Data sheet

HRU – Heat Recovery Unit

General description and application

Danfoss Heat Recovery Unit provide the link between a CO_2 refrigeration systems and the heating installation. It is developed and designed for recovery of waste heat from refrigeration installations, where CO_2 is used as medium, to heat supermarkets (hot tap water, heating, air handling units) and enables selling surplus heat back to the district heating network. Danfoss HRU can be used in installations with different external heat supply, such as District energy, boiler or other heat source.

Characteristic:

• Heating demand: 22-540 kW

• Maximum recovered heat from CO_2 pack up to 50-400kW

Two different solutions based on store size:

1. one- tank solution - for small stores up to 1500 m²

2. two-tanks solution - for medium and large stores

Standard layout in 6 versions:

• indirect connection (type A2,A6) or directly connection (type A4,A7).

• indirect connection (type A1) or connection to DHU (type A3), designed for areas where it is possible to sell heat to DHU network.

Maximum operating parameters

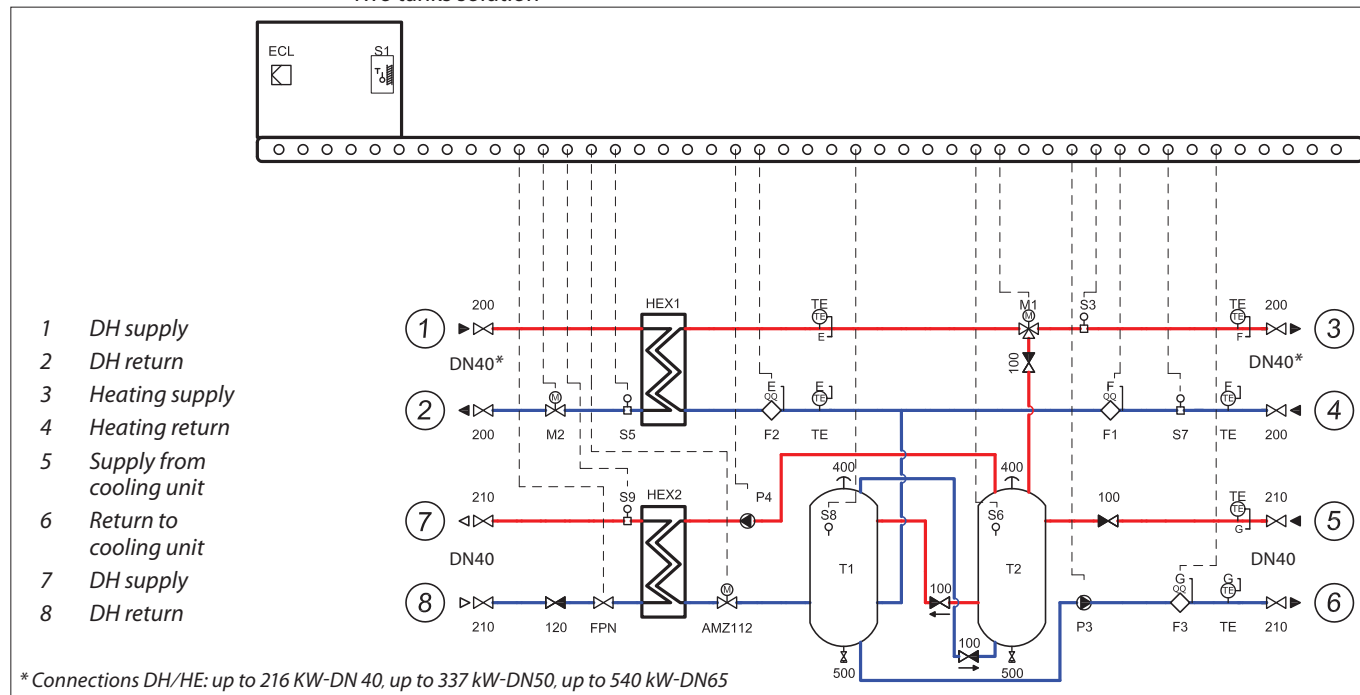| Primary	
Maximum permissible supply temperature, primary*	90 °C
Maximum permissible operating pressure, primary	10 bar
Rated pressure, primary	PN 10
Maximum permissible flow, primary	15 m³/h for v= 1,2 m/s (A1, A2, A3, A4) 3 m³/h for v= 1,2 m/s (A6,A7)
Secondary heating	
Maximum permissible temperature, secondary*	90 °C
Maximum permissible operating pressure, secondary	(A1, A2) – 6 bar, (A3, A4, A6, A7) – 10 bar
Minimum required pressure (static), water supply	1,0 bar
Maximum permissible flow, secondary	15 m³/h for v= 1,2 m/s (A1, A2, A3, A4) 3 m³/h for v= 1,2 m/s (A6,A7)
CO_2 heat supply	
Maximum permissible temperature, secondary	90 °C
Maximum permissible operating pressure, secondary	(A1, A2) – 6 bar, (A3, A4, A6, A7) – 10 bar
Minimum required pressure (static), water supply	1,0 bar

* For higher temperatures – contact Danfoss

Materials

Pipes, fittings, flanges, valves (Primary side)	P235GH, EN-GJL-250 (GG25), CuZn36Pb2As
Pipes, fittings, flanges, valves (Heating side)	P235GH, EN-GJL-250 (GG25), CuSn5Pb5Zn5-C (RG-5)
Heat exchanger	1.4404 with Cu solder
Insulation	Elstomeric Foam (Nitrile Rubber) – λ = 0.035 W/mK (piping) PU foam – λ = 0.029 W/mK (heat exchanger)

Circuit diagram A1   Indirect connection to DHU network with possibility of transfer heat outside heating system
Two-tanks solution

	1	DH supply
	2	DH return
	3	Heating supply
	4	Heating return
	5	Supply from cooling unit
	6	Return to cooling unit
	7	DH supply
	8	DH return

* Connections DH/HE: up to 216 KW-DN 40, up to 337 kW-DN50, up to 540 kW-DN65

A1 selection list

		CO₂ output [kW] (sales demand)			
		up to 100	up to 150	up to 300	up to 400
Heating demand [kW]	up to 22	146B9108	146B9109		
	up to 54	146B9120	146B9121	146B9122	146B9123
	up to 85	146B9126	146B9127	146B9128	146B9129
	up to 135	146B9132	146B9133	146B9134	146B9135
	up to 216	146B9138	146B9139	146B9140	146B9141
	up to 337	146B9144	146B9145	146B9146	146B9147
	up to 540	146B9150	146B9151	146B9152	146B9153

Function

Waste heat from CO₂ system is transferred via CO₂ heat exchanger * using water as medium, into supply storage tanks T2 and T1.

The temperature sensor (S6) check the temperature in tank (T2) and send a signal to a 3-way valve (M1), which will open and heat accumulated in tanks will be transferred into the heating circuit.

Lower demand for heat will cause closing of the controlling valve (M2) and reduce or cut the need for energy from the external heat source. The temperature sensor (S8) control the pump (P3) and when the temperature reaches the desired level and no more heat can be accumulated. Secondary heat meters (F1 and F2) are measuring flow and heat meter F3 on the charging circuit calculates the recovered energy.

The primary function is to recover as much energy as possible, and secondary as high temperature as possible.
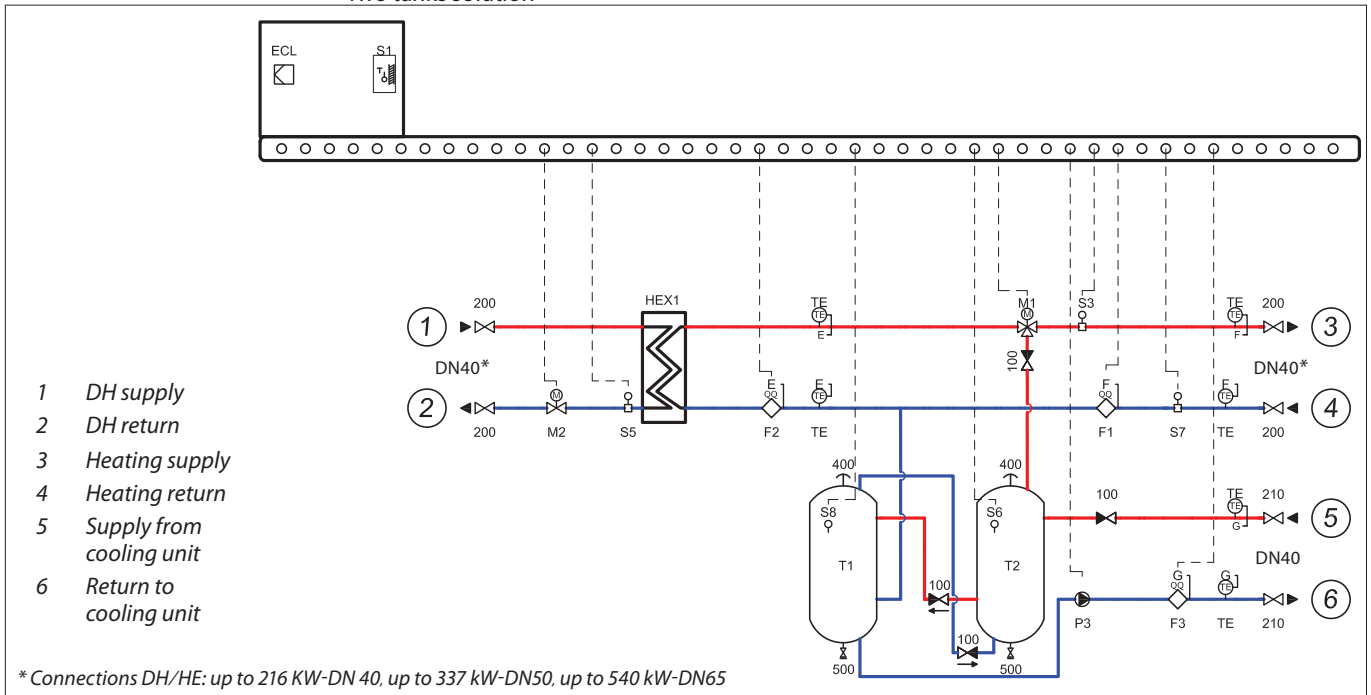We always prioritize usage of heat recovered from cooling unit, before supplying from external heat source. A1 version offers returning heat back into the DHU network or other external network via heat exchanger HEX2.
If the recovered energy is more than the stores can reuse, the pump P4 is activated so this energy can be sold to the district heating.

* CO₂ HEX is not included in the delivery of HRU, but is part of the cooling unit

Circuit diagram A2   Indirect connection to DHU network
Two-tanks solution

1   DH supply
2   DH return
3   Heating supply
4   Heating return
5   Supply from
     cooling unit
6   Return to
     cooling unit

* Connections DH/HE: up to 216 KW-DN 40, up to 337 kW-DN50, up to 540 kW-DN65

A2 selection list

		CO$_2$ output [kW]			
		up to 100	**up to 150**	**up to 300**	**up to 400**
Heating demand [kW]	up to 135	146B9164	146B9165		
	up to 216	146B9168	146B9169	146B9170	
	up to 337	146B9173	146B9174	146B9175	146B9176
	up to 540	146B9179	146B9180	146B9181	146B9182

Function

Waste heat from CO$_2$ system is transferred via CO$_2$ heat exchanger * using water as medium, into supply storage tanks T2 and T1.

The temperature sensor (S6) check the temperature in tank (T2) and send a signal to a 3-way valve (M1), which will open and heat accumulated in tanks will be transferred into the heating circuit. Lower demand for heat will cause closing of the controlling valve (M2) and reduce or cut the need for energy from the external heat source.

The temperature sensor (S8) controls the pump with PWM signal (P3) and when the temperature reaches the desired level and no more heat can be accumulated.

In two-tanks solution application, secondary heat meters (F1 and F2) are measuring flow and heat meter F3 on the charging circuit calculates the recovered energy.
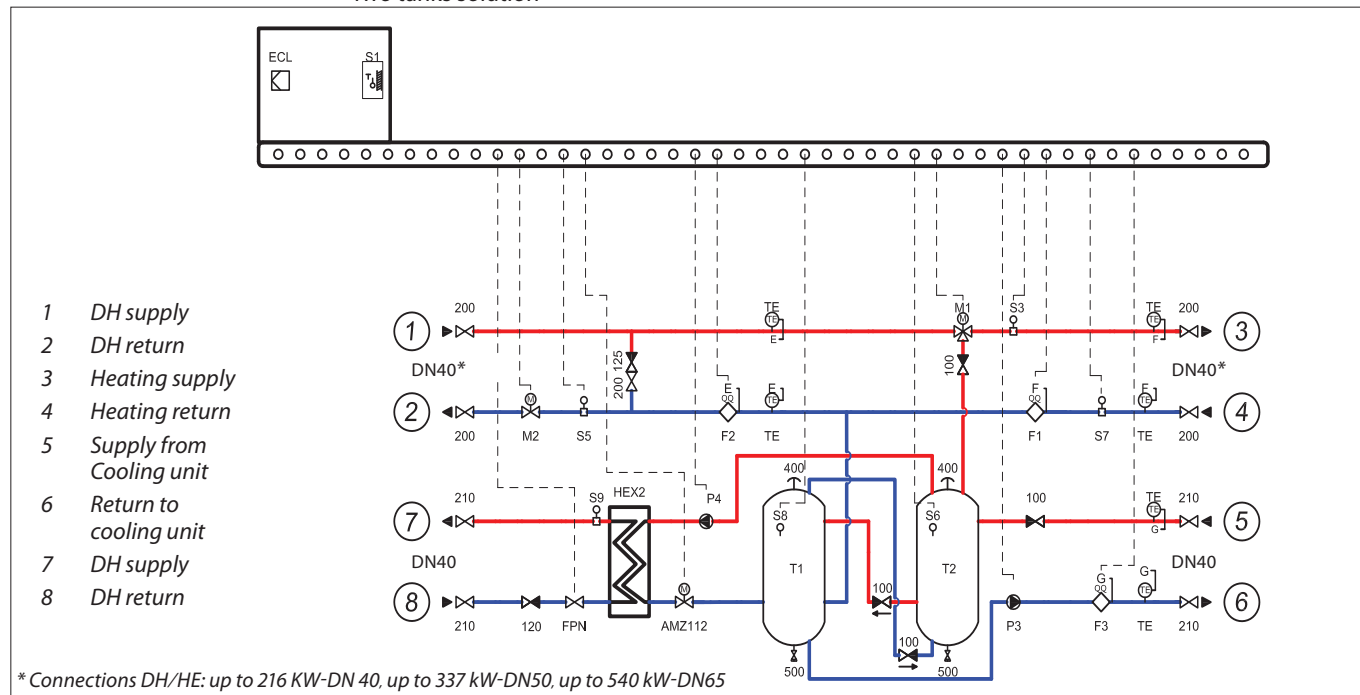
* CO$_2$ HEX is not included in the delivery of HRU, but is part of the cooling unit)

The primary function is to recover as much energy as possible, and secondary as high temperature as possible.

We always prioritize usage of heat recovered from cooling unit, before supplying from external heat source.

Circuit diagram A3   Direct connection to DHU network with possibility of transfer heat outside heating system
Two-tanks solution

1   DH supply
2   DH return
3   Heating supply
4   Heating return
5   Supply from Cooling unit
6   Return to cooling unit
7   DH supply
8   DH return

* Connections DH/HE: up to 216 KW-DN 40, up to 337 kW-DN50, up to 540 kW-DN65

A3 selection list

		CO$_2$ output [kW] (Sales demand)			
		up to 100	up to 150	up to 300	up to 400
Heating demand [kW]	up to 22	146B9191	146B9192		
	up to 54	146B9203	146B9204	146B9205	146B9206
	up to 85	146B9209	146B9210	146B9211	146B9212
	up to 135	146B9215	146B9216	146B9217	146B9218
	up to 216	146B9221	146B9222	146B9223	146B9224
	up to 337	146B9227	146B9228	146B9229	146B9230
	up to 540	146B9233	146B9234	146B9235	146B9236

Function

Waste heat from CO2 system is transferred via CO2 heat exchanger * using water as medium, into supply storage tanks T2 and T1.

The temperature sensor (S6) check the temperature in tank (T2) and send a signal to a 3-way valve (M1), which will open and heat accumulated in tanks will be transferred into the heating circuit.

Lower demand for heat will cause closing of the controlling valve (M2) and reduce or cut the need for energy from the external heat source. The temperature sensor (S8) control the pump (P3) and when the temperature reaches the desired level and no more heat can be accumulated. Secondary heat meters (F1 and F2) are measuring flow and heat meter F3 on the charging circuit calculates the recovered energy.

The primary function is to recover as much energy as possible, and secondary as high temperature as possible.
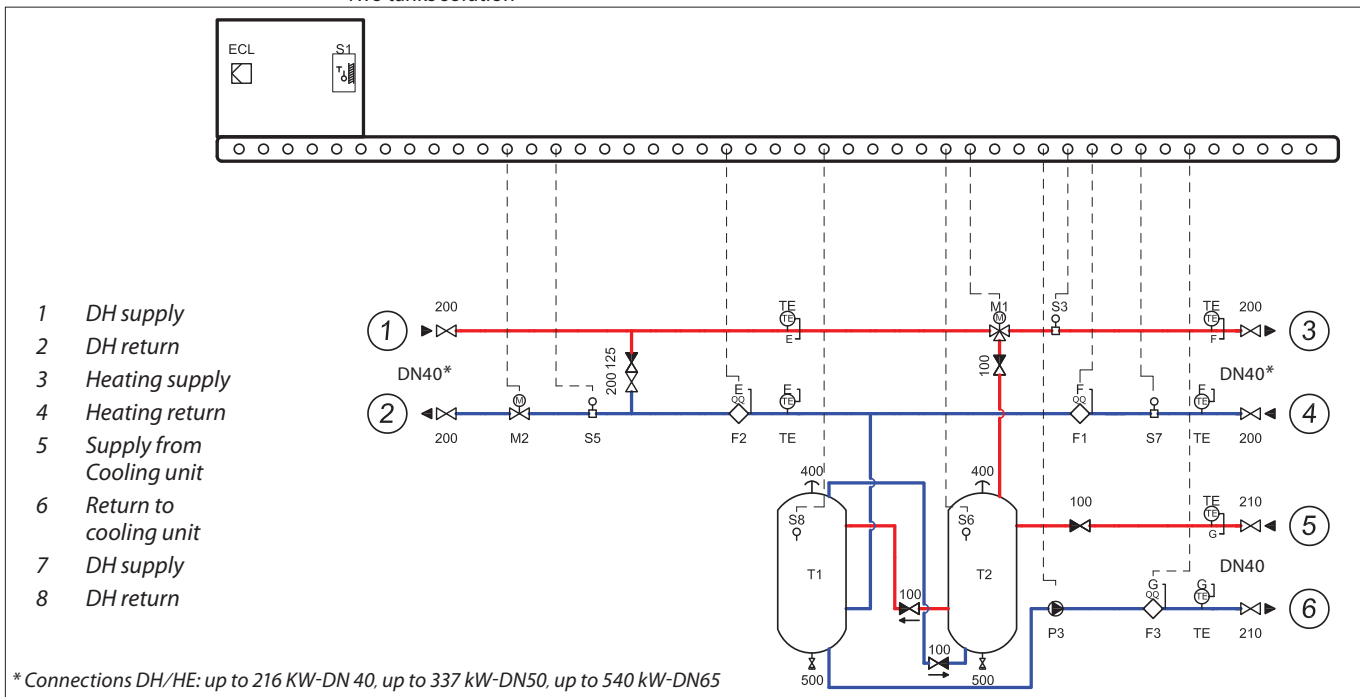We always prioritize usage of heat recovered from cooling unit, before supplying from external heat source.
A3 version offers returning heat back into the DHU network or other external network via heat exchanger HEX2.
 If the recovered energy is more than the stores can reuse, the pump P4 is activated so this energy can be sold to the district heating.

* CO$_2$ HEX is not included in the delivery of HRU, but is part of the cooling unit

Circuit diagram A4   Direct connection to DHU network
Two-tanks solution

1 DH supply
2 DH return
3 Heating supply
4 Heating return
5 Supply from Cooling unit
6 Return to cooling unit
7 DH supply
8 DH return

* Connections DH/HE: up to 216 KW-DN 40, up to 337 kW-DN50, up to 540 kW-DN65

A4 selection list

		CO₂ output [kW]			
		up to 100	**up to 150**	**up to 300**	**up to 400**
Heating demand [kW]	up to 135	146B9247	146B9248		
	up to 216	146B9251	146B9252	146B9253	
	up to 337	146B9256	146B9257	146B9258	146B9259
	up to 540	146B9262	146B9263	146B9264	146B9265

Function

Waste heat from CO_2 system is transferred via CO_2 heat exchanger * using water as medium, into supply storage tanks T2 and T1.

The temperature sensor (S6) check the temperature in tank (T2) and send a signal to a 3-way valve (M1), which will open and heat accumulated in tanks will be transferred into the heating circuit. Lower demand for heat will cause closing of the controlling valve (M2) and reduce or cut the need for energy from the external heat source.

The temperature sensor (S8) controls the pump with PWM signal (P3) and when the temperature reaches the desired level and no more heat can be accumulated.

In two-tanks solution application, secondary heat meters (F1 and F2) are measuring flow and heat meter F3 on the charging circuit calculates the recovered.
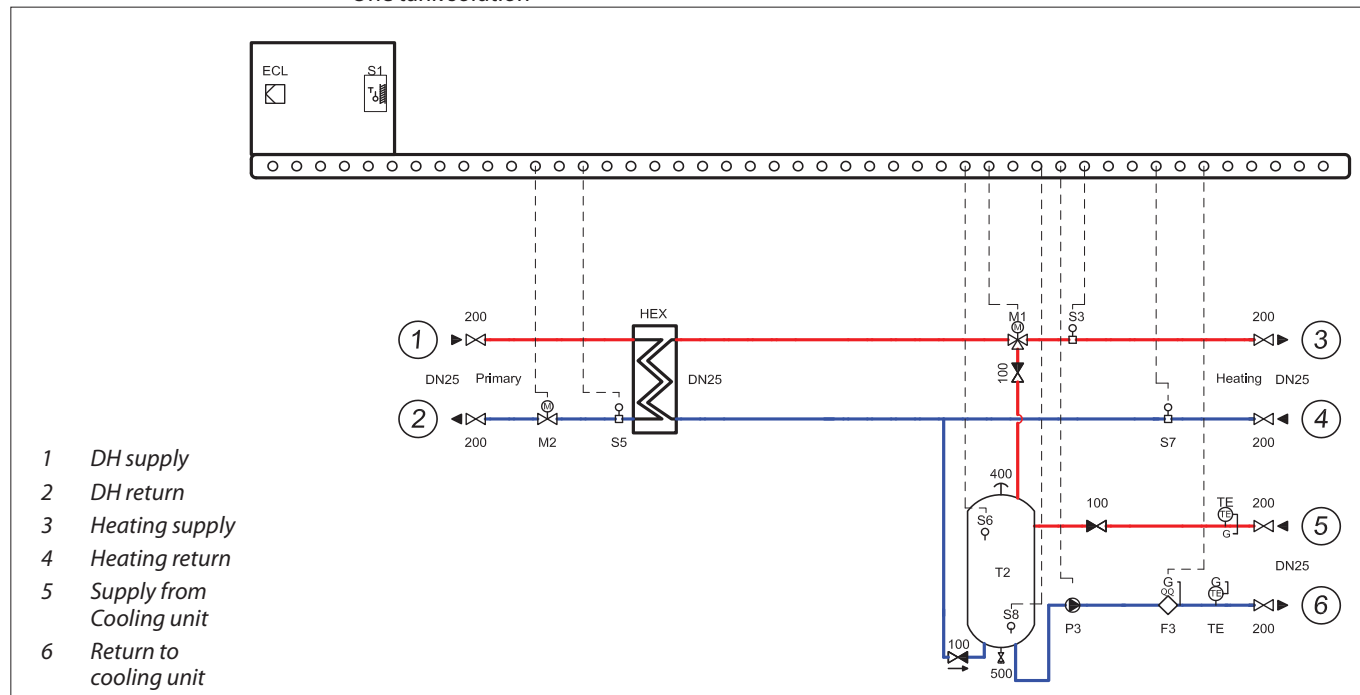
* CO₂ HEX is not included in the delivery of HRU, but is part of the cooling unit
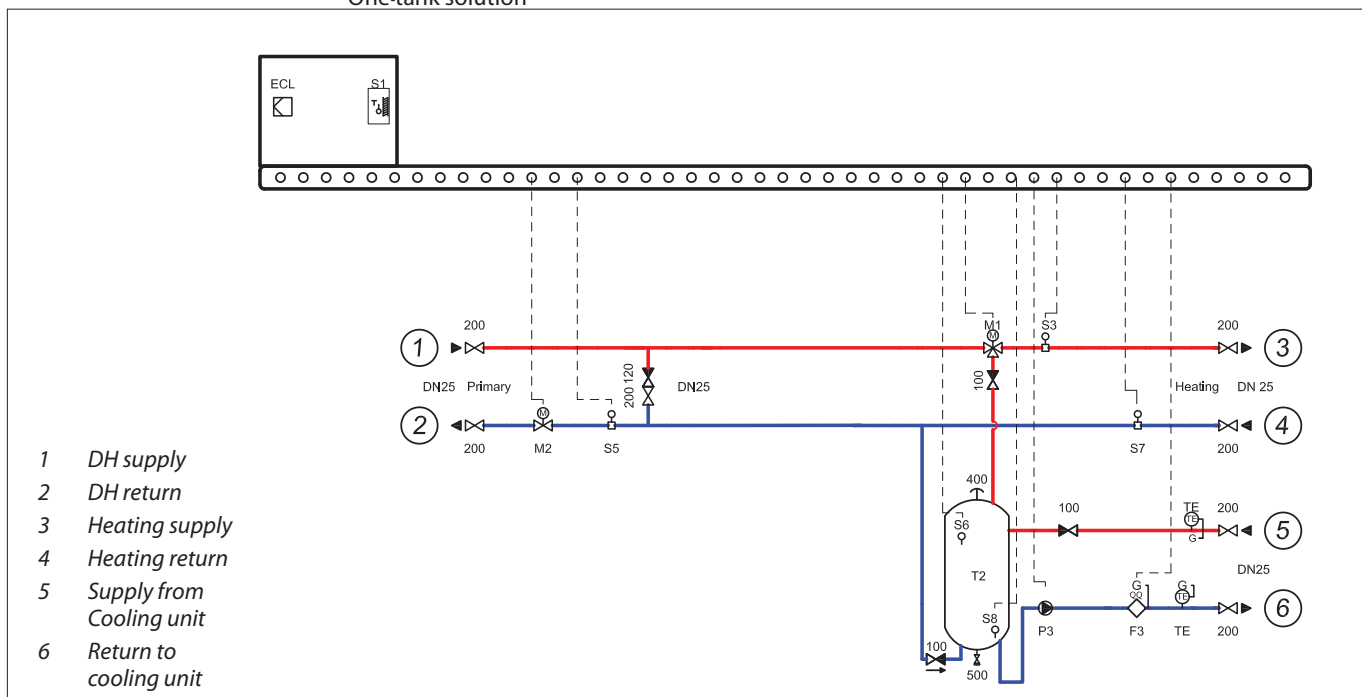
The primary function is to recover as much energy as possible, and secondary as high temperature as possible.

We always prioritize usage of heat recovered from cooling unit, before supplying from external heat source.

Circuit diagram A6   Direct connection to DHU network with possibility of transfer heat outside heating system
One-tank solution

1   DH supply
2   DH return
3   Heating supply
4   Heating return
5   Supply from
     Cooling unit
6   Return to
     cooling unit

A6 selection list

		CO₂ output [kW]
		up to 100
Heating demand [kW]	up to 22	146B9400
	up to 54	146B9401
	up to 85	146B9402

Function

Waste heat from CO_2 system is transferred via CO_2 heat exchanger * using water as medium, into supply storage tank T2. The temperature sensor (S6) check the temperature in tank (T2) and send a signal to a 3-way valve (M1), which will open and heat accumulated in tank will be transferred into the heating circuit. Lower demand for heat will cause closing of the controlling valve (M2) and reduce or cut the need for energy from the external heat source. The temperature sensor (S8) control the pump with PWM signal (P3) and when the temperature reaches the desired level and no more heat can be accumulated. In one-tank solution application, heat meter F3 on the charging circuit calculates the recovered energy.

The primary function is to recover as much energy as possible, and secondary as high temperature as possible.

We always prioritize usage of heat recovered from cooling unit, before supplying from external heat source.

CO₂ HEX is not included in the delivery of HRU, but is part of the cooling unit

Data sheet   **HRU – Heat Recovery Unit**

Circuit diagram A7   Direct connection to DHU network
One-tank solution

1   DH supply
2   DH return
3   Heating supply
4   Heating return
5   Supply from
    Cooling unit
6   Return to
    cooling unit

A7 selection list

		CO$_2$ output [kW]
		up to 100
Heating demand [kW]	up to 22	146B9403
	up to 54	146B9404
	up to 85	146B9405

Function

Waste heat from CO$_2$ system is transferred via CO$_2$ heat exchanger * using water as medium, into supply storage tank T2. The temperature sensor (S6) check the temperature in tank (T2) and send a signal to a 3-way valve (M1), which will open and heat accumulated in tank will be transferred into the heating circuit. Lower demand for heat will cause closing of the controlling valve (M2) and reduce or cut the need for energy from the external heat source. The temperature sensor (S8) control the pump with PWM signal (P3) and when the temperature reaches the desired level and no more heat can be accumulated. In one-tank solution application, heat meter F3 on the charging circuit calculates the recovered energy.

The primary function is to recover as much energy as possible, and secondary as high temperature as possible.
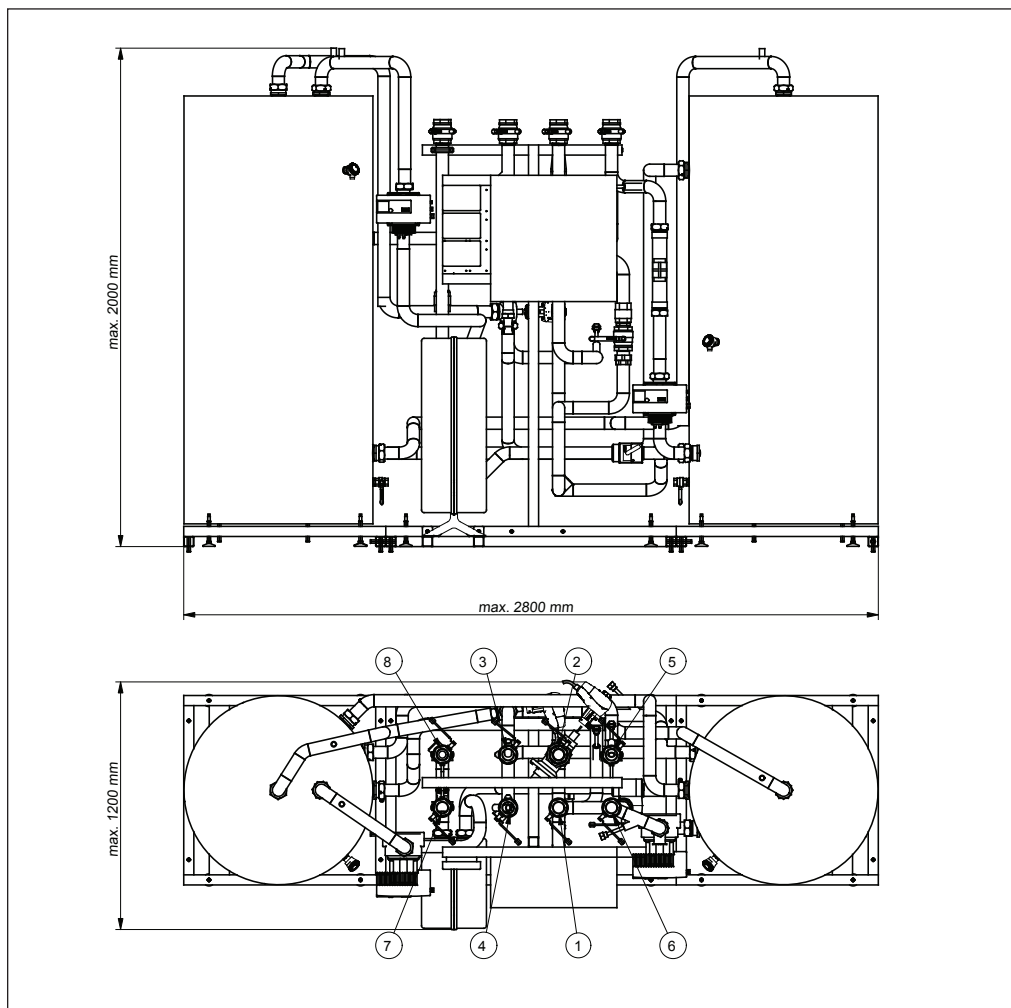
We always prioritize usage of heat recovered from cooling unit, before supplying from external heat source.temperature as possible.

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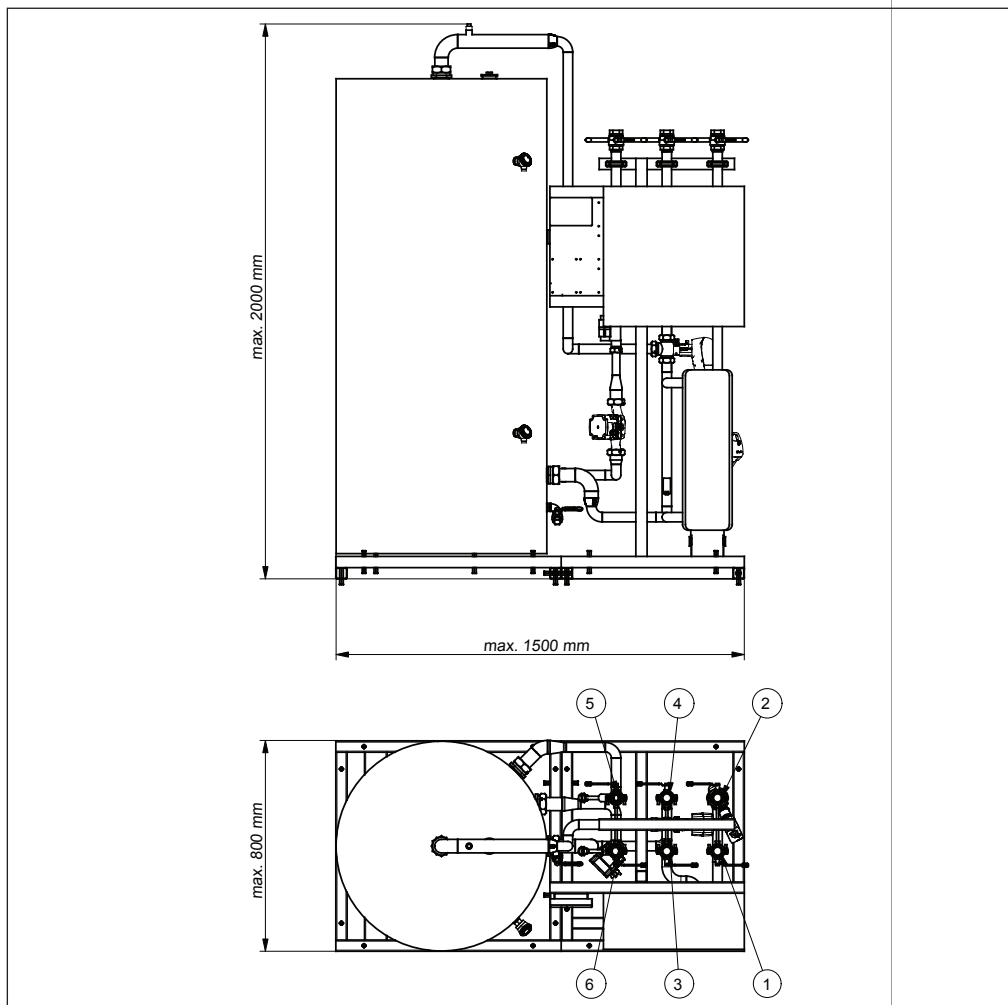
Dimensions

Two-tanks solution (A1, A2, A3, A4)

Component overview

Item (see circuit diagram)	Description
100, 120, 125	Check valve
200, 210	Shut-off Ball valve
AMZ112	Motorized ON/OFF ball valve
FPN	Flowswitch DN25
400	Air vent
500	Drain
F1,F2,F3	Heat meter
M1	Motorized Control valve HE (3-way) VRB3+AMV
M2, M3	Motorized Combi valve AHQM + AMV
P3	Pump
P4	Pump (ver. A1, A3)
S1	Outdoor temperature sensor, ESMT
S3, S5, S7,S9	Surface temperature sensor, ESM-11
S6, S8	Immersion temperature sensor, ESMU 250
T1, T2	Tank 6 bar(ver. A1, A2), Tank 10 bar(A3, A4)
HEX1	Heat exchanger XB 37/XB 59 (ver. A1, A2)
HEX2	Heat exchanger XB 37/XB59 (ver. A1, A3)
ECL	Electronic controller+ A501

Dimensions

One-tank solution (A6, A7)

Component overview

Item (see circuit diagram)	Description
100, 120	Check valve
200, 210	Shut-off Ball valve
400	Air vent
500	Drain
F3	Heat meter
M1	Motorized Control valve HE (3-way) VRB3+AMV
M2	Motorized Combi valve AHQM + AMV
P3	Pump
S1	Outdoor temperature sensor, ESMT
S3, S5, S7	Surface temperature sensor, ESM-11
S6, S8	Immersion temperature sensor, ESMU 250
T2	Tank 10 bar(ver. A6, A7)
HEX	Heat exchanger XB 37/XB 59 (ver. A6)
ECL	Electronic controller+ P501