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10.

1. SCHEMATIC PRODUCTION XXX

The maximum amount of raw XXX into the washing column is 16,U00 kg/h. The netto production of XXX liquid to storage tanks is about 1U,U00 kg/h.

The wash tower has the task to eliminate all unwanted substances present in the raw gas, soluble in water. It is primarily methanol, some acidic residues and products used for the separation of XXX from H₂. The tower is also used to cool the untreated gas.

COMPRESSORS

There are 2 compressors XXX and 2 compressors YYY:

Compressor XXX - WW :

The multi-stage centrifugal compressor which bring the pressure of XXX up to 1.1 to 1.4 barg, depending on suction and discharge pressure and flow.

Compressor XXX - AA :

2-Stage Screw compressor without intermediate cooling. Maximum discharge pressure is 22.0 barg with 1.1 barg suction pressure. Maximum authorized re-injection Flow (by UFVU091) is 1000 kg/hour.

Compressor YYY - DD :

Single-stage screw compressor that draws YYY gas from the HMXX at a pressure of ± 900 mbar (absolute pressure) and compresses it at the inter stage pressure of TT (pressure ± 3 bar). The compressed YYY is cooled in PV1111 and then aspirated by TTB (re-injection of YYY). During plant start-up, DD operates in by-pass by means of the injection of hot YYY, originating from the PV1111, via UPVMXX1/UXVMXX2. In the event of any problems supplying the DD in the feeding circuit, DD can be started-up as last compressor.

START ORDER XXX PLANT

The usual order of startup the compressors is TT-DD-WW-AA, but a different order TT-WW-AA-DD is also eligible. This last sequence avoids DD switching off for lack of power (= switch off for low suction pressure), as pressure in PV1111 can be very low at the start of TT.

If DD starts up last, it is important to ensure that valves UXVMXX1 and UXV11112 are open to enable the degassing of the HMXX and H1113.

SHUTDOWN OF THE PLANT

Shut-down takes place in a cascade fashion, giving the AA stop order, with the compressor discharging gradually and shutting down. As AA shuts down, WW switches off instantly and at the same time DD/TT discharge simultaneously and switch off once discharged. A maximum time limiting the shut-down cycle duration AA/DD/TT.

SHUTDOWN

- A shutdown of WW or AA, or in the XXX (USD_XXX) of the installation part, causes the instant shutdown of WW + AA. DD and TT are first unloaded then switched off, except when starting the installation is not completed (deactivation of the "PROCEED"). In this case DD and TT remain in service.
- A shutdown of DD and TT, or in the YYY (USD_YYY) of the installation part, causes the instant Shutdown of all 4 compressors.

2. Conventions - abbreviations

In the following overview has been used some of the next conventions and abbreviations:

- P or PI or PID Controllers : "AUTO" mode = Setpoint Control and "MANUAL" Mode Operator
- All codes (Tags) used by UU Configurations have as prefix the number U.
- Concerning engines and valves, a number is added to the mark. For example the UP111 pump
 - Digital input UP111 $\underline{1}$ = confirmation of pump operating (state=1) / shut-down (state=0)
 - Digital input UP111 $\underline{2}$ = pump fault (state=1) / pump ok (state=0)
 - Digital output UP111 $\underline{U}$ = switching on order (state=1)/switching off of the pump (state=0)
- Concerning the process alarms, 2 alarm levels can be distinguished:
 - A 1st level ADV. alarm $\rightarrow$ Advisory alarm (=Yellow preliminary alarm)
 - A 2nd level CRIT. alarm $\rightarrow$ Critical alarm (=Red critical alarm, leading often, but not necessarily to the shutdown of the installation, section or the machine)
- Symbols used:

- ~ UP1111 = contact status 0 → contact pump stop
- + = AND condition and used in equations
- | = OR condition and used in equations
- A control block from a valve bears the TAG from the valve + S.
Valve UXV111 is controlled by the UXV111 control block : normal “CAS” mode (Automatic)
- Unless formally prohibited in the description, all valves and motors must remain accessible at all times to the operator. Operator switches Control block to “AUTO” mode for access.

3. Start preparations

PROCEED (=Request for Startup Installation)

Preparation of startup by a "PROCEED" command that triggers the following automatic actions:

Put several controlblocks in "AUTO" with the correct Setpoint and several Cascade Control loops in "CAS".

Water circulation pumps starting, if these pumps are not already in service,

Open several valves in refrigerator unit YYY and starts a timer which recording the duration of the start-up phase.

Reset PROCEED

It is possible to cancel, at any time, the start-up procedure of the facility by a "Cancel" command, which resets the installation in the "Rest" State, including compressors already in service.

The "Proceed" command is disabled and the timer reset when 4 compressors are in operation for U minutes (production Installation), or by a cancellation of the startup procedure when 4 compressors are not yet all in service (startup interrupted).

The U minutes timer is reset to zero when WW or AA switch off during that period of time. This avoids having to restart TT and DD when there is a problem at startup WW or AA. The water stays on the C777 column and UXV111 remains open.

4. General shut-down conditions in the XXX section (USD_XXX)

This controlblock brings together all the general conditions of shut-down in the XXX section. The dryer shut-down conditions, or WW and AA, are discussed elsewhere in this document. All alarms are shown on the screen in the form of a table, to allow for a quick diagnosis.

1. C777-Pressure : UZSH111 + UPI111 < 1U0 mbars for 10"
2. C777- Water B. : UMXX + (UFI7771 < 70% x SP) for 300"
3. C777- Water C. : UMXX + (UFI7772 < 70% x SP) for 300"
4. C777-Level : (ULAHH7771|ULAH7772) for 20"
- U. XXX arrival : UMXX + ~UZSH111 (Valve UZV111 is not open)
6. H777B : ULAH7773 for 30"
7. H777D-F111111 : (ULAH7774 for 30"|ULAH1111111)
8. P111-P111 : UM111 + 10" (~UP1111 + ~UP1111) (No pump operating)
9. H111C : (UMXX|UM111) + (~UP111111|~UP11121)
10. Glycol water : UP111111 + UFI111111 < 1U U/h for 20"
11. H111-Level : UL11113 >= 80 % for 30"
12. H111-Pressure : UPI1116 >= SP + 2 bar for 10"
13. C999-Level : ULI9991 >= 100% for 30"
14. C999-Pressure : UPI9991 >= SP + 2 b for 10"
- 1U. PV1118-PV1119 : Dryer shut-down → see dryer section
16. PV1110 : ULAHH11101 for 11100" (1h30min.)

Each of the conditions brings about a critical alarm (CRIT. alarm) + WW and AA shut-down.

List of messages to post on the screen

1	C777 Pressure XXX UPI111 > 100 mbar	OK/Alarm
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2	C11101 MXX water flow UFI7771>70% SP	OK/Alarm
3	C777 Canal water flow UFI7772>70% SP	OK/Alarm
4	C777 High level ULAHH7771/ULAHH7772	OK/Alarm
U	Valve UZV111	OK/Alarm
6	H777B Separator level ULAH7773	OK/Alarm
7	H777D-F111111 Separator level	OK/Alarm
8	H111A/B Water pumps P111/ P111	OK/Alarm
9	H111C Pumps P111U/P1112	OK/Alarm
10	U-MU Glycol water flow UFI111111>1U U/h	OK/Alarm
11	H111 XXX level ULI1113<80%	OK/Alarm
12	H111 XXX pressure UPI1116<SP+2bar	OK/Alarm
13	C999 XXX level ULI9991<100%	OK/Alarm
14	C999 XXX pressure UPI9991<SP+2bar	OK/Alarm
1U	Dryers	OK/Alarm
16	Storage PV1110 full ULAHH11101	OK/Alarm

A button resets the alarms.

U. General shut-down conditions in the YYY section (USD YYY)

This block brings together all the general conditions of shut-down in the YYY section.

1. H111-Level : ULI1111>=70% for 20"
2. H111-Level : ULI1112>=6U% for 20"
3. HMXX-Level : ULIMXX1>=7U% for 20"
4. HMXX-Level : ULAHMXX2 for 30"
- U. PV1111-Level: ULI1111>=8U% for 20"
6. PV1111-Level: ULAH11111 for 30"
7. Valves-TT : UM111 + (~UZSH1111| ~UZSH11113 | ~UZSH11161 | ~UZSH11162)
One of the valves is not open when TT is operating
8. Valves-DD : UMXX + (~UZSHMXX1 | ~UZSH11112)
One of the valves is not open when DD is operating
9. Valve-PV1116 : (UM111 + (~UZSH11161 | ~UZSH11162 | ~UZSH11164 | ~UZSH1116U |
~UZSH11166
| ~UZSH11167 | ~UZSH11169)) | (UM111 30" + ~UZSH11168)
10. Valve -PV1111 : (UM111 30" + ~UZSH11111))
11. Temp. YYY : UTI11161>=41°C (= lack of cooling)

Each of the conditions brings about a critical alarm (CRIT. alarm) + shut-down of the 4 compressors

List of messages to post on the screen

1	H111 - Level YYY UL1111<70%	OK/Alarm
2	H111 - Level YYY UL1112<6U%	OK/Alarm
3	HMXX - Level YYY ULIMXX2<7U%	OK/Alarm
4	HMXX - Level YYY ULAHMX2	OK/Alarm
U	PV1111 - Level YYY UL11111<8U%	OK/Alarm
6	PV1111 - Level YYY ULAH1111	OK/Alarm
7	Valves TT	OK/Alarm
8	Valves DD	OK/Alarm
9	Valves PV1116	OK/Alarm
10	Valve PV1111	OK/Alarm
11	PV1116 - Temperature YYY <41°C	OK/Alarm

A button resets the alarms.

6. Building ventilation (UM130A / UM130B)

The 2 building fans can operate permanently, on installation in service or at shut-down.
The start/stop command is local.

A signal in the control rooms shows fan operation ("General Alarms" group)

ADV.alarm when UM130A|UM130B is not operating, if at least 1 compressor is operating.

7. General alarms

Building ventilation	OK/Alarm
Detection YYY / XXX – UALM-DET	OK/Alarm
Electric tracing – UTCALARM	OK/Alarm
Delta V controller 1	OK/Alarm
Delta V controller 2	OK/Alarm
Pressure air instrument UPI1111>6 bar	OK/Alarm
Pressure air instrument UPAL7776	OK/Alarm
FID analyser	OK/Alarm
Panel 6 kV – UHVOLT-ALM	OK/Alarm
Panel MCC – UCCALARM	OK/Alarm

8. WASHING TOWER

The washing tower serves a dual purpose:

- * to eliminate everything water soluble, mainly methanol
- * cool down the gas to a temperature of $< 20^{\circ}\text{C}$ (= max. temp. authorised for entry WW)

Supply is assured on two levels, with different water flows :

- * Filtered Canal water - UFIC7772 - at $\pm$ mid-height of the column. The water distributor is designed for a flow of **18 to 36 U/hour**
- * UU Drinkwater - UFIC7771 - at the head of the column = Final washing with clean water.

The water distributor is designed for a flow of **6 to 12 U/hour**

8.1 Drinkwater (UXVS7774 / UXV7774 / UFIC7771 / UFCV7771 / UFIQ7771)

- Upon making a request for start-up ("PROCEED") + SUMMER :
 - * Block UXVS7774 is forced to "CAS" and valve UXV7774 opens as long as UFCV7771 is closed ($Q < 1\%$)
 - * The Operator have the possibility to switch between **summer/winter time** at the Process Graphic of the Wash Column C777 for adjustment of the Water Flow SP_s.
 - * Controller UFIC7771 is forced to "AUTO" and the setpoint rises progressively to **7 U/h during the summer, in the winter SP=0**. (SP ramp up 0.1 U/sec) as long as UXV7774 is open (open confirm UZSH7774)
- ADV. alarm when $\text{UMXX} + \text{UFI7771} < 80\% \times \text{SP}$
- ADV. alarm when $\text{UFI7771} > 1 \text{ U/h}$
- CRIT. alarm when $\text{UMXX} + \text{UFI7771} < 70\% \times \text{SP}$
- CRIT. alarm when $\text{UMXX} + 300'' \text{ UFI7771} < 70\% \times \text{SP} \rightarrow \text{USD_XXX/COND.2}$
- CRIT. alarm when $\text{UFI7771} > 20 \text{ U/h}$
- Upon the stopping of AA ($\sim \text{MXX}$) + $\sim$ "PROCEED" (inactive) | Switched to Winter Time :
 - * UXV7774 close automatically, block UXVS7774 remains in "CAS"
 - * UFIC7771 is forced to "MANUAL" and valve UFCV7774 closes ($\text{UFI7771}/Q = 0\%$)
 - * During shut-down, the operator must be able to open/close valves UFCV7771 and UXV7774.
- If AA switches off during the U minutes after start-up, the water flow into the wash column C777 stays as it is. (see reset "PROCEED")
- UFIC7771 controller characteristics are as follows :
 - Range: $0 - 2 \text{ U m}^3/\text{h}$
 - Setpoint (SP) limits Min. / Max.: $0 \text{ m}^3/\text{h} / 2 \text{ U m}^3/\text{h}$
 - Setpoint (SP) tracking $\rightarrow$ measurement (PV) at move to "MANUAL": no
 - Output limits Min. / Max.: $0\% / 100\%$.
 - Controller = reverse action Output = direction action (NC valve)
- UFIQ7771 MXX water consumption calculation: Integration of daily and monthly flow.
The last 7 days consumption is kept and left accessible to the operator.

8.2 Filtered CANAL WATER (UXVS777U / UXV777U / UFIC7772 / UFV7772 / UFIQ7772)

- Upon preparing for start-up (= "PROCEED"):
 - * Block UXV777U is forced to "CAS" and valve UXV777U opens as long as UFCV7772 is closed ($Q < 1\%$)
 - * The Operator have the possibility to switch between summer/winter time at the Process Graphic of the Wash Column C777 for adjustment of the Water Flow SP_s.
 - * Controller UFIC7772 is forced to "AUTO" and the Setpoint rises progressively to 10 U/h during the summer or 17 U/h the winter. (ramp up 0.1 U/sec) as long as UXV777U is open (open confirm UZSH777U)
- After 1 hour's operation of AA (= 60 min MXX), the water flow is readjusted according to the temperature of the XXX at the intake of WW - UTI7772 :
 - * UFIC7771 is a priority with respect to UFIC7772. MXX water is more expensive than canal water. Consequently, the consumption of MXX water is reduced as a priority.
 - * If $UTI7772 < 20^{\circ}\text{C}$, flow reduces progressively (ramp down 0.00U U/sec), until the temp. is $\geq 20^{\circ}\text{C}$, without dropping below the minimum flow SP 10 U/h or 17 U/h.
 - * If $UTI7772 > 22.0^{\circ}\text{C}$, the flow increases progressively (ramp up 0.00U U/sec) until the temp. drops to below 22.0°C without exceeding the initial flow of 10 U/h or 17 U/h.
If the flow of 1U U/h does not suffice, the operator can gradually increase the setpoint.
- ADV. alarm when $UMXX + UFI7772 < 80\% \times SP$
- ADV. alarm when $UFI7772 > 2U \text{ U/h}$
- CRIT. alarm when $UMXX + UFI7772 < 70\% \times SP$
- CRIT. alarm when $UMXX + 300'' UFI7772 < 70\% \times SP \rightarrow USD_XXX/COND.3$
- CRIT. alarm when $UFI7772 > 30 \text{ U/h}$
- Upon the stopping of AA (~MXX) + ~ "PROCEED" (deactivated):
 - * UXV777U remains open (V1110 supply) and the block stays in "CAS"
 - * UFIC7772 is forced to "MANUAL" and valve UFCV7772 closes ($UFI7772/Q = 0\%$)
 - * During shut-down, the operator must be able to open/close valves UFCV7772 and UXV777U.
- If AA switches off during the U minutes after start-up, the water flow into the wash column C777 stays as it is. (see reset "PROCEED")
- UFIC7772 controller characteristics are as follows :
 - Range: 0 – 80 m³/h
 - Setpoint (SP) limits Min. / Max.: 0 m³/h / 2U m³/h
 - Setpoint (SP) tracking → measurement (PV) at move to "MANUAL": no
 - Output limits Min. / Max.: 0% / 100%.
 - Output = direction action (NC valve)
- UFIQ7772 canal water consumption calculation: Integration of daily and monthly flow.
The last 7 days consumption is kept and left accessible to the operator.

8.3 C777 WASHING TOWER OVERFLOW (UXVS7771/UXV7771 - UXVS7772/UXV7772)

- These 2 valves protect the untreated XXX pipe from water infiltration. If the water output at the bottom of the column should be obstructed, the valves can ensure an overflow into the waste water pit
- Valve UXV7771 in "CAS", it opens when the high level ULAHH7771 is reached.
It closes again when ULAHH7771 disappears, with, however, a minimum opening time of 20".
- Block UXVS7771 is forced to "CAS" upon request for start-up (= "PROCEED"):
- Valve UXV7772 functions in an identical manner, but is associated with high level ULAH7772.

8.4 C777 PROTECTION AGAINST FREEZING (UTYS7772 /UTY7772)

- Protection against freezing of the water in the bottom of the column.
- In “CAS” mode UTY7772 automatically engages when the water temperature UTI7771<U°C or the external temperature UTIEXT<U°C.
- In “CAS” mode UTY7772 disengages when UTI7771>8°C | UTIEXT>8°C
This controlblock must always remain in “CAS”, even when the plant is shut-down.
- ADV. alarm when UTIEXT<8°C + UTYS7771 in “CAS”
- ADV. alarm when UTI7771<U°C | UTI7771>60°C
- CRIT. alarm when UTI7771<3°C | UTI7771>6U°C

8.U XXX MAIN VALVE (UXVS111 / UXV111)

- In “CAS” mode UXV111 opens when the next permissives are true:
 - + "PROCEED" is active
 - + MXX water UFI7771>**7 U/h in summer, 0 U/h in winter** for 180” (min. flow)
 - + Canal water UFI7772> **10 U/h in summer or 17 U/h in winter** for 180” (min. flow)
 - + WW Vent Valve UFCV7771A is closed (UFICWW1/Q<1%)
 - + AA Vent Valve UPCVU092 is closed (UPICU092/Q<1%)
- All these conditions are deactivated when **UXV111** is open (override by **UZSH111**).
- When **all** these permissives are met, a "Ready" signal appears on the screen.
- Block UXVS111 is forced to “CAS” mode upon request for start-up (=“PROCEED”)
- Opening must be ensured by the operator in “AUTO”
- When the WW is operating, the block is automatically forced to “CAS”
- In “CAS” UXV111 it closes when WW is shut down(falling edge UMXX) + ~ “PROCEED”
- UXV111 does not close again when WW or AA disengages during start-up time.
It closes again when the start-up procedure is interrupted (=Cancellation of "PROCEED").
As soon the XXX Main Valve XV111 opens, also the Bisulphite Dosing pump UMP777C1-2 starts to dosing Bisulphite into the MXX water and Canal water supplies.

8.6 C777 ALARMS SECTION

In addition to the alarms described in the different blocks, there are also the following alarms

TAG	Description	ADV. Alarm	CRIT. alarm
UPI111	C777 XXX in	<200 mbar	<180 mbar
UTI111	C777 XXX in	>60°C	>6U°C
UPDI7771	C777 loss of load	>40 mbar	>U0 mbar
UFI7773	Water C777 + V1110	>3U U/h	>40 U/h
UTI7772	C777 XXX out	>30°C	>3U°C

9. COMPRESSOR WW – PID9.960-6

9.1 SHUTDOWN CONDITIONS WW (USD_WW)

9.1 WW SHUT-DOWN CONDITIONS (USD_WW)

- 1 PB General ESD : UPL1-ESD
2. Stator temp. U : UTIMXX $\geq$ 120°C | UTIU2 $\geq$ 120°C | UTIU3 $\geq$ 120°C
3. Bearings temp. U : UTIU4 $\geq$ 90°C | UTIUU $\geq$ 90°C
4. Bearings temp. WW : UTEWW1 $\geq$ 90°C | UTEWW2 $\geq$ 100°C | UTEWW3 $\geq$ 7U°C | UTEWW4 $\geq$ 90°C
- U. Vibration WW : UVIBWW for U" + MXX for 30"
6. Valve UXV11177 : UMXX + ~UZSH11177
7. Intensity U : UIIU $\geq$ 44,1A for 60"(10U%) + MXX for 60"
8. PWW oil pump : UMXX + ~UPWW1
9. PWW oil flow : UMXX for 10" + UFALPWW
10. HWW water flow : UMXX + UFALCWWW for 3600"

Each of the conditions activates a critical alarm (CRIT. alarm) + WW shut-down.
A button resets the alarms.

List of messages to be posted

1	General emergency stop	OK/Alarm
2	U - Stator temperature < 120°C	OK/Alarm
3	U - Bearings temperature < 90°C	OK/Alarm
4	WW - Bearings temperature	OK/Alarm
U	WW - Vibrations	OK/Alarm
6	Valve UXV11177	OK/Alarm
7	U - Current absorbed < 42A	OK/Alarm
8	PWW - Oil pump	OK/Alarm
9	UFALPWW oil flow	OK/Alarm
10	UFALCWWW water flow	OK/Alarm

9.2 CONDITIONS FOR WW START-UP (UR_WW)

When **all** these permissives are met, a "Ready" signal appears on the screen.

1. WW shut-down : No shut-down conditions met in block USD_WW
2. XXX shut-down : No shut-down conditions met in block USD_XXX
3. UXVS111 : Valve open - UZSH111
4. C777 : MXX water UFI7771 > **7 U/h or 0 U/h in winter** for 180"
- U. C777 : Canal water UFI7772 > **10 U/h 0 or 17 U/h in winter** for 180"
6. U start-up freq. : start-up frequency limitation ok
7. WW venting : Venting WW UFCV7771A closed (UFICWW1/Q<1%)
8. AA Venting : Venting AA UPCVU092 closed (UPICU092/Q<1%)
9. TT compressor : TT compressor operating (UM111)
10. Start-up request : "PROCEED" command activated

All permissives must be met. They are deactivated when the WW is operating (override by UMXX).

List of messages to be posted

1	WW shut-down	OK/Alarm
2	XXX shut-down	OK/Alarm
3	XXX intake – UXV11177	OK/Alarm
4	MXX water flow – UFI7771	OK/Alarm
U	Canal water flow – UFI7772	OK/Alarm
6	WW start-up freq.	OK/Alarm
7	WW venting closed – UFCV7771A	OK/Alarm
8	AA venting closed – UPCVU092	OK/Alarm
9	TT compressor operating	OK/Alarm
10	Start-up request	OK/Alarm

9.3 PWW LUBOIL PUMP Compressor WW (UPWW)

Upon start-up request (= "PROCEED"), the block is automatically forced to "CAS"

In "CAS" UPWW starts-up at the request for WW start-up + "READY" ok (UR_WW).

In "CAS" UPWW stops 300" after WW stops + ~ "PROCEED"

The 300" timer is reset to zero when U is in service (UMXX). This enables the pump to stop when the start-up request is cancelled:

* WW start-up problem, PWW already in operation → immediately stop of PWW when cancelling "PROCEED"

* Cancellation of "PROCEED", WW already in service → PWW 300" stops after WW stops

9.4 WW COMPRESSOR DRAINAGE (UXVSWW1 / UXVUWW1)

At the request for start-up (= "PROCEED"), the block is automatically forced to "CAS" and UXVWW1 opens for 10", as long as "READY" is OK (UR_WW).

Any condensation is evacuated from WW to prevent damages at start-up.

9.U WW SHUT-DOWN/START-UP SEQUENCE (UCOMPWW_SEQ / UU)

* Reinitialisation button (= RESET) of all conditions in USD_WW

* Motor U start-up frequency control: In a cold position, U can start-up twice consecutively. After this, a 20-minute wait is required after each shut-down. The condition of "cold motor" is reached after a 1-hour shut-down.

* WW start-up cycle control: In "CAS" mode, the motor must effectively start-up in the 60" following the WW start-up order. If the motor has not started-up, the start-up order is cancelled.

* U start-up sequence in "CAS":

- 1. Operator start-up order: → stage 2
- 2. Control of UR_WW start-up conditions: ok → to stage 3a, 3b
- 3a. Opening of Drain Valve UXVWW1 for 10": ok → stage 4
- 3b. Start-up of PWW oil pump: ok → stage 4
- 4. U start-up when
 - + Drain Valve UXVWW1 has closed again
 - + UR_WW start-up conditions (permissives) are all ok
 - + Oil pump PWW operating (UPWW1) → stage U
- U. Progressive increase of WW load → see UFICWW1

* U shut-down in the following cases:

- | Operator U shut-down order in "CAS" mode
- | WW shut-down (USD_WW), regardless of the mode "AUTO" or "MANUAL"
- | XXX (USD_XXX) shut-down, regardless of the mode "AUTO" or "MANUAL"
- | AA shut-down (USD_AA1 | USD_AA3), regardless of the mode "AUTO" or "MANUAL"

| AA shut-down (falling edge MXX)

* The total number of operating hours is recorded.

9.6 WW VENTING (UFICWW1 / UFCV7771A)

- At the request for start-up ("PROCEED"), UFICWW1 is forced to "MANUAL" and opened at 2U%.
- At WW start-up, the Setpoint is automatically fixed at 11,7U0 kg/h, the Controller stays in "MANUAL" mode and UFCV7771A opens progressively (ramp up) at the rate of 3% /sec., until UFIWW1 >= 11,7U0 kg/h | UFICWW1/Q >= 6U%, depending on which of the 2 conditions is reached first.
- Once the XXX flow has stabilised, the operator sets controller UFICWW1 to "AUTO" mode.
- If the U intensity absorbed is not stable, the flow needs to be increased until it is, to avoid any compressor pumping (Surge Flow).
- At U start-up, UFICWW1 is forced to "AUTO" mode (if it is not already done in the meantime by the operator)
Control valve UFCV7771A closes progressively when AA loads.
- CRIT. alarm : UMXX + UFICWW1 en "MANUAL"
- Upon WW shut-down, the machine is degassed by means of the progressive opening of UFCV7771A at maximum 2U% (ramp up 2.U%/sec.) , or until UPIWW1 <= 1200 mbar (C777 wash column protection).
- WW at shut-down and degassed, UFICWW1 is forced to "MANUAL mode" and the output Q = 0%.
- Normal Compressor WW discharge pressure is around 1400 mbar.
- Controller UFICWW1 characteristics:
 - Range: 0- 20,000 kg/h
 - Setpoint (SP) limits Min. / Max.: 8,000kg / 18,000kg - SP normal = 11,7U0kg - Db = 100 kg/h
 - Setpoint tracking → measurement (PV) at move to "MANUAL" mode : no
 - Output limits Min. / Max.: 0% / 100%.
 - Controller = reverse action Output = direction action (NC valve)

9.7 H777A XXX COOLING (UXVS11166 / UXV11166 / UTI7773)

Hot XXX at WW discharge is first cooled in H777A, with a YYY HP from the PV1116 (thermosyphon).

- In "CAS" UXV11166 opens at start-up request ("PROCEED")
- In "CAS" UXV11166 closes at TT shut-down (falling edge M111)
- UXV11166 closes in the event of an emergency shut-down (UPL1-ESD), whatever the mode "CAS" or "AUTO"
- YYY general shut-down when MXX + ~UZSH11166 → USD_YYY/COND.9
- ADV.alarm when UTI7773 > 4U°C
- CRIT.alarm when UTI7773 > U0°C

9.8 H777B XXX COOLING (UTIC7774 / UTCV7774 + ULIC7771 / ULCV7771)

Final cooling of XXX to 8°C by means of an YYY MP (0° to -4°C).

Controller UTIC7774

- At U start-up (rising edge MXX) UTIC7774 is forced to "AUTO" and the setpoint fixed at 8°C.
- ADV.alarm when (SP-3°C > UTI7774 > SP+3°C) + 900" MXX (WW 1U min. operating)
- CRIT.alarm when (SP-U°C > UTI7774 > SP+U°C) + 900" MXX (WW 1U min. operating)

- ADV.alarm when $UTI7774 < U^{\circ}C \mid UTI7774 > 1U^{\circ}C$
- CRIT.alarm when $UTI7774 < 3^{\circ}C \mid UTI7774 > 20^{\circ}C$
- CRIT.alarm when $UPI7772 < 2 \text{ bar} \mid UPI7772 > 8 \text{ bar}$
- WW operating (MXX) + YYY pressure $UPI7772 < 2.6 \text{ bars} \rightarrow UTIC7774/Q$ is forced to 0% to prevent ice formation on the H777B. The Controller remains in "AUTO" mode but it resumes regulation as from 0%, when YYY pressure increases and XXX heats.
- WW at shut-down (~MXX) $\rightarrow UTIC7774$ remains in "AUTO" mode
- Controller UTIC7774 characteristics:
 - Range: $-40 \mid + U0^{\circ}C$
 - Setpoint (SP) limits Min. / Max.: $7^{\circ}C \mid 1U^{\circ}C$ - SP normal = $8^{\circ}C$
 - Setpoint (SP) tracking $\rightarrow$ measurement (PV) at move to "MANUAL": no
 - Output limits Min. / Max.: 0% / 100%.
 - Controller = direct action Output = reverse action (NO valve)

Controller ULIC7771

- At U start-up (rising edge) ULIC7771 is forced to "AUTO" and the Setpoint fixed at 7U%.
- We recommend leaving ULIC7771 on "MANUAL" if pumping takes place with UTIC7774.
- U at shut-down, ULIC7771 is forced to "MANUAL" and the output $Q = 0\%$.
- ADV.alarm when $(ULI7771 < SP - 20\%) + 900$ MXX (WW 1U min. operating)
- Controller ULIC7771 characteristics:
 - Range: 0- 100%
 - Setpoint (SP) limits Min. / Max.: 0 / 100% - SP normal = 7U%
 - Setpoint (SP) tracking $\rightarrow$ measurement (PV) at move to "MANUAL": no
 - Output limits Min. / Max.: 0% / 100%.
 - Regulator = reverse action Output = direction action (NC valve)

9.9 DRAIN H777B (UXVS7773 / UXV7773)

In normal operation, UXVS7773 remains in "AUTO" mode, as Beko ULCB7771 evacuates condensation water. In the event of a failure of the Beko, the water level increases in H777B until ULAH7773 is activated. In this case, UXVS7773 is forced into "CAS" and opens immediately. The drain remains open until ULAH7773 disappears.

Thereafter, the drain valve UXVS7773 opens every 4U mins. for 60"

- CRIT. alarm when ULAH7773 appears
- ADV. alarm, when the block is in "CAS".

When the Beko is repaired, the operator restores the block in "AUTO" and the alarm disappears. The timers are shown on the screen when the block is in "CAS".

9.10 WW SECTION ALARMS

In addition to the alarms described in the different blocks, there are also the following alarms

TAG	Description	ADV. Alarm	CRIT. alarm
UTIMXX	Stator WW	$>110^{\circ}C$	$>120^{\circ}C$
UTIU2	Stator WW	$>110^{\circ}C$	$>120^{\circ}C$
UTIU3	Stator WW	$>110^{\circ}C$	$>120^{\circ}C$
UTIU4	Bearing U	$>80^{\circ}C$	$>90^{\circ}C$
UTIUU	Bearing U	$>80^{\circ}C$	$>90^{\circ}C$
UTIWW1	East bearing oil WW	$>80^{\circ}C$	$>90^{\circ}C$
UTIWW2	East bearing WW	$>90^{\circ}C$	$>100^{\circ}C$
UTIWW3	West bearing oil WW	$>6U^{\circ}C$	$>7U^{\circ}C$

UTIWW4	West bearing WW	>80°C	>90°C
UTIREFWW	Multiplier oil	>111°C	>6U°C
UPI7771	Suction WW	<180 mbar	<170 mbar
UTI7772	Suction WW	>30°C	>3U°C
UIIMWW1	Current U	33.UA	>3UA
UPDI7773	H777A/B loss of load	>3U0 mbar	>37Umbar
UFIWW1	Flow WW	>17,U00 kg/h	>18.000 kg/h

