and pumps (two supply cables necessary).
- piping, valves and wiring.

- insulation of cold parts (polyurethane with aluminium covers).
- factory testing prior to dispatch.
- first charge of oil for compressors.

## Options

Options available with Sabroe CAFP installations include

- version for use with remote condenser.
- titanium plates in condenser.
- oversized CO<sub>2</sub> pump separator for high CO<sub>2</sub> evaporator volume.
- oversized CO<sub>2</sub> pumps for higher circulation rate.
- oversized ammonia condenser for higher cooling water temperature.
- fully welded cascade cooler (shell-and-tube).
- external interstage load, e.g. a brine cooler on the R717 side of the cascade cooler.

| Model    | Evaporation temperature<br>°C | Capacity at evap. temp. <sup>1)</sup><br>kW | Power consumption <sup>2)</sup><br>kW | Compressors<br>R744/R717 | NH <sub>3</sub><br>charge approx.<br>kg | Max. CO <sub>2</sub><br>charge<br>l | Dimensions approx.<br>L x W x H<br>mm | Weight <sup>3)</sup><br>kg | Sound pressure level dB(A) |
|----------|-------------------------------|---------------------------------------------|---------------------------------------|--------------------------|-----------------------------------------|-------------------------------------|---------------------------------------|----------------------------|----------------------------|
| CAFP 80  | -50                           | 87                                          | 64                                    | HPO24 / SMC104S          | 45                                      | 800                                 | 5200 x 2600 x 2800                    | 8000                       | 78                         |
| CAFP 80  | -45                           | 112                                         | 74                                    | HPO24 / SMC104L          | 45                                      | 800                                 | 5200 x 2600 x 2800                    | 8500                       | 80                         |
| CAFP 80  | -40                           | 144                                         | 84                                    | HPO24 / SMC104E          | 45                                      | 800                                 | 5200 x 2600 x 2800                    | 9000                       | 79                         |
| CAFP 80  | -35                           | 144                                         | 82                                    | HPO24 / SMC106S          | 45                                      | 800                                 | 5200 x 2600 x 2800                    | 9000                       | 79                         |
| CAFP 120 | -50                           | 131                                         | 94                                    | HPO26 / SMC106S          | 55                                      | 800                                 | 5200 x 2600 x 2800                    | 9500                       | 80                         |
| CAFP 120 | -45                           | 169                                         | 110                                   | HPO26 / SMC106L          | 55                                      | 800                                 | 5200 x 2600 x 2800                    | 9500                       | 80                         |
| CAFP 120 | -40                           | 217                                         | 126                                   | HPO26 / SMC106E          | 55                                      | 800                                 | 5200 x 2600 x 2800                    | 9500                       | 80                         |
| CAFP 120 | -35                           | 264                                         | 137                                   | HPO26 / SMC108L          | 55                                      | 800                                 | 5200 x 2600 x 2800                    | 10000                      | 82                         |
| CAFP 160 | -50                           | 174                                         | 125                                   | HPO28 / SMC108S          | 60                                      | 800                                 | 5200 x 2600 x 2800                    | 10500                      | 80                         |
| CAFP 160 | -45                           | 223                                         | 147                                   | HPO28 / SMC108L          | 60                                      | 800                                 | 5200 x 2600 x 2800                    | 11000                      | 82                         |
| CAFP 160 | -40                           | 288                                         | 167                                   | HPO28 / SMC108E          | 60                                      | 800                                 | 5200 x 2600 x 2800                    | 11000                      | 82                         |
| CAFP 160 | -35                           | 363                                         | 188                                   | HPO28 / SMC112L          | 60                                      | 800                                 | 5900 x 2800 x 3000                    | 12000                      | 83                         |
| CAFP 200 | -50                           | 211                                         | 150                                   | HPC104 / SMC106E         | 80                                      | 800                                 | 5200 x 2600 x 2800                    | 12000                      | 80                         |
| CAFP 200 | -45                           | 277                                         | 177                                   | HPC104 / SMC108E         | 80                                      | 800                                 | 5200 x 2600 x 2800                    | 12000                      | 82                         |
| CAFP 200 | -40                           | 353                                         | 200                                   | HPC104 / SMC112L         | 80                                      | 800                                 | 5900 x 2800 x 3000                    | 13500                      | 82                         |
| CAFP 200 | -35                           | 415                                         | 214                                   | HPC104 / SMC112L         | 80                                      | 800                                 | 5900 x 2800 x 3000                    | 13500                      | 83                         |
| CAFP 300 | -50                           | 324                                         | 228                                   | HPC106 / SMC112L         | 120                                     | 1650                                | 6300 x 3200 x 3100                    | 14000                      | 82                         |
| CAFP 300 | -45                           | 416                                         | 263                                   | HPC106 / SMC112E         | 120                                     | 1650                                | 6300 x 3200 x 3100                    | 14000                      | 82                         |
| CAFP 300 | -40                           | 511                                         | 290                                   | HPC106 / SMC116L         | 120                                     | 1650                                | 6300 x 3200 x 3100                    | 15000                      | 83                         |
| CAFP 300 | -35                           | 599                                         | 310                                   | HPC106 / SMC116L         | 120                                     | 1650                                | 6300 x 3200 x 3100                    | 15500                      | 83                         |
| CAFP 400 | -50                           | 421                                         | 296                                   | HPC108 / SMC112E         | 155                                     | 1650                                | 6300 x 3200 x 3100                    | 16000                      | 82                         |
| CAFP 400 | -45                           | 520                                         | 332                                   | HPC108 / SMC116L         | 155                                     | 1650                                | 6300 x 3200 x 3100                    | 17000                      | 83                         |
| CAFP 400 | -40                           | 667                                         | 375                                   | HPC108 / SMC116E         | 155                                     | 1650                                | 6700 x 3200 x 3200                    | 17000                      | 83                         |
| CAFP 400 | -35                           | 793                                         | 398                                   | HPC108 / SMC116E         | 155                                     | 1650                                | 6700 x 3200 x 3200                    | 18000                      | 83                         |

1) Capacity is based on 50 Hz. In addition, 25°C/30°C cooling water to/from condenser

2) Power consumption applies to compressors only

3) Dry weight (approx.)

All information is subject to change without previous notice

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