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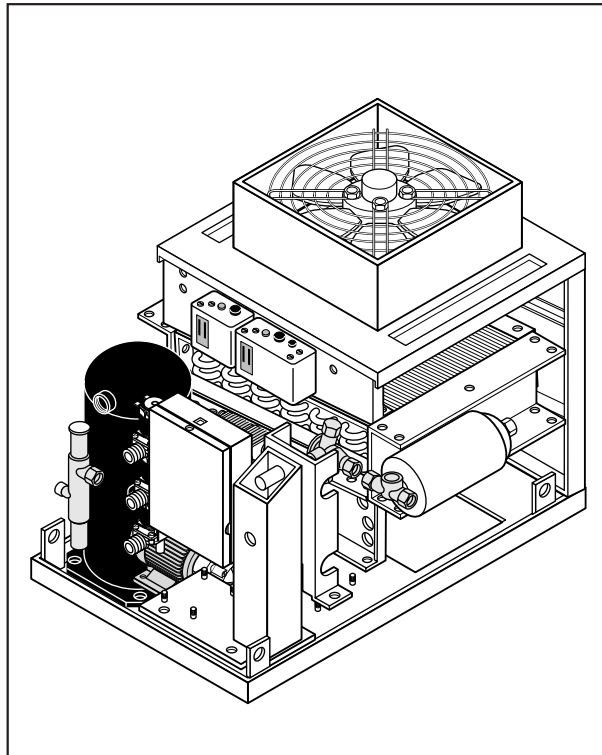
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# SERVICE TRAINING CENTER

**HOBART**

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## SERVICE MANUAL III

### HEAT PUMP

# CHP18

(CNA / CNR with "Kurz" Control)



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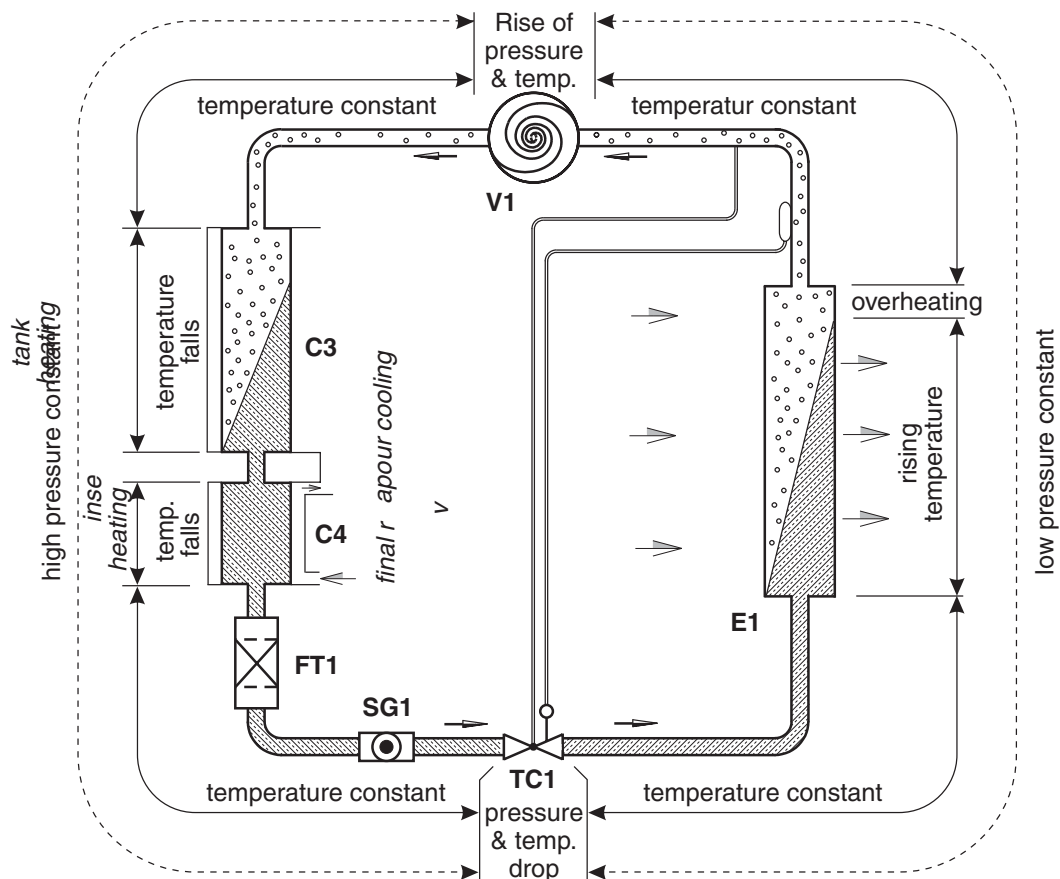
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## OPERATING PRINCIPLE

The heat pump contains all the components which are required to run a so called "thermodynamic process". These components are: Compressor [V1], condenser [C3], expansion valve [TC1] and evaporator [E1].

- A heat pump takes off heat energy at a relatively low temperature level from the exhaust vapour of the dishwasher.
- Extra electrical energy is required to run the compressor which transposes the heat to a higher output temperature level in order to heat up wash tanks and rinse water.



The refrigerant R134a ( $\text{CH}_2\text{F} - \text{CF}_3$ ) is constantly circulated in a closed loop where it changes its condition, taking up low temperature energy and delivers high temperature energy.

The vaporized refrigerant enters the scroll compressor [V1] in superheated condition at about 10 - 20°C and at a pressure of 3 - 4,2 bar.

The refrigerant condition at the compressor exit is 17 - 23 bar at approx. 90 - 100°C.

The refrigerant is cooled down and condenses to its liquid state in the tank heater [C3] while the tank water is heated up to approx. 65°C.

Subsequently, the liquefied refrigerant is passing through the undercooler [C4] where the refrigerant heats up the final rinse water to approx. 45 - 55°C while it cools down to 40 - 45°C.

In the next step, the refrigerant is passing the dryer [FT1], the sight glass [SG1] and enters the expansion valve [TC1] where a throttling process reduces the pressure to 3 - 4,2 bar and the temperature to 1 - 11°C.

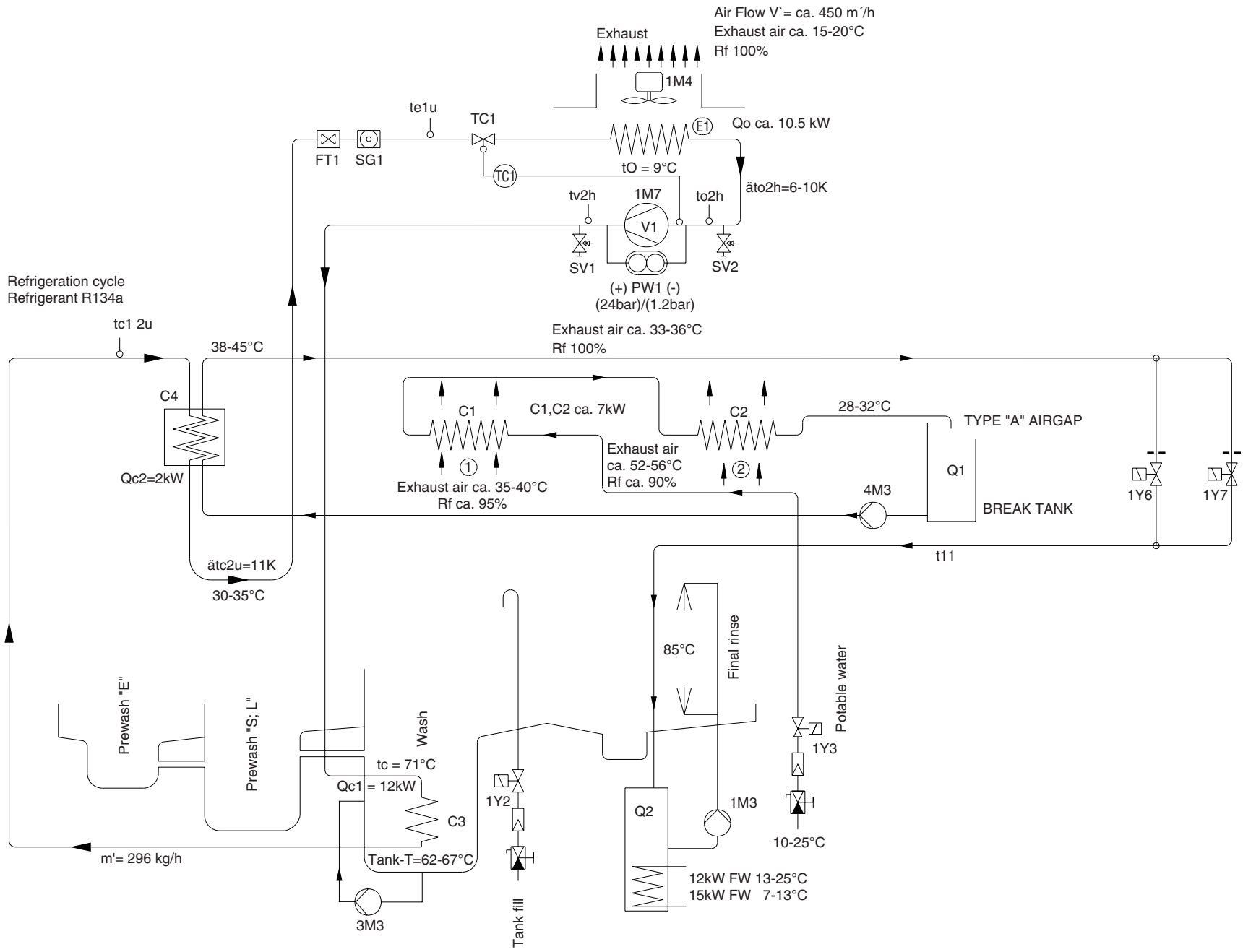
During this stage, a part of the liquefied refrigerant becomes gaseous due to inherent heat. The refrigerant changes its condition from liquid into gas in the evaporator [E1].

**NOTE:**

The absolute *pressure corresponds* with the measured overpressure (manometer) and the ambient pressure (1 bar).

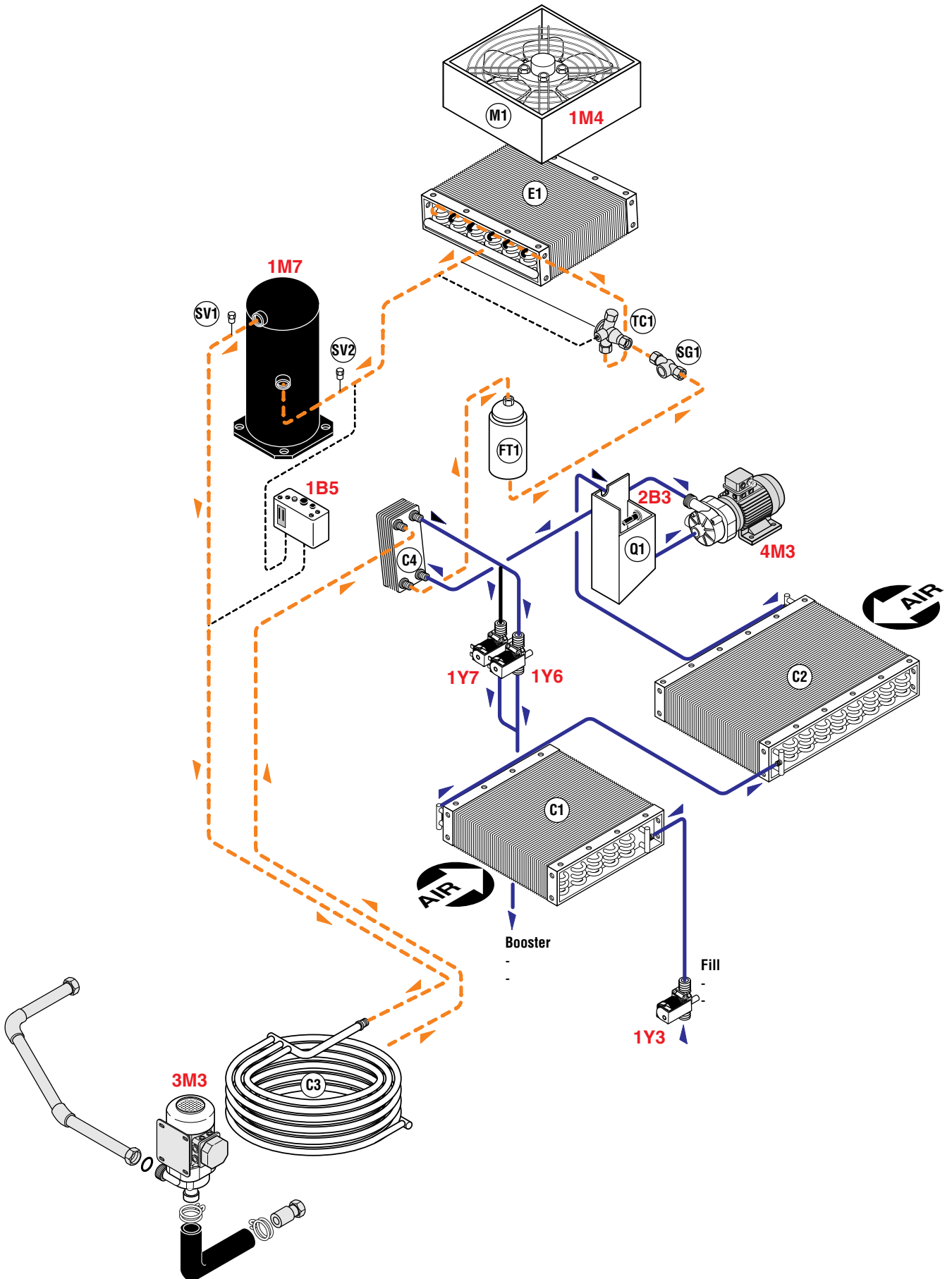
$$P_{abs} = P_e + P_{amb} / = P (\text{manometer}) + (1 \text{ bar})$$

**HEAT BALANCE OF THE REFRIGERATION CIRCUIT**



The above temperature ranges depend on the operating state of the machine and are valid for fresh water temperature of approx. 15°C.

CHP18 – COMPONENTS



## HEAT PUMP FUNCTION

### VAPOUR EXTRACTION AND HEAT RECOVERY

The vapour which is generated in the wash and rinse compartments is taken up at the suction openings [1] and [2] and directed through the heat exchangers [C1] and [C2] followed by the evaporator [E1]. This air flow is forced by the ventilator [1M4].

The extracted vapour is cooled down at the evaporator [E1] from approx. 28 - 30°C to at least 18°C and blown into the room.

During the heat-up cycle, the compressor [V1 / 1M7] and ventilator [1M4] are in operation. During that period the primary energy is **extracted** from the room and from the vapour inside the tank.

#### **Important:**

*The exhaust ducts [1] and [2] must be sealed carefully against the heat pump housing and against the evaporator [E1] so that the vapour is directed completely through the condensers [C1] and [C2] into the evaporator suction chamber.*

### WATER CIRCUIT

Cold water at min. 1.5 bar is passing through the solenoid valve [1Y3] and the condensers [C1 and C2] and enters the break tank [Q1] via class "A" air gap.

In the condensers the water will be heated up to approx. 35°C.

By the pressure pump [4M3] the water passes the undercooler [C4] where it is heated up to 45-55°C.

Thereafter, the water is directed through the solenoid valves [1Y6] and [1Y7] to the booster where it is heated up to 80 - 85°C.

The pressure pump [1M3] forces the water from the booster into the final rinse spray system.

The solenoid valve [1Y6] is provided with a diaphragm 3,5 mm Ø (696936-33, 250l/h).

During heat pump operation the solenoid valve [1Y6] will be activated permanently.

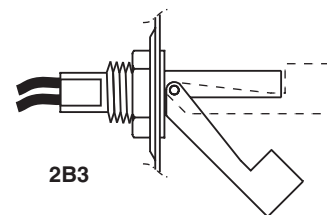
Due to the flow control valve the booster gets less water than needed for final rinse. If the water level is below [1B3], the bypass solenoid valve [1Y7] will be opened additionally and the booster will be filled to the upper level.

#### **Filling the break tank**

The final rinse system is **fed** via break tank [Q1] (on top).

The water level in the break tank is controlled by the float switch [2B3] (NO).

If water level is below [2B3], the fresh water valve [1Y3] will be activated with approx. 5 sec. time delay.



#### **Filling with warm water**

The water temperature shall be in the range of 50-60°C.

The fill valve [1Y2] will be actuated as soon as the machine is switched on. It remains actuated until the float switch of the last wash tank switches and the time delay [C02] ceases.

The compressor [1M7] will be switched on for approx. 5 sec. (fixed time) when the solonid valve [1Y2] opens the first time.

#### **Filling via booster**

As soon as the machine is switched on, the pressure pump [2M3] will run and the fill valves [1Y6] and [1Y7] open. The booster will be filled until the upper level of float switch [1B3] is reached.

The compressor [1M7] will run for approx. 5 sec. (fixed time) after switch on the machine resp. fill start.

When the operation **temperature** of the booster is reached, the rinse pump [1M3] will run and fill valve [1Y6] opens. If the water level in the booster falls below float switch [1B3], the valve [1Y7] will be activated in addition to [1Y6]. After the water level has reached the float switch [2B2] in the main washtank (AR), the machine continues to fill until the float switch of the last washtank is reached and the overfill time [C02] is completed.

## HEAT PUMP FUNCTION

### HEATING PHASE

After reaching the water level float switch [2B2] (AR wash tank level), the compressor [1M7] and exhaust ventilator [1M4] will be activated.

**Requirement:** there is no failure in the heatpump control system (e.g. motor protection 1Q7.1) and the high-pressure or low-pressure switch [1B5] (via 1K10 LP or 2K10 HP) has not tripped (switch-on lock is active).

The circulation pump [3M3] will start when the compressor is switched on, tank temperature is 56°C and the wash is switched off (stand-by).

Compressor [1M7] and exhaust ventilator [1M4] stop after the set temperature of 65°C is reached. The heating element of the prewash tank (if installed) switches off after the set temperature of 40°C is reached.

If these conditions are fulfilled, machine is ready for operation.

### WASH CYCLE

During heating up, when the water level in the tanks is reached, all wash pumps will run for 15 sec. when the following temperatures are reached: 55°C, 59°C, 61°C, 63°C. This is essential to heat up the machine housing and to keep the energy in the whole system balanced.

The circulation pump [3M3] will be switched off during this 15 seconds.

During stand-by mode, every 14 min. [C13] (= 800 sec.) the wash pumps will run for 15 sec. [C14].

The circulation pump [3M3] will also be switched off during this 15 sec.

The wash cycle will be activated by parameter [S16] of the control.

This function is automatically activated if machine program with heat pump is chosen.

### STAND-BY MODE

Wash cycle is activated during stand-by mode.

Compressor [1M7] and exhaust [1M4] as well as tank circulating pump [3M3] (only at temperatures  $\geq 56^\circ\text{C}$ ) will start again as soon as the temperature drops below 63°C.

The named units operate until 65°C has been reached.

Switch-on lock time [C41] of the compressor [1M7] is set to 30 seconds.

### WASH AND RINSE PHASE

As soon as the wash is started, the compressor [1M7] and the exhaust ventilator [1M4] start to work, independent of the CHP-lockout status.

Rinse pump [1M3] and pressure pump [4M3] start and the valve [1Y6] opens.

The water level in the booster is controlled by the float switch [1B3].

If the booster is short of water, the valve [1Y7] will open until the upper water level is reached and the fill time delay (set to 5 sec [C01] / adjustable) is over.

If the wash stops, the machine will be set into stand-by mode.

Compressor [1M7] and exhaust will work until the tank temperature F04 (65°C) is reached.

When the wash is switched off, the tank circulating pump [3M3] runs parallel to the compressor.

If the conveyor is stopped by the table end switch [1S6], the wash pump will stop after 45 sec. [C06]. As long as the end switch is not free again, the machine works as in the stand-by mode.

The compressor [1M7] runs with the same conditions as in the case of normal switch off the wash.

## PRESSURE CONTROL

### Low pressure / high pressure switch control

As too many on and off cycles could possibly reduce the life time of the scroll compressor, the on and off cycles are controlled by the compressor lockout [**C41** = 30 sec].

During start up, if the wash or room temperature is too low, the compressor may be switched off by the low-pressure switch [**1B5**] (via **1K10** LP – pressure lower then 1.2 bar at the manometer).

If there is not enough refrigerant, if the supply water is too cold (min. 45°C) or the wash has been started before readiness for operation, the compressor will be permanently switched on / off by the activated low-pressure switch [**1B5**] (via **1K10** LP).

Therefore, the switching cycles of the low-pressure and high-pressure switch 1B5 (via **1K10** LP and **2K10** HP) are counted within a time period [**C42** = 900 sec -> 15 min]. This means, after the 4th switching off [**C24**] via the low-pressure switch within this time period, the compressor [**1M7**] will be switched off and the error message "**AL5 001**" is displayed.

The high-pressure switching cycles (C25 = 4) will be controlled the same way and displayed by the error message "**AL5 002**" (possible cause e.g. water splash-over).

To quit the failure "**AL5 001**" or "**AL5 002**" and to clear the display, switch off machine via ON/OFF button.

When the time period has expired or the machine has been switched off via ON/OFF button, the counters [**C42**], [**C24**] and [**C25**] will be reset.

If the low-pressure or high pressure switch has tripped, the restart of the compressor is blocked for 3 min. (fixed time). The exhaust fan [**1M4**] will not be switched off.



## TROUBLE SHOOTING

In order to detect malfunctions successfully, it is essential to use refrigeration pressure gauges for high and low pressure as well as a temperature meter.

### UNITS TO BE CHECKED:

- rinse arms (correct mounting, no leaks)
- fresh water supply temperature in the range 8° to 25°C
- check water feed and float switch in the break tank
- are all covers and panels in place
- is the tank circulation pump [3M3] running when wash pump is stopped and the compressor is switched on
- if the above is OK, connect pressure gauge

### PRESSURE SWITCH (LOW PRESSURE) TRIPS OFF

(see page 8 "pressure control")

If the low pressure drops below 1.2 bar, the compressor will be switched off for 3 minutes.

In case of a malfunction due to low pressure switch tripping, the compressor may stop and run in intervals. Too many on and off cycles could possibly reduce the life time of the compressor unit. Therefore, the frequency of switch off cycles is counted by the microprocessor.

If 4 intervals are identified within a time period of 4 minutes, the microprocessor categorises this as a malfunction and blocks the compressor. At the same time, the message "**AL5 001**" is displayed.

Switch off the machine to clear the fault message and to quit this failure.

### Pressure switch (low pressure) [1B5] stops the compressor [1M7].

This failure could be caused by the following:

- Not enough refrigerant (leakage in the refrigeration circuit)
- Evaporator frosted (exhaust fan [1M4] defective, heat pump cover and panels not in place)
- Tank fill temperature insufficient (to be 45 - 65°C)
- Operation has been started before readiness for operation (tank temperatures) has been achieved.
- Obstruction or defective component in the refrigeration circuit

### PRESSURE SWITCH (HIGH PRESSURE) TRIPS OFF

(see page 8 "pressure control")

If the pressure in the refrigeration circuit reaches 24 bar, the compressor will be stopped for 3 minutes.

In this case the on / off cycles are also monitored. If the compressor has been switched off 4 times within an adjustable time period the compressor will be blocked and the message "**AL5 002**" is displayed.

Switch off the machine to clear the fault message and to quit this failure.

### Pressure switch (high pressure) [1B5] stops the compressor [1M7].

This failure could be caused by the following:

- Tank temperature too high (see "adjusting values")
- Inaccurate measuring by temperature probe (check)
- Tank water level insufficient (foam, leaking drain valve)
- Too much primary energy from the blower dryer

**TROUBLE SHOOTING**

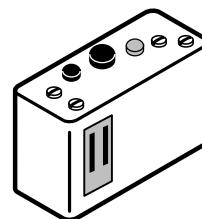
CODE	FAULT DESCRIPTION	POSSIBLE CAUSE
<b>AL5 001</b>	Low pressure	The compressor has been switched off 4 times within an adjustable time by pressure switch 1B5 (LP). Switching cycle and time control are stored in parameter C24 (= 4) and C42 (= 900 sec).
<b>AL5 002</b>	High pressure	The compressor has been switched off 4 times within an adjustable time by pressure switch 1B5 (HP). Switching cycle and time control are stored in parameter C25 (= 4) and C42 (= 900 sec).
<b>AL5 003</b>	Motor protector compressor tripped	
<p>To clear the fault messages AL5 001 and 002:</p>		<p>Up to EPROM Rev. 1.17: eliminate error and switch off the machine via main switch. Starting from Rev. 2.00: switch off machine via ON/OFF button</p>

**ATTENTION !!!**

- The compressor sounds very noisy if its motor turns in the wrong direction (during installation for instance). Even the temperatures at the compressor inlet and outlet indicate correct / incorrect direction of rotation. The outlet at the compressor head reaches a temperature of about 90°C after a short time and the compressor inlet becomes cool in the case of proper direction of rotation. An overheating and tripping of the internal coil protection is the consequence, if this is ignored. All the internal windings will be switched off and no resistance can be measured during a test with a resistance meter. This may lead to the diagnosis that the compressor is defective but the coil protection will reset after a cooling down period of about one hour and allow to operate it after rewiring (change) of two phases.
- If a compressor is destroyed due to burnt out windings, an acid will be generated in combination with the compressor oil. The dryer must be replaced together with the compressor. In such a case, an acid absorbent dryer must be installed additionally in the suction line. The coils of the new compressor motor may be destroyed after a short time if this advice is ignored.
- The **bracket** between heat pump housing and compressor is just a **transportation lock** and **must be removed before switch-on** to prevent damaging due to vibration.
- **The pressure switches and expansion valves are adjusted at the manufacturers site and must not be manipulated.**

**SETTINGS OF LOW / HIGH PRESSURE SWITCH 1B5**

Pressure	Pü (manometer)	Difference
low pressure (LP)	1.2 bar	0.7 bar
high pressure (HP)	24 bar	4 bar





NOTES

A large grid of graph paper for taking notes, consisting of approximately 30 columns and 40 rows of small squares.

**SERVICE TRAINING CENTER**





SERVICE TRAINING CENTER

## Service Manual

HOBART GmbH  
An ITW-Company

EFFICIENT – RELIABLE – INNOVATIVE



# SERVICE MANUAL

CONVEYOR RACK TYPE DISHWASHER

**CNA**

PRESSURE BOOSTER SYSTEM / STARTING FROM EPROM rev. 3.00



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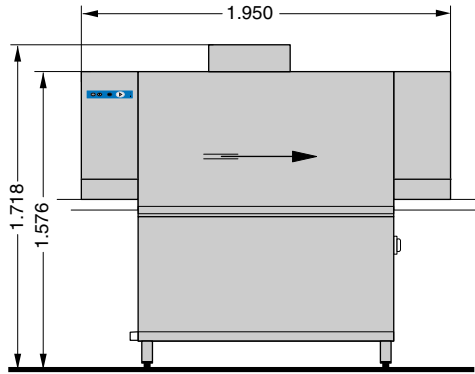
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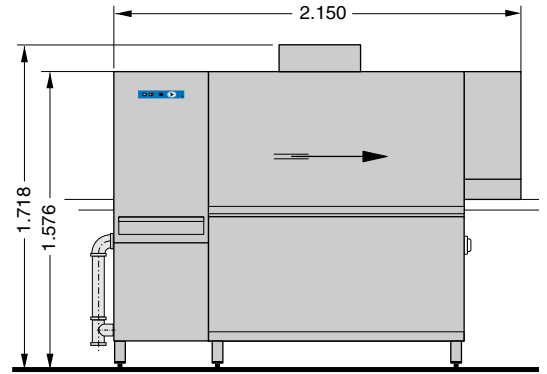
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CNA MODULES

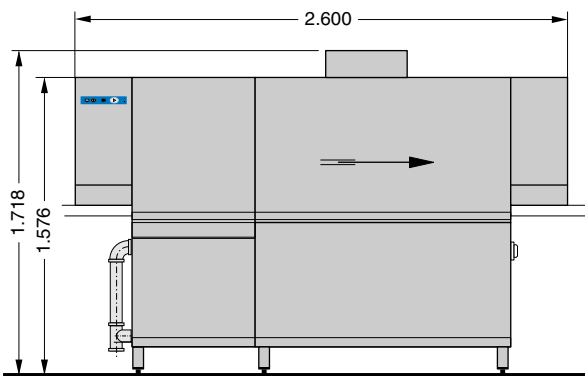
CNA



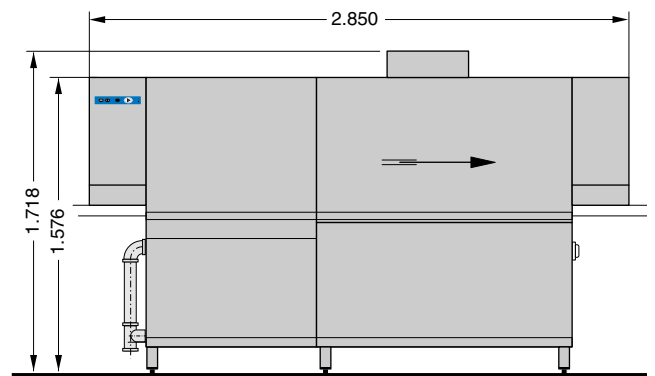
CNA-E



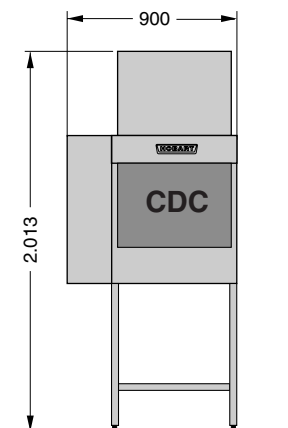
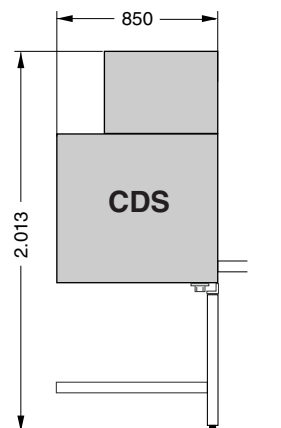
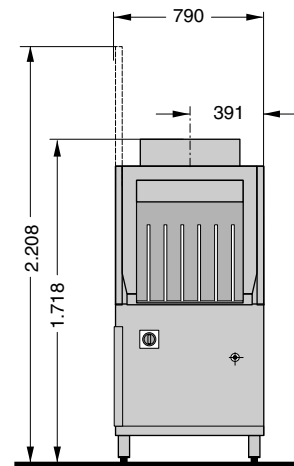
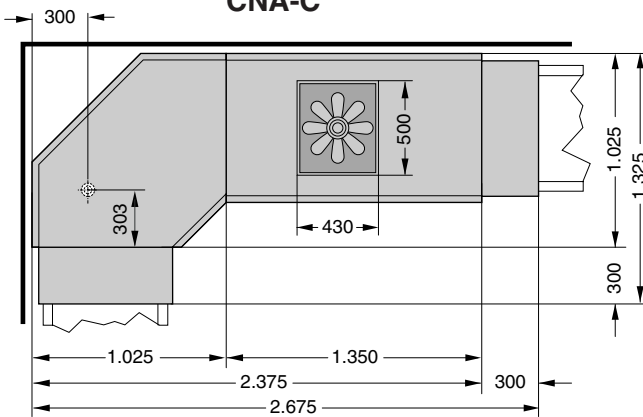
CNA-L



CNA-S



CNA-C

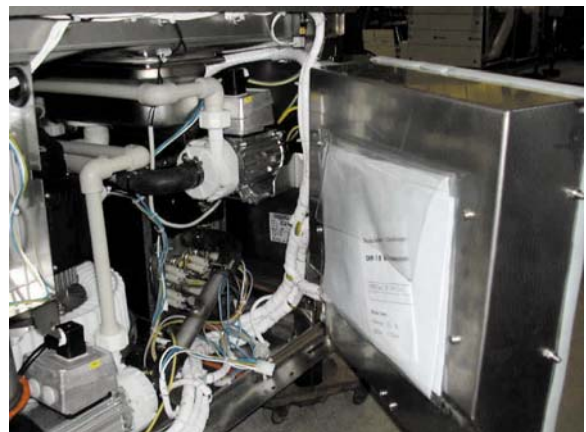


## TECHNICAL DATA

MODEL	CNA	CNA-E	CNA-L	CNA-S	CNA-C
<b>Capacity (racks - plates / hour)</b>					
standard	120 - 2160	150 - 2700	180 - 3240	220 - 3960	180 - 3240
accordant DIN0510	80	100	120	150	120
<b>Prewash</b>					
Pump load (kW)	–	0.3	1.1	1.5	1.1
Delivery rate (l/min)	–	250	740	1020	740
Tank volume (l)	–	30	54	100	54
<b>Wash</b>					
Pump load (kW)	1.5	1.5	1.5	1.5	1.5
Delivery rate (l/min)	1020	1020	1020	1020	1020
Tank volume (l)	100	100	100	100	100
<b>Rinse</b>					
Water consumption (l / hour)	260	260	260	260	260
<b>Dryer</b>					
Heating (kW)	4.5 / 9	4.5 / 9	4.5 / 9	4.5 / 9	4.5 / 9
Air circulation (m-/h)	1800	1800	1800	1800	1800
Fan motor (kW)	0.42	0.42	0.42	0.42	0.42
<b>Equipment</b>					
2 speeds	yes	yes	yes	yes	yes
Auto-timer	Option	Option	Option	Option	Option
Isolating switch	Option	Option	Option	Option	Option
Dual rinse	yes	yes	yes	yes	yes
Triple rinse	Option	Option	Option	Option	Option
Heat recovery C30	Option	Option	Option	Option	Option
Heat pump CHP18	Option	Option	Option	Option	Option

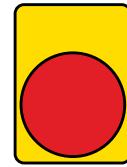
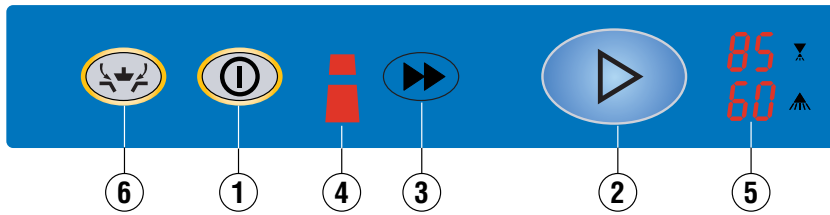
## MACHINE DOCUMENTS

Wiring diagrams and general machine data are stored in a pocket at the rear of the hinged electric box.





## CONTROLS



**Emergency Stop  
(option)**

**1. Machine ON / OFF**



Pushing this button switches the dishwasher on or off.

**NOTE: After switch off, the machine is not voltage free!** At the temperature indicator **Rinse** appears a point.

**2. Start / Stop button – Conveyor / Wash**



Pushing this button starts the conveyor with the selected speed. The button illuminates to indicate the mode of the machine:

- RED** = machine fills and starts heating
- GREEN** = machine is ready for operation
- BLUE** = washing on

**When the button flashes:**

- RED** = when switching on the machine: machine is filled but heating-up.  
fault: the temperature indicators display an error code.
- GREEN** = machine refills and heats up
- BLUE** = program started, but machine is not ready for operation

**3. Conveyor speed button**



By pushing this button, it is possible to select between two pre-set conveyor speeds. The selected speed will be indicated.

By pushing this button for approx. **4 seconds**, temperatures will be indicated.

"Ch0" = rinse / "Ch1" = wash

"Ch2" = prewash (option – activated by S03 in configuration mode)

"Ch5" = fill booster (option – activated by S23 and S24 in configuration mode)

The temperatures will be displayed one after the other by repeated pushing the **Conveyor speed** button.

*The indicators go out 10 seconds after releasing the button.*

**4. Conveyor speed indicator**



Indicates the selected speed.

= slow    = fast

When the conveyor speed indicator **flashes**, the table end switch is activated [1S6].

**5. Temperature indicators**



Indicates the current temperature:

Temperature indicator **Rinse** (°C)

Temperature indicator **Wash** (°C)

*With a machine malfunction, the temperature indicators display a code.*

**6. Drain button**



By pushing this button for approx. **2 seconds**, only the prewash tank will be drained.

The drain button illuminates and the Start / Stop button illuminates red.

After a pre-set time (C04) drain cycle stops and the machine will be refilled automatically.

To drain the machine completely, push drain button for approx. **4 seconds**.

The drain valves will be controlled via adjustable time delay [C05].

The Drain button illuminates and the Start / Stop button switches off.

## INITIAL OPERATION

### FILLING THE RINSE BOOSTER (pressure booster and separate fill booster (if installed))

This is necessary after setting the machine type, when the dishwasher has been initially installed or when the booster has been drained (to prevent frost damage or to replace heating elements for instance).

- Remove lower front panel and switch on all circuit breakers and motor protection switches in the control box.
- **Open shut-off valves at site and switch on main switch.**

When switching on the machine, the temperature indicator displays flashing:

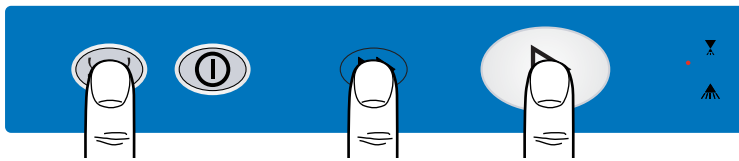


**This indicates that the booster is empty and requires filling.**

For the initial fill of pressure booster, the rinse pump has to be energised. This can be carried out via the test mode after the break tank is filled (via mechanically operated float valve):

**Switch off the machine** by pushing the **ON/OFF** button  **and open the doors.**

Push and hold the **drain**, **conveyor speed** and **Start / Stop** button together (= test mode access).




The temperature indicators display:  
**50 1**  
**-- 0**  
**50 1** corresponds to the first tested input (doors) of the control board.




**Close the doors.** The wash temperature display changes to **-- !**.

**Generally the switch settings are display with -- ! when activated (close) and -- 0 when inactive (open).**

### PRESSURE BOOSTER:

Push the **conveyor speed** button repeatedly until the temperature indicator **rinse** displays **"R 17"** (output rinse pump). Push the **start** button  (**-- !** appears in the wash temperature display) **and hold until water sprays out of rinse nozzles.**

### SEPARATE FILL BOOSTER (OPTION):

Push the **conveyor speed** button repeatedly until the temperature indicator **rinse** displays **"R09"** (output fill valve 1Y2). Push the **start** button  (**-- !** appears in the wash temperature display) **and hold until water flows into the wash tank.**

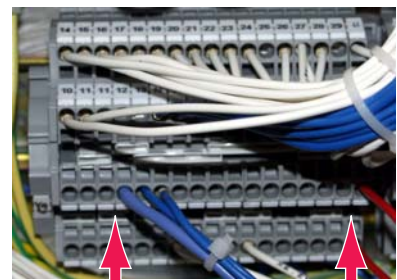
### Switch off main switch.

Remove electr. control cover and put the provided jumper on **X2 (16/17)**.

**At machines with separate fill booster additional jumpers have to be put on X2 (43a/43b and 44a/44b).**

Put the control cover and front panel in place.

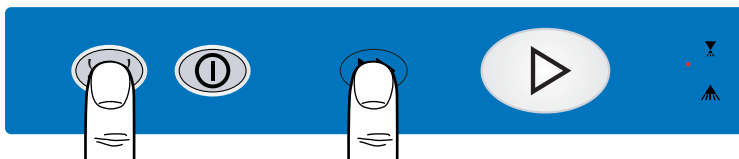
**Switch on main switch but not the machine.**



(16/17)

(43a/43b + 44a/44b)

**Open doors**, push the **drain** and **conveyor speed** button together.



The temperature indicators display:



To clear the message, push the **start** button .

The temperature indicators display:



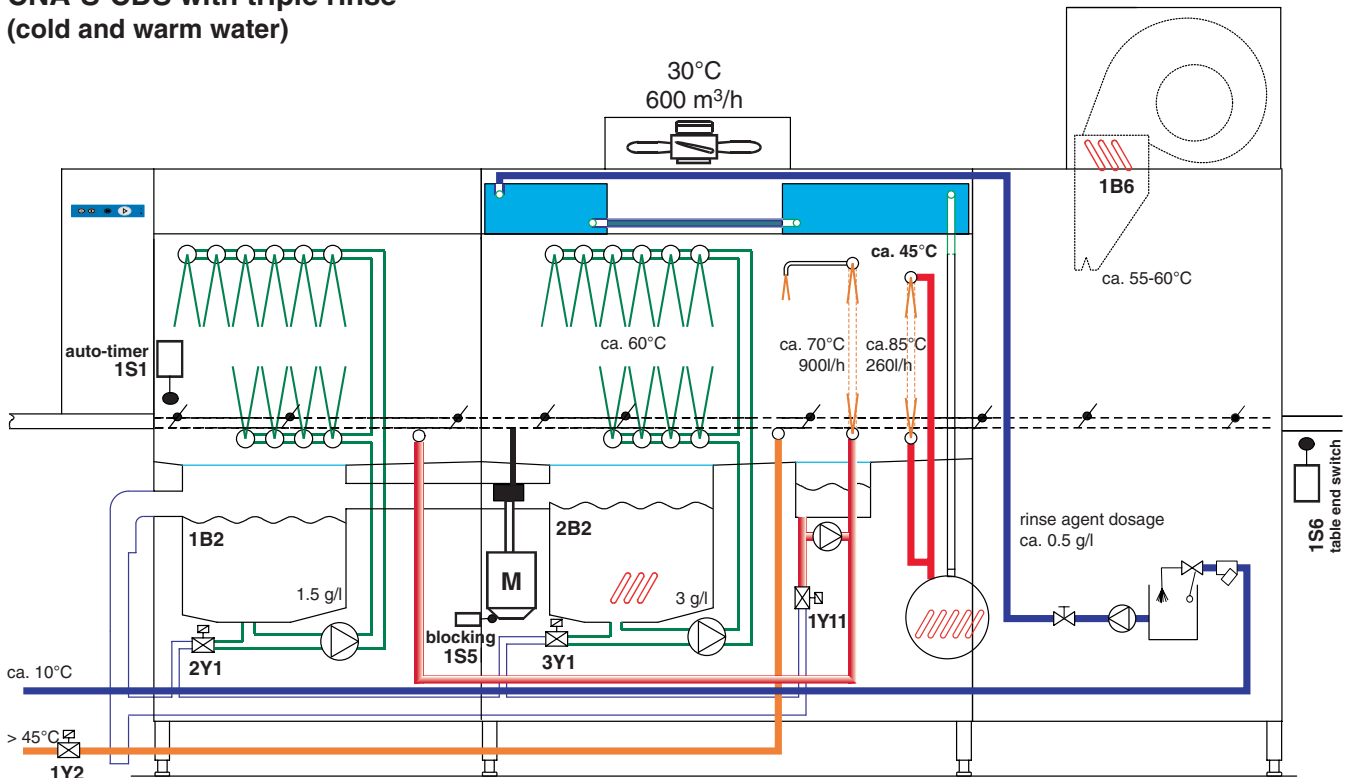
The wash temperature display will change immediately to **-- 0**.

Close the doors. The indicators go out and the machine is now ready for operation.

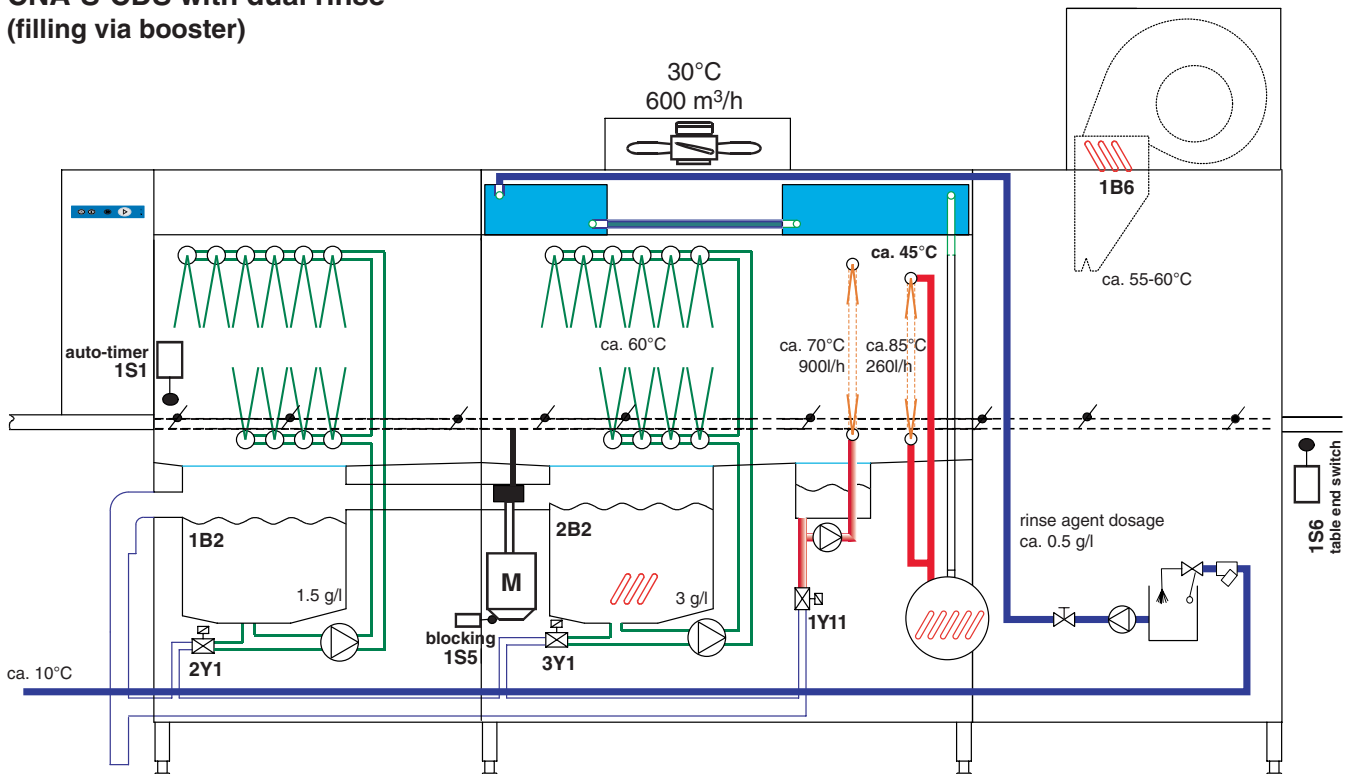
**NOTE:** After setting the machine type or reset of the parameters C28 and C29 to "0", **boF** will also be indicated and the initial booster fill has to be repeated.

## WATER CIRCULATION AND HEAT BALANCE

### CNA-S-CDS with triple rinse (cold and warm water)



### CNA-S-CDS with dual rinse (filling via booster)



## FUNCTIONAL DESCRIPTION

### OPERATION


When the machine is switched off, a luminous red point (at the rinse temperature display) indicates that the machine is connected to the main power supply.



#### Switching on the machine:

##### Note:

**When switching on the machine, a test program of the control (inputs and outputs) will run and the control panel is locked during this time. Therefore you should wait approx. 5 sec., before commands are given via control panel.**

When the doors are closed and the machine is switched on by pushing the ON/OFF button , fill will be started.

### TANK FILL



#### Via separate fill valve (hot water connection) [S18 = 1]:

The machine will be filled by the cascade principle via warm water valve **1Y2**.

When all float switches [**1B2** & **2B2**] of the machine are activated, the heatings in the respective tanks will be switched on.

Then the machine will be overfilled via adjustable time [**C02**] (see service mode).

Refill during operation is controlled via timer [**C03**].

The conveyor start button illuminates red  during the fill and heating phase and will change to green light  when all operation temperatures (adjustable) are reached.

#### Via booster: machines with 1 cold water connection [S18 = 0]:

When the machine is switched on, first the booster will be heated [**1K1**]. If 70°C [**F01**] are reached, the rinse pump **1M3** will start and the tanks will be filled via the rinse pipes.

Machine fill via booster can be temperature-controlled by parameter [**S14 = 1**].

In this case the booster will be heated up to 70°C before the rinse pump **1M3** will be started to fill the machine. If the temperature drops below 48°C, fill (rinse pump) will be stopped until the booster has reached 70°C again.

#### Fill time control

The fill time of the machine will be controlled via adjustable time [**C09**] (base value = 30 min).

When the respective float switch has not close after this time period, the error message **FIL 002** will be displayed.

The fault will be cleared as soon as the float switch closes again.

The filling of the machine remains activated when the failure occurs.

**NOTE:** The exhaust ventilator will also be controlled during the whole fill time.



### BOOSTER

When the machine is switched on, the pressure pump will be started for approx. 5 sec. [**C17**] to guarantee refilling of the pressure booster in case of water loss (e. g. evaporation or leakage during a longer standstill period).

During the machine tanks are filled, the booster will be heated up to 70°C [**F01**].

When the tanks are filled ( after time delay [**C02**] ), the booster will be heated up to 85°C ( set value [**F02**] ).

### WASH OPERATION

When the machine is ready for operation, the conveyor can be started by pressing the conveyor start button . The conveyor speed (slow / fast) will be selected by pressing the conveyor speed button  and indicated by the LED.

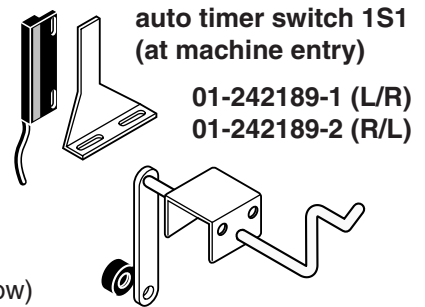
##### Note:

**The conveyor can only be started when the machine is filled (re-fill completed) and the set value of 85°C is reached in the booster.**

## FUNCTIONAL DESCRIPTION

### AUTOTIMER

As a rack enters the machine, the auto timer actuator lever (magnet) triggers a reed switch [1S1] and the wash functions of the machine will be started. Each signal of the magnet activates a time delay which will stop the wash function when the last rack has passed the machine (autotimer) [C08] / [C44]. The conveyor is still working and wash will start again as soon as a rack enters the machine (lever pulse).



For every speed a separate wash time via autotimer is adjusted. At speed 1 (slow) the autotimer is controlled via time [C08] and at speed 2 (fast) via [C44].

If during wash operation the table end switch [1S6] is activated by a rack, the conveyor will be stopped immediately as well as rinse and pre-rinse if activated.

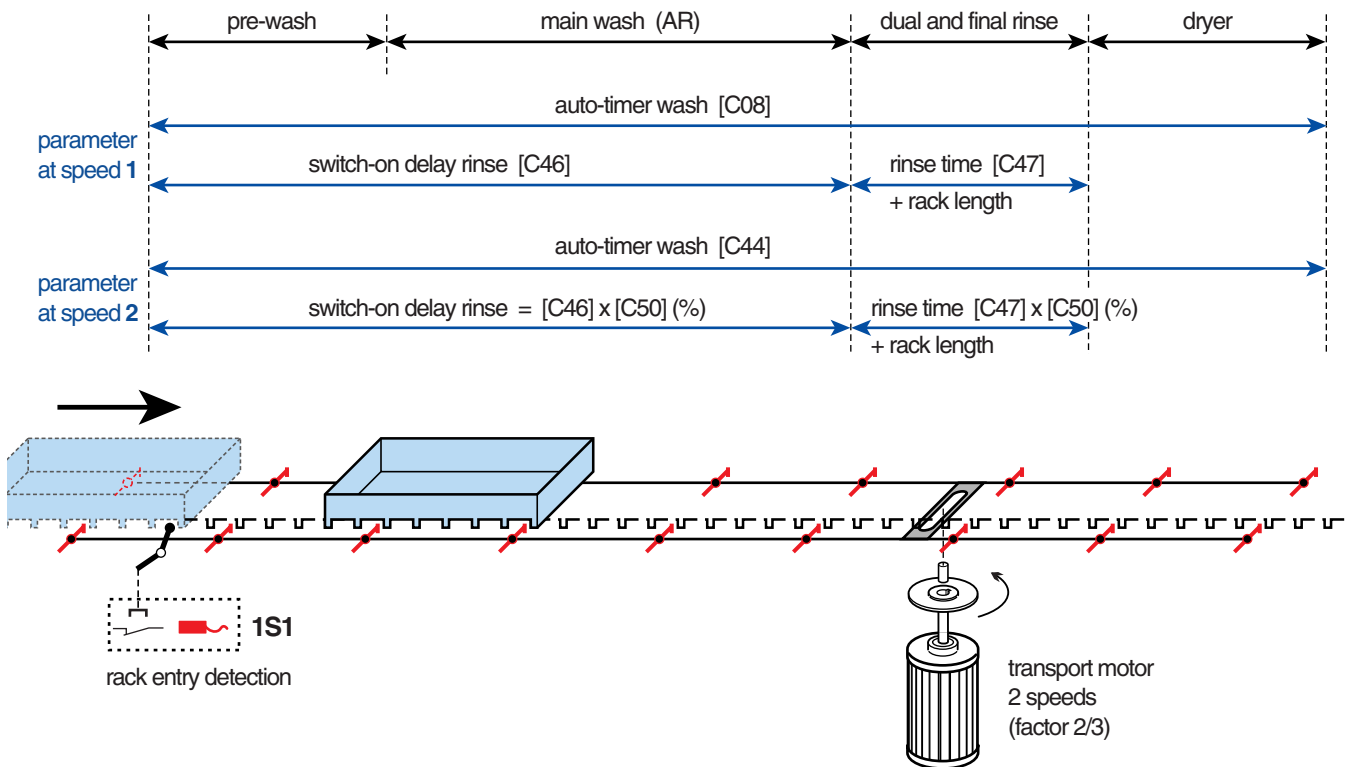
If the rack isn't removed, the wash pumps will stop after 45 sec. [C06].

The activated table end switch [1S6] will be indicated by the flashing **conveyor speed indicator**.

If the end switch is free, the conveyor will start again with the chosen speed. Rinse and pre-rinse will also be started if activated by a rack.

The autotimer [C08] or [C44] will be reactivated and wash will be started again.

### Autotimer rinse



After wash is switched on via autotimer [1S1], pre-rinse (option) and final rinse will be activated time delayed (depending on chosen conveyor speed) for a preset time. The rinse period is also adjustable according to conveyor speed.

At speed 1 (slow) rinse will be started time delayed via [C46] after the rack switch [1S1] was activated. The rinse time is given by [C47] and by the contact time (rack length) of switch [1S1].

So the rinse time is equal [C47] + contact time of [1S1].

Every new rack will be registered, the respective time will be measured and executed. The rack before will keep its turn on and turn-off times.

If the conveyor was stopped (e.g. by the table end switch [1S6] or by the operator), the times will be stored and the autotimer functions will proceed after restart.

## FUNCTIONAL DESCRIPTION

The functions of conveyor speed 2 (fast) are the same as described for speed 1.

As the rack enters the pre-rinse (option) and final rinse zone faster than with speed 1, other times are required.

This time will be proportionally calculated of parameter [C46] which corresponds to the slow speed.

The conversion factor is indicated in % via [C50] and is normally set to 67%. This value corresponds to the transmission between slow and fast speed of the conveyor motor.

The effective rinse time of a rack will be calculated the same way via [C47] and [C50].

### NOTE:

If during wash operation the machine will be refilled or a temperature drops below the preset value, the blue illuminated conveyor start button will flash until the normal operation conditions are reached again.

During stand-by the conveyor start button is flashing green in this case.



### Automatic conveyor switch-off

After wash is switched off via autotimer, the conveyor will be stopped automatically after the adjustable time [C07 = 300 sec.].

To start again, the **conveyor start button** must be pressed or a rack must enter the machine.

The automatic re-start via rack switch [1S1] is only possible after the conveyor has been started one-time by pushing the start button.

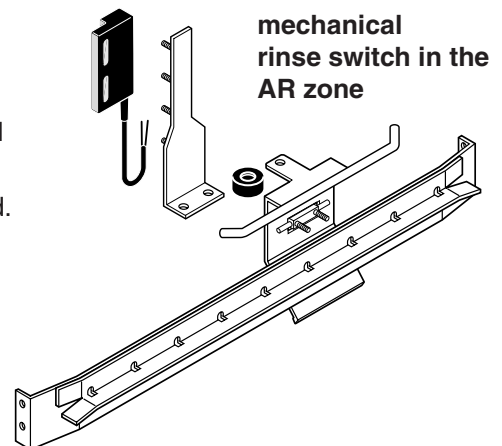
### Mechanical rinse switch (option)

The autotimer rinse function (controlled by the software) can be realized alternatively via an additional mechanical switch.

Pre-rinse and final rinse will be started as long as the switch is activated.

With this option the parameters [C46] and [C47] must be set to "0".

Parameter [S01] (configuration) must remain activated resp. set to "1".



## DRAINING

### Partial draining

Pressing the drain button for approx. 2 sec. will initiate a partial draining of the machine if prewash tank is installed [S03 = 1].

The drain button illuminates  and the conveyor start/stop button illuminates red .

The drain valve of the prewash tank will be activated for an adjustable time [C04]. After this time period the valve will be closed and the prewash tank will be refilled.

### Complete draining

Pressing the drain button for approx. 4 sec. will initiate a complete drain of all tanks (even if the machine is switched off).

The drain button illuminates  and the red conveyor start/stop button switches off .

All drain valves will be activated for an adjustable time [C05]. After this time period the valves will be closed and the machine will be switched off (ON/OFF button is no longer illuminated).

If the machine will be switched off before draining (partial or complete) has finished, only the drain button remains illuminated.

To stop a drain cycle, machine must be switched OFF and ON again (ON/OFF button).

**Draining (partial or complete) can also be done with doors open.**

### Drain control

When drain cycle is completed resp. the drain valves close (after time period C4 & C5), the float switches of the respective tanks must be free again.

If not, an error message will be displayed (see also page 22):

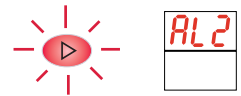
**AL1** = drain fault – prewash tank / **AL0** = drain fault – wash tank.

## FUNCTIONAL DESCRIPTION

### SAFETY CIRCUIT

The security circuit controls the doors and the conveyor system (motor protection and jam switch) [1S5].

If the circuit is interrupted, wash functions will be switched off and only the heaters will be activated.



#### NOTE:

*The safety circuit does not control the release of motor protection switches (wash pump motors etc.) and therefore it will not display any fault.*

### DOOR SWITCH

The door reed switch is located behind the front panel at the lower tank support, the magnet is fitted at the door stop.

The door contacts [..S2] are wired with the safety circuit and interrupt the washing functions of the machine.

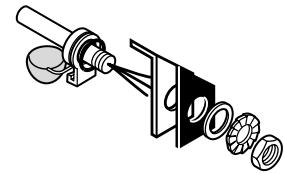
The door contacts must be connected to the wiring harness with plugs which can be replaced by AMP-plugs if defective.



### FLOAT SWITCHES

All tanks are equipped with a float switch which will activate or switch off the heater (depending on temperature).

The float switch is a change-over contact which will disable the fill contact and enable the heating at upper level [..B2] (1-2 opens, 1-3 close).



### TEMPERATURE SENSORS

The temperature sensors (NTC) can be checked by resistance measuring.

Check also for earth fault as this can cause galvanic currents which could result in pitting corrosion. For this test (500 V DC, R > 1 M Ohm) both wires must be short-circuited to prevent damage of the sensors.

The temperature sensors are attached to the exterior wall of the respective wash tanks and booster. Temperature adjustment is not possible.

temperature °C	resistance kOhm	temperature °C	resistance kOhm
0	35.979	60	3.243
1	34.325	65	2.745
5	28.519	70	2.333
10	22.765	75	1.990
20	14.774	80	1.704
30	9.787	85	1.464
40	6.653	90	1.262
50	4.608	100	0.950
55	3.856		

## WASH SYSTEM

### WASH PUMPS

Modul	pump load	delivery rate	tank volume
prewash E	0.2 kW	250 l/min	30 l
prewash L	1.1 kW	740 l/min	54 l
prewash S	1.5 kW	1200 l/min	100 l
prewash C	1.1 kW	740 l/min	54 l
wash AR	1.5 kW	1200 l/min	100 l

#### Replacement of the mechanical shaft seal

1. Remove clamps (1) & (2). Take down the pump, turn over and set it down onto the motor. Be carefully that no water run into the motor.
2. Loosen the self-locking nut (3) and remove washer (4) & spacer (5).
3. Remove the impeller (6).
4. Dismantle the shaft seal (7).
5. Clean shaft and support before fitting the new shaft seal.
6. Installing the new shaft seal **324 815-4** :
  - a) Wet the rubber collar of the ceramic part with rinse aid.
  - b) Press ceramic part right-angled into place. The ceramics surface must not be damaged.
  - c) Clean the ceramics surface and wet it with paraffin oil.
  - d) Wet the inner rubber ring off the shaft seal with rinse aid and put some paraffin oil to the sealing face.
  - e) Press shaft seal against the ceramic ring.
7. Reinstall carefully the impeller.
8. Mount spacer (5), washer (4) and nut (3) and tighten.
9. Use new o-ring **276903-27** (8) & **276903-31** (9) for reassembling the pump.

#### Wash pump construction

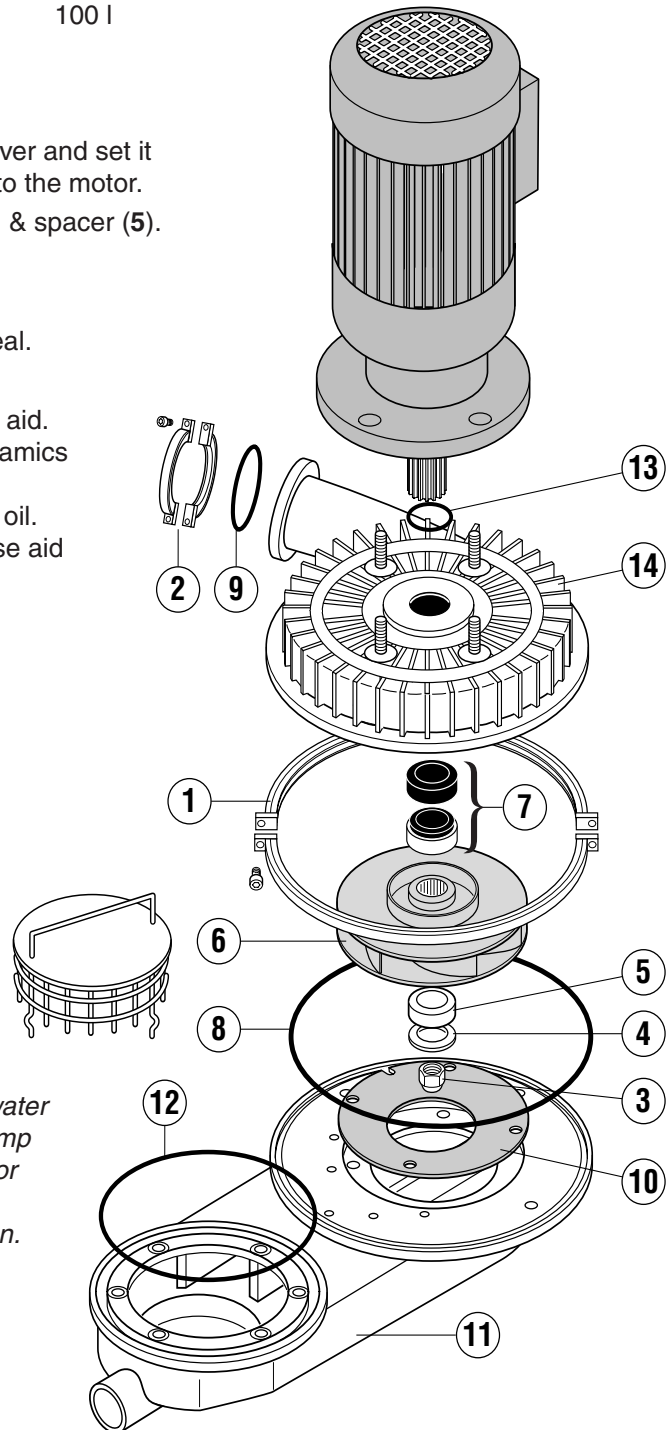
To optimise the pump capacity, a throttling ring (10) is fitted between lower part of pump housing (11) and impeller (6). Pay attention to mounting direction!

When the pump housing will be replaced, a new o-ring **276903-28** (12) must be fitted.

**NOTE** : If the shaft seal is leaky, the o-ring (13) prevent water splashing into the motor. The water run into the upper pump housing (14). Therefore let it drain before turning the motor on top when dismantling

Cr-Ni cover **695797-39** is available for machine installation.

Impeller	Part no.	Pump
Ø168 mm	774 146-1	1.5 kW/ 50Hz
Ø152 mm	774 147-1	1.5 kW/ 60Hz
Ø120 mm	774 146-2	1.1 kW/ 50-60Hz





## WASH SYSTEM

### WASH ARMS

The wash arms consist of a different number of pipes with 7 nozzles per pipe:

wash arm	upper	lower
L prewash	3 pipes	1 pipe
S, A wash	6 pipes	4 pipes
C prewash	4 pipes	3 pipes

The illustration shows the wash system of a main wash tank.

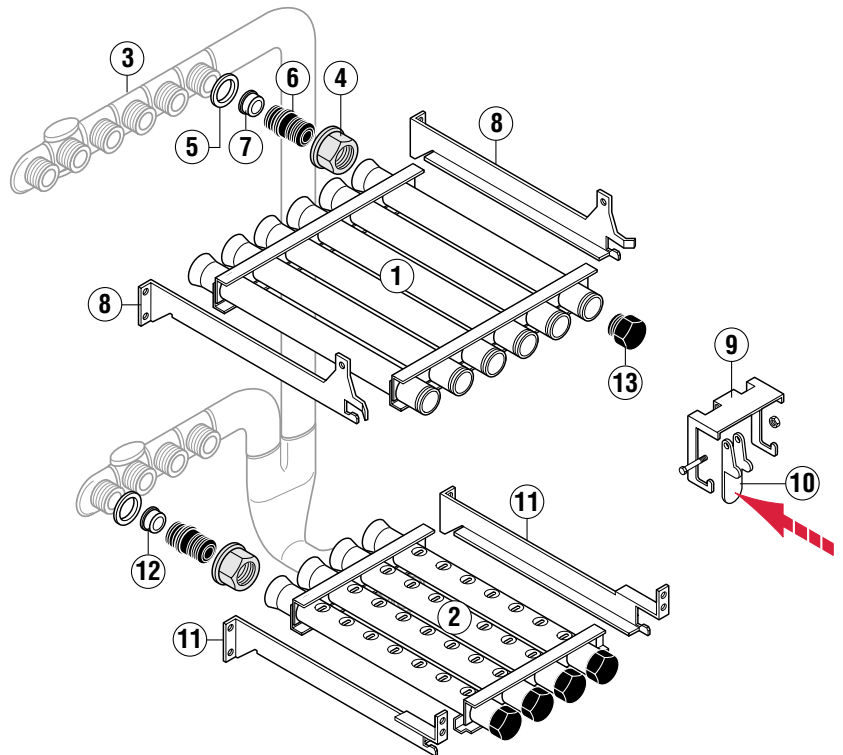
The rounded plastic manifolds (3) are mounted to the rear surface of tank and fixed with plastic nut (4) and gasket (5) from inside. This nut serves as wash arm support.

The wash pipe gasket (6) will be pressed into nut (4) and fixed with the diaphragm (7).

To mount the wash arm (1) set it in side guides (8), move to end position and drop-in over stop unit (9).

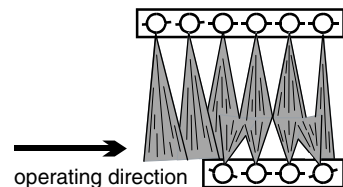
To remove the upper wash arm press latch (see arrow), lift wash arm over stop unit and pull out.

The front of the wash pipes will be sealed by pressed-in rubber plugs (13).



**Special tool is needed** for the replacement of wash arm guides resp. manifold (available as ring wrench 695797-36 or socket wrench 695797-81).

To avoid tilt over of dishes and to reduce splash over of wash water, the upper wash arms are placed in such a way, that the first two water jets do not hit a lower one.



### Diaphragm

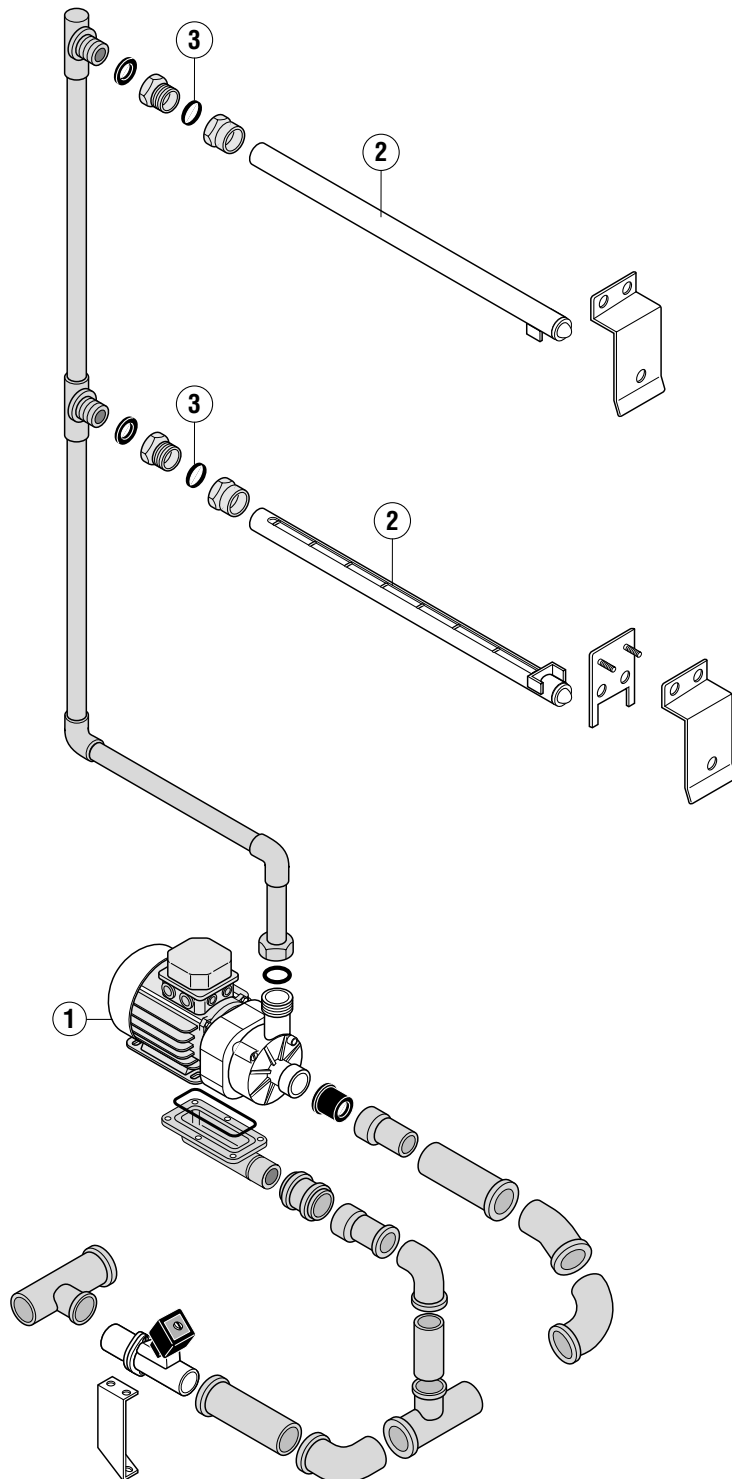
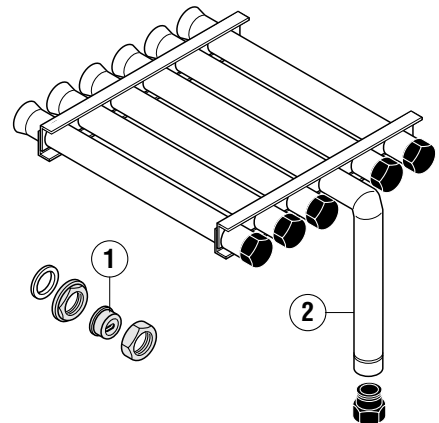
Every nut (4) is provided with a diaphragm (7 + 12) to distribute the pump pressure on upper and lower wash arms in a way, that a good washing result will be achieved with different kinds of washware and dishes do not tilt over.

diaphragm Ø / part no.	"C" corner prewash	"L" prewash	"S" prewash + AR wash
14 mm / 885 538-4		lower arm	lower arm
24 mm / 885 538-1	upper arm	upper arm	upper arm
12 mm / 885 538-6	lower arm		

**WASH SYSTEM**

**LATERAL WASH (OPTION)**

The part (1) shows the wash nozzle at the back side (3 x) which is mounted to the manifold by means of a nut.  
 An additional wash pipe (2) with three nozzles is fitted on front side.  
 The parts (1) and (2) are different on machines with left-to-right or right-to-left operating direction. The water jet is directed against the operation direction.



**E-PREWASH**

The "E" prewash system consists of a 30 l tank and two wash arms (2), supplied by a 0.2 kW pump (1) with a delivery rate of 250 l/min.

The wash arms (2) are equipped with a diaphragm (3) to ensure a pressure of 0.2 bar (upper) resp. 0.1 bar (lower).

## RINSE SYSTEM

The rinse zone consist of two systems (pre-rinse (option) and final rinse) and is connected to the last wash tank (AR module) as standard.

### FINAL RINSE

The final rinse water is needed to remove residual detergent and to reduce the surface tension in combination with rinse aid. The temperature of 85°C enables dishes to dry and ensure the hygiene regulation.

The water streams through the line strainer into the break tank (1) (airgap). The water level in the break tank is controlled by the mechanically operated float valve (2).

The rinse pump (3) delivers the water through the condensers (C1 and C2) and through the booster (8) into the final rinse arms. In the condensers the water will be heated up to approx. 40 - 45°C.

The booster (8) will heat the water to 85°C. The heating elements (11) are controlled by a temperature sensor (10).

The safety relief valve (9) shall prevent that the pressure exceeds 2 bar in case of fault.

The final rinse water consumption of 260 l/hr will be controlled by a diaphragm (4) at rinse pump (3) outlet resp. at pipe (5) outlet\*.

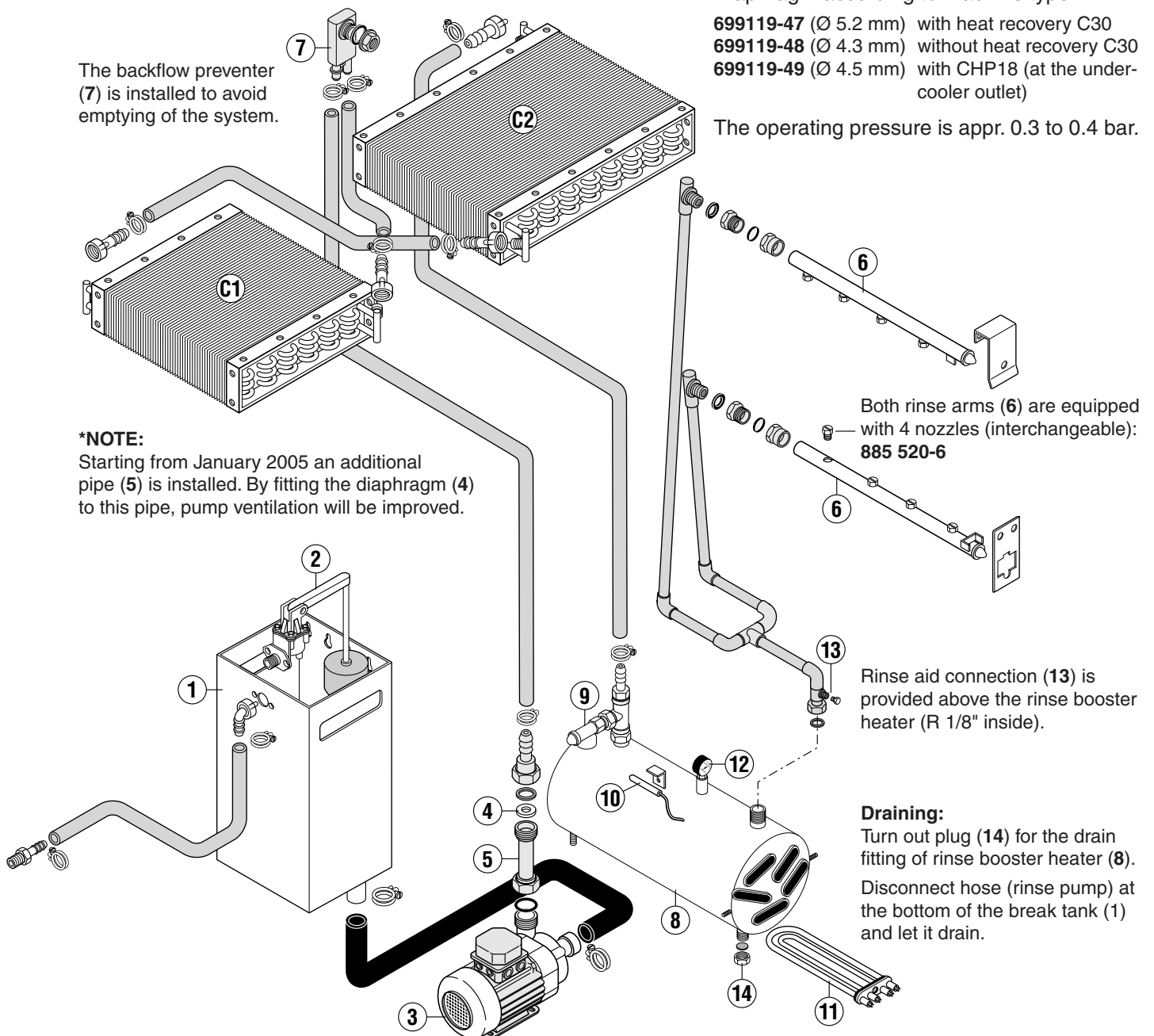
Diaphragm according to machine type:

- 699119-47 (Ø 5.2 mm) with heat recovery C30
- 699119-48 (Ø 4.3 mm) without heat recovery C30
- 699119-49 (Ø 4.5 mm) with CHP18 (at the under-cooler outlet)

The operating pressure is appr. 0.3 to 0.4 bar.

The backflow preventer (7) is installed to avoid emptying of the system.

**\*NOTE:**  
Starting from January 2005 an additional pipe (5) is installed. By fitting the diaphragm (4) to this pipe, pump ventilation will be improved.



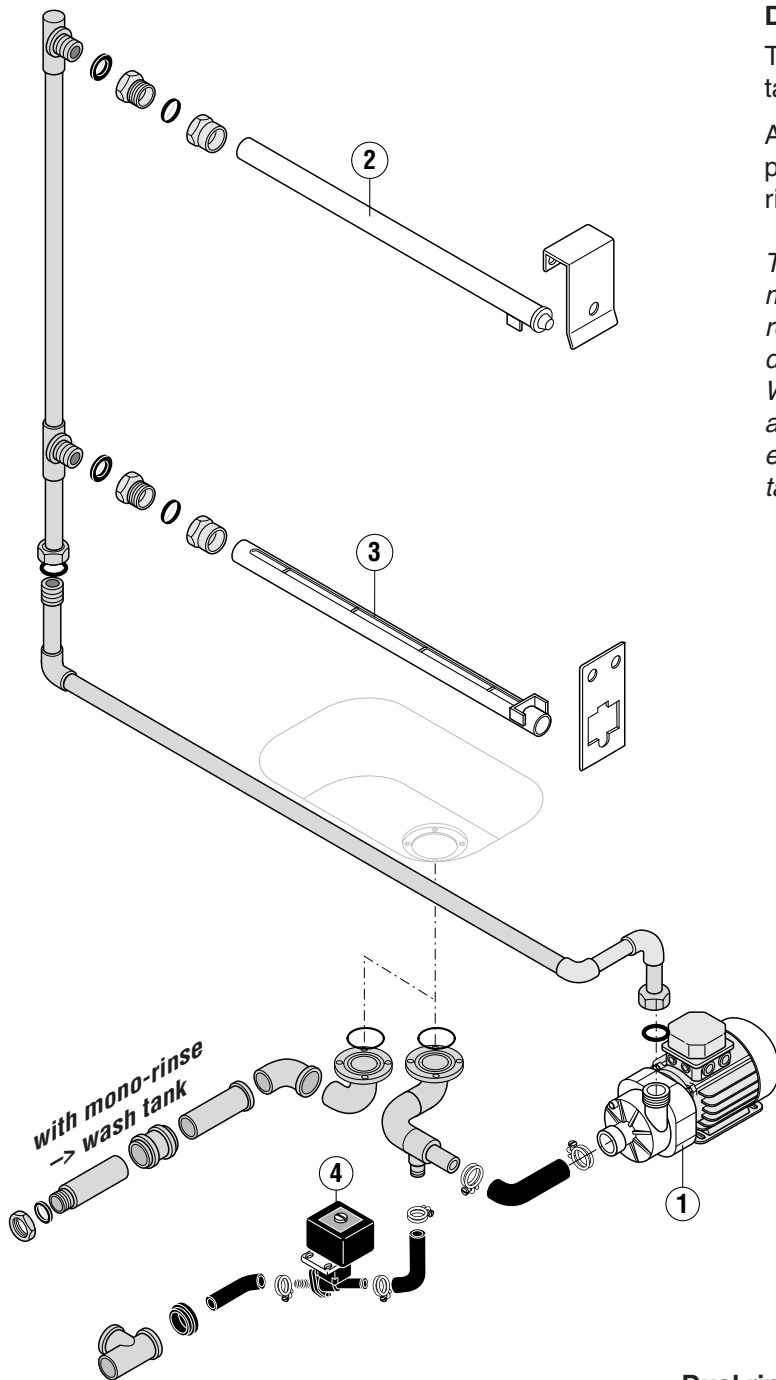
Rinse aid connection (13) is provided above the rinse booster heater (R 1/8" inside).

**Draining:**  
Turn out plug (14) for the drain fitting of rinse booster heater (8). Disconnect hose (rinse pump) at the bottom of the break tank (1) and let it drain.

**PRE-RINSE SYSTEM**

The CNA can be delivered with three types of rinse system:

- mono rinse
- dual rinse
- triple rinse



**DUAL RINSE**

The final rinse water passes into the dual rinse tank and will be used for pre-rinse.

At this system, the final rinse water will be passed into the main wash tank via the dual rinse tank.

*The pre-rinse system will not be installed at machines with mono rinse. Hereby the recirculating pump (1), rinse arms (2 + 3) and drain valve (4) are not fitted. When complete draining of the machine is activated, draining of the dual rinse tank will be executed via the connection to the main wash tank.*

**Dual rinse:**

When complete draining of the machine is activated, draining of the dual rinse tank will be executed directly to drain via valve (4).

## PRE-RINSE SYSTEM

### TRIPLE RINSE

The final rinse water enters the dual rinse tank (5 l volume) and will be circulated by the dual rinse pump (1) which is not installed at machines with mono rinse system.

The delivery rate of approx. 700 l/h is given by the impeller (Ø 51.5 mm) and the nozzles (4 x Ø 2.3 mm at each rinse arm (2 and 4)).

At machines with triple rinse, residual detergent on dishes will be removed by pre-rinse.

Approx. 160-200 l water will be passed from the upper rinse arm (2) via T-piece to an especially designed nozzle (3) with a broad spraying angle.

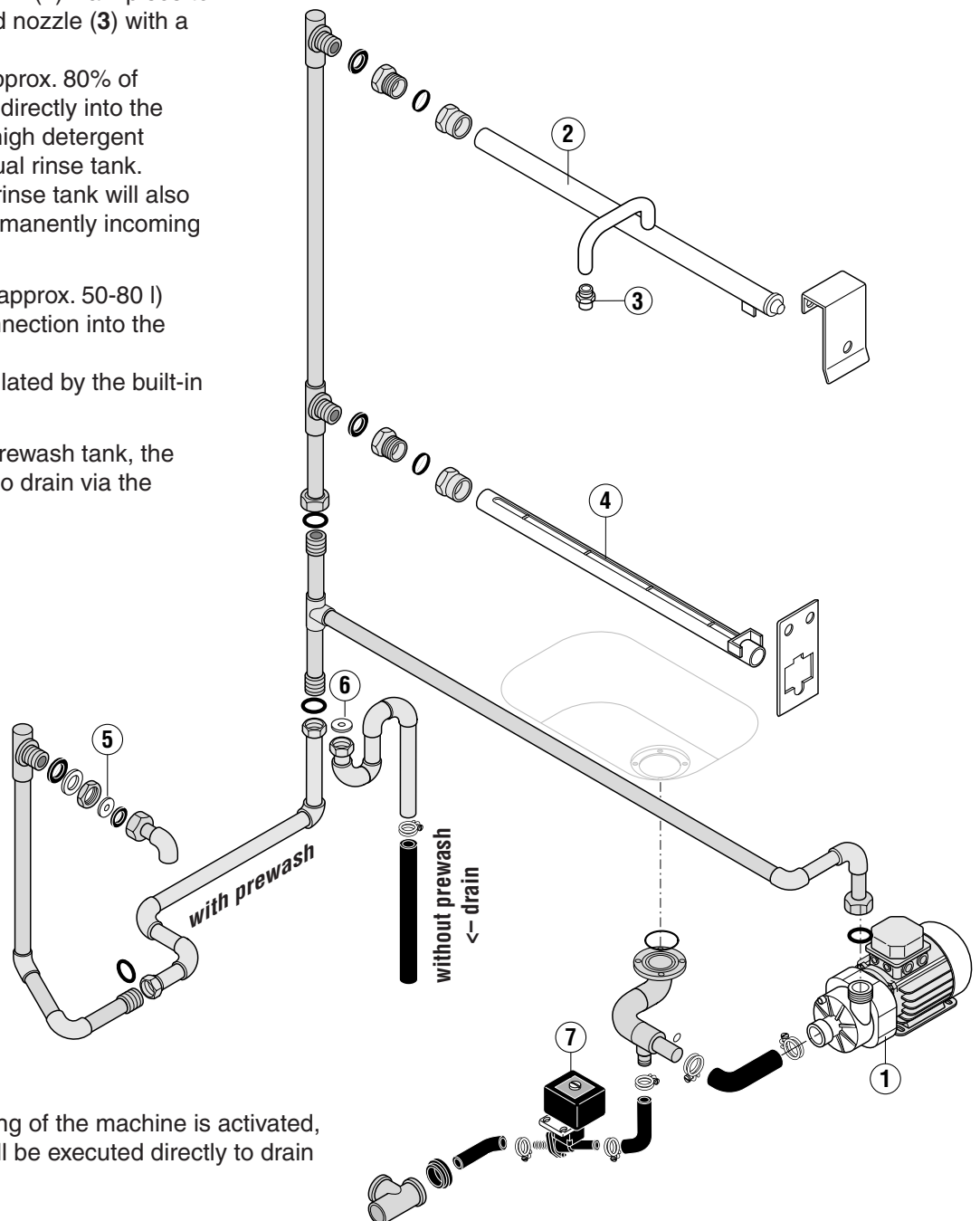
This water removes approx. 80% of detergent and passes directly into the wash tank to prevent high detergent concentration in the dual rinse tank.

The water in the dual rinse tank will also be regenerated by permanently incoming final rinse water.

The remaining water (approx. 50-80 l) passes via branch connection into the prewash tank.

This water flow is regulated by the built-in diaphragm (5).

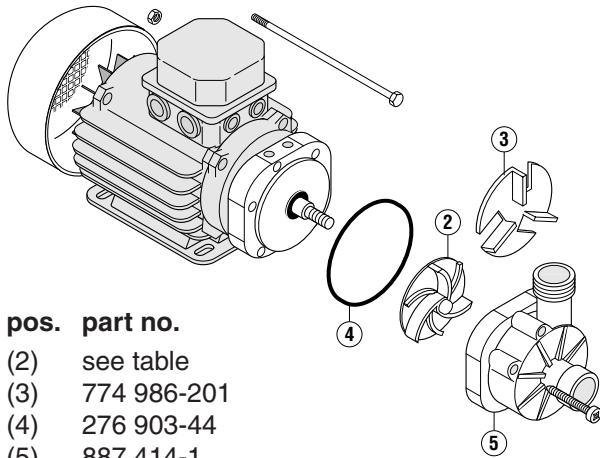
At machines without prewash tank, the water passes directly to drain via the diaphragm (6).



When complete draining of the machine is activated, draining of the tank will be executed directly to drain via valve (7).

## RINSE PUMPS

### Hanning Pump: 781237-..

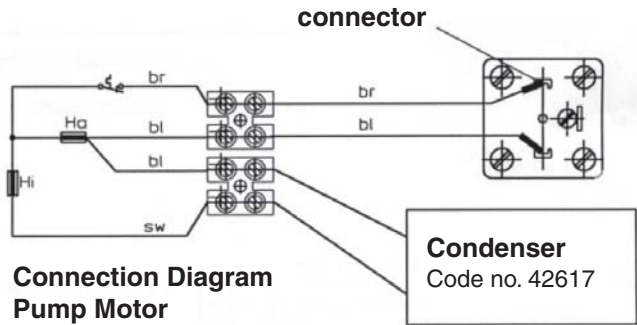


**pos. part no.**

- (2) see table
- (3) 774 986-201
- (4) 276 903-44
- (5) 887 414-1

Mechanical shaft seal: 897 225-1

Pump housing KIT (pos. (4) included): ML 102 854



**Connection Diagram  
Pump Motor**

### Motor connection

In case of overheating the pump will be switched off by the integrated thermal protection. The coil protection will reset after a cooling down period.

The pump delivery rate is given by the impeller:

function	Pump (230/1/PE)		impeller	
	part no.	diameter	part no.	diameter
rinse pump (pressure booster)	781 237-2	72.0 mm	774 986-101	72.0 mm
rinse pump (pressureless booster)	781 237-1	51.5 mm	774 986-104	51.5 mm
dual rinse	781 237-1	51.5 mm	774 986-104	51.5 mm
E-pretwash	781 237-2	72 mm	774 986-101	72 mm

## TANK AND BOOSTER HEATING

All wash tanks and the booster are provided with an electrical heating element or a heating coil when steam or hot water heated.

There are no heating elements in the pretwash tanks (E, L, S or C). In these tanks the temperatures (40-50°C) will be reached by wash tank overflow and regeneration.

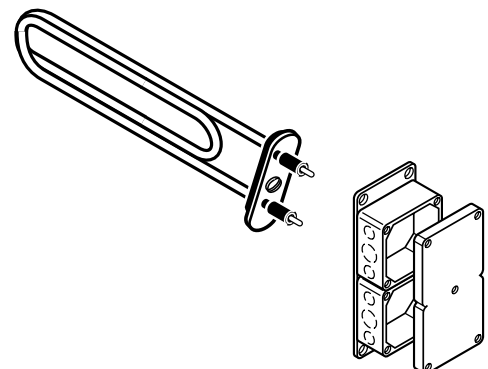
### ELECTRICAL HEATING

The tank heating elements are equipped at one connection with an internal thermal fuse (tripping temperature 167°C) and must be fitted with this side on top (see "TOP" mark).

The tank heaters consist of three elements (one element per phase) and have one or two heating coils depending on loading

Nominal voltage, loading (kW – equivalent to the nominal voltage), part number and the "TOP" mark are stamped on the flange.

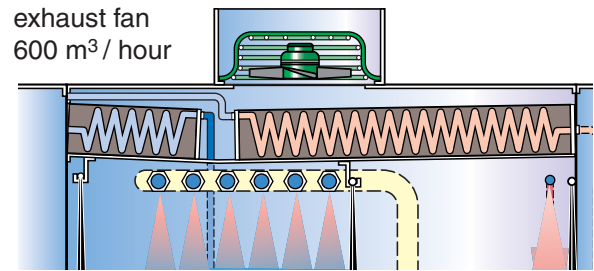
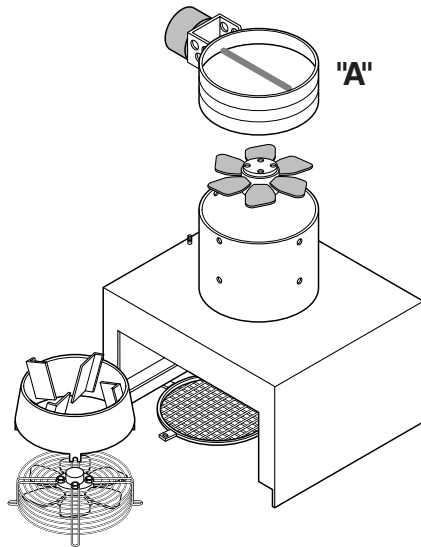
The specified loadings (see data plate, wiring diagram, documents etc.) are based on a supply voltage of 230V ~.



## HEAT RECOVERY

600 m<sup>3</sup>/h exhaust air will be sucked by the exhaust ventilator (0.11 kW) via two heat exchangers. As a result the supply rinse water will be heated to about 40-45°C, provided that the panels are closely mounted and all curtains are in place.

Required exhaust volume at site is 1000 m<sup>3</sup>/h. Otherwise a vent hood with additional ventilator (available as an option from HOBART) can be used. If the hood is connected to outside, an anti-freeze shutter ("A") must be provided.



## DISPENSERS

Normally, dispensers and controls are delivered and installed by the detergent and rinse aid suppliers.

Please pay attention to the following rules:

- In principle, the **detergent** will be dosed in the last wash tank.
- **Rinse aid** connection is provided above the rinse booster heater (R 1/8" inside).

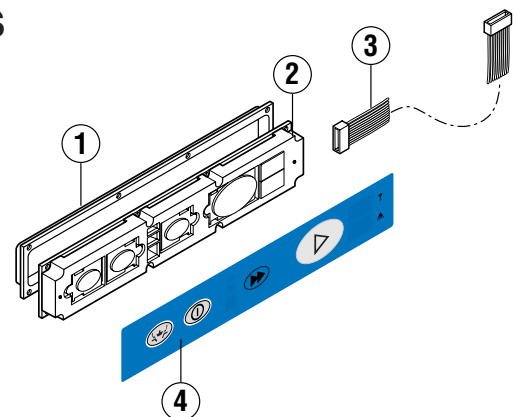
The dispensers have to be installed according to wiring diagram. Terminals (XD) (230V) are provided in the control box (see wiring diagram):

- XD/1: operation
- XD/2: fill
- XD/3: wash
- XD/4: rinse
- XD/N: neutral wire

**The connected load of both dispensers must not exceed 70 VA.**

## CONTROL PARTS

Pos.	Part no.	Part name
1	898 363-1	cover
2	897 501-1	operation unit
3	785 446-2	connecting cable (operation unit -> control)
4	895 770-1	keypad
	897 502-1	PCB (fully equipped)
	897 503-5	EPROM
	785 572-1	BUS cable 1A2/2A2 (with CHP18)



## CONVEYOR SYSTEM

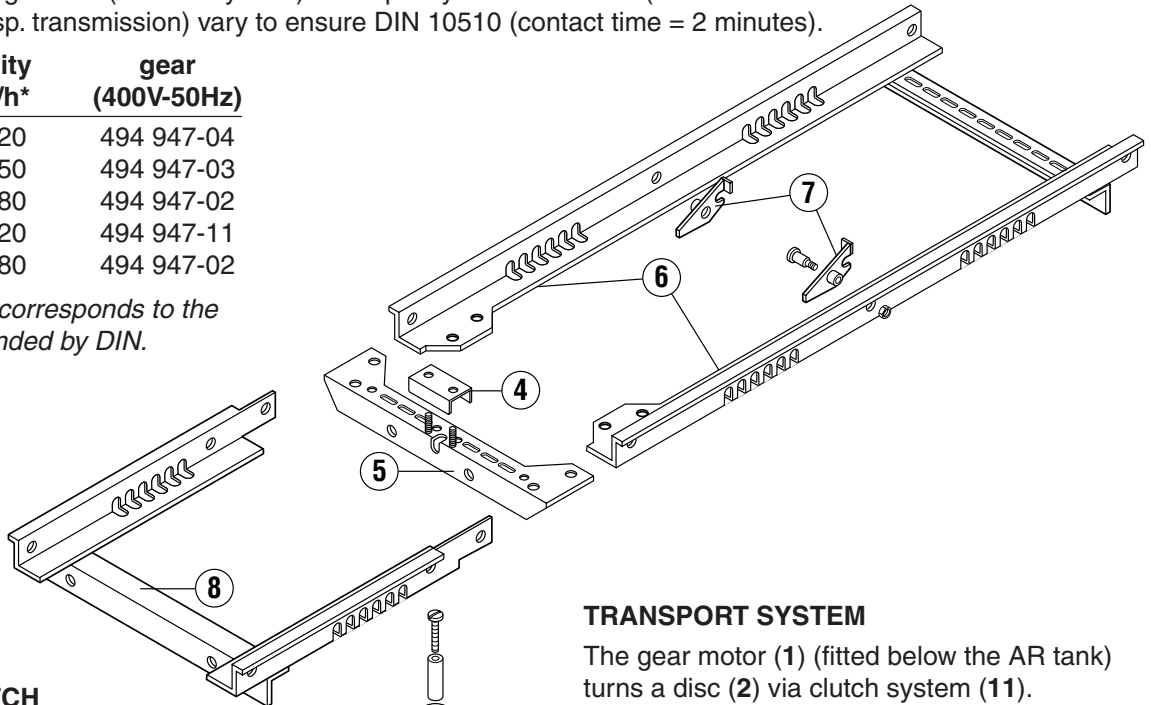
### MACHINE CAPACITY

Alternatively the CNA can be operated with two conveyor speeds resp. two different capacities (racks/hour). Depending on configuration (module system) the capacity of the machine (also conveyor speed resp. transmission) vary to ensure DIN 10510 (contact time = 2 minutes).

Model	capacity racks/h*	gear (400V-50Hz)
CNA	80/120	494 947-04
CNA-E	100/150	494 947-03
CNA-L	120/180	494 947-02
CNA-S	150/220	494 947-11
CNA-C	120/180	494 947-02

The least capacity corresponds to the contact time demanded by DIN.

\*with 50Hz



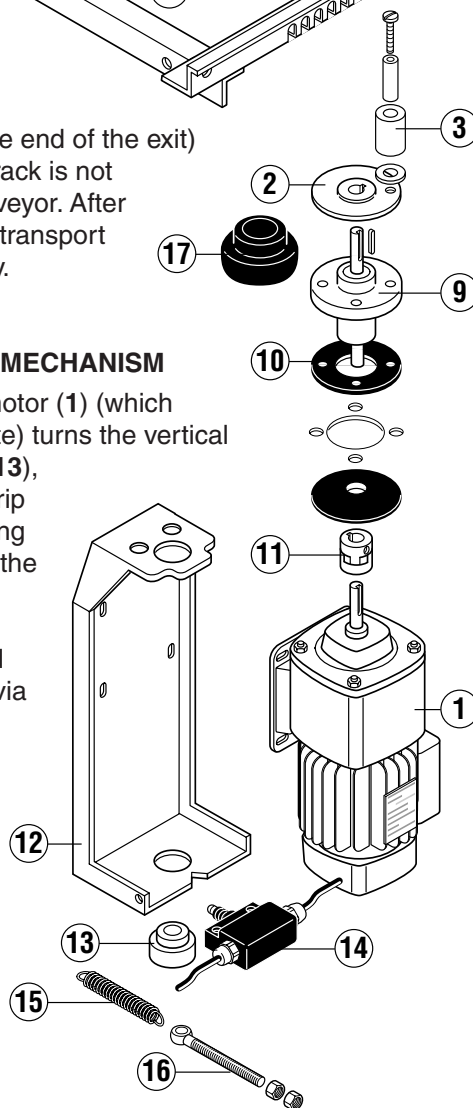
### TABLE END SWITCH

This switch [1S6] (at the end of the exit) will be actuated when rack is not unloaded from the conveyor. After removing the rack, the transport moves on automatically.

### CONVEYOR SAFETY MECHANISM

If conveyor jams, the motor (1) (which is bolted to vertical plate) turns the vertical plate (12) on its pivot (13), thereby operating the trip switch (14) [1S5 in wiring diagram] and stopping the machine.

The sensitivity of the system will be adjusted by spring (15) tension via adjusting screw (16).



### TRANSPORT SYSTEM

The gear motor (1) (fitted below the AR tank) turns a disc (2) via clutch system (11).

The axle (3) (excentrically fixed to the disc (2)) moves inside the chamber (4), coupled to the support (5).

This support moves the rails (6) forward / backward with a range of approx. 90 mm, given by the diameter of the disc (2).


The dogs (7) draw up in operation direction and take the rack along.

In opposite direction the dogs tilt over and the rack stays on the rail.

Coupling different rails will realise the transport system through the complete machine, also for machines with curves.

The gasket (10) is used to seal the tank. The gear shaft (9) will be protected against soil and water by a cap (17).

### REPLACEMENT OF GEAR MOTOR

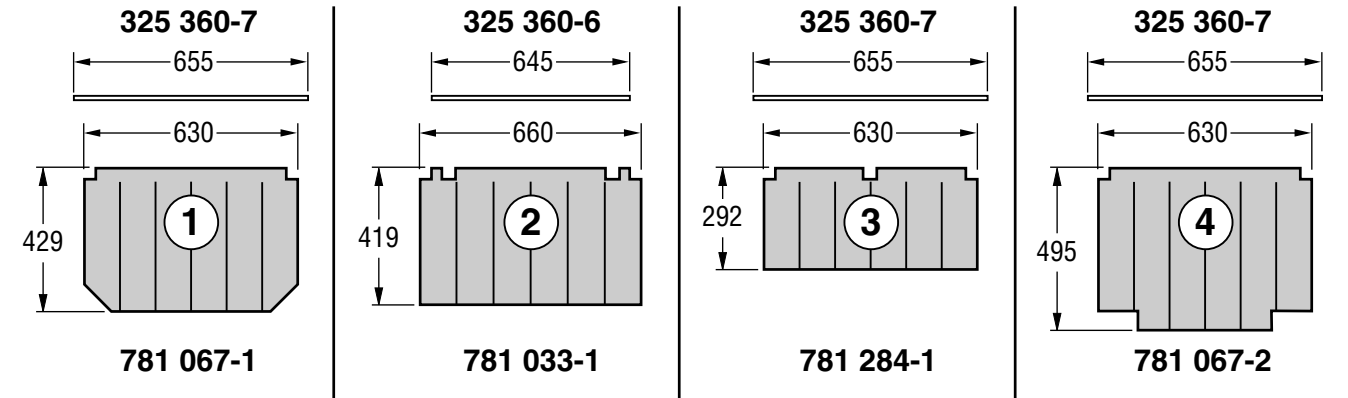
 When replacing the gear motor pay attention to the correct rotation direction to ensure that in case of blockage the safty end switch [1S5] will trip.



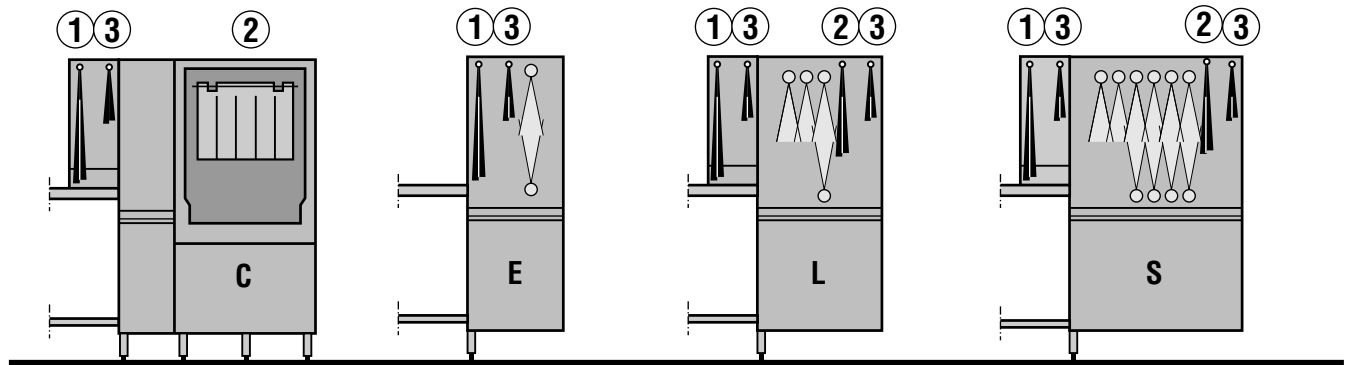
## POSITION OF CURTAINS

As there are different curtains, additional hooks and different rod lengths are used to prevent confusing.

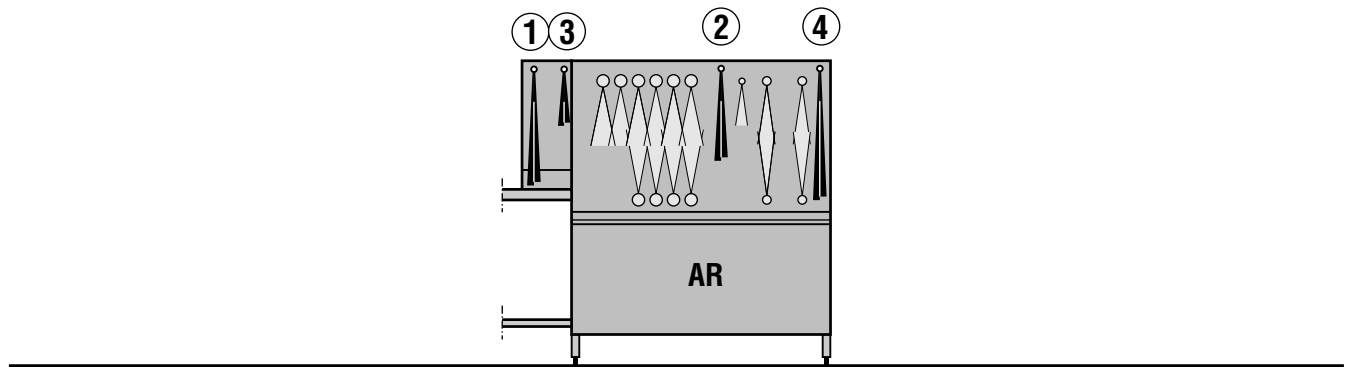
Illustrations are based on left-to-right operating machines. The position of curtains is mirrorwise in case of right-to-left operation.



### Prewash modules



### Wash modul



## FAULT DISPLAY

### STARTING FROM EPROM REVISION 3.00

CODE	FAULT DESCRIPTION	POSSIBLE CAUSE / REMEDY
<b>FIL 001</b>	Exceeded filling time – booster.	The booster fill is controlled via adjustable time (C10). When this time has expired and the float switch is not closed: None or not enough water at site, cold water valve defective, water consumption too high etc.  <b>This fault will only occur at machines with pressureless booster and retrofitted Eprom Rev. 3.00.</b>
<b>FIL 002</b>	Exceeded filling time – tank.	The wash tank water level is controlled via adjustable time (C09). When this time has expired and the float switches are not closed: None or not enough warm water at site, fill valve defective, strainer, drain valve leaky, float switch defective, splash-over.
<b>AL0</b>	Drain fault – wash tank.	When the drain time C05 has expired, the float switches must be open. If not: Drain valve defective, drain system clogged, float switch defective etc.  <b>The corresponding heaters are locked until the error is eliminated. The fault message will be cleared via ON/OFF and re-starting the wash cycle (start button) or via main switch.</b>
<b>AL1</b>	Drain fault – prewash tank.	Once the drain time C04 has expired, the float switch must be open. If not: Drain valve defective, drain system clogged, float switch defective etc.  <b>To clear the fault message: switch off machine via ON/OFF button or via main switch.</b>
<b>AL2</b>	Doors fault.	Security circuit X8 / 1-2 open: Doors open, reed switches, safety end switch transport actuated (1K8)
<b>AL3</b>	Deterget or rinse aid deficiency (option).	Input X9 / 1-3 closed: Check detergent and rinse aid container.
<b>-E- 001</b>	Bus system failure	The connection (RS232) of the two PCBs is broken.
<b>-C-</b>	Master slave fault	Communication fault between the two PCBs
<b>F01</b>	Temperature probe "booster" defective.	There are two possible messages: -- 1 = short circuit / -- 2 = open circuit
<b>F02</b>	Temperature probe "tank" defective.	General handling of temperature faults.
<b>F03</b>	Temperature probe "prewash tank" defective.	General handling of temperature faults.
<b>F06</b>	Temperature probe "fill booster" defective.	General handling of temperature faults.
<b>HEATPUMP CHP18 (Option)</b>		
<b>AL5 001</b>	Low pressure	The compressor has been switched off 4 times within an adjustable time by pressure switch 1B5 (LP). Switching cycle and time control are stored in parameter C24 (= 4) and C42 (= 900 sec).
<b>AL5 002</b>	High pressure	The compressor has been switched off 4 times within an adjustable time by pressure switch 1B5 (HP). Switching cycle and time control are stored in parameter C25 (= 4) and C42 (= 900 sec).
<b>AL5 003</b>	Motor protector compressor tripped	
<b>AL5 004</b>	Missing wire link on slave PCB 2A2, X8/1-2	
<b>The CHP fault message will be cleared via machine ON/OFF and with eliminated error.</b>		

## FAULT DISPLAY

### UP TO EPROM REVISION 2.00 (FOR INFO)

CODE	FAULT DESCRIPTION	POSSIBLE CAUSE / REMEDY
FIL 001	Exceeded filling time – booster.	The booster fill is controlled via adjustable time (C10). When this time has expired and the float switch is not closed: None or not enough water at site, cold water valve defective, water consumption too high etc.
FIL 002	Exceeded filling time – tank.	The wash tank water level is controlled via adjustable time (C09). When this time has expired and the float switches are not closed: None or not enough warm water at site, fill valve defective, strainer, drain valve leaky, float switch defective, splash-over.
AL0	Drain fault – wash tank.	When the drain time C05 has expired, the float switches must be open. If not: Drain valve defective, drain system clogged, float switch defective etc.  <b>To clear the fault message: Up to EPROM Rev. 1.17: switch off machine via main switch. Starting from Rev. 2.00: via ON/OFF button and re-starting the wash cycle (Start button).</b>
AL1	Drain fault – prewash tank.	Once the drain time C04 has expired, the float switch must be open. If not: Drain valve defective, drain system clogged, float switch defective etc.
AL2	Doors fault.	Security circuit X8 / 1-2 open: Doors open, reed switches, safety end switch transport actuated (1K8).
AL3	Deterget deficiency (option).	Input X9 / 1-3 closed – check detergent.
AL4	Rinse aid deficiency (option).	Input X9 / 1-4 closed – check rinse aid.
-E-001	Bus system failure	The connection (RS232) of the two PCBs is broken.
-C-	Master slave fault	Communication fault between the two PCBs.
F01	Temperature probe "booster" defective.	There are two possible messages: -- 1 = short circuit / -- 2 = open circuit
F02	Temperature probe "tank" defective.	General handling of temperature faults.
F03	Temperature probe "prewash tank" defective.	General handling of temperature faults.
<b>HEATPUMP (Option)</b>		
AL5 001	Low pressure	The compressor has been switched off 4 times within an adjustable time by pressure switch 1B5 (LP). Switching cycle and time control are stored in parameter C24 (= 4) and C42 (= 900 sec).
AL5 002	High pressure	The compressor has been switched off 4 times within an adjustable time by pressure switch 1B5 (HP). Switching cycle and time control are stored in parameter C25 (= 4) and C42 (= 900 sec).
AL5 003	Motor protector compressor tripped	Switch on motor protection switch.
<b>To clear the fault messages AL5 001 and 002:</b>		<b>Up to EPROM Rev. 1.17: eliminate error and switch off the machine via main switch. Starting from Rev. 2.00: switch off machine via ON/OFF button</b>

**NOTES**

A large grid of graph paper for taking notes, consisting of approximately 30 columns and 40 rows of small squares.



NOTES

A large grid of graph paper for taking notes, consisting of approximately 25 columns and 40 rows of small squares.

# SERVICE TRAINING CENTER



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