HYDAC INTERNATIONAL

Cooling Systems Compressor Cooler Unit

RFCS-BL - ...

1. DESCRIPTION

1.1. GENERAL

The compressor cooler units in the standard range BL are available in 6 sizes for cooling capacities of approx. 1 kW to 11.2 kW.

The compact compressor cooler units are suitable for connection to one or several cooling circuits. The coolant can either be a water glycol mixture or, as an alternative, a low viscosity oil.

The coolant is kept at a constant feed flow temperature which can be pre-set. The integral circulating pump supplies the cooling circuit from a generously sized tank. The units are wired ready-for-installation.

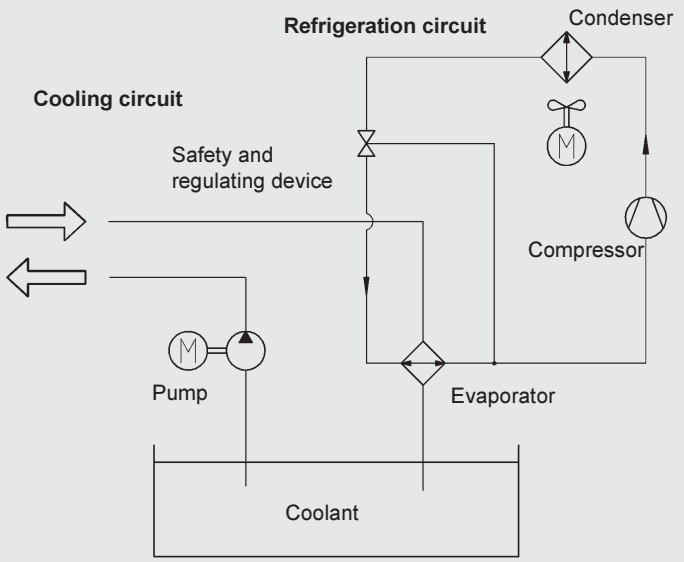
1.2. SYSTEM DIAGRAM

The compressor cooler unit consists of two circuits, the refrigeration circuit and the cooling circuit. The main components of the refrigeration circuit are:

- Compressor
- Condenser
- Safety and regulating devices
- Evaporator (component shared by refrigeration circuit and cooling circuit)

The main components of the cooling circuit are:

- Tank with coolant
- Pump



1.3. PRODUCT FEATURES

The compressor cooler unit consists of:

- A closed-loop refrigeration circuit with hermetic compressor
- Air-cooled condenser protected by a guard
- Plate heat exchanger as the evaporator
- Low noise axial cooling fan
- Precise temperature control of the coolant by means of micro-processor-controlled technology
- Switching, controlling and safety devices
- Large tank
- Pump for water glycol mixture or, as an alternative, for oil as the coolant.

1.4. AREAS OF APPLICATION

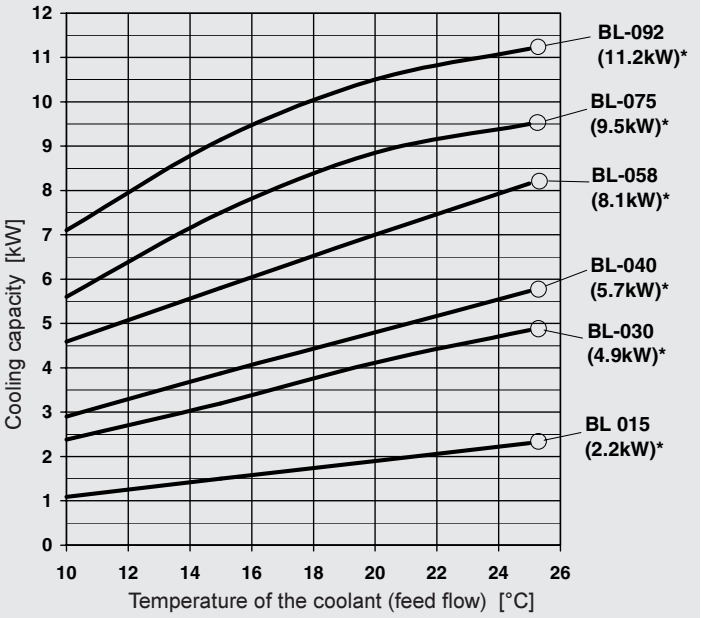
- Machine tools
- Machining centres
- Plastic injection moulding machines
- Presses
- Electrical components

2. SPECIFICATIONS

2.1. COOLING CAPACITY

The cooling capacity of compressor cooler units is dependent on the ambient temperature and the pre-set temperature of the coolant in the feed flow. In the graph the cooling capacities are shown as curves against temperature of the coolant in the feed flow for the relevant size of compressor cooler unit. These cooling capacity curves apply to an ambient temperature (air temperature) of 32 °C.
For higher temperatures, the cooling capacity is reduced by approx. 2% per 1K increase in temperature.

Selection graph RFCS - at 32°C ambient temperature



* (cooling capacity at 32 °C ambient temperature and 25 °C feed flow temperature)

2.2. REFRIGERANT

R134a (not harmful to ozone) is used as the standard refrigerant.

2.3. TEMPERATURE CONTROL RANGE

The temperature of the coolant in the feed flow can be pre-set to between 10 °C and 25 °C, according to customer requirements. For temperatures below the ambient temperature and with correspondingly high humidity, be aware that condensation ("sweat") can form on components carrying the coolant and which have not been insulated.

As an alternative to a fixed pre-set coolant temperature, there is also the possibility of using an ambient temperature-based control (as an option).

2.4. SWITCHING DIFFERENCE

The standard setting of the switching difference (hysteresis) is ±2K. This setting guarantees that the temperature fluctuation in the feed flow on the one hand, and the switching frequency of the compressor on the other, is not too great. A smaller switching difference can only be achieved up to a maximum switching frequency of 10 switching operations per hour. As an option, it is also possible to use a continuous operation control with a switching difference of ±0.3 K.

Please note that the control itself has an additional control tolerance of ±0.2 K.

2.5. SWITCHING FREQUENCY

The maximum permissible switching frequency of the compressor is 10 switching operations per hour. If this limit is exceeded, the life expectancy is considerably reduced (see point 2.4.).

2.6. COOLANT

Either a water/glycol mixture with a max. glycol content of 25% (preferably Antifrogen N), or mineral oil to DIN 51524 Part 1 and 2 can be used (attention must be paid to low viscosity due to pressure drops in the system, especially in the plate heat exchanger).

Other coolants on request.

The choice of coolant affects the sizing and model of the pump, the sizing of the compressor and possibly the cooling capacity.

2.7. PUMP FOR COOLANT

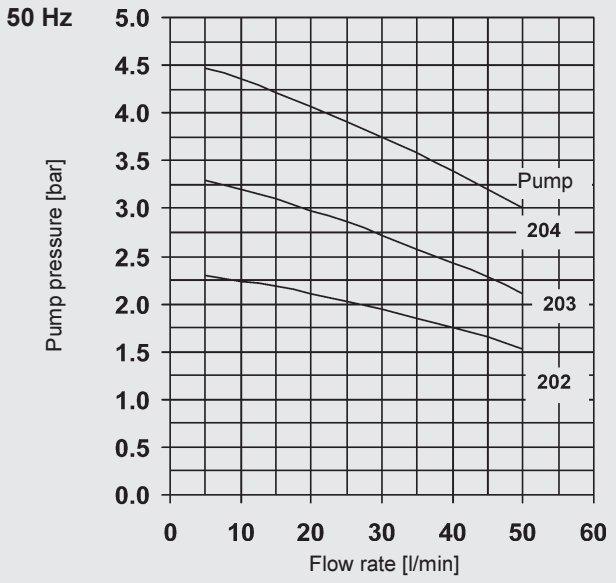
One must differentiate between the coolants water/glycol and oil.

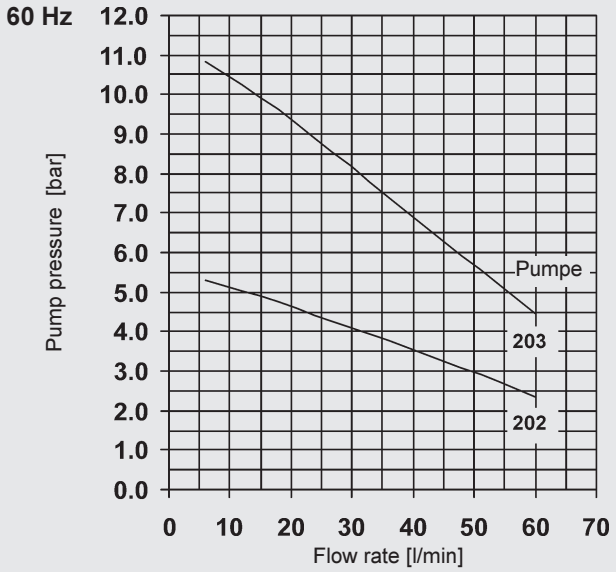
In both cases, standard pumps are specified according to the size of the cooling unit. Smaller or larger pumps can also be selected in each case as an alternative.

2.7.1 **Water/glycol mixture**

Type of pump: multi-stage centrifugal pump

Pump curves
Water or water/glycol





Standard allocation of the pump for water/glycol mixture:

Size	Pump type		Flow rate [l/min]	
	50 Hz	60 Hz	50 Hz	60 Hz
RFCS-BL-015	202	202	See pump curve 50 Hz	See pump curve 60 Hz
RFCS-BL-030	203	202		
RFCS-BL-040	203	202		
RFCS-BL-058	204	203		
RFCS-BL-075	204	203		
RFCS-BL-092	204	203		

Permissible contamination: no abrasive or long-fibred particles, max. quantity of solid particles in suspension 10 mg/l

2.7.2 **Mineral oil**

Type of pump:	fixed-delivery vane pump
Max. viscosity:	150 cSt
Permiss. contamination:	= NAS 12
Internal pressure relief:	6 bar

Standard allocation of the pumps for mineral oil:

Size/ cooler unit	Pump type 50 Hz	60 Hz	Flow rate[l/min] 50 Hz	60 Hz
RFCS-BL-015	MFZP-1/1.1/P/71/7/		10	12
RFCS-BL-030	MFZP-1/1.1/P/71/10/		14.3	17.1
RFCS-BL-040	MFZP-1/1.1/P/71/10/		14.3	17.1
RFCS-BL-058	MFZP-2/2.1/P/80/20/		28.5	34.2
RFCS-BL-075	MFZP-2/2.1/P/80/20/		28.5	34.2
RFCS-BL-092	MFZP-2/2.1/P/90/30/		43	51

2.8. AMBIENT CONDITIONS

Ambient temperature: min. 10 °C, max. 42 °C

The performance data is based on 32°C.

Between 32 °C and 42 °C, a reduction in performance of 2% of the nominal performance per 1K increase in temperature must be expected.

2.9. INSTALLATION POSITION; MOUNTING

The unit must be installed in a vertical position.

It is important to ensure there is free flow of air to the condenser. The minimum distance between the filter guard and a wall must be 0.5 m. It is equally important that the air expelled from the top cannot reach the inlet side. A sensible minimum distance would be 1.0 to 1.5 m from a partition or cover, for example, depending on the size of the unit.

2.10. AIR INLET AND OUTLET

The air inlet is via a filter guard on the back of the unit; the air outlet is on the top of the unit.

2.11. FILTER GUARD ON THE AIR INLET

Contamination of the condenser leads to reduced heat dissipation, an increase of the condenser temperature and finally to shut-down of the unit. For this reason it is important that the condenser is protected on the air inlet side by using a filter guard against contamination. Depending on the type of contamination in the surrounding area, either an air filter with a replaceable filter mesh (for dry dust, for example) can be used, or a metal filter (for oily contamination) which can be cleaned.

2.12. DIMENSIONS; WEIGHTS, TANK VOLUME

Size	Dimensions [mm] Width B	Depth T	Height H	Weight [kg] (empty)	Tank volume [Litres]
RFCS-BL-015	465	445	805	65	15
RFCS-BL-030	655	600	1088	145	52
RFCS-BL-040	655	600	1092	150	52
RFCS-BL-058	655	640	1315	180	70
RFCS-BL-075	750	800	1695	225	100
RFCS-BL-092	750	800	1695	240	150

2.13. ELECTRICAL SPECIFICATIONS

Standard model

Size	Voltage	Frequency	No. of phases
RFCS-BL-015	230 V	50 Hz	1 Ph
RFCS-BL-015	230 V	60 Hz	1 Ph
RFCS-BL-030 - 092	400 V	50 Hz	3 Ph
RFCS-BL-030 - 092	460 V	60 Hz	3 Ph

Special models

Size	Voltage	Frequency	No. of phases
RFCS-BL-015	400 V	50 Hz	3 Ph
RFCS-BL-015	460 V	60 Hz	3 Ph
RFCS-BL-030 - 092	575 V	60 Hz	3 Ph
RFCS-BL-030 - 092	500 V	50 Hz	3 Ph
RFCS-BL-030 - 092	380 V	60 Hz	3 Ph
RFCS-BL-030 - 092	230 V	50 Hz	1 Ph
RFCS-BL-030 - 092	230 V	60 Hz	1 Ph

2.14. PROTECTION CLASS

For size BL-015, the protection class is IP 21, for sizes BL-030 to BL-092, the protection class is IP 44.

2.15. HYDRAULIC CONNECTION

The connections are on the back of the cooler unit underneath the air inlet, as standard. The port is a G3/4 male thread.

2.16. NOISE LEVELS

RFCS-BL-	015	030	040	058	075	092
Sound pressure level (1m distance) approx.	61 dB(A)	63 dB(A)	63 dB(A)	63 dB(A)	59 dB(A)	59 dB(A)

2.17. HOUSING PAINT

The standard paint is light grey RAL 7035, the special paint is traffic grey RAL 7043.

2.18. OTHER OPTIONS

Apart from the basic model with the options described above, further options are also available.

– Ambient temperature-based control of the coolant (additional temperature sensor to measure the ambient temperature)
– Flow indicator to monitor the flow rate of coolant.
– Fault indication as floating contact for operational availability
– Continuous operation of the compressor (± 0.3 K control)
– Harting connector housing as electrical connection

3. GENERAL INFORMATION

3.1. SYSTEM CURVE FOR WATER / GLYCOL MIXTURE

For water and water/glycol mixtures, there is turbulent flow with the normal system components and at normal flow speeds. If the centrifugal pump pumps the coolant through a system, an operating point occurs, i.e. a specific flow rate is produced at a definite back-pressure from the pump.

If, in the same system, a higher flow rate is to be circulated in order, for example, to increase the cooling capacity, then the required pressure the pump must produce can be calculated using the following formula:

$$\mathbf{p_2 = p_1 \times (Q_2/Q_1)^2}$$

p_2 = new pressure to be calculated
p_1 = existing pump pressure
Q_2 = new flow rate
Q_1 = existing flow rate

As can be seen from the formula, the required pump pressure increases quadratically in relation to the flow rate.

That means, for example, that if the flow rate has to be doubled, then four times the pump pressure is required.

3.2. SYSTEM CURVE FOR OIL AS THE COOLANT

In contrast to water, or water/glycol mixtures, for viscous fluids such as oil, there is no turbulent flow in the cooling circuit, but instead laminar flow predominates.

For laminar flows the dependence between pressure and volume is not quadratic but linear

$$\mathbf{p_2 = p_1 \times (Q_2/Q_1)}$$

p_2 = new pressure to be calculated
p_1 = existing pump pressure
Q_2 = new flow rate
Q_1 = existing flow rate

4. MODEL CODE

(also order example)

RFCS-BL - 058 / 1.0 / W / 400 - 50 - 3 / A / 1 / FM / 000

Type
Refrigerator Fluid Cooling System
Base-Line

Nominal size
015 (2.2 kW) *
030 (4.9 kW) *
040 (5.7 kW) *
058 (8.1 kW) *
075 (9.5 kW) *
092 (11.2 kW) *
* Cooling capacity at 32°C ambient temperature
and with the temperature of the coolant in the feed flow at 25°C

Modification number

Coolant
W = water/glycol mixture (see 2.6)
M = mineral oil (see 2.6.)

Voltage - frequency - no. of phases
Standard 50 Hz:
230-50-1 for RFCS-BL-015
400-50-3 for RFCS-BL-030 to 092
For 60 Hz and other voltages, see 2.13.

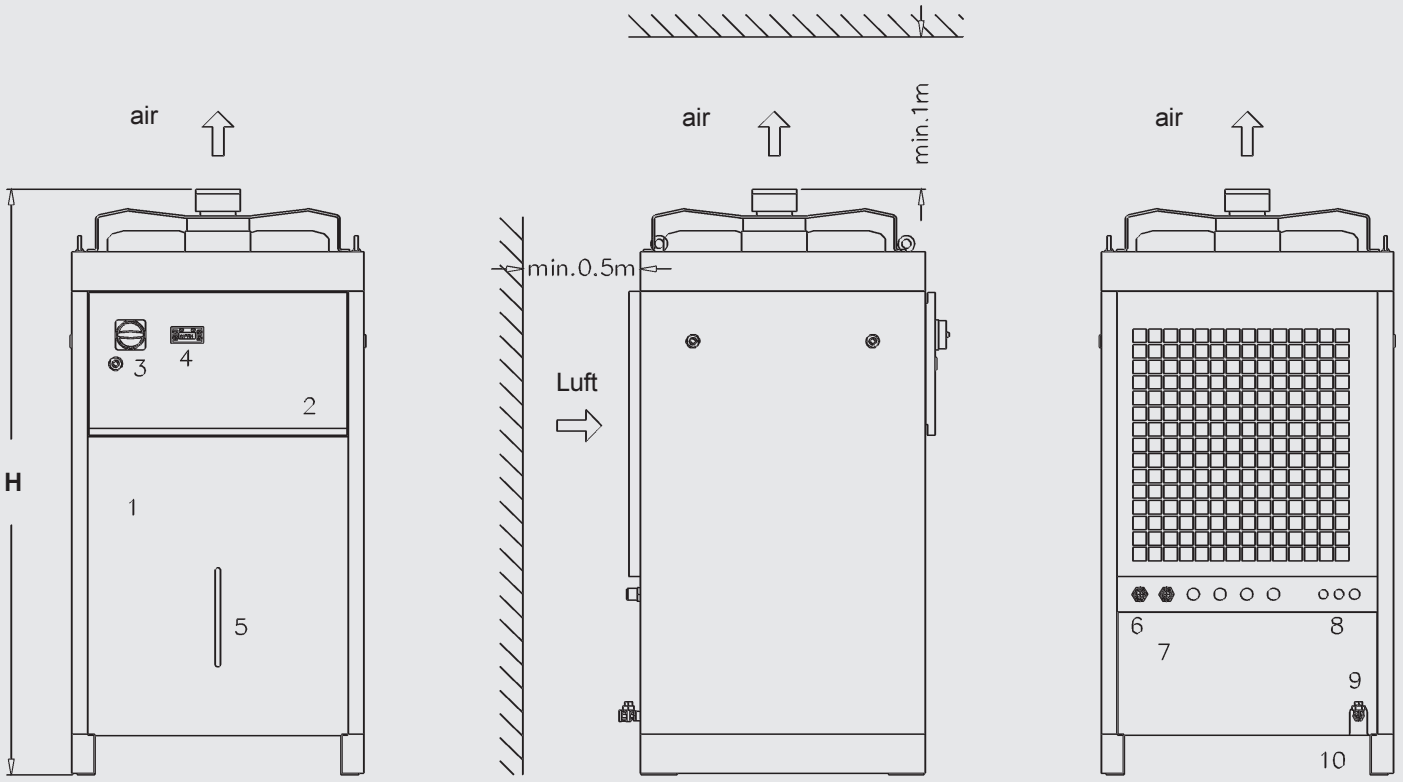
Pump (for circulating the coolant)
A = standard pump (see 2.7.)
B = a size smaller than the standard
C = a size larger than the standard

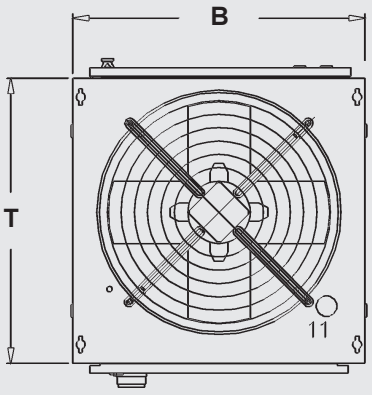
Paint
1 = light grey RAL 7035 (standard)
2 = traffic grey RAL 7043

Filter guard (in front of the air inlet in front of the condenser)
FM = filter mesh pack (see 2.11.)
MG = metal grid filter (see 2.11.)

Options and combinations of options
(see 2.18)
Serial number

5. DIMENSIONS





1 Housing
2 Control box
3 Main EMERGENCY OFF switch
4 Microprocessor temperature regulator
5 Fluid level gauge
6 Coolant inlet ¾"
7 Coolant outlet ¾"
8 Electrical connection
9 Drainage valve with hose connection
10 C-profile feet
11 Filling connection DN 40

Size	Dimensions Width B	[mm] Depth T	Height H	Weight [kg] (empty)
RFCS-BL-015	465	445	805	65
RFCS-BL-030	655	600	1088	145
RFCS-BL-040	655	600	1092	150
RFCS-BL-058	655	640	1315	180
RFCS-BL-075	750	800	1695	225
RFCS-BL-092	750	800	1695	240

6. NOTE

The information in this brochure relates to the operating conditions and applications described.

For applications or operating conditions not described, please contact the relevant technical department.

Subject to technical modifications.

7. CALCULATION SHEET

In order to make the correct selection, a number of details must be available. The following check list should be helpful in this.

Project			
Contact		Tel:	
Address		Fax:	

Application		
Nominal refrigeration capacity	KW	
Ambient temp. in normal operation	°C	
Coolant: water/glycol	%	
Coolant: mineral oil (type)		
Mineral oil viscosity at 10 °C	cSt	
Mineral oil viscosity at 40 °C	cSt	
Coolant temperature in feed flow line	°C	
Coolant temperature in return line	°C	
Flow rate of pump	l/min	
Pressure differential in cooling circuit	bar	
Nominal voltage	V	
Frequency - no. of phases	Hz -	
Installation dimensions	mm	Height: Width: Depth:
Air distribution		Suction direction::
		Vent direction:
Installation site		
Accessories		
Other requirements		
Annual quantities		