Test Project

Task C2 – Mechanical maintenance in water and wastewater treatment plants

Pump station

Water Technology

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Introduction

Maintenance task C2 consists of tasks related to the exchange and functional check of pumps in the pump station. During the tasks, it is essential to adhere to the safety protocols which include the mandatory use of the Personal Protective Equipment (PPE).

The following components are provided for your task:

- Extension kit EDS Pump Station WorldSkills 2026 Shanghai
- The serviced Pump from task C1
- Crane and lifting slings
- Modified pipe fittings
- Tools for this task

Note: All necessary spare parts are included with the extension kit. Use only the components required to fulfill this task.

Description of project and tasks

At the municipal water treatment plant, treated drinking water is delivered to the distribution network by the pump installed in the pump station. The station is currently in operation with a progressive cavity pump, which serves as its existing duty pump.

Following the workshop service carried out in Task C1, the centrifugal pump is available again as a service-ready unit. Before it can be accepted for use in the pump station, its operation must be checked under the operating conditions of the station.

For this check, the existing duty pump is removed from the station and the centrifugal pump is installed in its place using the modified pipe fittings. After the pump has been prepared for start-up, it is operated at defined speed setpoints. The flow rate is recorded, and the operational behavior of the pump in the station is observed.

Because the task is to check the centrifugal pump operationality, it should be removed afterwards. The existing duty pump needs to be reinstalled and returned to normal service, so that the station is restored to its original operating condition.

Initial Situation

The pump station is running with the existing duty pump. The centrifugal pump serviced in Task C1 is available and shall be temporarily installed in the station for an operational check.

The frequency-converter parameters are set by the technical support personnel before each pump is started. All work steps, measurements, and observations shall be recorded in the task protocol and the Task Form.

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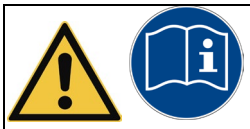
Tasks

Your task is to carry out a temporary pump exchange and operational check in the pump station.

This includes removing the existing duty pump, installing the centrifugal pump serviced in Task C1, operating the centrifugal pump at the specified speed setpoints, recording the required flow-rate values and observations, and restoring the station to its original operating condition.

At the end of the task, the station shall be left operating with the existing duty pump, and the centrifugal pump shall be left on the workbench.

Safety and Protective Equipment



Be aware of the hazards associated with pump maintenance and handling.

Keep the operating instructions and task protocol available at the workstation.

Read the task protocol carefully before starting the task.

Warnings



Warning of high voltage Electricity



Warning of Overhead load



Risk of tipping over when rolling



Risk of crushing hands

Mandatory PPE

Wear head protection



Wear safety shoes



Wear protective clothing



Wear protective gloves



Wear eye protection



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Instructions to the Competitor

System overview

The pump station is shown in **Figure 1** and the Piping and Instrumentation Diagram (P&ID) in **Figure 2**. Use both to identify the components referred to in the protocol. The figures are provided at the end of this document.

NO.	DESCRIPTION
[1]	Water tank (VE1)
[2]	Butterfly valve, manually operated at water inlet (AA1)
[3]	Water filter (SF10)
[4]	Pressure sensor on the suction side of the pump (-BP2)
[5]	Drain opening with ball valve (VV6) at the lowest point of the pipework
[6]	Pump drive (-GP1/MA1)
[7]	Gear
[8]	Eccentric screw / progressive cavity pump (PL1)
[9]	Butterfly valve, manually operated on the pressure side (AA3)
[10]	Station base, height adjustable
[11]	Basin (VE2)
[12]	Drain opening with threaded plug
[13]	Pressure sensor on the pressure side of the pump (-BP1)
[14]	Flow meter transmitter (-BF4)
[15]	Knife gate valve, pneumatically operated (SM4/-MB1)
[16]	Butterfly valve unit, pneumatically operated (AA5/-MB2)
[17]	Bypass circuit
[18]	Safety overpressure valve (VY9), opens at approx. 3 bar
[19]	Manually operated valve for the bypass simulation (VM8)
[20]	Control cabinet
[21]	Plug I/O connector (-XG2)
[22]	Connection pin – potential equalization
[23]	Plug connector reserve
[24]	Plug connector pump motor and thermal resistors
[25]	CEE 16 A connector for the power supply cable (-XD1)
[26]	Control panel with touch display (-PH1)
[27]	Main switch / mains disconnecting device (-QB1)
[28]	EMERGENCY-STOP button on the control cabinet (-FQ1)
[29]	Multi-function measuring instrument SENTRON PAC3200 (-BJ1)

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Safety checks before you begin

Before working on the pump, confirm that:

- All required PPE is worn;
- The pump is switched off;
- The station is electrically isolated and cannot be restarted;
- Lockout/tagout (LOTO) has been carried out;
- The pipework is depressurized and drained;
- The working area is clean and dry;
- The crane and lifting slings are undamaged;
- The workstation, tools, and the modified pipes & fittings are complete and undamaged. Report anything missing or damaged before starting

Important: *Do not switch the station on after installing a pump until the technical support personnel have set the frequency-converter parameters for that pump*.

Overview of the task

Carry out the work in phases, following the numbered protocol in the table below:

Phase 1 – Baseline measurement: Record the flow rate of the existing duty pump under normal station operation.

Phase 2 – Shutdown and removal: Shutdown, isolate, and drain the station. Then remove the existing duty pump using the crane.

Phase 3 – Install the centrifugal pump: Install the centrifugal pump serviced in Task C1 using the crane. Connect the modified pipe fittings with the correct suction and discharge orientation and vent the pump using the air-bleed screw.

Phase 4 – Operational check: After the technical support personnel have set the frequency-converter parameters, operate the centrifugal pump at defined setpoints, record the flow rate, and have the running behavior assessed by the observing expert.

Phase 5 – Restore the station: Remove the centrifugal pump, reinstall the existing duty pump, have the support team reset the frequency converter parameters. Confirm the station is running normally. Leave the station running with the existing duty pump and leave the centrifugal pump on the workbench.

Note: *Competition time is paused only while the technical support personnel set or reset the frequency-converter parameters.*

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Task Protocol

Use the table below to carry out task C2. Work through the protocol in the order shown. For every step, tick the "Done" column and record any measurement, observation or remark in the "Note / observation / result" column. The flow-rate values are entered in the Task Form.

Station:	_____	**Order No.**	WorldSkills 2026
No.	**Activity**	**Done**	**Note / observation / result**
0	**Baseline measurement of the existing pump**		
1	Ensure the station is filled and the valves are set for normal operation. Start the existing duty pump if it is not already running and let it run until the reading is stable.	☐	
2	Record the baseline flow rate of the existing duty pump (-BF4).	☐	Enter the baseline value in the Task Form.
3	Stop the pump.	☐	
10	**Shutdown and lockout/tagout (LOTO), and removal of the existing pump**		
11	On the control panel, ensure the pump is off and the pneumatic valves AA5/-MB2 and the knife gate valve SM4/-MB1 are closed. ↳ See **Figure 1** and **Figure 2**	☐	
12	Press the EMERGENCY-STOP (-FQ1), switch off the main switch (-QB1), lock it with the padlock and fit a warning tag with the date, time and your name.	☐	LOTO carried out
13	Disconnect the pump motor cable (24), the power supply plug (25), the I/O connector (21) and the protective earth cable (22) from the control cabinet in this order. ↳ See **Figure 1**	☐	
14	Close the manual valves AA1 and AA3, lock them and fit warning signs.	☐	
15	Drain the pipework via the drain valve VV6 while opening the filter trap (**Figure 1**) slowly until the water drains, then close it.		
16	Disconnect the suction and discharge pipe connections and the mounting fasteners connected to the pump.	☐	
17	Attach the crane at the designated lifting points; lift the existing duty pump from the station and place it securely on the workbench.	☐	Existing duty pump removed.
20	**Install the centrifugal pump**		
	Inspect the Pump that you have serviced in Task C1, if there are any labels or comments attached to it.		
21	Do not switch on the electricity to the station after installing the centrifugal pump in the station. Please see step 28.	☐	

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	Hint: Do not unlock the electrical cabinet		
22	Attach the crane to the Wilo Pump serviced in task C1 using its sling points and the correct sling (**Figure 3**); lift it to the station and lower it carefully into the mounting position.	☐	
23	Fit the modified pipe connections to the pump, observing the correct orientation: connect the suction and discharge sides correctly (**Figure 4**). Tighten the connections evenly.	☐	Check suction / discharge orientation.
24	Open the manual valve AA1 gradually to fill the suction side and check the pipe connections for leaks.	☐	
25	Reconnect the motor cable and the protective earth cable.	☐	
26	Vent the pump using the air-bleed screw. The Wilo Pump is non-self-priming and must be filled before operation: Open the air-bleed screw, fill until water escapes without air, then close the screw. ↳ See **Figure 5**.	☐	*Venting is essential before starting the pump*
27	Check that the pump is installed correctly, the modified pipe fittings are tight, the pump has been vented, and no visible leaks are present.	☐	*Ready for parameter setting.*
28	**STOP — call the technical support personnel to set up the pump station with the new parameters for the Wilo Pump (frequency converter).** *Do not switch on the electricity until the support team has confirmed the settings.* **The timer will be paused during this step.**		
30	**Commission and operational check**		
31	After the technical support personnel have confirmed the frequency-converter parameters, remove the locks and warning tags. Open the valves AA1 and AA3, switch on the station and acknowledge any messages on the control panel. Open the Knife gate valve SM4/-MB1.	☐	
32	Start the centrifugal pump at a low-speed setting and check all pipe connections for any leakage and examine for any abnormal noises. *If there is any noise, please call the technical support personnel to take a look*.	☐	Leakage? Yes / No Noises? Yes / No
33	Run the pump at 25 %, 50 %, 75 % and 100 % speed setpoints (set on the touch panel) and record the flow rate at each setpoint. ↳ See **Figure 6**	☐	Enter the values in the Task Form
34	Call the observing expert to assess how the pump is running.	☐	

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	Important: *The observer's assessment will be used for evaluation.*		
35	Stop the pump.	☐	
40	**Restore the station**		
41	Carry out the shutdown, lockout/tagout (LOTO) protocol (steps 11–14) and drain the pipework.	☐	
42	Disconnect the motor cable, protective earth cable, and the pipe connections from the centrifugal pump. Attach the crane to the designated lifting points, lift the centrifugal pump from the station, and return it securely to the workbench.	☐	
43	Reinstall the existing duty pump using the crane and reconnect the original pipe fittings. Reconnect all electrical connections, then check for leakages. *Hint: Do not unlock the electrical cabinet yet*	☐	Leaks? Yes / No
	STOP — call the technical support personnel to reset the station parameters for the existing duty pump. *Do not start the pump until the technical support personnel have confirmed the settings.* **The timer will be paused during this step.**		
44	After the technical support personnel have confirmed the settings, remove the locks and warning tags. Open the valves, switch on and start the pump. Confirm that it runs normally (flow ≥ 1850 l/h) and record the flow rate.	☐	Enter the end value in the Task Form.
45	Leave the station running with the existing pump at 90% speed and the water flowing through the Kinfe gate valve SM4/-MB1, and keep the Butterfly valve AA5/-MB2 closed. Leave the Wilo Pump on the workbench.	☐	
Date and finish time		**Carried out by:**	Country: _____ Competitor: _____

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To continue.

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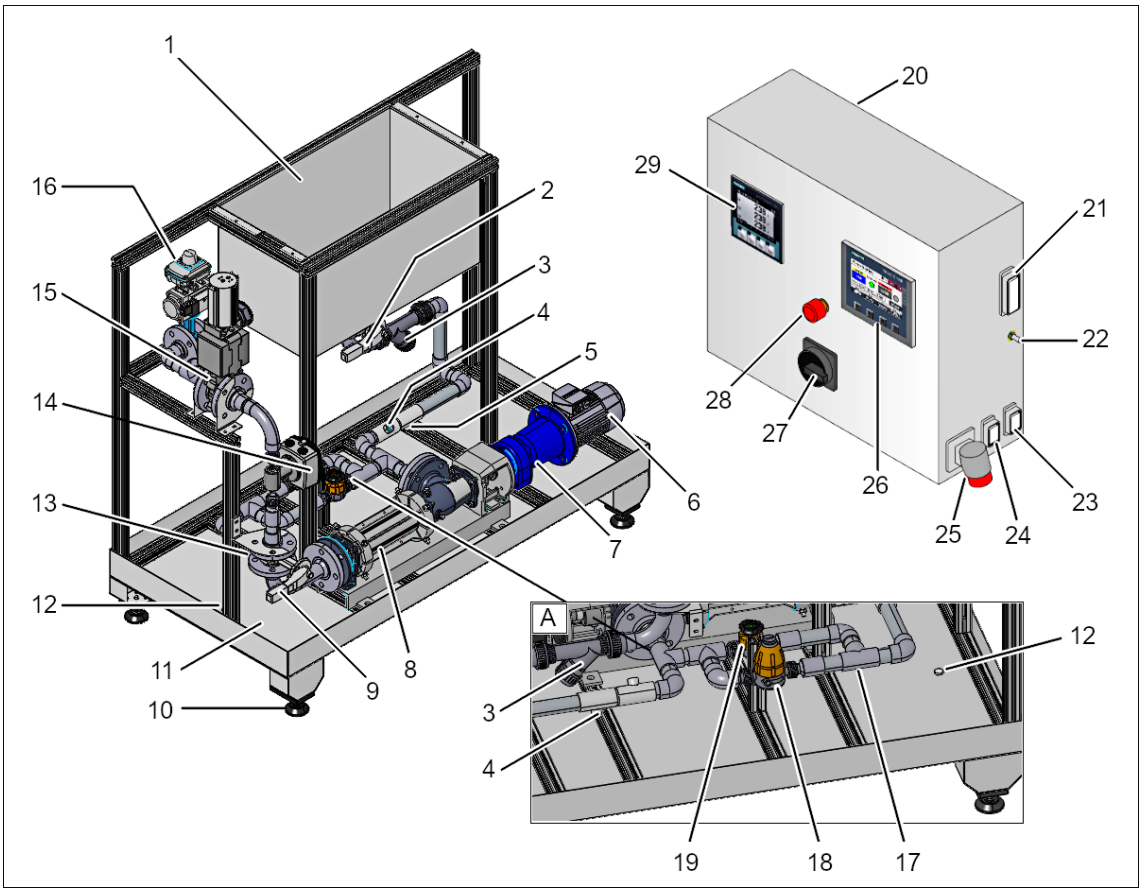


Figure 1 — Pump station components.

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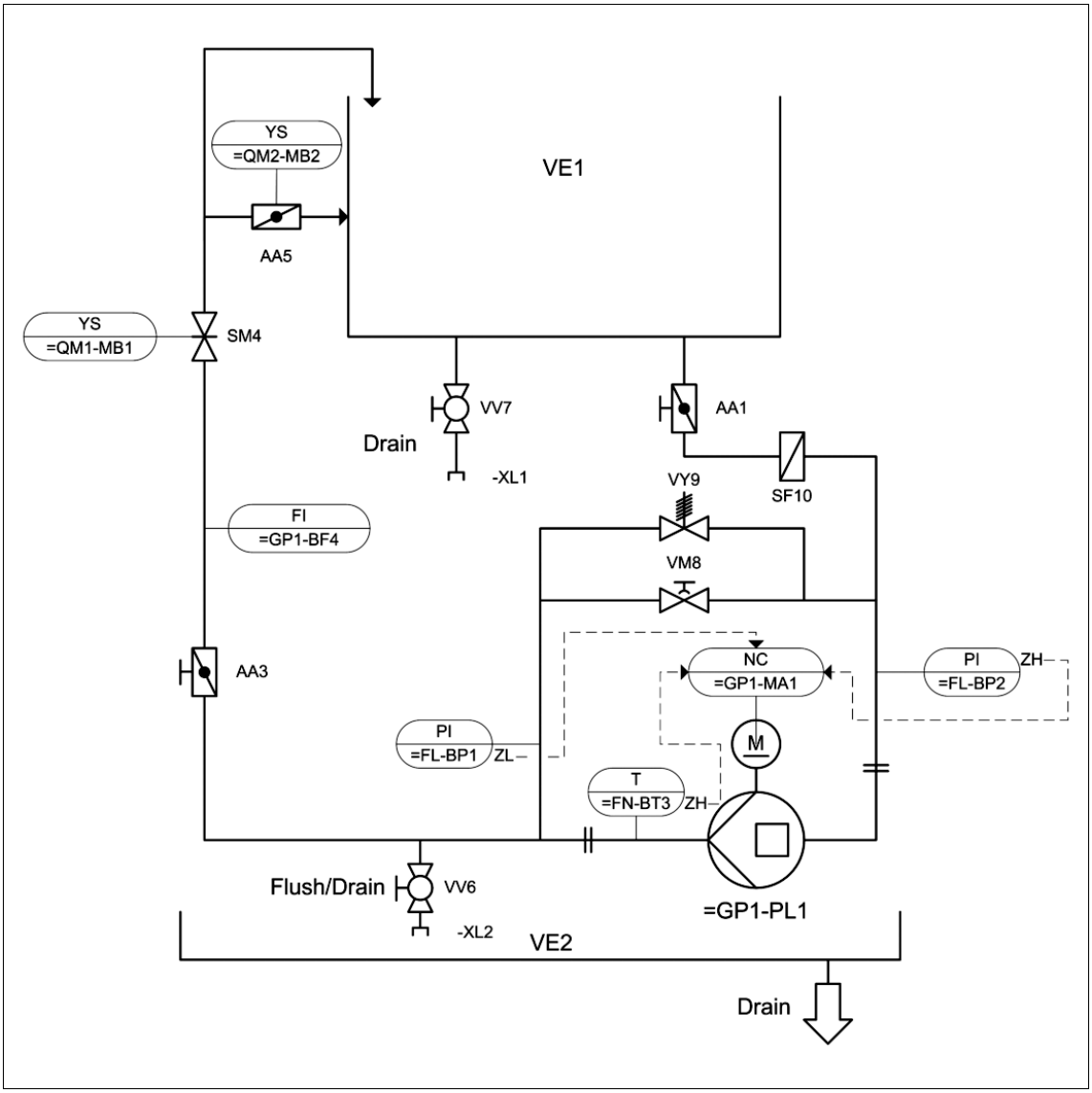


Figure 2 — Pump station Piping and Instrumentation Diagram (P&ID).

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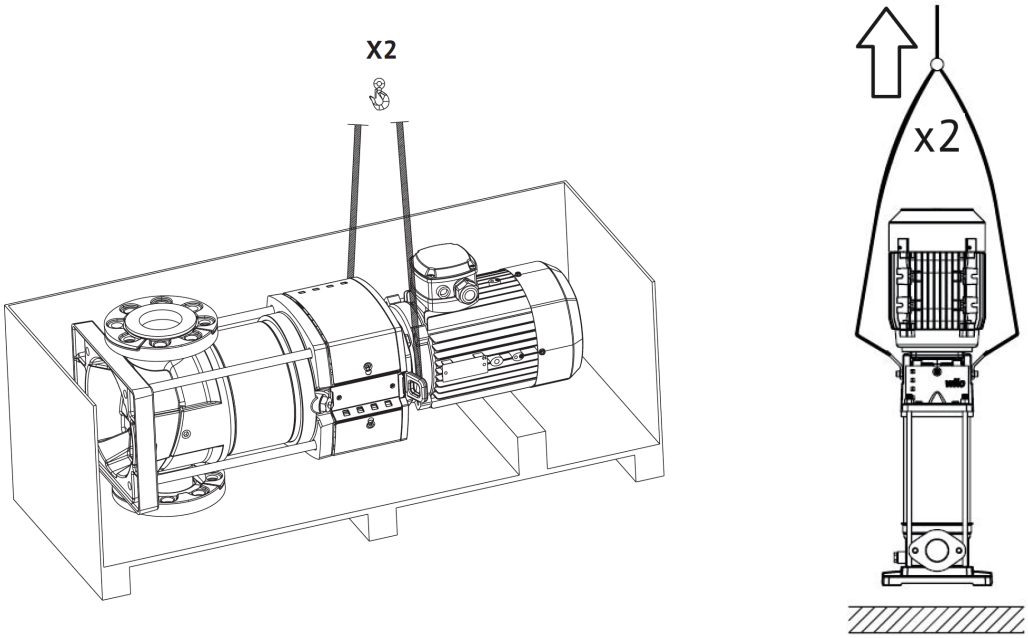


Figure 3 — Slinging points on the Wilo Pump.

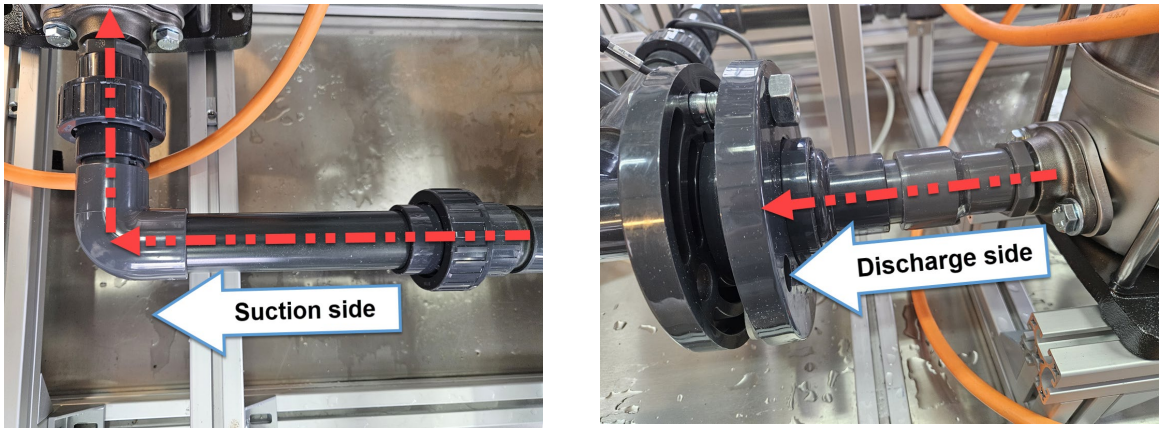


Figure 4 — Connecting the Wilo pump with the modified pipe fittings.

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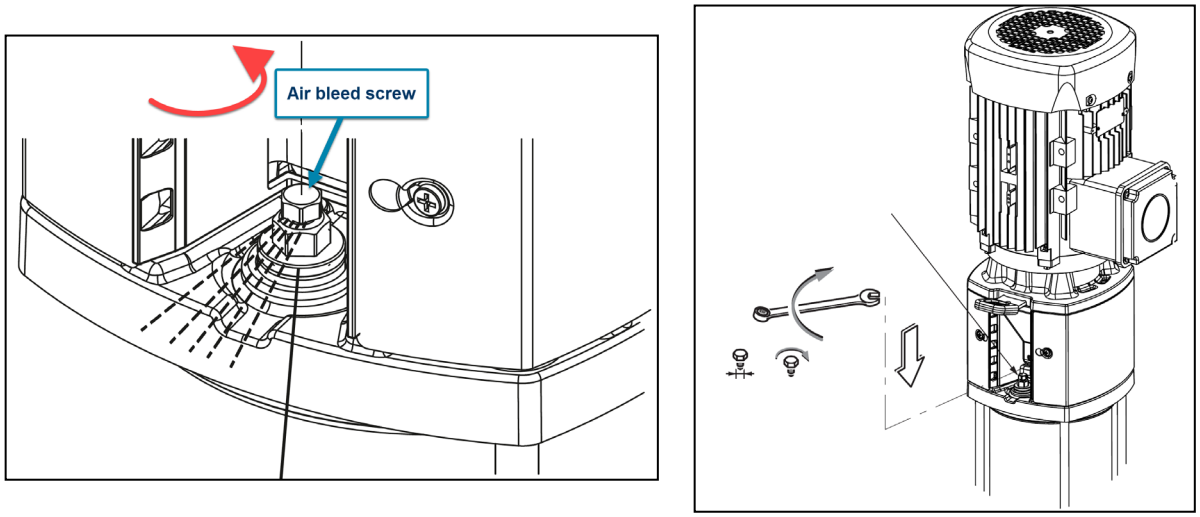


Figure 5 — Venting the Wilo Pump using the air-bleed screw.

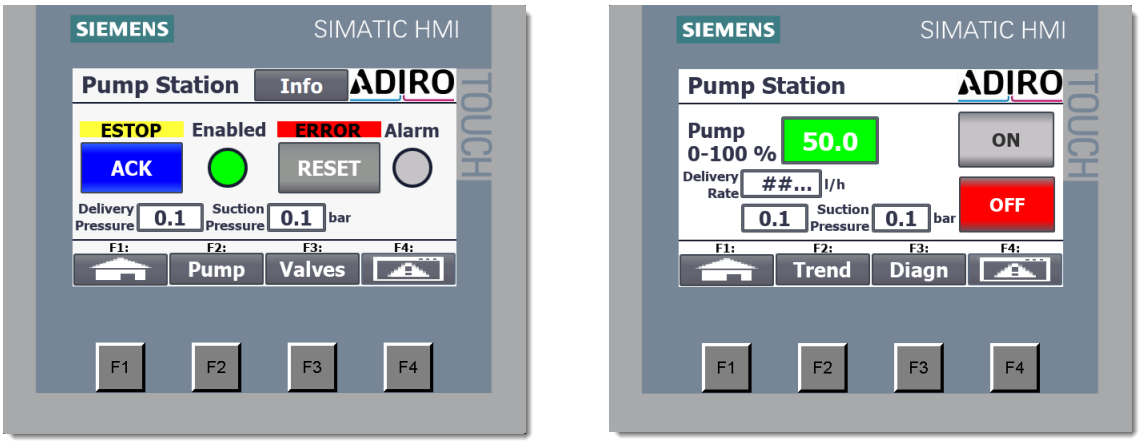


Figure 6 — Touch panel interface for operating the pump station.

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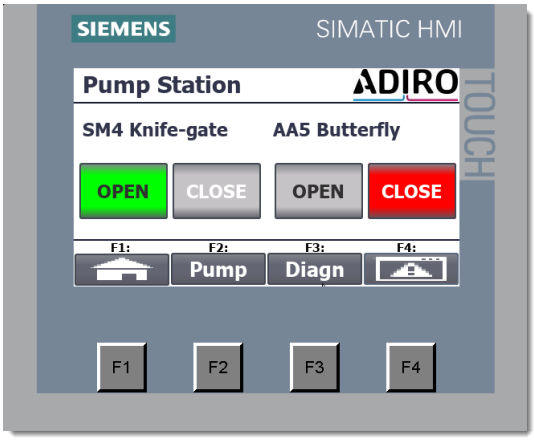
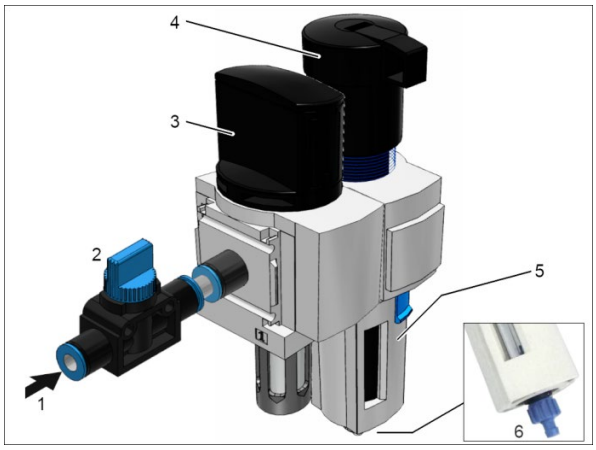


Figure 7 — Touch panel controls for the valves.



[1] Compressed-air connection (Pneumatic tubing 8 mm)
[2] Compressed-air shut-off valve
[3] ON-OFF valve MS4-EM1
[4] Pressure control valve with filter
[5] Water separator
[6] Drain plug for the condensate

Figure 8 — Pneumatic air service unit description.

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Task Forms

Country: _____Competitor Name: _____

1. Flow rate of the existing duty pump:

EXISTING PUMP	BASELINE – START (L/H)	AFTER REINSTALLATION – END (L/H)
Flow rate – -BF4		

2. Centrifugal pump – flow rate at different speed setpoints:

SPEED SETPOINT (TOUCH PANEL)	FLOW RATE – -BF4 (L/H)
25 %	
50 %	
75 %	
100 %	

3. Leak checks:

- Were there any leaks observed after installing the centrifugal pump? Yes / No
- Were there any leaks observed after reinstalling the existing duty pump? Yes / No

4. Operation observations

Were there any abnormal operation conditions observed while running the centrifugal pump in the station?

- Noise: Yes / No
- Vibration: Yes / No
- Unstable operation: Yes / No
- Visible leakage: Yes / No

Remarks (if any):

_____

Final condition:

- Is the station left running with the existing pump? Yes / No
- Is the Wilo Pump left on the workbench? Yes / No

Remarks (if any):

_____

Marking Scheme

The task evaluation will be made according to the Competition Information System (CIS) of Water Technology defined for WorldSkills 2026.

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