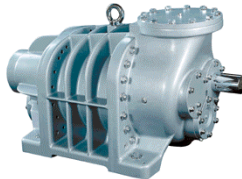


**Ammonia Liquid Chiller  
Series FX PP, LP, VP  
200 – 6000 kW**

**Product Information**



| Capacity range                  | 200 – 350 kW                                                                                                               | 450 – 900 kW                                                                                                         | 800 – 2800 kW                                                                                                                     | 3300 – 5800 kW                                                                                                                  |
|---------------------------------|----------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------|
| Screw Compressor (SC)           | Small highintegrated<br><br>4 Types : C, D, E, G<br>swept volume $V_{th}$<br>$V_{th} = 231 \dots 375 \text{ m}^3/\text{h}$ | Medium compact<br><br>4 Types : H, L, M, N<br>swept volume $V_{th}$<br>$V_{th} = 450 \dots 860 \text{ m}^3/\text{h}$ | Large traditional<br><br>6 Types : P, R, S, V, W, Y, Z<br>swept volume $V_{th}$<br>$V_{th} = 805 \dots 2748 \text{ m}^3/\text{h}$ | X-Large traditional<br><br>4 Types : XA, XB, XC, XD<br>swept volume $V_{th}$<br>$V_{th} = 3250 \dots 5800 \text{ m}^3/\text{h}$ |
|                                 |                                           |                                   |                                                |                                              |
| Screw Compresor Packages (SCP)  | <b>SMALL</b>                                                                                                               | <b>MEDIUM</b>                                                                                                        | <b>LARGE</b>                                                                                                                      | <b>X-LARGE</b>                                                                                                                  |
| Liquid Chiller                  | <b>SMALL</b>                                                                                                               | <b>MEDIUM</b>                                                                                                        | <b>LARGE</b>                                                                                                                      | <b>X-LARGE</b>                                                                                                                  |
| Evaporator Type                 | Plate type evaporator                                                                                                      | Plate type evaporator                                                                                                | Plate type evaporator                                                                                                             | Plate type evaporator                                                                                                           |
| Working principle               | Flooded evaporation                                                                                                        | Flooded evaporation                                                                                                  | Flooded evaporation                                                                                                               | Flooded evaporation                                                                                                             |
| Liquid separator                | horizontal                                                                                                                 | vertical                                                                                                             | vertical                                                                                                                          | horizontal                                                                                                                      |
| Condenser Type P                | Plate type condenser                                                                                                       | Plate type condenser                                                                                                 | Plate type condenser                                                                                                              | Plate type condenser                                                                                                            |
| Condenser Type L                | Air-cooled condenser                                                                                                       | Air-cooled condenser                                                                                                 | Air-cooled condenser                                                                                                              | Air-cooled condenser                                                                                                            |
| Condenser Type V                | Evaporative condenser                                                                                                      | Evaporative condenser                                                                                                | Evaporative condenser                                                                                                             | Evaporative condenser                                                                                                           |
| For transportation divided into | 1 fragment                                                                                                                 | 1 fragment                                                                                                           | 3-4 fragments                                                                                                                     | 4-5 fragments                                                                                                                   |

**DESIGNATION CODE**

|                                                                                                                    |                                                                                    | <b>FX</b> | <b>P</b> | <b>P</b> | <b>900</b> | <b>HP</b> | <b>NH3</b> |
|--------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------|-----------|----------|----------|------------|-----------|------------|
| Series                                                                                                             | Flooded evaporation                                                                |           |          |          |            |           |            |
| Condenser model                                                                                                    | P - plate type evaporator<br>L - air cooled condenser<br>V - evaporative condenser |           |          |          |            |           |            |
| Evaporator model                                                                                                   | P - plate type evaporator                                                          |           |          |          |            |           |            |
| Capacity of liquid chiller in kW<br>refer to cold water operation                                                  |                                                                                    |           |          |          |            |           |            |
| Chiller design type:<br>without indication : Standard design<br>S : Special design<br>HP : High Performance design |                                                                                    |           |          |          |            |           |            |
| Refrigerant                                                                                                        |                                                                                    |           |          |          |            |           |            |

| Screw Compressor | Nominal capacity in kW |
|------------------|------------------------|
| C                | 200                    |
| D                | 250                    |
| E                | 300                    |
| G                | 350                    |
| <b>H</b>         | <b>450</b>             |
| L                | 550                    |
| M                | 650                    |
| N                | 900                    |
| P                | 800                    |
| R                | 1100                   |

| Screw Compressor | Nominal capacity in kW |
|------------------|------------------------|
| S                | 1300                   |
| V                | 1700                   |
| W                | 2000                   |
| Y                | 2400                   |
| Z                | 2800                   |
| <b>XA</b>        | 3300                   |
| <b>XB</b>        | 4200                   |
| <b>XC</b>        | 5000                   |
| <b>XD</b>        | 5800                   |

**AMMONIA LIQUID CHILLER  
SERIES FX P**

**INTRODUCTION**

The standard ammonia liquid chiller programme comprises well-proven components which are assembled to form complete refrigerating systems both for medium and large refrigerating and air conditioning requirements.

Main fields of application:

- old water for air conditioning
- cold brine for air conditioning with combined ice storage operation
- cold water for industrial processes
- cold brine for industrial processes
- (cold) and warm water for heat pump operation

On principle, the refrigerant used in the refrigerating systems is ammonia which features a high specific refrigerating capacity, a low energy demand, an attractive price and an environmentally neutral behaviour.

Based on the screw compressor series, the ammonia liquid chiller programme covers a refrigerating capacity ranging from 200 to 5800 kW, related to the cold water range. The capacity ranges are determined by the 18 sizes of the Grasso screw compressors.

The liquid chiller programme consists of three series which comprise different condenser designs and are operated with flooded evaporator systems on the basis of gravity recirculation.

The ammonia liquid chillers are of modular design and consist of the following main modules:

- Standard Screw compressor unit
- heat exchanger assembly with low-pressure separator and oil return system
- low-voltage switchgear installation with control device

The modular design of the chillers is guided to the standard series of Grasso screw compressor packages, which are executed with horizontal oil separators within the SMALL series and vertical oil separators within the MEDIUM and LARGE series.

For chillers equipped with SMALL packages is the liquid separator with respect to the package design as well executed in horizontal design. For MEDIUM and LARGE series chillers vertical compact vessels are used for liquid separation. This ensures the compact design of ammonia liquid chillers.

For the new X-LARGE size of packages a horizontal liquid separator is used in difference to the vertical oil separator.

Solely plate-type evaporators are used as evaporators. Each series is optionally fitted with a standard evaporator, but can also be adapted to specific operating conditions and customer requests, if need be.

On the condenser side, the following versions are used:

- plate-type condenser PP
- evaporative condenser VP
- air cooled condenser LP

The ammonia chillers 200 – 550 will be delivered as a compact, complete pre-fabricated factory packaged and wired unit, ready for connection on site.

The modular design enables a divided delivery in different parts especially from the chiller size 800 up to 5800. The modules will be re-assembled on site under consideration of certain special machine room conditions.

The ammonia liquid chillers FX LP and FX VP are delivered completely so that solely the air cooled condenser (FX LP) or the evaporative condenser (FX VP) has to be connected on site.

The heat exchangers of the three series are designed for the parameters of a project on both the evaporator- and condenser side. In doing so, the temperature differences are chosen so that the customer requirements are met optimally. If the difference between the evaporating temperature and the temperature of the leaving secondary refrigerant is lower than 5K, the liquid chiller gets the addition HP (High Performance).

The standard version of the liquid chillers is equipped with a freely programmable standard logic controller PLC SIMATIC C7-633. All operating and fault signals as well as the process variables can be read from a LCD-display with background lighting. The display is operated via a robust foil keyboard having 6 function- and 24 system keys.

The liquid chillers are delivered without refrigerant and oil; they are filled with dry nitrogen (0.5 bar gauge pressure).

Each liquid chiller consignment is accompanied by the respective User Documentation which comprises a description of the refrigeration circuit, assembly and commissioning instructions as well as operating and maintenance instructions.

For detailed information about the screw compressors and standard screw compressor units specific Product Documentation is available.

## AMMONIA LIQUID CHILLER SERIES FX P

### FUNCTION

The screw compressor sucks refrigerant gas out of the liquid separator and brought up to condensation pressure. The refrigerant turns to liquid as its cooled in the condenser. Afterwards the liquid is injected back to the liquid separator via a high pressure float valve as expansion device. Inside the liquid separator takes place the separation of the liquid and gaseous phases. The liquid passes in a gravity driven circuit the evaporator. By taking up heat (delivered by the secondary refrigerant) it evaporates and a mixture of gas and liquid is coming back to the liquid separator.

During the operation of the screw compressor, oil is injected into the working chamber and then separated again from the refrigerant in the discharge side oil separator. The oil which has heated up in the compressor is cooled in an oil cooler to reach the entry temperature and passes a fine filter.

Despite of the highly effective oil separation system, oil penetrates to the low pressure side of the Chiller. A special automatic and maintenance-free oil returning system developed by Grasso returns the oil from the liquid separator back into the screw compressor. This is a basic precondition for a flawless operation of the evaporator system.

The capacity control of the screw compressor operates infinitely variable by volume flow control (internal bypass) and thus adapts optimally to the refrigeration capacity being effectively required and ranging from 100% to approx. 15%. The capacity slide is hydraulic driven and activated by 4 solenoid valves. The position of the slide is displayed on the compressor control.

### SAFETY DEVICES

The ammonia chillers are equipped with a comprehensive software safety chain preventing higher pressures, temperatures and freezing of secondary refrigerant. A suction- and discharge pressure control and a motor current control is dominating the normal capacity control in the way if a limit value is exceeded then the capacity slide is activated into minimum position.

Several organizations in different countries require in due to laws and rules extensive additional safety equipment independent from software.

Following additional safety equipment is required by German TÜV:

#### Series FX PP

- Overflow valve from discharge- to suction side
- Safety pressure limiter (2 independent switches with internal and external reset)
- a safety relief valve (with blow off line) is not necessary, because there is a defined refrigerant charge and no vessel can be filled up with more than 90% of liquid refrigerant

#### Series FX LP, VP

- Safety relief valve (with blow off line, to be connected to the outside by contractor)
- Overflow valve from discharge- to suction side
- Overflow valve from HP-receiver of thermosyphon oil cooler to LP side
- Safety pressure limiter (2 independent switches with internal and external reset)

Following additional safety equipment is required if the chiller is delivered according to **EN 378 CE marked**:

#### Series FX PP, LP, VP

- a pressure relief device for every vessel, which might contain liquid refrigerant, within stop valves and a diameter > 152mm. This is not valid for oil separators and oil filters. The pressure relief device is executed as overflow valve.
- Safety pressure limiter (2 independent switches with internal and external reset)
- a double safety valve with change over valve, (with blow off line, to be connected to the outside by contractor)

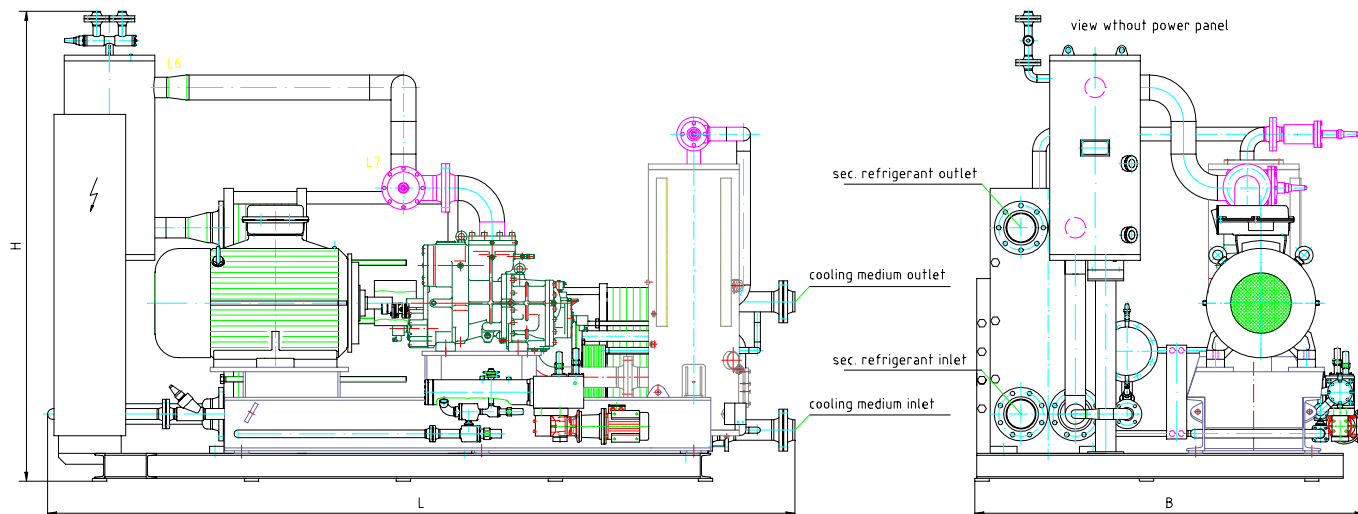
If delivery is according to EN 378 then all in this rule definitely mentioned documentations will be delivered in the national language where the chiller is erected.

All other approvals have to be agreed separately.

Below mentioned data are valid for following standard conditions:

**Secondary refrigerant temperature +12°C/+6°C and Cooling medium temperature +27°C/+32°C**

For other conditions there might be divergent data.



### Dimensions and Weights

| Chiller | L (mm) |      | B (mm) | H (mm) | Weight without charging (kg) |      | Operating weight (kg) |      |
|---------|--------|------|--------|--------|------------------------------|------|-----------------------|------|
| Type    | ST     | HP   |        |        | ST                           | HP   | ST                    | HP   |
| PP 450  | 3200   | 3200 | 2000   | 2300   | 4200                         | 4300 | 4400                  | 4550 |
| PP 550  | 3200   | 3200 | 2000   | 2300   | 4500                         | 4600 | 4750                  | 4900 |
| PP 650  | 3700   | 3700 | 2200   | 2800   | 7000                         | 7100 | 7280                  | 7400 |
| PP 900  | 3800   | 4000 | 2200   | 2800   | 7200                         | 7400 | 7500                  | 7750 |

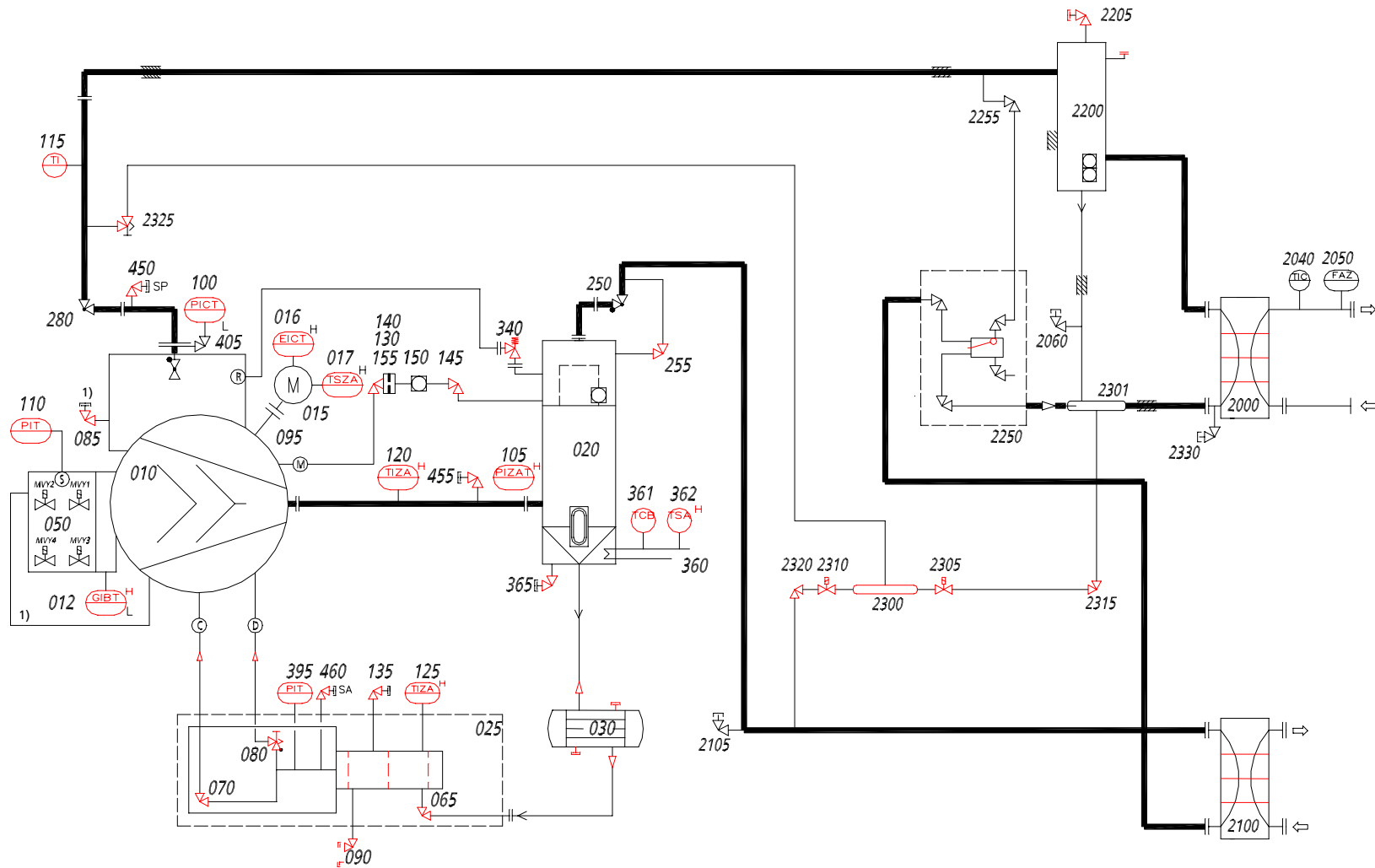
### Chargings, Ports, Sound pressure level

| Chiller Type | Oil charging    | Refrigerant charging | Cold water | Cooling water | Oil cooler | Power supply | Sound press. level |
|--------------|-----------------|----------------------|------------|---------------|------------|--------------|--------------------|
|              | dm <sup>3</sup> | kg                   | NB         | NB            | NB         | kW           | dB(A) 1m           |
| PP 450       | 110             | 52                   | 100        | 100           | 1 1/2"     | 110          | 80                 |
| PP 550       | 110             | 55                   | 100        | 100           | 1 1/2"     | 132          | 81                 |
| PP 650       | 120             | 85                   | 100/150    | 100/150       | 1 1/2"     | 160          | 83                 |
| PP 900       | 120             | 89                   | 100/150    | 100/150       | 1 1/2"     | 200          | 84                 |

ST – Standard :  $\Delta T=5K$  at heat exchangers

HP – High Performance:  $\Delta T<5K$  at heat exchangers

**STANDARD LIQUID CHILLER  
TYPE FX PP 450 ... 900**



AMMONIA LIQUID CHILLER  
SERIES FX PP - STANDARD

| Chiller type | Performance parameters<br>in kW | Cold water inlet-/ cold water outlet temperatures (°C) |      |      |       |       |
|--------------|---------------------------------|--------------------------------------------------------|------|------|-------|-------|
|              |                                 | 11/5                                                   | 12/6 | 14/8 | 16/10 | 18/12 |
| PP 200       | Q <sub>o</sub>                  | 201                                                    | 209  | 215  | 223   | 238   |
|              | P <sub>e</sub>                  | 43                                                     | 43   | 44   | 44    | 46    |
|              | Q <sub>c</sub>                  | 233                                                    | 242  | 249  | 258   | 276   |
| PP 250       | Q <sub>o</sub>                  | 236                                                    | 245  | 253  | 262   | 279   |
|              | P <sub>e</sub>                  | 50                                                     | 50   | 51   | 52    | 54    |
|              | Q <sub>c</sub>                  | 274                                                    | 284  | 292  | 303   | 324   |
| PP 300       | Q <sub>o</sub>                  | 283                                                    | 294  | 303  | 314   | 335   |
|              | P <sub>e</sub>                  | 59                                                     | 59   | 61   | 61    | 63    |
|              | Q <sub>c</sub>                  | 326                                                    | 338  | 348  | 360   | 385   |
| PP 350       | Q <sub>o</sub>                  | 336                                                    | 348  | 359  | 372   | 397   |
|              | P <sub>e</sub>                  | 70                                                     | 70   | 72   | 72    | 75    |
|              | Q <sub>c</sub>                  | 388                                                    | 402  | 414  | 428   | 458   |
| PP 450       | Q <sub>o</sub>                  | 429                                                    | 445  | 459  | 476   | 507   |
|              | P <sub>e</sub>                  | 84                                                     | 85   | 87   | 88    | 91    |
|              | Q <sub>c</sub>                  | 496                                                    | 514  | 529  | 548   | 586   |
| PP 550       | Q <sub>o</sub>                  | 506                                                    | 525  | 542  | 561   | 538   |
|              | P <sub>e</sub>                  | 99                                                     | 100  | 103  | 103   | 108   |
|              | Q <sub>c</sub>                  | 587                                                    | 608  | 626  | 648   | 693   |
| PP 650       | Q <sub>o</sub>                  | 623                                                    | 646  | 666  | 690   | 736   |
|              | P <sub>e</sub>                  | 126                                                    | 127  | 130  | 131   | 136   |
|              | Q <sub>c</sub>                  | 736                                                    | 763  | 786  | 813   | 870   |
| PP 800       | Q <sub>o</sub>                  | 767                                                    | 795  | 820  | 850   | 906   |
|              | P <sub>e</sub>                  | 152                                                    | 153  | 157  | 158   | 164   |
|              | Q <sub>c</sub>                  | 885                                                    | 917  | 945  | 978   | 1045  |
| PP 900       | Q <sub>o</sub>                  | 825                                                    | 855  | 882  | 914   | 975   |
|              | P <sub>e</sub>                  | 162                                                    | 163  | 167  | 168   | 175   |
|              | Q <sub>c</sub>                  | 949                                                    | 983  | 1012 | 1048  | 1121  |
| PP 1100      | Q <sub>o</sub>                  | 991                                                    | 1027 | 1059 | 1087  | 1170  |
|              | P <sub>e</sub>                  | 196                                                    | 197  | 202  | 203   | 212   |
|              | Q <sub>c</sub>                  | 1148                                                   | 1190 | 1226 | 1268  | 1357  |
| PP 1300      | Q <sub>o</sub>                  | 1229                                                   | 1274 | 1314 | 1361  | 1452  |
|              | P <sub>e</sub>                  | 243                                                    | 245  | 251  | 253   | 263   |
|              | Q <sub>c</sub>                  | 1423                                                   | 1475 | 1519 | 1572  | 1681  |
| PP 1700      | Q <sub>o</sub>                  | 1589                                                   | 1647 | 1699 | 1760  | 1877  |
|              | P <sub>e</sub>                  | 302                                                    | 304  | 312  | 314   | 327   |
|              | Q <sub>c</sub>                  | 1829                                                   | 1895 | 1952 | 2020  | 2160  |
| PP 2400      | Q <sub>o</sub>                  | 2225                                                   | 2306 | 2379 | 2465  | 2628  |
|              | P <sub>e</sub>                  | 423                                                    | 426  | 438  | 440   | 458   |
|              | Q <sub>c</sub>                  | 2576                                                   | 2670 | 2750 | 2846  | 3044  |
| PP 2800      | Q <sub>o</sub>                  | 2664                                                   | 2761 | 2849 | 2951  | 3147  |
|              | P <sub>e</sub>                  | 506                                                    | 510  | 524  | 526   | 548   |
|              | Q <sub>c</sub>                  | 3085                                                   | 3197 | 3293 | 3408  | 3645  |
| PP 3300      | Q <sub>o</sub>                  | 3146                                                   | 3260 | 3363 | 3484  | 3716  |
|              | P <sub>e</sub>                  | 601                                                    | 606  | 623  | 625   | 651   |
|              | Q <sub>c</sub>                  | 3617                                                   | 3748 | 3860 | 3995  | 4273  |

Q<sub>o</sub> - Refrigerating capacity

Q<sub>c</sub> - Condensing capacity at cooling water temperatures in-/outlet = 27/ 32°C

P<sub>e</sub> - Power consumption