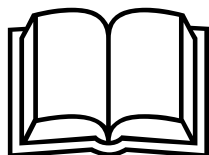


1171**S/N****Gas scrubber system for
type PE2061S Epitaxy Reactor****Model****4NR25S****LPE S.p.A.**
Via Falzarego, 8
20021 BOLLATE**Client****CIRECO S.r.l.**Via Puccini, 12 - 20028 SAN VITTORE OLONA (MI)
Tel. +39 0331 200141 - Fax +39 0331 281300**Manufacturer**

It is mandatory to read carefully and make sure to have comprehensively understood the content of this manual and relevant annexes, as well as to diligently follow the rules set forth.

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The manual is to be properly kept through the life of the machine which belongs to; it is therefore compulsory to hand over the manual with the annexes in case of property change



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1 - Main features

Gas flow rate	500 slm of Hydrogen
Effluent temperature	15 to 50 °C
Vacuum at reactor	Adjustable, - 0.5 mBar to - 12.5 mBar, - 15 mBar maximum
Accuracy of vacuum	Plus/minus 0.1 mBar
Dilution of Hydrogen	Mixing at 2 % in volume with 1.600 m ³ /h of air supplied by fan
Contaminants	HCl, HSiCl ₃ , PH ₃ , B ₂ H ₆
Operation of scrubbing	Liquid curtain at entry, packed bed, venturi throat First two steps at negative pressure, third step atmospheric
Stack emission	2 ppm on hydrochloric and silanes
Turret parameters	0.07 m/s superficial velocity, 13 sec residence time
Water flow rate	First step: 6.5 cm/h Second step: 2.5 cm/h Third step: up to 7 cm/h
Volume of the solution	480 Litre
Make up water demand	Up to 450 l/h at 2 Bar and 15 °C
Control nitrogen	8 Bar, but not less than 5 Bar, supply pressure 40 lpm at 5 Bar demand
Ambient temperature	From - 5 °C (with the pump running) to 50 °C
Service	Indoors or outdoors
Ports	Entry from reactor: 2 x 2", exit to fan system d. 63 and d. 200 stack
Material	PVC
Supply voltage	400 V, 50 Hz, three-phase
Installed power	5.1 kw
Protection degree	IP55

Dimensions and weights:

- scrubber	900 x 1.020 x 3.250 (L x D x H) mm, 815 kg with water
- control panel	585 x 300 x 800 (L x D x H) mm, 55 kg

2 - Machine description

As per drawing G5054.03.01

2.1 - Suction of the gas at controlled negative pressure

The pump activated venturi ejector provides the negative pressure at the process chambers of the epitaxy reactor and the suction of the exhaust gas

The negative pressure is tuned by the liquid flow rate in turn adjusted by the drive frequency, out of the VSD, of a centrifugal pump motor

The VSD compares the programmed set point and the actual 4-20 mA signal from the vacuum transducer as well as adjusts the output frequency for the pump motor resulting into a negative pressure kept steady versus the variable carrier gas flow rates of growth, cooling and etching

With the regulation loop there is a minimum rotation rate for the pump, set at 10 Hz, in order to keep flooded the ejector nozzle thus separating the turret at negative pressure from the atmospheric exit chamber

- 1 Pump activated venturi ejector to provide a regulated vacuum, featuring at minus 15 mBar:
 - 700 slm gas flow rate (hydrogen)
 - 8 cm/h water flow rate
- 2 Centrifugal pump, magnet drive:
 - 24 m³/h flow rate, 20 m w.g. pressure
 - ECTFE wetted parts
 - 4 kw - 2 poles motor (Atex)
- 3 Piezoelectric transducer for reactor vacuum, IP67, SST316L process connection, 0 to - 50 mBar sensing conditioned to 4 to 20 mA output, display built-in, Atex
- 4 Frequency converter with operator terminal (control panel)
- 5 Emergency blow of nitrogen at the exhaust port for a temporary barrier to outside air until safety is restored by the reactor changing over to nitrogen flow
It is triggered by a normally open solenoid valve reflecting a loss of power or a lock out on fault

2.2 - 3-step scrubbing

2.2.1 - First step: bell type inlet chambers

Two pairs of inlet bells to match the two exhaust pipes out of the reactor process chambers, each pair being inclusive of the following equipments

- 6.1 Junction distributing the effluent to the inlet bells, 2-way, DN-50 constant section, 2" clamp ends, stub and loose flange for the exhaust pipe, indicator port
- 2 transparent bell type inlet chambers:
- 6.2 - passage of the gas through the liquid cone generated by the nozzle at the bottom of the bell
The effect is an immediate dissociation of silanes into hydrogen, hydrochloric and silica, which crystallizes into flakes incorporating some part of the hydrides
- 6.3 - gas distribution technique with gradual expansion and recycle by swirl for a consistent exposure of silanes to the cone of water
- 6.4 - inner tube, concentric, d. 75, clear PVC
The pump circulated water fills the cavity between the concentric inner/outer tubes and pours over the brim through holes with the upper lip of the inner tube
The exhaust gas flows toward the cone nozzle inside a waterfall, which makes difficult for the silica to growth on the inner tube
The same inner tube is large cumulated surface to bear a large amount of solid residues before maintenance is due
Some of the water exits holes with the lower lip of the inner tube for jets, hitting and wetting the cone of the bottom nozzle, so that it is made difficult for the silica to growth
- 6.5 - outer tube, d. 120, clear PMMA
- 6.6 - Y shaped bell head, DN-50, 2" clamp end, nitrogen port
- 6.7 - PP made ring scraper to remove deposited silica from the inside wall of the bell head, non wetted yet exposed to moisture
- 6.8 - double action pneumatic cylinder, 50/200 bore/stroke, ST316L shaft, nitrogen operated
Mode of scrapers:
- automatic:
· 2 solenoid valves as VSD Output, each one driving 2 cylinders of both the pairs (1A with 2A, 1B with 2B)
· sequential operation of the two solenoid valves so that the exhaust gas passage area is not impaired
· intermittent duty cycle, typically 5 seconds of actuation every 60 minutes of rest
- manual, or test:
· push button to activate the sequence without having to wait for the rest time to elapse
· when the drive shaft is fully extended the edge of the ring scraper is visible just below the bell head
- 6.9 - nitrogen curtain as a barrier against moisture diffusing upwards, made by the thin passage between the inner wall of the bell head and the ring scraper when it is (for most of the time) at the upper position of rest
- 7 Negative pressure indicator, 0 to 20 mBar range, to show any clogging of the bells against the transducer display

The silica flakes fall in the underneath tank and float by overflow into the drain

2.2.2 - Second step: absorption

As the gas expands upwards, into the packed-bed turret for the second step of scrubbing, solid bodies are hosed down by a counter current spray

The contaminants, hydrochloric and residual hydrides, carried by the exhaust hydrogen stream are removed by absorption at the passage through a double packed bed, which is wetted by water in a counter current pattern, and they are transferred to the volume of circulated water

Packed-bed tower section:

- 8 - 2 transfer units coarsely filled with rib cage Eco-Fill rings of 130 m²/m³ specific surface, on support grillworks, to provide a 14.3 m² interface and an extended residence time
- 9 - 3 1/2" counter current spray nozzles, solid cone, for wetting the packed rings and hosing down residual solid bodies just ahead of the turret
 - portholes with clear windows, for inspection, loading/unloading of rings and nozzles maintenance
- 10 - d. 75 gravity check-valve to seal the hydrogen filled column in the event of loss of gas suction or loss of power

2.2.3 - Third step: Venturi throat

The water nozzle is centered just ahead of the converging section of the throat

The high turbulence creates an extended surface for gas-liquid contact and mixture

The mixture of the fluids serves well also to absorb condensable gases further boosting the overall scrubbing action

2.3 - Liquid phase

The scrubbing liquor falls into an underneath reservoir, distributes through a submerged passage and is circulated to the nozzles by a centrifugal pump

- 11 Non floating silica flakes, once carried by the liquid flow, are broken by the strainer below a safe size to avoid plugging of the nozzles and of the packed bed rings
- 12 Maintenance nozzle, with d. 20 hand valve (ball), above the brim of the overflow port to break large silica flakes and to facilitate their floating into drain
- 13 Variable area float flow meter, 3.000 l/h reach, as visual indication for the flow rate of the turret path
- 14 d. 40 hand valve (ball) for the flow adjustment of the nozzles at the base of the inlet bells
- 15 d. 32 hand valve (membrane) for the flow adjustment of the waterfalls of the inlet bells
- 16 Spray unit, with d. 20 hand valve (ball), again to break any aggregation of floating silica flakes

Water is added during the growth or etching phases of the epitaxy process, that is when HSiCl₃ or HCl gases are flowing, in order to keep the chemical concentration low enough by the gravity dump, by overflow, of the silica precipitate and the hydrochloric laden solution

Water is also added, continuously, to compensate for the evaporation losses

- 17 Pneumatic valve (membrane), d. 20, normally closed actuator, operated by YV1 normally closed solenoid valve to be controlled by a remote signal (normally open contact)
- 18 d. 20 hand valve (ball) to trim the flow for the continuous mode
- 19 Variable area flow meter as visual indication (discontinuous and continuous modes), 800 l/h reach, with needle valve to trim the flow of discontinuous mode

If no remote signal is available and the automatic valve remains inoperative then the hand valve (18) and the needle valve (19) have to trim the flow rate of make water for the de-concentration of the scrubbing solution

The reaction between the silanes and water creates HCl and other chlorine compounds, which make the solution acid, therefore the use of wastewater with NaOH or KOH residues serves better than pure water

In any case a water supply with high concentration of Ca or Mg compounds must be avoided for the hazard of an unwanted plugging of nozzles or packed bed rings

Reservoir holding the neutralizing solution:

- clear walls, front and rear
- internal baffles to segregate the free volume above the water between a negative pressure zone (entry bells and turret) and an atmospheric zone (exit)
- overflow port with airlock made of internal baffles
- chamber of the overflow port ducted to the fan intake, to vent the hydrogen released from the water
- 20 - d. 32 drain hand valve (ball)
- 21 - chemical add port for the optional pH correction by an alkaline additive, with submerged pipe as airlock
- 22 - 2-float level control device:
 - LSA, as alarm indication
 - LLSA, as safety stoppage

2.4 - Dilution of hydrogen

The exhausted hydrogen is mixed with ambient air so that the concentration to oxygen is kept well below a safe level

- 23 Centrifugal fan:
 - 1.600 cm³/h flow rate, 800 Pa pressure
 - 1.1 kw-2 pole motor (Atex)
 - PP casing and wheel, with antivibration spring pads, intake grid and flexible sleeve
- 24 Low active power relay (control panel) as safety feature for the dilution system
- 25 Converging Y junction for mixing the scrubber exhaust with the air
- 26 d. 200 weather cap, 1 m long, for the stack (supplied loose)

3 - Instrumentation and controls

3.1 - Operator panel and devices

Two-position selector switch S1, Scrubber On-Off, to start and stop the scrubber:

- the dilution fan, first
- the VSD operation and the automatic drive of the venturi pump, after a 2 sec time elapse

Green pilot light H1, Fan, lit with the energized contactor

Red pilot light H2, Empty Tank, lit on LLSA float switch operation

Red pilot light H3, Water Level, lit on LSA float switch operation

Blue pilot light H4, Water Make-up, lit with the energized solenoid valve

Green pilot light H5, Scrubber OK, lit with the relay Output of the VSD being energized

P1 push button, Bells Cleaning, when hit and released it starts the down/up cycle of the ring scrapers

Scrubber OK pilot light lit Fan pilot light lit	Normal conditions of operation
Water Level pilot light lit	Loss of make up water detected by the LSA float switch For alarm only, the scrubber operation goes on A warning contact opens for a remote acquisition
Empty Tank pilot light lit Scrubber OK pilot light unlit	Persistent loss of make up water detected by the LLSA float switch Hazard of air suction from the water drain even if the elevation of the low level float is still far from a real danger The VSD is locked out and the pump stops The stoppage of the pump makes the level to increase for the water flowing back from the pipe system and the wetted rings, but the float contact is latched and the pilot light stays lit The dilution fan keeps running
Scrubber OK pilot light unlit Fan pilot light unlit	Loss of dilution airflow for electric fault with the fan motor or for occlusion resulting into a too low flow rate The VSD is locked out and the pump stops

The W01 low active power relay, with the fan starter, detects a loss of dilution airflow as low power demand for low flow rate:

- LEDs:
 - green: lit when powered
 - red: lit on detection of low active power
- dip switches:
 - range in Amps: switch 5 set to 1, switch 2.5 and switch 10 set to 0
 - W: set to m for detection of low active power
 - T: set to 1 for a delayed operation of the contact

- trimmers:
 - W: threshold of low active power, setting at 20 % of load
 - T: delay of the contact, setting at 30 % for about 10 seconds

KFD2-SR2-Ex2.W intrinsic safety barrier, 2-Input digital, for the level control device:

- green LED: lit when powered
- yellow LEDs of channels 1 and 2: lit in normal conditions when the water level is above the floats
- dip switches, S1 to S3: set to Off (left)

Type KFD2-STC4-Ex1 intrinsic safety barrier, analogue, for the pressure transducer, power green LED

3.2 - VSD and regulation of negative pressure

3.2.1 - Input/Output

IMC expansion card	
Analog Input AI51	4-20 mA from the vacuum transducer as reference value for the PID control of the venturi pump motor
Digital Input LI51	S1 selector switch, when 1 the operation is enabled
Digital Input LI52	Fan starter, when 0 the operation is stopped
Digital Input LI53	P1 push button, when passing from 1 to 0 the cleaning feature of the bell heads is started
Digital Input LI54	Remote contact, when 1 the cleaning feature of the bell heads is stopped
Digital Input LI56	Relay K2 reflecting the Low-Low level switch, when 1 the operation is stopped
Digital Input LI57	Low level switch
Digital Input LI58	Remote contact, when 1 the cleaning feature of the bell heads is started
Digital Output LO51	Relay K3 and solenoid valve YV3 of bells 1A-2A ring scrapers
Digital Output LO52	Relay K4 and solenoid valve YV4 of of bells 1B-2B ring scrapers
Digital Output LO53	Relay K5 and solenoid valve YV2 of the nitrogen purge
Digital Output LO54	H6 red light light, water level
Digital Output LO56	Relay K6 and solenoid valve YV1 of the water make-up

ATV61	
Relay Output 1	R1A-R1C, Scrubber Trouble, closed contact as normal operation, open contact as operator stoppage or fault
Relay Output 2	R2A-R2C, Warning, closed contact as normal operation, open contact as alarm

3.2.2 - Regulation of negative pressure

At power up LO53 (solenoid valve of the nitrogen purge) is set to stop the nitrogen purge

The gas extraction at controlled negative pressure is a PID regulation using the transducer as Feedback and a parameter as Set point

It is started by LI51 at 1 (S1 selector switch):

- set of Water Level timer to disable a warning from Low level switch spurious operation
- set of a timer to let the fan contactor energize

- acquisition of LI52 and LI56 at 1, as dilution fan running and adequate level of water
- set of RO1, for the closed contact to unlock the reactor
- PID regulation enabled
- the venturi pump starts and it accelerates to a speed depending on the set-point of negative pressure and the gas flow rate
- bells cleaning enabled

The result of the PID regulation, that is the motor drive frequency of the the pump, is compared against both:

- the Low Speed parameter so that the liquid flow rate at the venturi unit remains enough for the separation between the hydrogen filled turret zone and the atmospheric exit zone
- the High Speed parameter as the allowable negative pressure, at the venturi unit, for the reactor chamber

Low Speed and High Speed parameters are with 1.3 Settings Menu and are expressed in Hertz

Stoppage of the PID regulation:

- LI51 at 0 (S1 selector switch), by the operator
- or LI52 at 0, (fan contactor) on fan motor fault or clogged fan intake
- or LI56 at 0, on water level too low
- or electrical faults as Over Current, Phase Failure, Motor Stalled and Link Undervoltage
- stoppage of the pump
- reset of LO53, triggering the nitrogen purge for 60 seconds by the dennergized solenoid valve
- reset of RO1, for the open contact of K5 relay to lock the epitaxy process out

Auto-restart:

- a Link Undervoltage event, that is a low voltage at the DC section, may be a fault with the capacitors or a loss of power supply
- a try is given to internally reset the Link Undervoltage stoppage for the operation to be restarted if the loss of power supply is just temporary
- such a try is delayed for the VSD having to start up
- if the fault is with the capacitors then the auto-restart fails and the VSD remains locked out on fault

3.2.3 - Cleaning system of the inlet bells

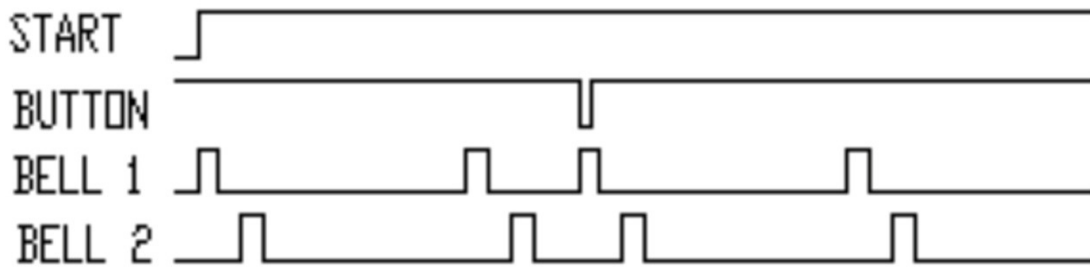
Four modes:

- Stand Alone
- Reactor Output to start
- Reactor Output to stop
- Push Button Test

In the Stand Alone mode the cleaning strokes may take place, randomly, during the growth step of the epitaxy process:

- with one ring scraper being activated after the other, the exhaust gas passage area retains the full size in a bell
- in the other bell there is a little impairment for the gas passage area as the gas flows through the gaps between the spokes of the scraper ring

STAND ALONE

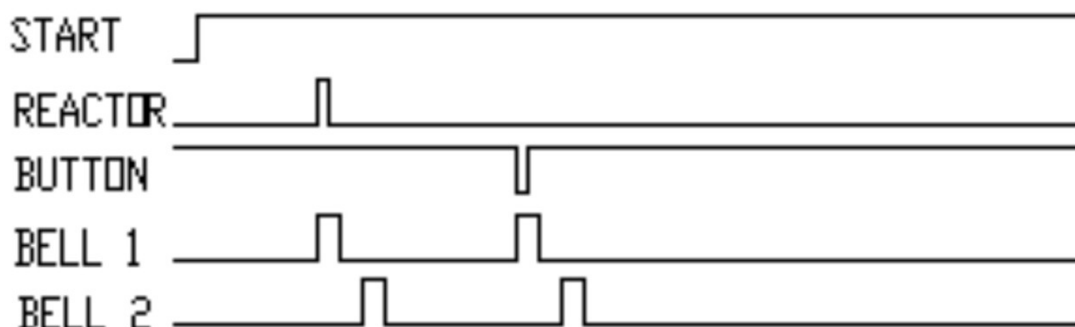


Stand Alone mode, sequence of the ring scrapers:

- value of 1 for Loc-Rem parameter, at the Application Menu
- S1 selector switch to On, LI51 at 1 for clearance
- set of Pause timer
- set of Repeat timer
- set of Stroke timer, set of LO51 (solenoid valve of bell 1A-2A ring scrapers), rings begin downward motion
- elapse of Stroke timer, reset of LO51 (solenoid valve of bell 1A-2A ring scrapers), rings begin upward motion
- elapse of Pause timer
- set of Stroke timer, set of LO52 (solenoid valve of bell 1B-2B ring scrapers), rings begin downward motion
- elapse of Stroke timer, reset of LO52 (solenoid valve of bell 1B-2B ring scrapers), rings begin upward motion
- elapse of Repeat timer
- back to set of Stroke timer for the next cyclical operation

With the Reactor Output to start mode, the remote contact represents a step of the epitaxy process which best suits a cleaning

REACTOR TRIGGER



Also, Reactor Output to start mode, it is a single cleaning cycle and the next one will take place on remote contact operation

Reactor Output to start mode, sequence of the ring scrapers:

- values of 1 for Loc-Rem parameter and of 0 for Start-Lock parameter, at the Application Menu
- S1 selector switch to On, LI51 at 1 for clearance
- LI58 at 1, it has to remain at 1 for half a second
- set of a 30 second timer for LI58 back to 1, not to interfere with Stroke and Pause timers
- set of Pause timer
- set of Stroke timer, set of LO51 (solenoid valve of bell 1A-2A ring scrapers), rings begin downward motion
- elapse of Stroke timer, reset of LO51 (solenoid valve of bell 1A-2A ring scrapers), rings begin upward motion
- elapse of Pause timer
- set of Stroke timer, set of LO52 (solenoid valve of bell 1B-2B ring scrapers), rings begin downward motion
- elapse of Stroke timer, reset of LO52 (solenoid valve of bell 1B-2B ring scrapers), rings begin upward motion
- back to LI58 at 1 for the next cyclical operation
- if Pause timer is set to 0 then the result is a single stroke of both the ring scrapers at the same time

The Reactor Output to stop mode applies when it is wished that nothing may interfere with the process chamber exhaust during the growth step

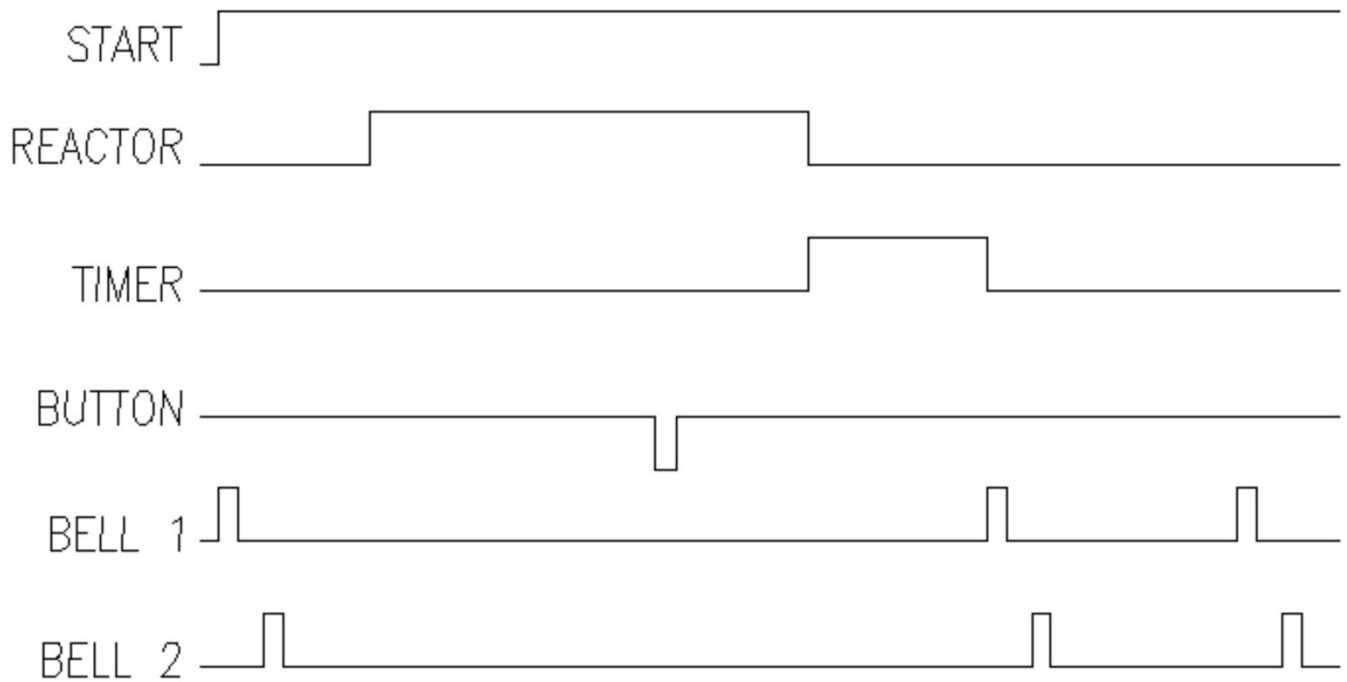
The remote contact to stop is the one representing HSiCl₃ flow, the same which starts the water make-up

The inhibit persists beyond the stoppage of HSiCl₃ flow for the time elapse of Growth timer, that reflects the volume of HSiCl₃ still inside the pipe system

The sequence of the ring scrapers, Reactor Output to stop mode, is same as the above Stand Alone mode:

- values of 1 for Loc-Rem parameter and of 1 for Start-Lock parameter, at the Application Menu
- when LI54 is at 1 and until Growth timer is counting, reset of both LO51 and LO52

REACTOR LOCK-OUT



Push Button Test mode:

- a single actuation for the strokes to be checked
- enabled with Stand Alone mode
- enabled with Reactor Output to start mode, precautions to be taken
- disabled with Reactor Output to stop mode
- when LI53 at 0, P1 push button hit, the sequence begins with set of timers and LO51 as the above Stand Alone mode

3.2.4 - Water make-up

The water make-up stays open for a while after the remote signal of HSiCl₃ or HCl gases flowing has reset

That time elapse is with Make-up timer and it reflects residual HSiCl₃ or HCl, still inside the pipe system and to be dumped when reaching the scrubber

3.2.5 - Operator terminal

Rotary switch:

- to move through a menu with backlit lines
- to increase or decrease the value of the selected parameter

Central push button of rotary switch as Enter to select a line or parameter, also to confirm a modified value

F2 and F3 keys to move cursor through the digits of a parameter

When the S1 selector switch is turned to On the display shows:

- upper line: the drive frequency and the set point
- the negative pressure

3.2.6 - Application menu

1.14-ATV-IMC menu, under 1-Drive Menu

Vacuum	mBar	Of the negative pressure out of the transducer	Actual value
Frequency	Hz	Of the drive frequency of the venturi pump motor	Actual value
Current	A	Of the venturi pump motor	Actual value
Set Point	mBar	Of the negative pressure Value ranging from 0.0 to 50.0 mBar The changed set value is instantly retained and the pump rotation rate does change as well E key confirms to memory	Parameter
PID-TN	Numeric	Integration gain	Parameter
PID-TV	Numeric	Derivative gain	Parameter
PID-KD	Numeric	Proportional gain	Parameter
Repeat Time	Minute	Dead time between an actuation cycle of bell 1A-2A and bell 1B-2B ring scrapers	Parameter
Stroke Time	Second	Time elapse for the stroke of the ring scrapers	Parameter
Pause	Second	Between the actuations of bell 1A-2A and bell 1B-2B ring scrapers At least twice the seconds of Stroke timer to allow for the ring scraper to come back to rest position	Parameter
Loc-Rem	Numeric	0 value for Stand Alone mode 1 value for Reactor Output to start or Reactor Output to stop modes	Parameter
Start-Lock	Numeric	0 value for Reactor Output to start mode 1 value for Reactor Output to stop mode	Parameter
Trans Span	mBar	Sensing of the transducer as conditioned to 4-20 mA output	Parameter
Growth	Second	To continue with the cleaning strokes being held after TCS flow is finished off	Parameter
Make-up	Second	To continue with the dumping of scrubbing solution after TCS or HCl flow is finished off	Parameter
Water Level	Minute	To inhibit the Low Level alarm at start	Parameter
Water Osc	Second	To inhibit the Low Level alarm for level fluctuations from the venturi jet hitting the water surface	Parameter

With the PID regulation loop parameters, the proportional and integrative gains only matter

The derivative gain is not very effective as the response of the pump-venturi combination is very fast

To set the maximum achievable proportional gain:

- set the integrative gain to zero

- increase the proportional gain and observe the system response
- repeat until the system response becomes oscillatory
- reduce the proportional gain until the oscillations of negative pressure disappear

The integrative gain need to be tuned if the feedback never reaches the setpoint:

- increase the integrative gain and observe the system response
- if the system response becomes oscillatory than reduce the proportional gain slightly

The gains have been set at the factory test, that is in simulation, as:

- proportional gain: 9.0
- integrative gain: 0.7

3.3 - Anomalies

Stoppages on anomaly are as follows:

- loss of dilution airflow for overcurrent/overload trip:
 - LI52 at 0
 - Fan alarm
- persistent loss of make up water detected by the LLSA float switch:
 - DI56 at 0
 - Empty Tank alarm
- disconnected loop or analogue signal of the vacuum transducer fallen below 3.84 mA:
 - AI51
 - Under 4 mA alarm
- electric faults, displayed as Over Current, Phase Failure and Motor Stalled

On any of the above faults the VSD is locked out:

- the venturi pump stops
- DO53 is reset, triggering the nitrogen purge into the exit port
- RO1 is reset, for the open contact to lock the epitaxy process out and a change-over to nitrogen flow
- the green H5 pilot light (Scrubber OK) is off

To restart a locked out VSD, after the fault has been eliminated, the S1 selector switch must be first set to Off then back to On

The S1 selector switch resets also:

- the Empty Tank pilot light in case of a low level event, when the water level is restored
- the low active power relay in case of clogged fan intake, when the occlusion is eliminated

The loss of make up water, detected by the LSA float switch, does not stop the operation of the scrubber:

- LI57 at 0
- red pilot light lit by DO54
- RO2 is reset for the remote acquisition of an open contact
- back to normal, red pilot light unlit and RO2 contact closed, when the water level is restored

4 - Installation

Drawings:

- G5054.02.02 - Installation
- G5054.04.01 - Pneumatic diagram
- SE-943 - Electric diagram

Requirements for the site:

- being its main tank body self-supporting, this scrubber does not require foundations, it can be installed directly on a well-levelled concrete floor
- the floor is to be resistant to possible leakages of acid water
- the scrubber can be installed either indoor or outdoor
- drawing G5054.07.01 shows the Zone 2 extension around the scrubber as per the Atex regulations
- with outdoor installation:
 - the scrubber is to be protected by an overhead lightning rod or earthwire
 - it is advisable that the scrubber is shrouded by a suitable fence
- with indoor installation:
 - the area around the scrubber must be ventilated with not less than 11.25 exchanges per hour
 - the dilution requirement, which is placed as 1.600 cm/h, adds up to the above ventilation requirement

Mechanical assembly:

- for the placement of the base unit (say 240 kg) a forklift may be used, provided that the forks are spaced enough for the bottom lifting slots, these slots are suitable also for belts but special care must be paid to pipes and fittings
- the tags on the parts separated for dispatch are to be matched with drawings when re-assembling the scrubber and the inlet bells
- do not tighten too much the nuts of the tower base flange
- check and tighten the parts may be loosened by transport vibrations (bolted flanges, 3-piece unions):
 - turret windows
 - pump, fan
 - level control device
- the guideline for tightening is that a plastic part does not deform
- spanners to be avoided with 3-piece unions
- attention is to be exercised for presence and correct placement of the various o-rings of the machine, especially the ones that are to seal the hydrogen stream
- silicon grease is to be applied again with the large o-rings (head and socket of entry chamber, tower base)

Reactor exhaust (A):

- stub (o-ring) and loose flange
- the pipe system out of the reactor is terminated with a flat flange, size 2"

Water supply:

- (B): 1 " male
- stopcock and 100 micron filter are recommended for the pipe system

Drain:

- (C) PVC socket for d. 40 pipe
- the waste water is to be disposed to a treatment system for silica flakes and purge of an acid solution

Scrubber exhaust:

- (D) with a PVC socket for a d. 200 duct
- d. 200 mm pipe system to be routed above the roof and to be terminated with the weather cup supplied loose
- any extension duct is to be fastened in such a way that the air/hydrogen mixer does not have to bear the load of that extension duct
- the extension duct must feature a resistance not exceeding 400 Pa at 1.600 cm/h air flow, that is approximately a route of 20 meters with 3 bends

Nitrogen:

- supply at control panel (port IN), d. 6 tubing
- d. 6 clear tubing to Y fitting and d. 6 distribution to lower ports of bell 1A/2A pneumatic cylinders, from control panel (port 1-)
- d. 6 blue tubing to Y fitting and d. 6 distribution to upper ports of bell 1A/2A pneumatic cylinders, from control panel (port 1+)
- d. 6 clear tubing to Y fitting and d. 6 distribution to lower ports of bell 1B/2B pneumatic cylinders, from control panel (port 2-)
- d. 6 blue tubing to Y fitting and d. 6 distribution to upper ports of bell 1B/2B pneumatic cylinders, from control panel (port 2+)
- d. 6 clear tubing to double Y fitting and d. 4 distribution to the nitrogen curtains of the bell heads, from control panel (port 3)
- d. 6 clear tubing to the exhaust port (E) of the scrubber, from control panel (port 4)
- d. 6 clear tubing to the water make up valve, from control panel (port 5)

2-way distributors of the entry bells are to be connected to the vacuum indicators by d. 6 clear tubings, with the care of having a loop of the tubing upward oriented in order to make an airlock for the acid moisture

Vent of the overflow chamber: d. 6 clear tubing to be connected to the fitting at the blower fan intake

Plugged ports are available for the automatic dosing of an additive:

- (H): additive out of a remote dosing pump, 1/4" F
- (I): return of the pump circulated solution from a remote in-line pH probe, 1/2" F
- (L): tap-off at the pump for a remote in-line pH probe, 1/2" F

Electric system:

- the control panel is to be located outside the classified area around the scrubber
- with outdoor installation of the control panel a protective canopy is advisable
- separate metal trunkings are to be used for laying the power and control cables
- main feeder: on the grounds of the capacitors fitted to the VSD line filter an Earth Leakage relay is to be avoided
- pump: cable to be shielded, with the shield grounded at the control panel side
- the vacuum loop cable must be a shielded twisted pair, with the shield grounded at the control panel side

5 - Start up and settings

Make sure that:

- the windows are closed
- the exhaust duct is free
- the drain valve is closed
- the overflow is connected

Adjust the nitrogen supply pressure to 5-8 Bar

Inspect the nitrogen fittings for leakage

Fill the tank with the make up hand valve and the flow meter needle valve fully opened until the water overflows

Adjust the flow meter needle valve to 400 l/h on the indicator

Inspect the tank and the pump pipe system for water leakages

Energize the control panel

Turn the Scrubber switch to On

The dilution fan starts

After a second the venturi pump starts and it will be running at a speed depending on the set-point of negative pressure and the gas flow rate

Check for the correct rotation of the pump and fan motors

Inspect the pipe system for water leakage

Check for the fan motor current not to exceed the rated value, if it is too high then some additional resistance has to be added to the ductwork

The setting of the fan low power relay may possibly need to be recalibrated with the actual load of the system resistance; the W trimmer is to be set at 100 % and, with the motor at full load, is to be dialled back until the Led begins to blink, then dialled forward a little bit

If a remote signal is available for the automatic valve make up water:

- adjust the make up hand valve to 100 l/h with the flow meter indication
- by a jumper across terminals 26 and 44 open the make up pneumatic valve and trim the water flow rate to 400 l/h with the needle valve of the flow meter

Run a check of the Water Level light by draining the water until the low level float operates

Run a check of the Scrubber Trouble contact as well as of the emergency nitrogen release:

- stopping the dilution fan by the circuit breaker
- stopping the VSD and the venturi pump by the Scrubber selector switch
- draining the water until the low-low level float operates

Restore the water level and the operation of the scrubber

At this point a Leak Test is advisable to clear the hydrogen to flow

With the reactor at the maximum flow of Hydrogen adjust the membrane hand valves in order to get a good laminar flow from the bells waterfall, it must be consistent but not turbulent as some areas of the inner tubes may remain uncovered

Open the ball hand valve in order to obtain a fully horizontal spread from the cone nozzles at the bottom of the entry bells

Check the flow meter with the turret path to show a flow rate of 2.500 l/h

6 - Running the scrubber

6.1 - Start and stop

The scrubber duty is continuous as required by the epitaxy application

The start up steps apply also to the restart after the programmed maintenance, possibly with an abbreviated procedure with the rotation of motors

In case of stoppage:

- with temperature below zero the base reservoir is to be drained so that the freezing of scrubbing solution may be avoided
- with high temperature the turret windows have to be opened as precaution against greenhouse effect

6.2 - Emergency stop

Turn to Off the Scrubber selector switch, on turn the main feeder breaker to Off

Shutting off the water supply may be considered

6.3 - Routine operations

The inlet bells are to be inspected at regular intervals and the hand valves to be adjusted so that the spray at the bottom remains a full cone and the waterfall remains consistent however not turbulent

Whenever practical a Leak Test is to be run:

- set the reactor in Nitrogen flow (100 slpm) with HCl addition (20 slpm) and allow the HCl to reach the scrubber and fill it

- with a small sniffer filled with Ammonia, check all flanges, junctions and fittings (entry flange, base of the entry bells, tower hatches)

Inspection is called for in order to detect early signs of plugging or efficiency decay:

- the display of motor Amps and Hz
- the flow meter of the venturi pump
- the flow meter of the turret
- the inside of inlet bells through the clear walls
- the vacuum indicators

An increase of the drive frequency is a sign of the venturi unit or of the packed bed being plugged

A decrease of the drive frequency is a sign of the entry bells being choked:

- a growth of silica at the bottom is visible through the clear tubes of the bells
- the Cleaning button is to be hit at once to remove the, non visible, growth of silica inside the bell heads

The Cleaning button serves also to check for the full extent of the cleaning stroke, with the tip of the ring scraper being visible

The air velocity at the intake grill of the fan is to be measured in order to monitor the efficiency of the dilution system, a decreased air velocity is a sign of deposits and occlusions (intake grill, fan wheel, ductwork)

Also monitor flow meter of the turret for the liquid flow to be about 3.000 l/h

A decreased flow rate is a sign of the spray nozzles or the filter being plugged

The main corrective action is to increase the make up water flow rate in order to keep the concentration below the threshold which is safe to avoid an unwanted plugging of nozzles or packed bed rings

Again for the decay of the liquid flow the chemical port serves well to pour an additive, generally an alkaline one, for dissolving any deposit. It can be done without having to stop the scrubber, as the chemical port is made atmospheric by airlock

Keep free the overflow brim using the hand valve of the maintenance spray to break any floating silica flake may obstruct the passage

Inspect the tank for floating silica and open the hand valve of the spray system to break any growth of silica

7 - Cleaning and maintenance

Being the safety rules covered by next chapter

Inlet bells:

- clear tubes:
 - do not use brushes to remove the buildup from the bell surface
 - dip the tubes in a 50 % aqueous solution of caustic to quickly dissolve the crystals
 - caution: flammable hydrogen develops from the cleansing solution, it is to be done in open air or under suitable ventilation
 - thoroughly rinse the tubes afterwards with water afterwards
 - the outer bell tubes are to be carefully inspected for any sign of slit, even barely visible, for hazard of further deterioration possibly leading to explosion
 - slits may originate from improper handling or long term exposure to direct sunshine without water flow
 - a tube should be discarded if there are signs of fissures
 - gloves to be used when handling the tubes, both for chemical hazard and for avoiding skin grease to impair the full wetting as silica is likely to grow on greased traces
- by clamping in a vice the square key, as per drawing G5054.06.01, the bell head breaks into:
 - Y body
 - cylinder holder, pneumatic cylinder and ring scraper
- Y body of bell head:
 - nitrogen fitting to be unscrewed first
 - to be dipped in a caustic solution as per the clear tubes
- cone nozzles: unscrew and brush to remove solid residues
- care should be paid in lubricating slightly the o-rings with silicon gel grease before re-assembly
- do not hesitate to replace the o-rings if loose in their slots, they should be tight and any swelling will make the re-assembly difficult and the next servicing almost impossible

Packed rings:

- the packed rings are unloaded and reloaded through the mid and lower hatches
- the cleaning of the packed rings is done with dipping in a caustic solution as with the bells
- the rings are to be reloaded up to the brim of mid and lower hatches
- a major attention must be paid to the correct placement of the o-rings and to the tightening of the windows bolts
- the o-rings should be slightly coated with silicon gel grease, this protects them from aggressive media and allows for visual inspection of correct bolts tightening

Spray nozzles of the turret:

- access through the mid and lower hatches
- the spray nozzles can be unscrewed with a spanner
- the cleanup of the spray nozzles is the removal, by sharp instrument and brush, of solid residues out of the exit orifice and the inner distributor
- a major attention must be paid to the correct placement of the o-rings and to the tightening of the windows bolts
- the o-rings should be slightly coated with silicon gel grease, this protects them from aggressive media and allows for visual inspection of correct bolts tightening

Fan system:

- intake grill and rain head to be checked for being free
- fan wheel to be inspected for deposits, eventually to be wiped clean

Filter at the water pump: cage to be inspected and cleaned by a compressed air jet

Transducer port: as per drawing G5054.06.01 it can be brushed clean after the cup has been unscrewed

Some of the water, or the whole, is to be drained by the hand valve in case of decay of the liquid flow, or an increased drive frequency, for the replacement of fresh water to keep the concentration below the threshold which is safe to avoid an unwanted plugging of nozzles or packed bed rings

Venturi ejector:

- to be disassembled and the inside nozzle to be cleaned, in case of decay of the circulation flow rate, for possible deposits of limestone
- with deposits of limestone it is simpler to add an acid additive using the chemical port, to keep the scrubber running for circulation, then to drain the water

All the seals must be routinely checked and tightened, or eventually replaced, with silicon grease to be applied as lubricant/sealant:

- hydrogen containment:
 - inlet bells
 - base and windows of the turret
 - venturi ejector
 - exit port and air/hydrogen mixer
 - transducer
- above water level, where hydrogen may diffuse on anomaly:
 - turret pipe system and flow meter
 - make up water system
 - inlet bell hand valves
 - venturi flow meter
- water side:
 - drain hand valve
 - filter
 - pump

Tightening:

- bolts of the pump
- anti-vibration spring pads and casing bolts of the fan
- screws of motor cable boxes
- terminals of the electric system

Nitrogen system: fittings to be inspected for leakage

A maintenance plan depends on the epitaxy process and various criteria have been formulated (time elapse, processed wafers, cumulated microns)

A likely maintenance plan is as follows

Fortnight	Inspection and tightening of all 3-piece unions, flanges and hatches
Fortnight	Leak test
Month	Cleanup of the bells and cone nozzles
Six months	Cleanup of the filter
Six months	Complete drain of the base tank
Six months	Cleanup of the packed rings and the spray nozzles of the turret
Six months	Inspection of fan intake and stack for being free

8 - Safety instructions

Special rules are imposed by the hazard of explosion for flammable hydrogen:

- the opening of the Scrubber Trouble contact must trigger a stoppage of the hydrogen flow as well as a change over to nitrogen flow for the reactor
- routinely leak tests with hydrochloric and ammonia or similar methods
- all the seals must be routinely checked
- special care is to be paid to o-rings at every disassembling/inspection, with a possible replacement, and silicon grease must be applied as lubricant/sealant
- the scrubber room (indoor installation) must be ventilated with not less than 11.25 exchanges per hour

It is advisable that the scrubber is shrouded by a suitable fence

Maintenance activities are to be carried out by skilled personnel using tools meeting Appendix A of UNI EN 1127-1 stipulation or making sure that there is no hazard of explosion

The unit has no exposed moving parts

The radiated noise is less than 75 dBA

Residual areas of hazard are as follows:

- 380 V voltage, inside the control panel and the motor cable boxes
- turning wheel inside the fan, accessible if the intake grating is tempered with
- possible leakages of acid water
- toxic and irritant materials resulting from maintenance (droplets, residues, cleaning additives)

The machine must be serviced in a stopped condition:

- under a nitrogen purge from the reactor
- with power and water supplies shut off
- having drained the base tank

Heavy loads are to be properly fastened when handling

Protective clothing applies to maintenance, however without excluding operation: gloves, masks, hard hats, ear protectors

The disposal of waste water is Customer responsibility in line to applicable law

The same applies to machine scrapping

Maintenance personnel is bound to give a warning on any failure or wearing that may jeopardize the original safety system

Temporary repairs must be avoided, repairs must be done with original spares only

As automatic devices are concerned the operator is to be fully aware of how the individual devices are operated by the control system

It is expressly forbidden to run the machine in any way other than stated in this manual, moreover CIRECO is not liable for bodily injuries originated by the improper use or modification of safety devices

9 - Packing, lifting, transport

For the handling of the machine or parts thereof one has to secure the service of skilled operators with devices suiting the transport weight

The ropes must carry the machine load with a suitable safety factor, the angle should not exceed 90°

On handling one has to check a correct weight distribution and to avoid sudden moves or excessive speeds likely to endanger, attention must be paid to fastened parts like pipes and cables

The transport of the machine, particularly the trucking, requires means and ways in position to protect the equipment, particularly the electronics, against shocks, moisture and vibrations

It must be appreciated that the package materials must be carefully disposed

10 - Dismantling

Should the machine not being run over a substantial period certain rules must be observed:

- disconnect the main feeder line
- drain the tank, refill it and let the pump run for say 2 minutes, then drain completely the unit
- let the drain valve opened and the inlet valve closed
- unscrew and clean the spray nozzles
- disassemble and clean the inlet bells and place the parts in a safe place, cover the openings with a polyethylene sheet however not airtight since the direct sunshine may deform the base tank
- unload and clean the packing rings from the tower
- make sure that no unauthorized personnel may have access to the machine

Should the machine be put out of service and scrapped, the rules stipulated by the local legislation apply

The manufacturer is not liable for the scrapping of the machine and the disposal of its parts or associated consumables and particularly for a reuse other than the one covered by this manual

11 - Spare parts

Main unit, as per drawing G5054.05.01			
Item	P/N	Q.ty	Description
1	SC-AEFS2PP	1	Filling of packing bed 2" rings
2	UDW2294M	3	1/2" solid cone spray nozzle
3	OBTDE280	1	Clear PVC hatch for tower unit (upper)
4	OBTDE430	2	Clear PVC hatch for tower unit (mid/lower)
5	RBST63	1	PVC strainer with SST cartridge
6	DFM350.5030	1	Turret flow meter, 3.000 l/h
7	ST-30832E	1	Membrane hand valve for entry bells waterfalls
8	R-2R12	1	Make-up water flow meter, 800 l/h
9	ST-31020E	1	Membrane valve with pneumatic actuator for water make up
10	S1-S41-310-375	1	2-float level switch
11	TMR3015GXVN2BEG4	1	Centrifugal pump with Eex electric motor
11	TM3015-4-331	1	Axial thrust bushings, SiC
11	TM3015-5-233	1	Impellor, E-CTFE
11	TM3015-7-545	1	Guide bushing, Graphite
11	TM3015-8-412	1	Casing o-ring, FPM
11	TM3015-9-162	1	Rear shell, E-CTFE
11	TM3015-25-210	1	Shaft, SiC
12	VSB202LEx	1	Fan with Eex motor
12	VTB20ML19KL	1	Wheel, nose and seals for fan
13	47740511/G	1	PVC venturi ejector d. 63
14	PMC711AA1C1RD	1	Vacuum transducer
15	MD200MM	2	Vacuum indicator
16	CDK75	1	Check valve
17	BVD40	1	Hand valve for cone nozzles
18	BVD32	1	Hand valve for drain
19	BVD20	2	Hand valve for water make up and maintenance nozzle

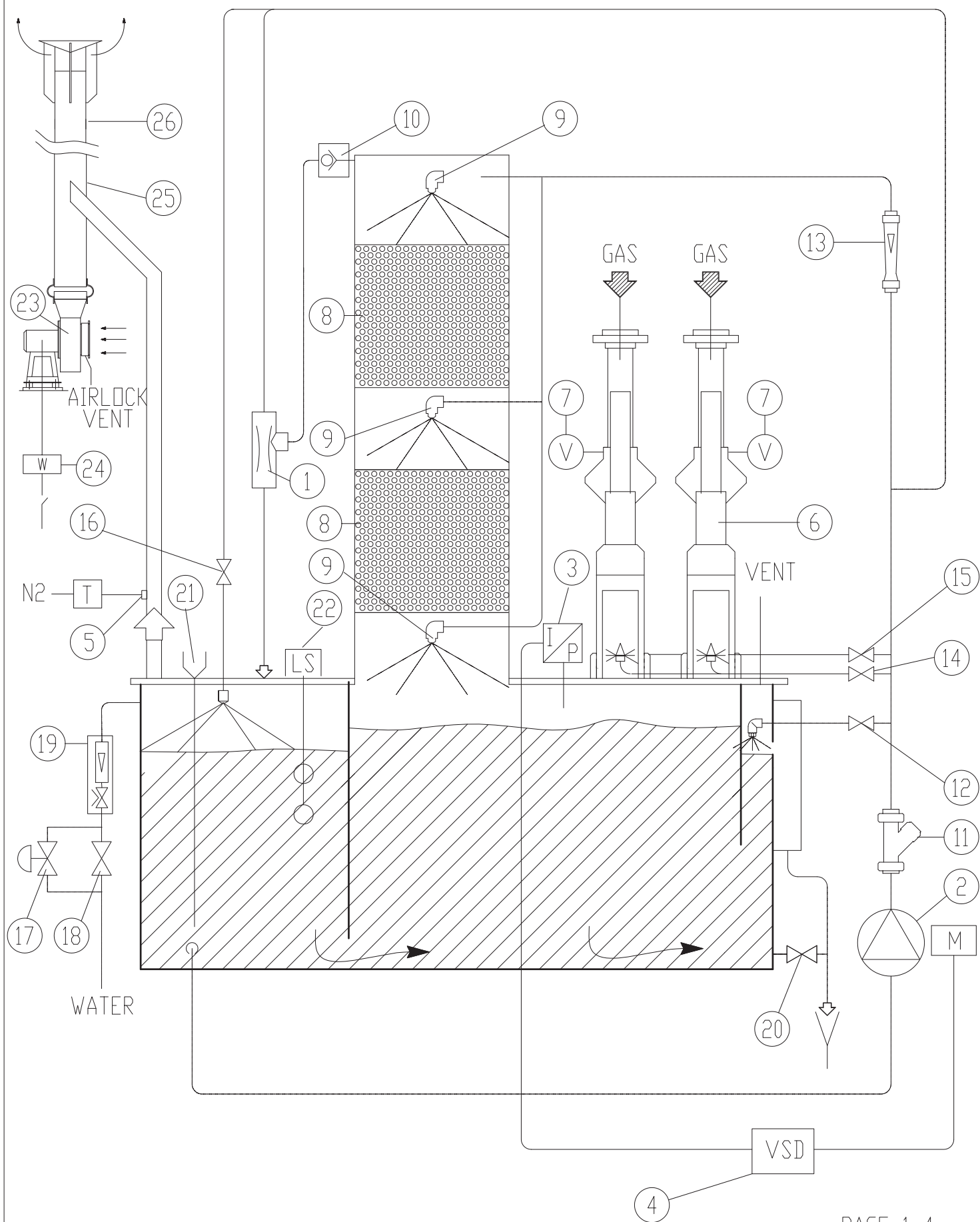
Hydrogen related seals, as per drawing G5054.05.01			
Item	P/N	Q.ty	Description
1H	VI435D/7	1	O-ring for tower base flange
2H	EP81450	2	O-ring for mid/lower tower hatch
3H	EP8857	1	O-ring for upper tower hatch
4H	EPQGV75	2	O-ring for check valve
5H	EPBIV63	6	O-ring for venturi ejector, exit port of scrubber, air/hydrogen mixer
6H	EPBIV50	3	O-ring per tower header, tower nozzles flow meter
7H	EPBVD40	1	Kit for bell nozzles hand valve
8H	EPBIV32	2	O-ring for bell waterfall membrane valve
10H	EPBIV25	2	O-ring for vacuum transducer port
11H	EPBIV20	4	O-ring for make up water flow meter, make up water pneumatic valve
12H	EPBVD20	1	Kit for make up water hand valve
13H	EFS4124	1	Flat seal for level float switch

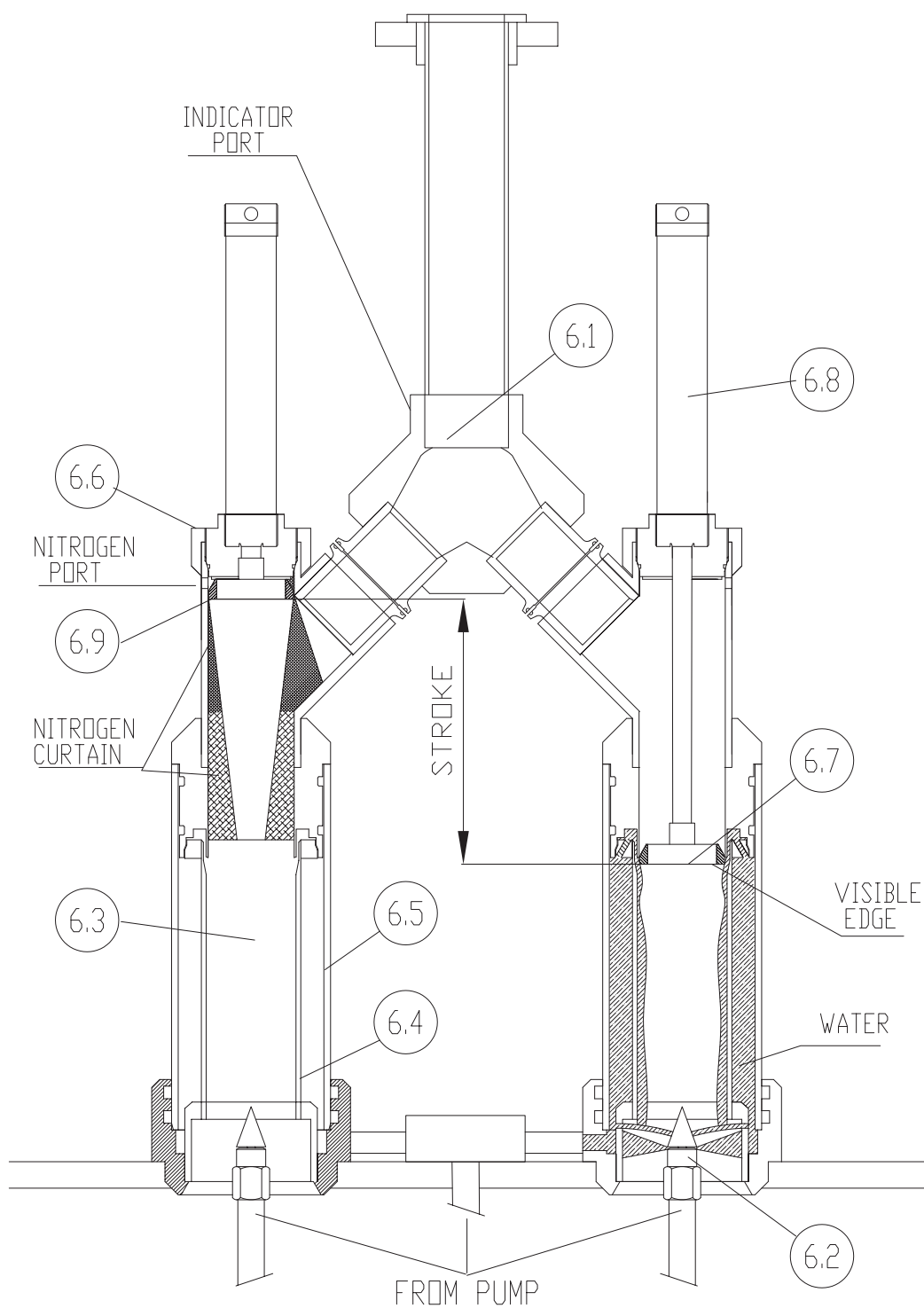
Bell style entry chambers, as per drawing G5054.05.01			
Item	P/N	Q.ty	Description
25.1	EPQGV63	2	O-ring for 2-way distributor flange
20	M1022-1	2	2-way distributor with flange and clamp ends
21	M1025-2SA	4	Bell head with clamp end, nitrogen distributor, ring scraper and 50/200 pneumatic cylinder
21.1	M1025-2-A	4	Bell chamber head
25.2	EP6837	8	O-ring for bell chamber head
21.2	M1025-2-D	4	Ring scraper
21.3	M1025-2-B	4	Cylinder mount
25.3	EP3243	4	O-ring for pneumatic cylinder mount
21.4	PN12131200	4	50/200 pneumatic cylinder
25.4	EP420635	4	Clamp seal
22	M1022-3	4	Bell outer tube, d. 120, clear PMMA
23	M1024-4	4	Bell inner tube, d. 75, clear PVC, with water distributors
24	47460700/G6	4	Downward oriented cone nozzle with holder
25.5	EP8475	8	O-ring for bell socket
25	M1024EB	2	Kit of seals for a group of two bell chambers: - distributor flange o-ring, quantity: 1 - clamp seals, quantity: 2 - pneumatic cylinder o-rings, quantity: 2 - chamber head o-rings, quantity: 4 - socket o-rings, quantity: 4

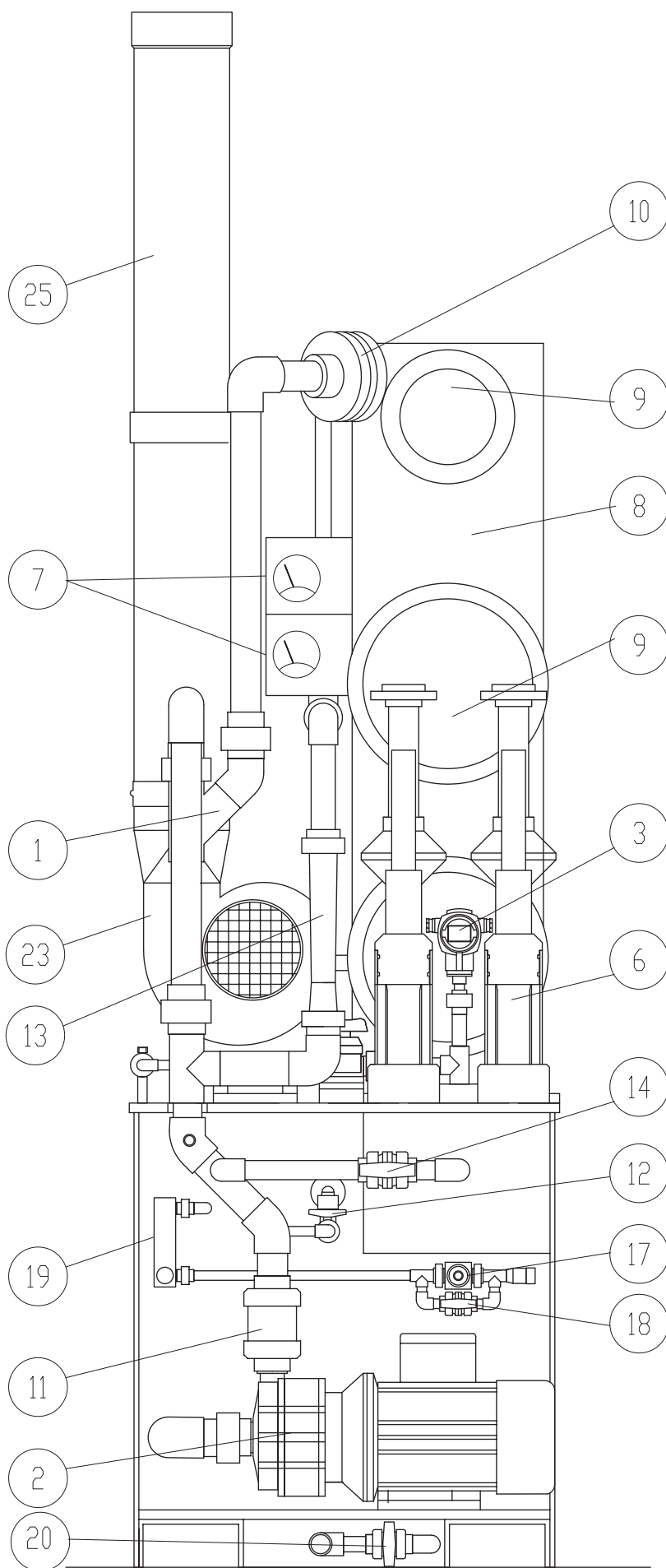
Pneumatics, as per drawing G5054.04.01			
Item	P/N	Q.ty	Description
YV1, YV2, YV3, YV4	T4885201M56	4	Solenoid valve 5/2, 24 V ac coil Configured with 1/8" plugs as normally closed or normally open
RB1	AM145	1	Flow meter with needle valve

12 - Annexes

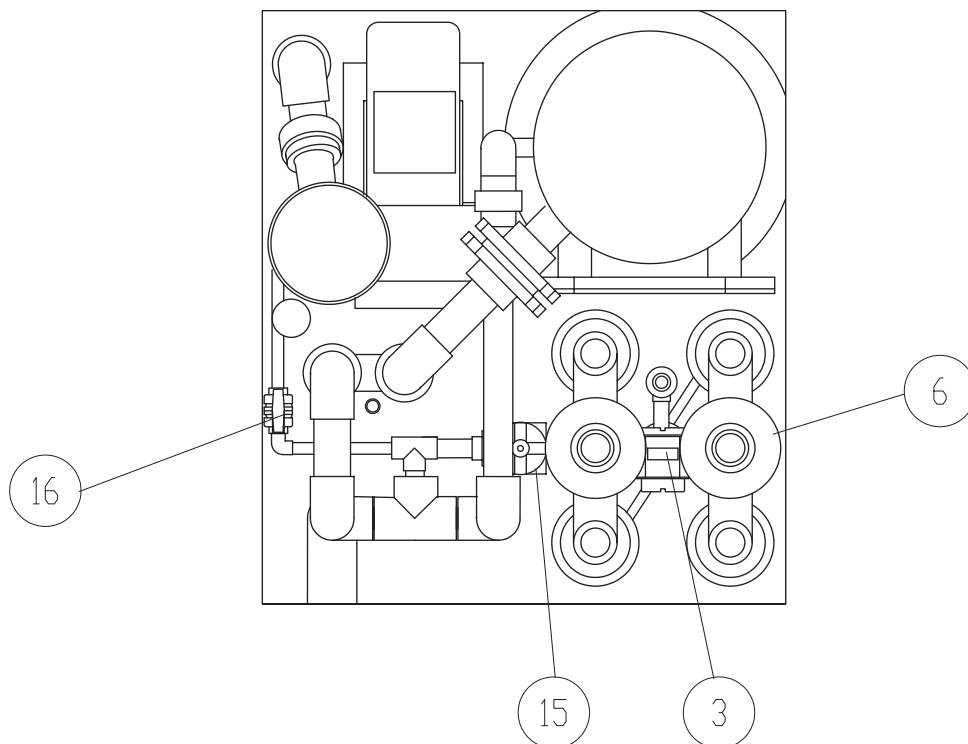
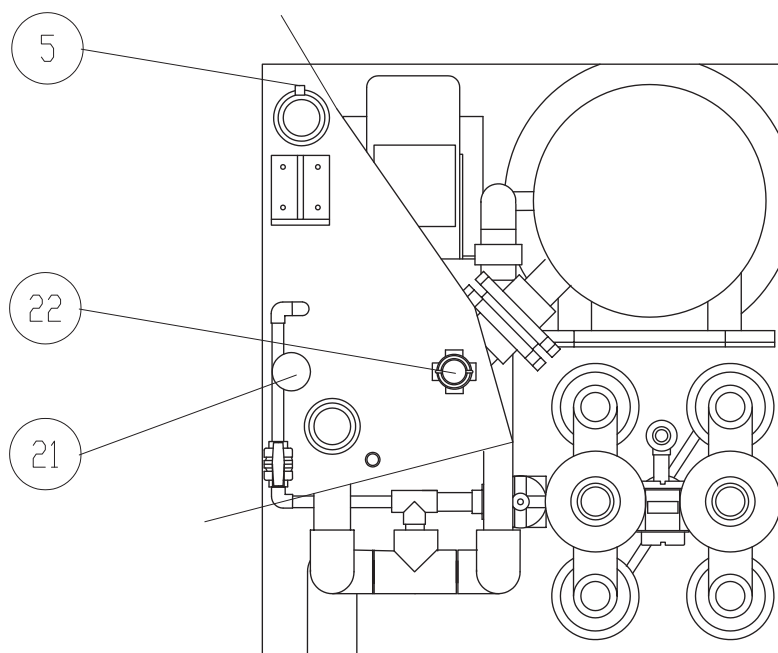
Drawing G5054.03.01 - Description
Drawing G5054.02.02 - Installation
Drawing G5035.04.01 - Pneumatic diagram
Electric diagram SE-943
Drawing G5054.07.01 - Classified area
Drawing G5054.06.01 - Maintenance
Drawing G5054.05.01 - Spare parts
Manual - Pump
Manual - Transducer



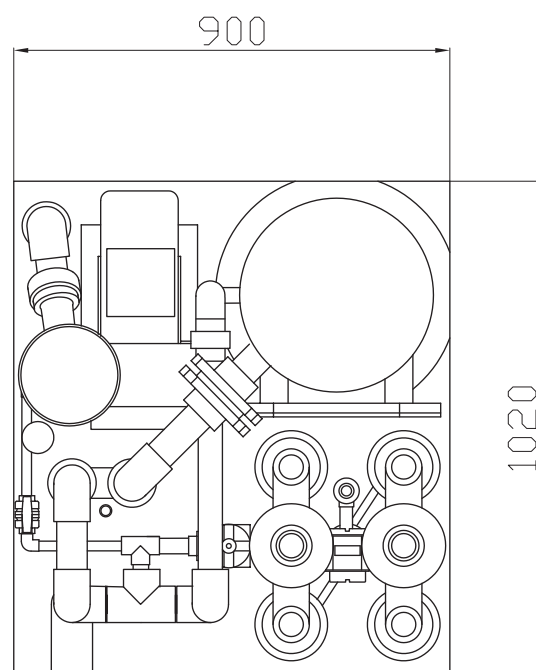
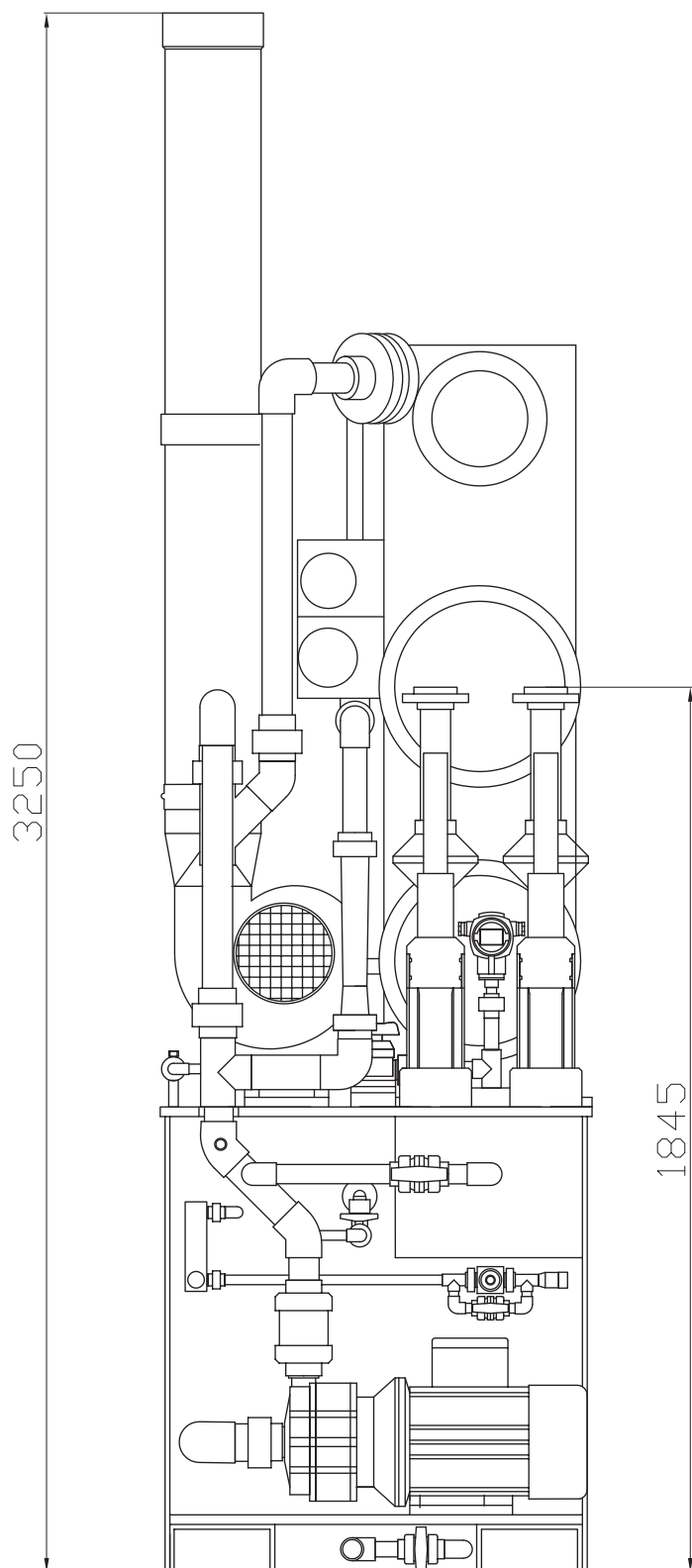




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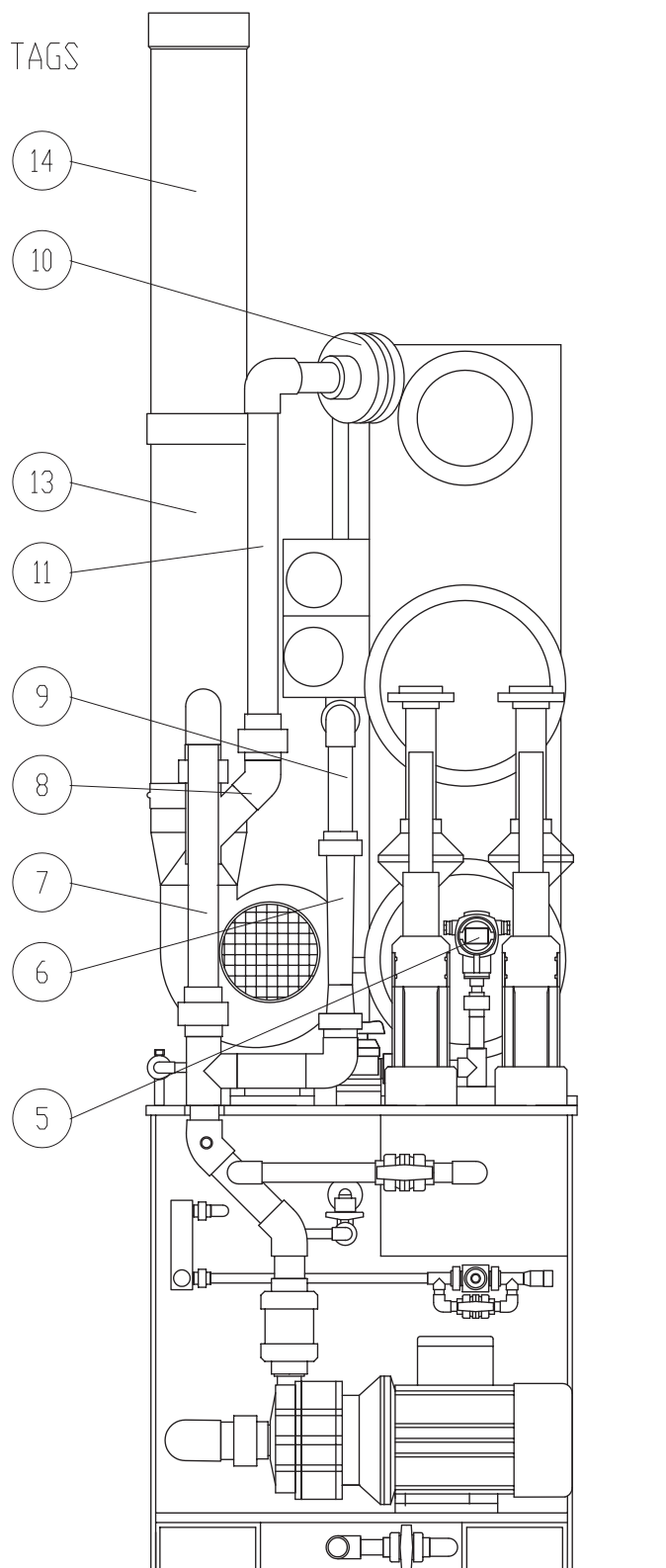
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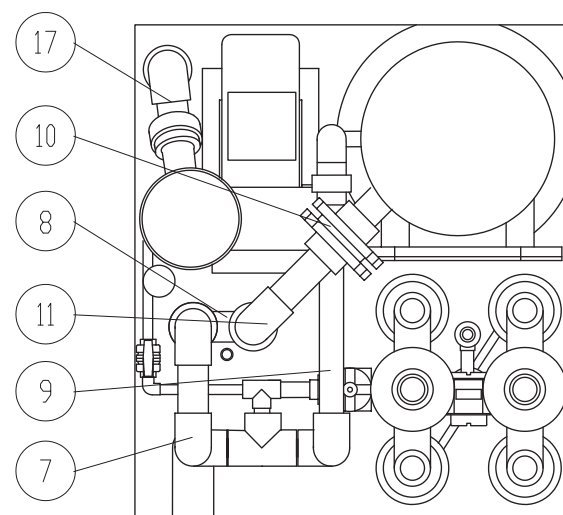
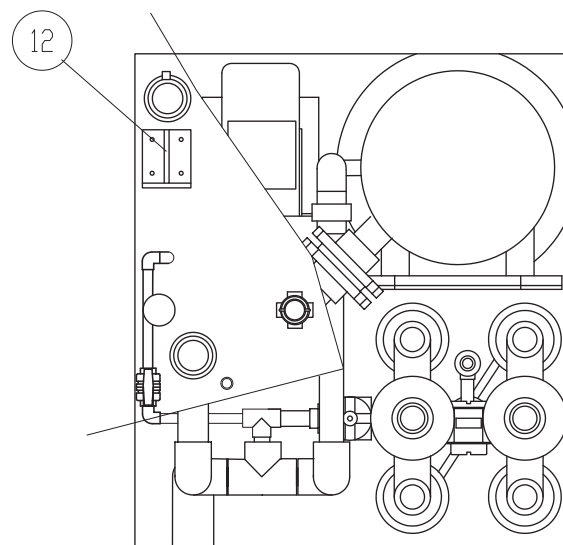
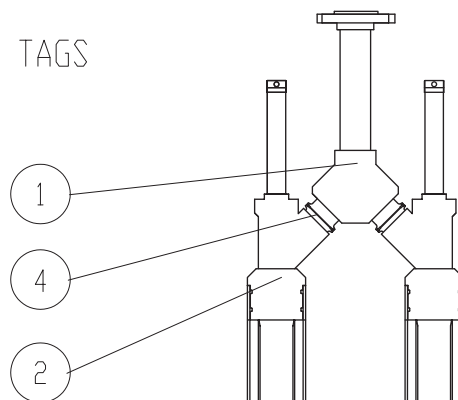
MAINTENANCE SIDE

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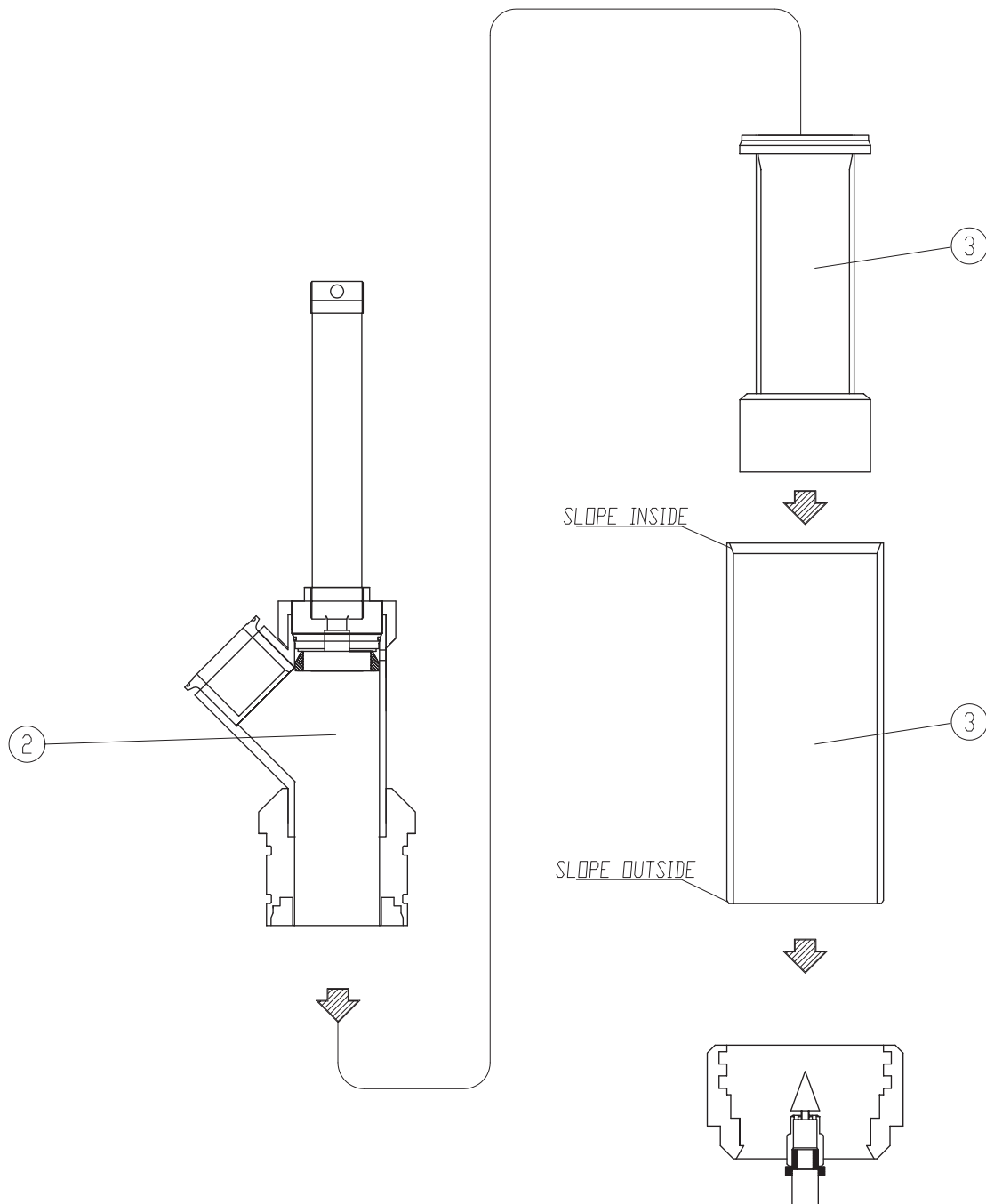
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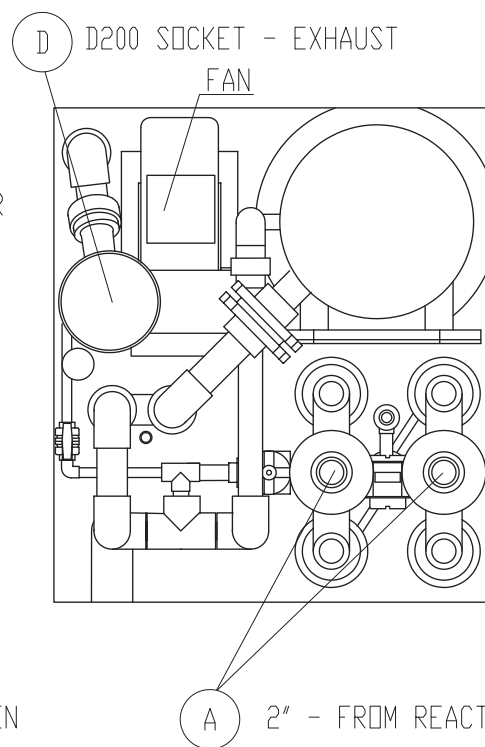
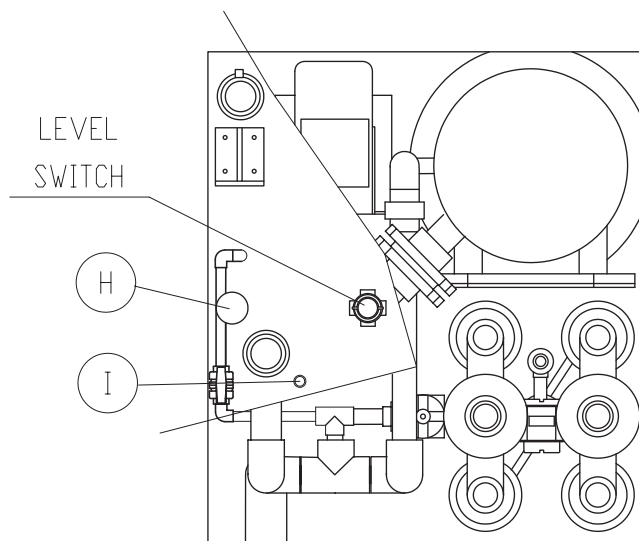
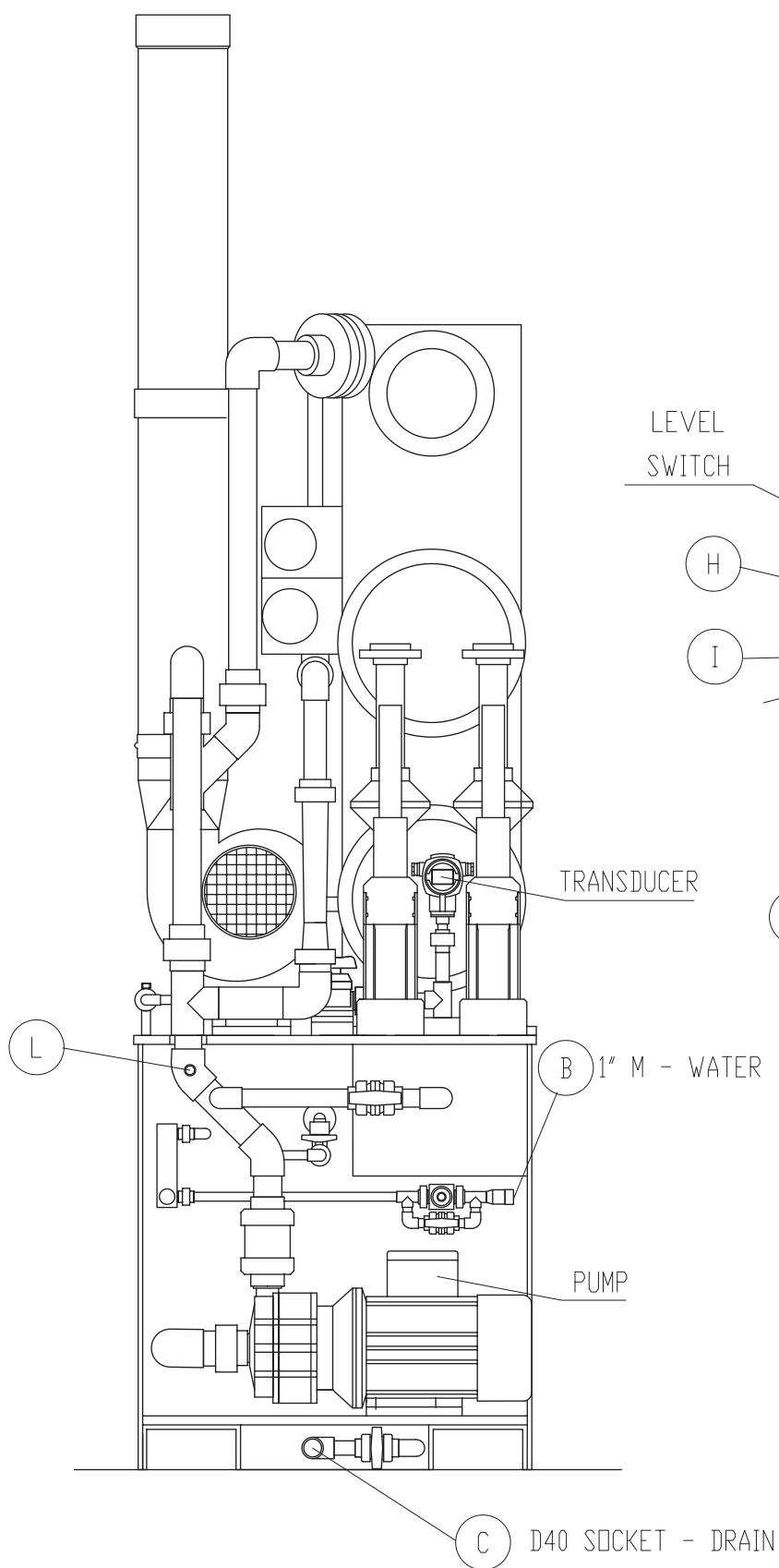


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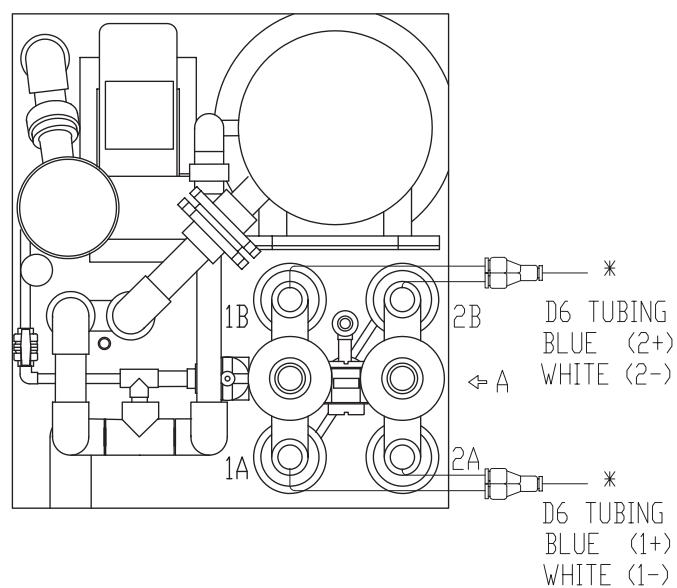
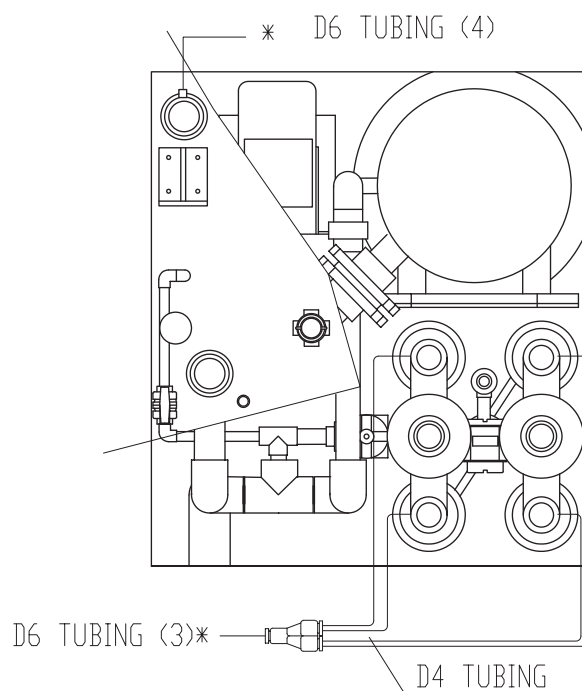
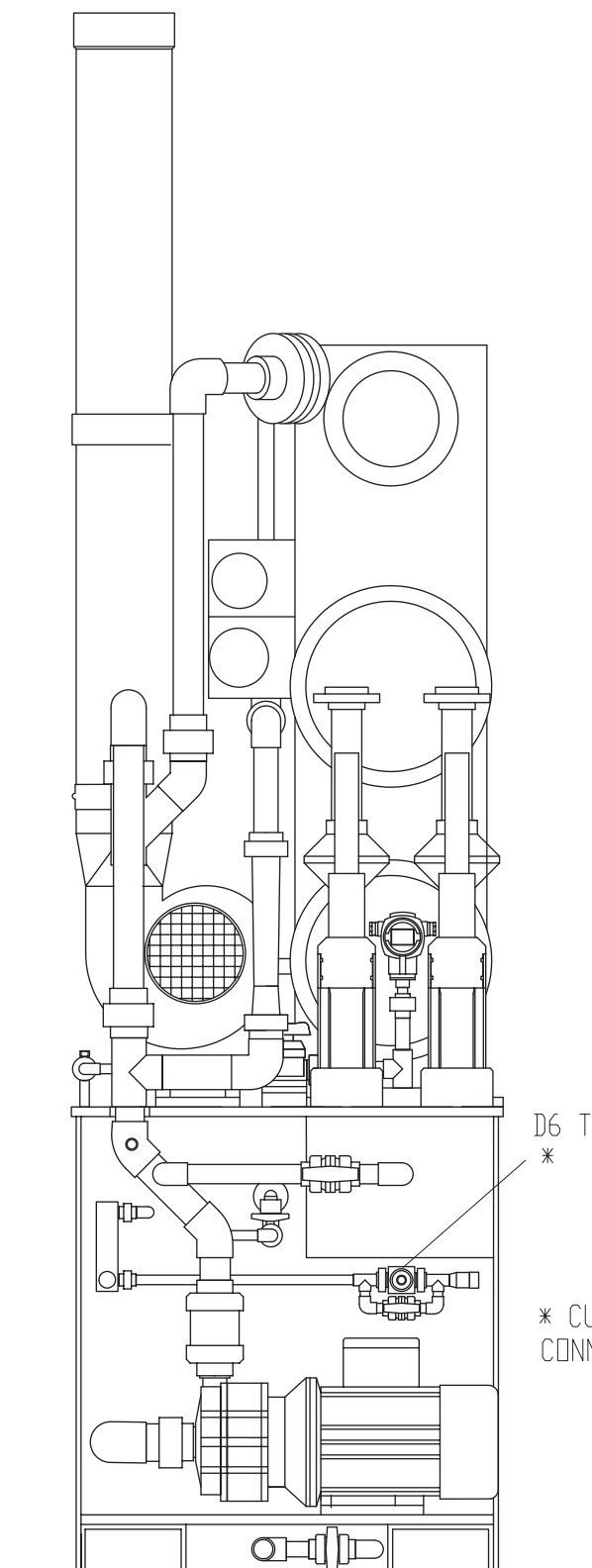


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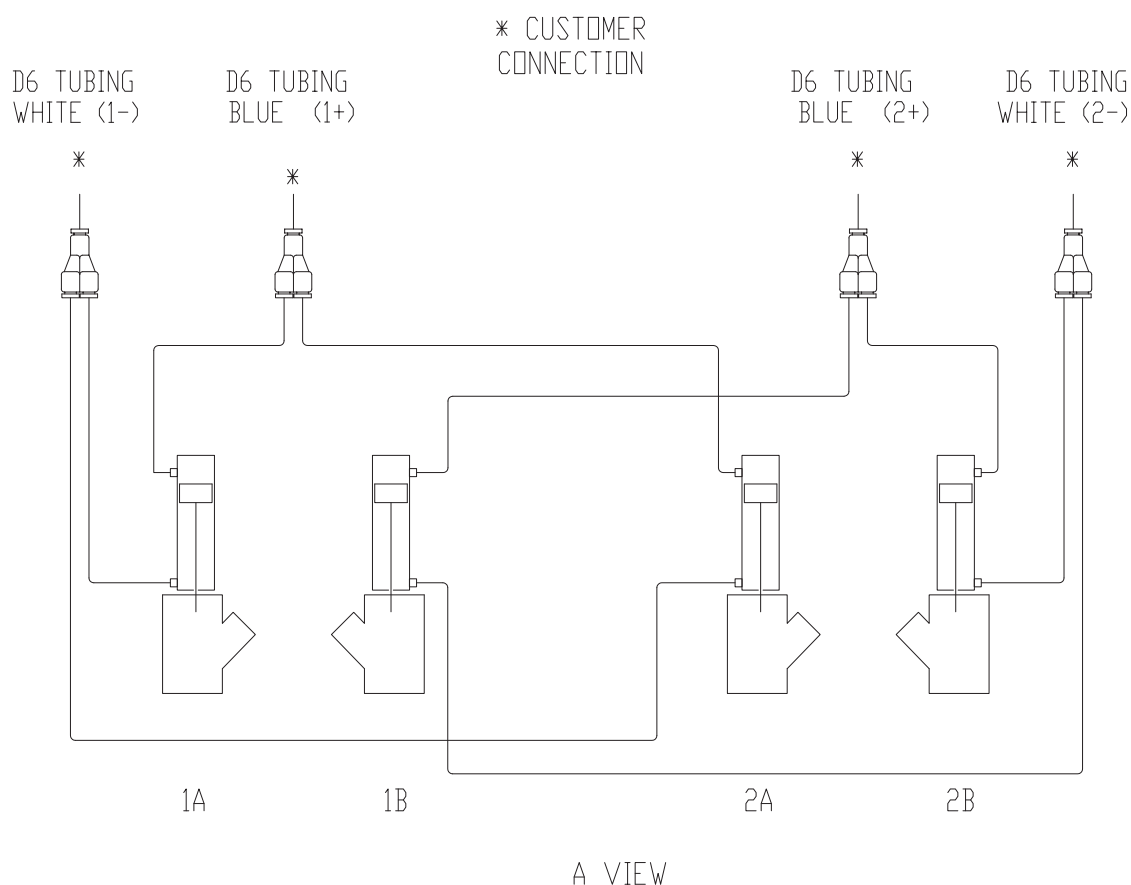
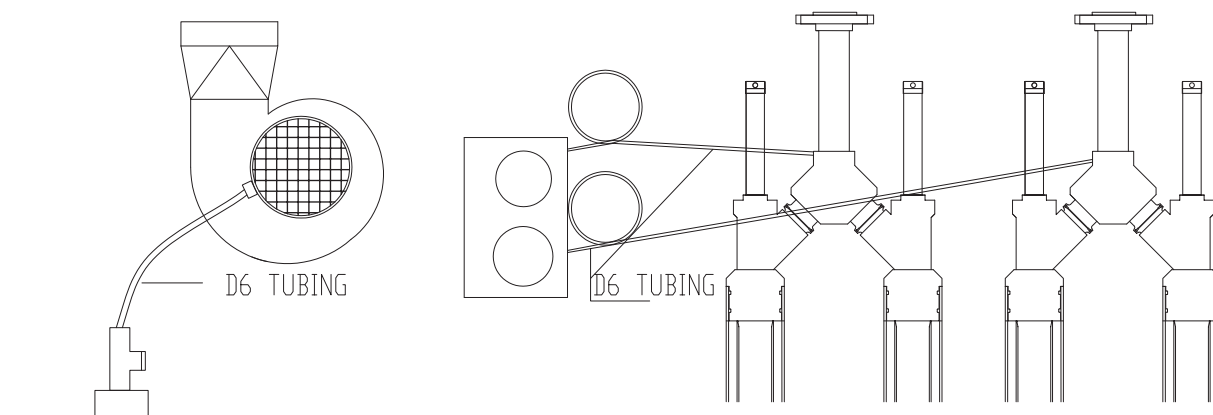


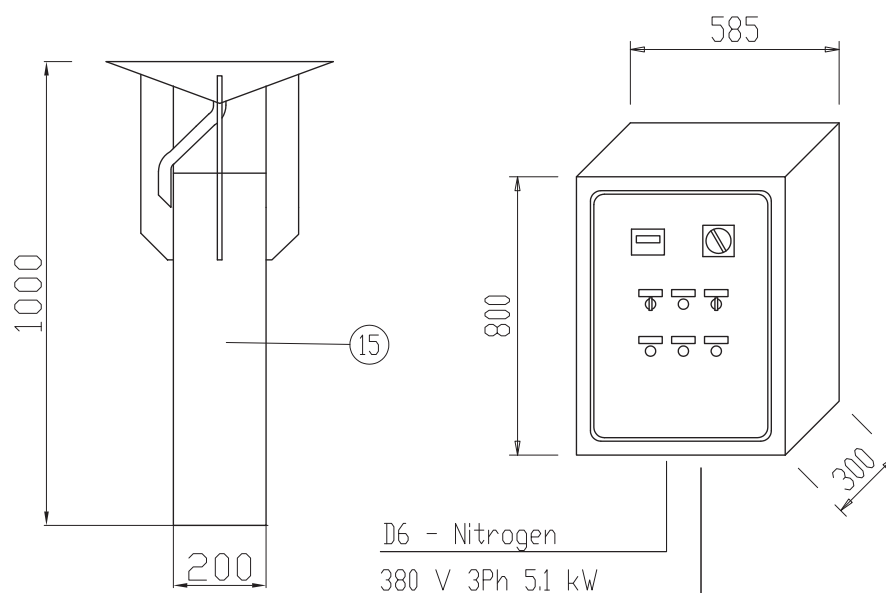


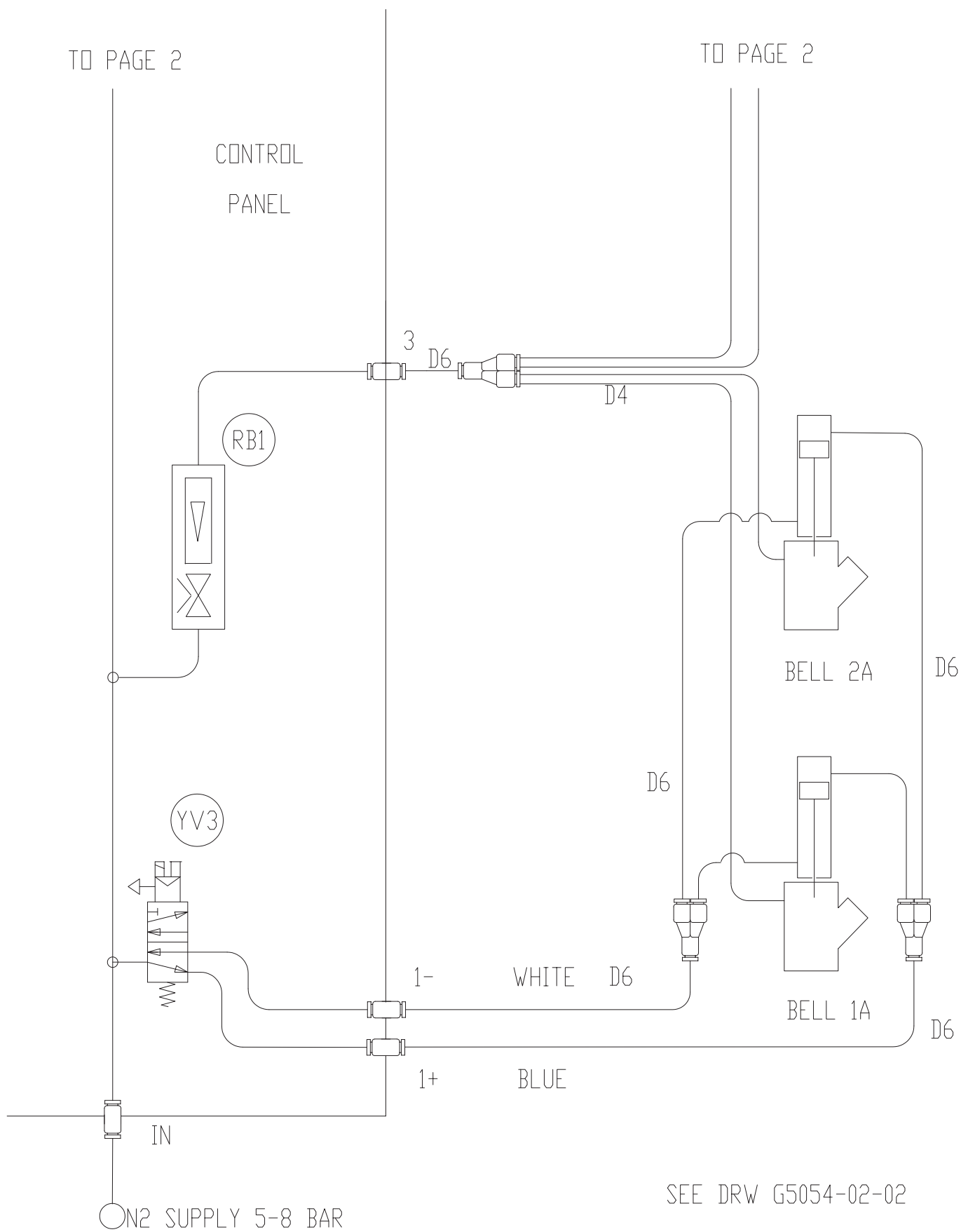
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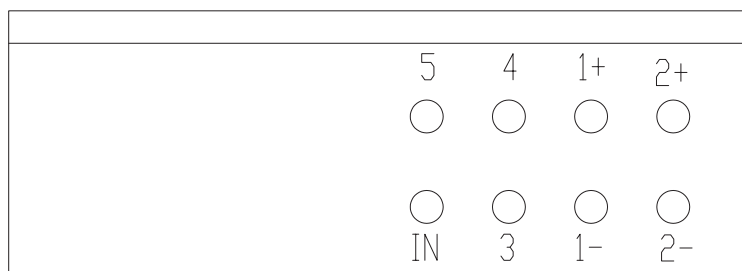




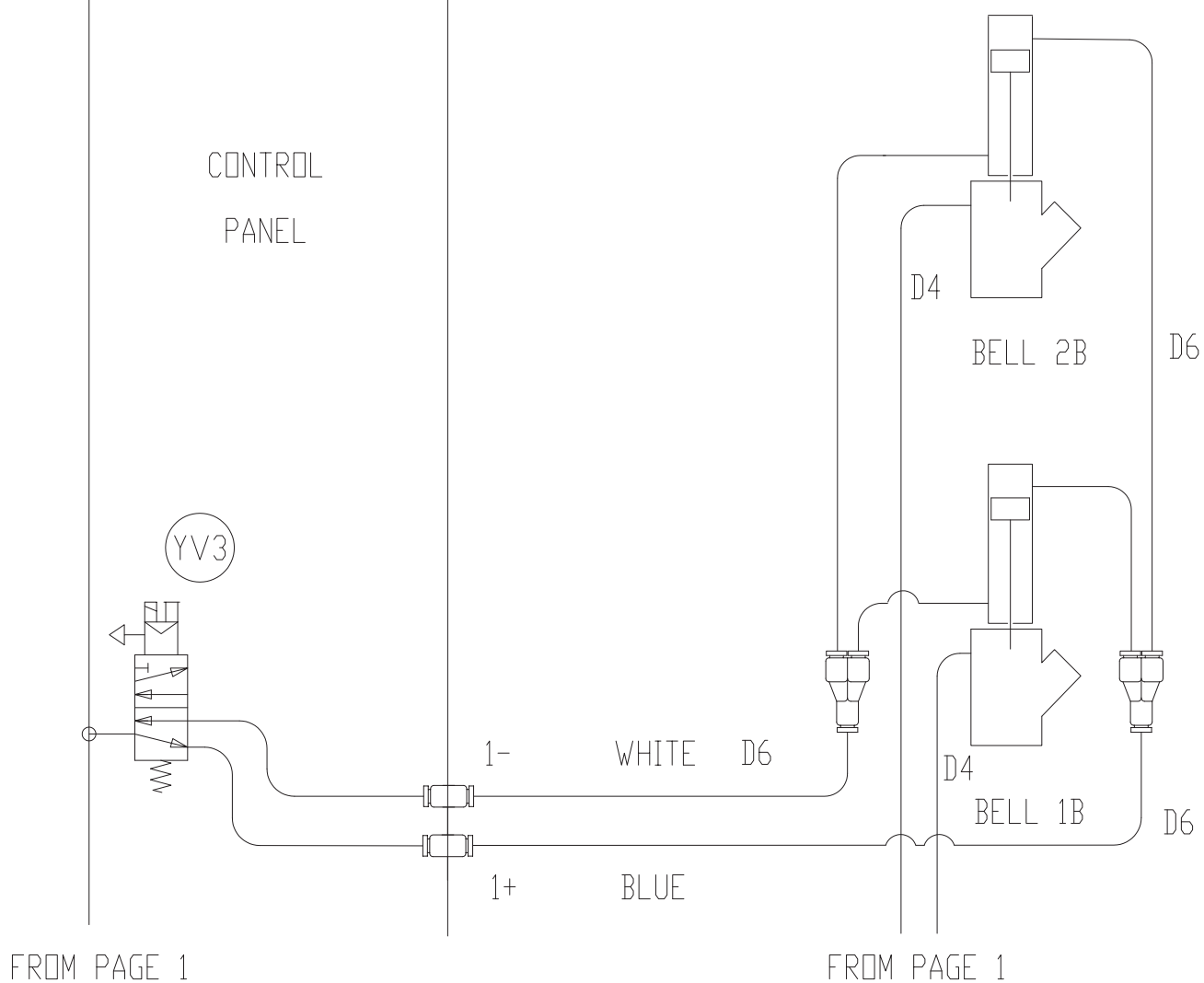


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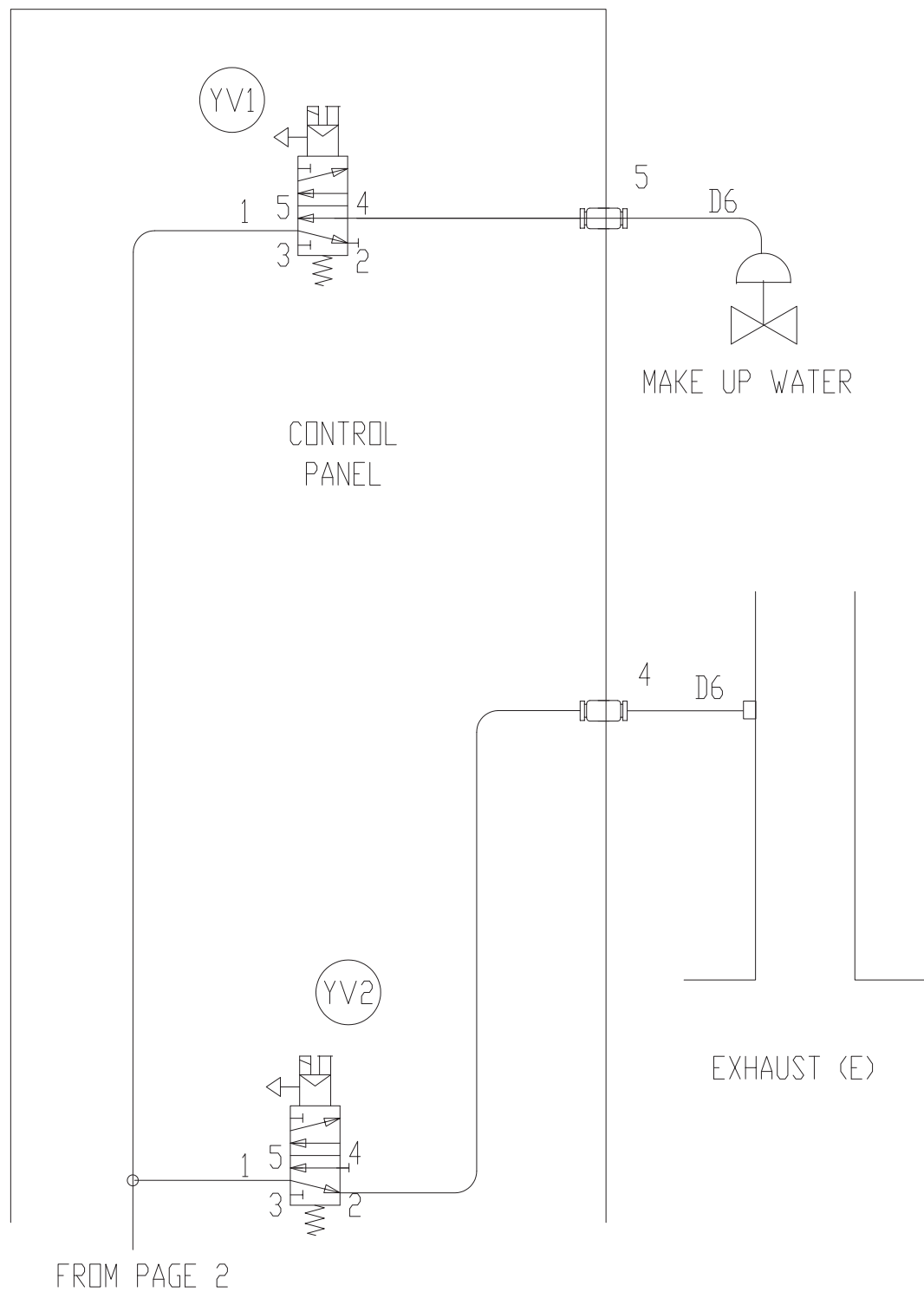
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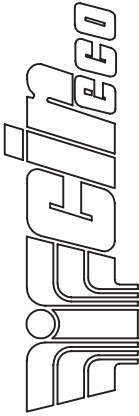
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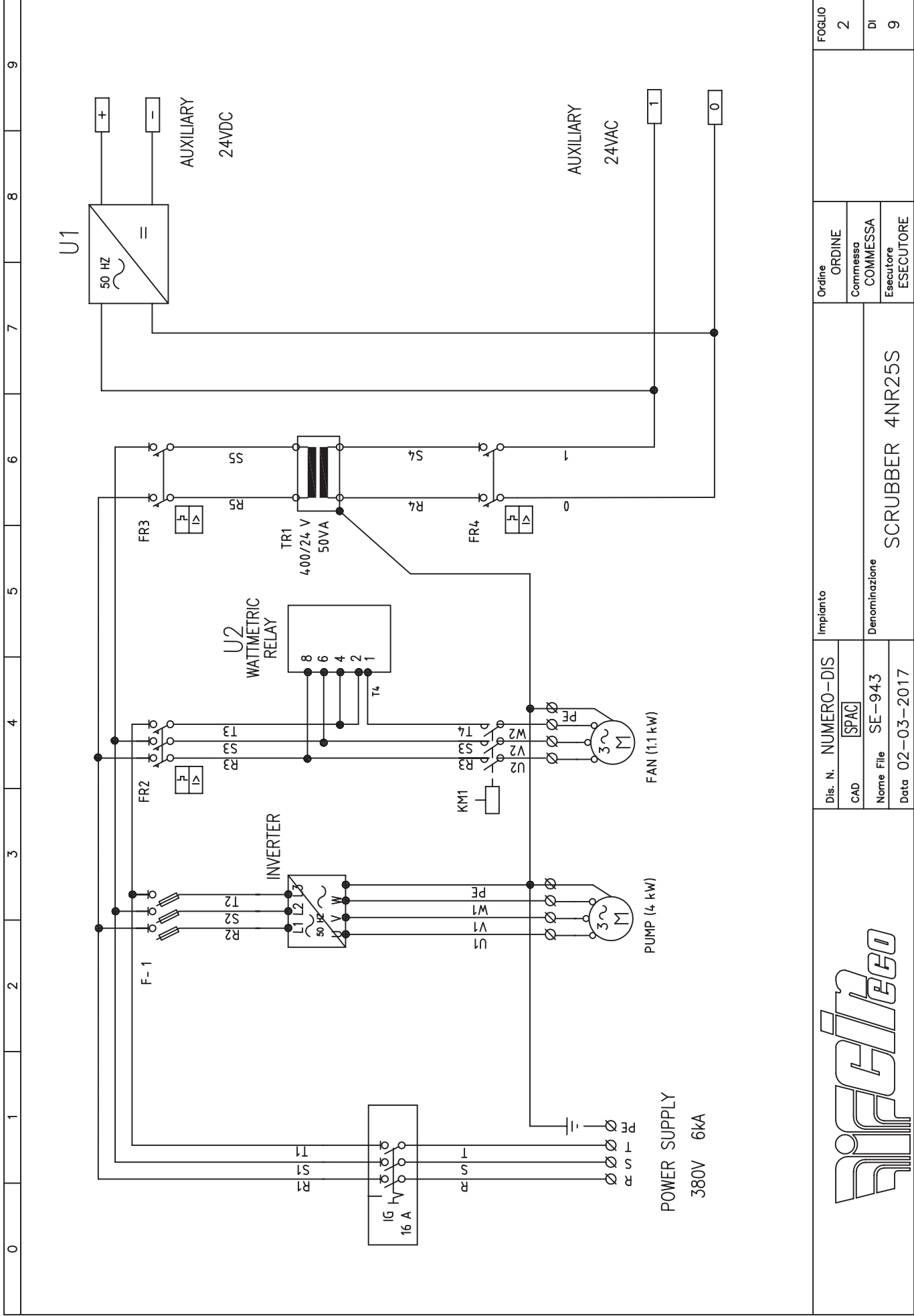


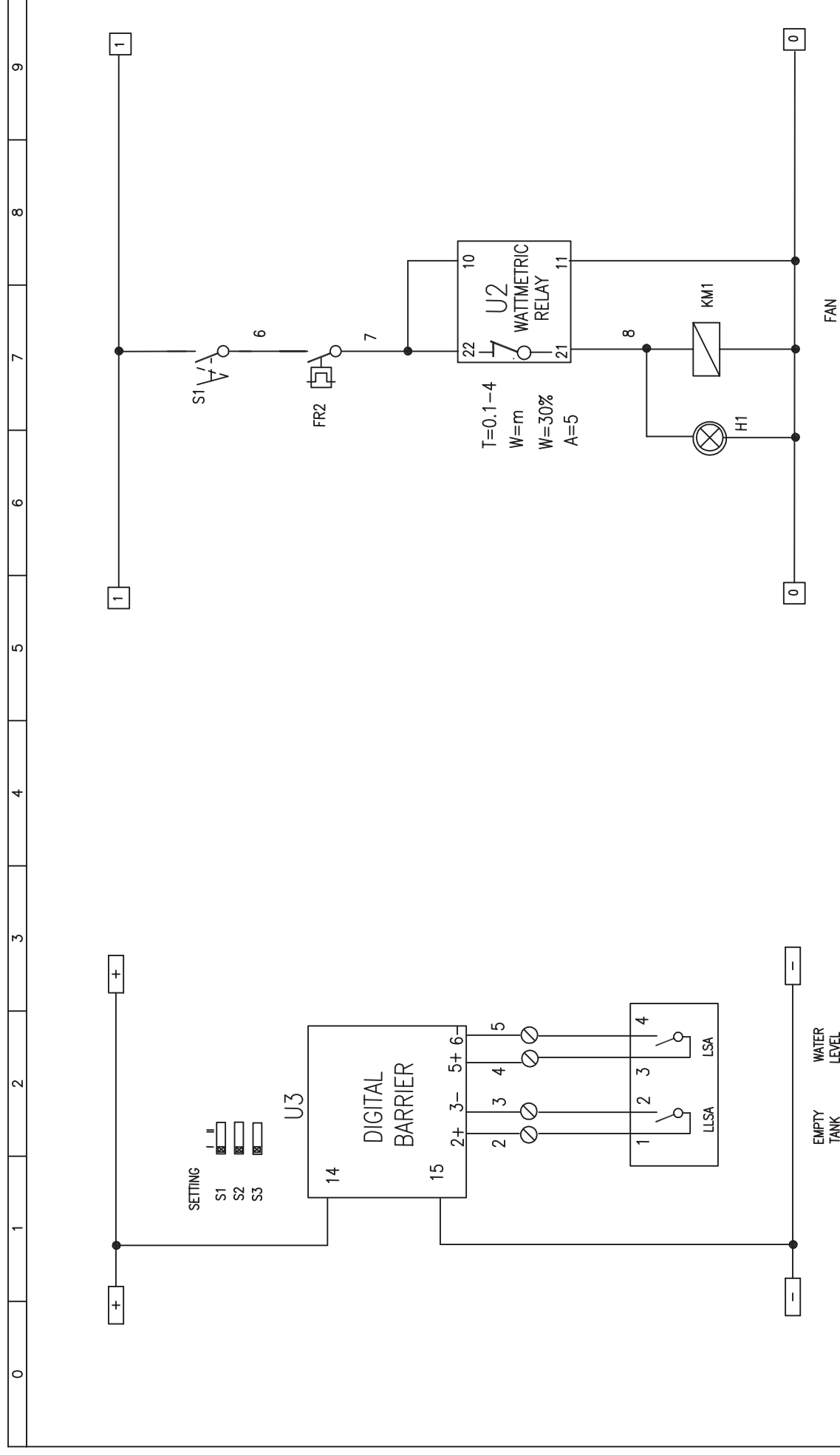
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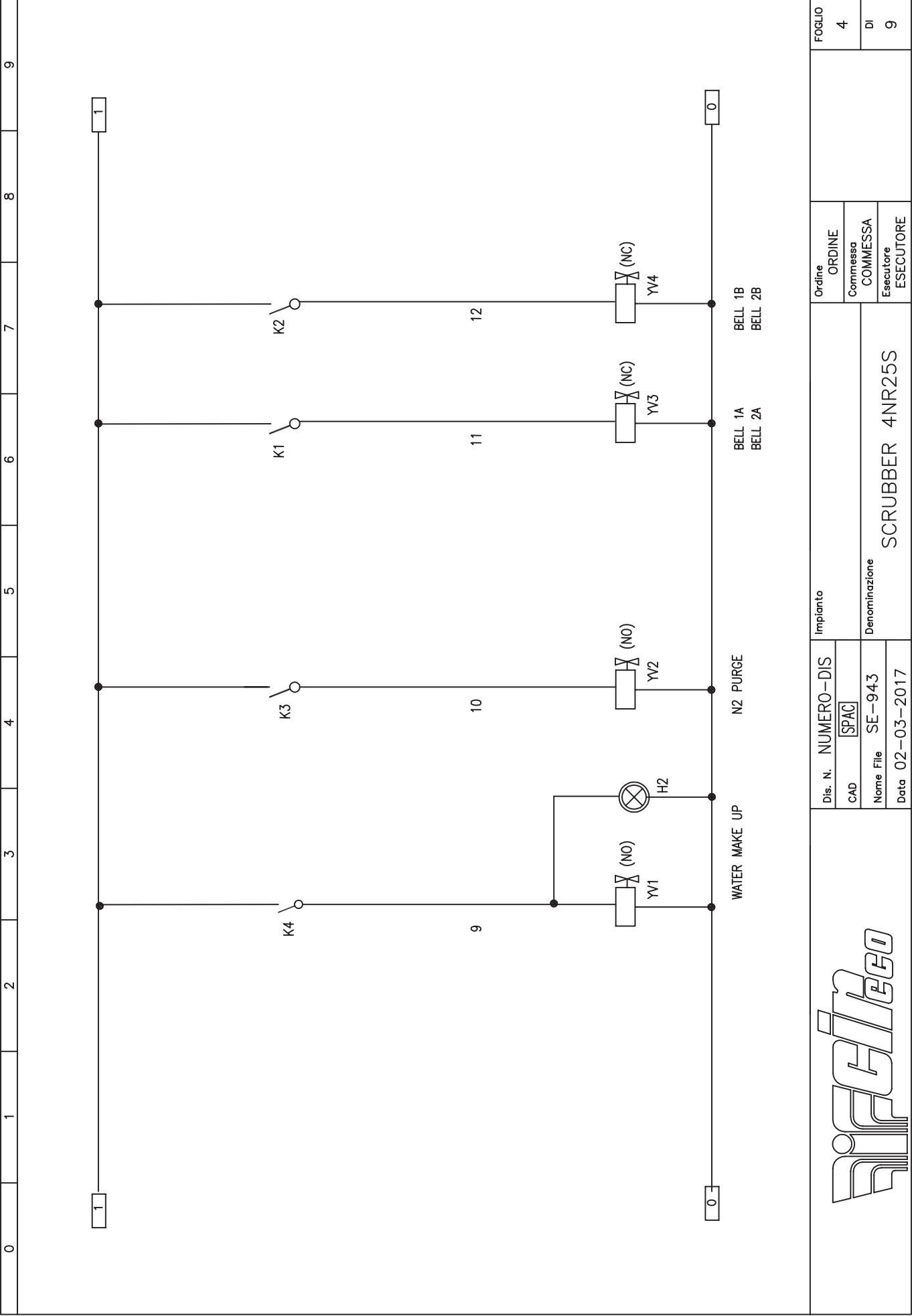
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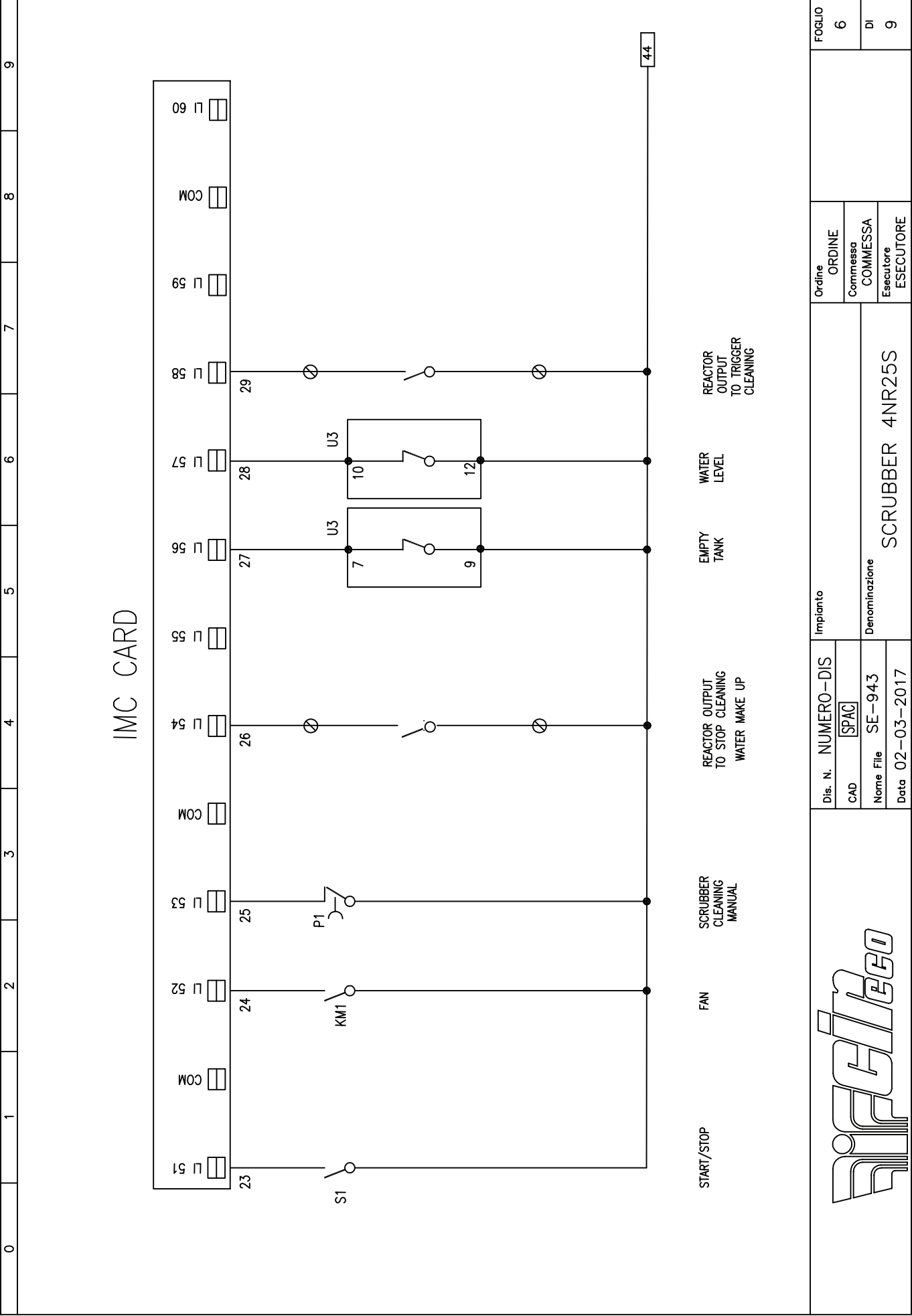
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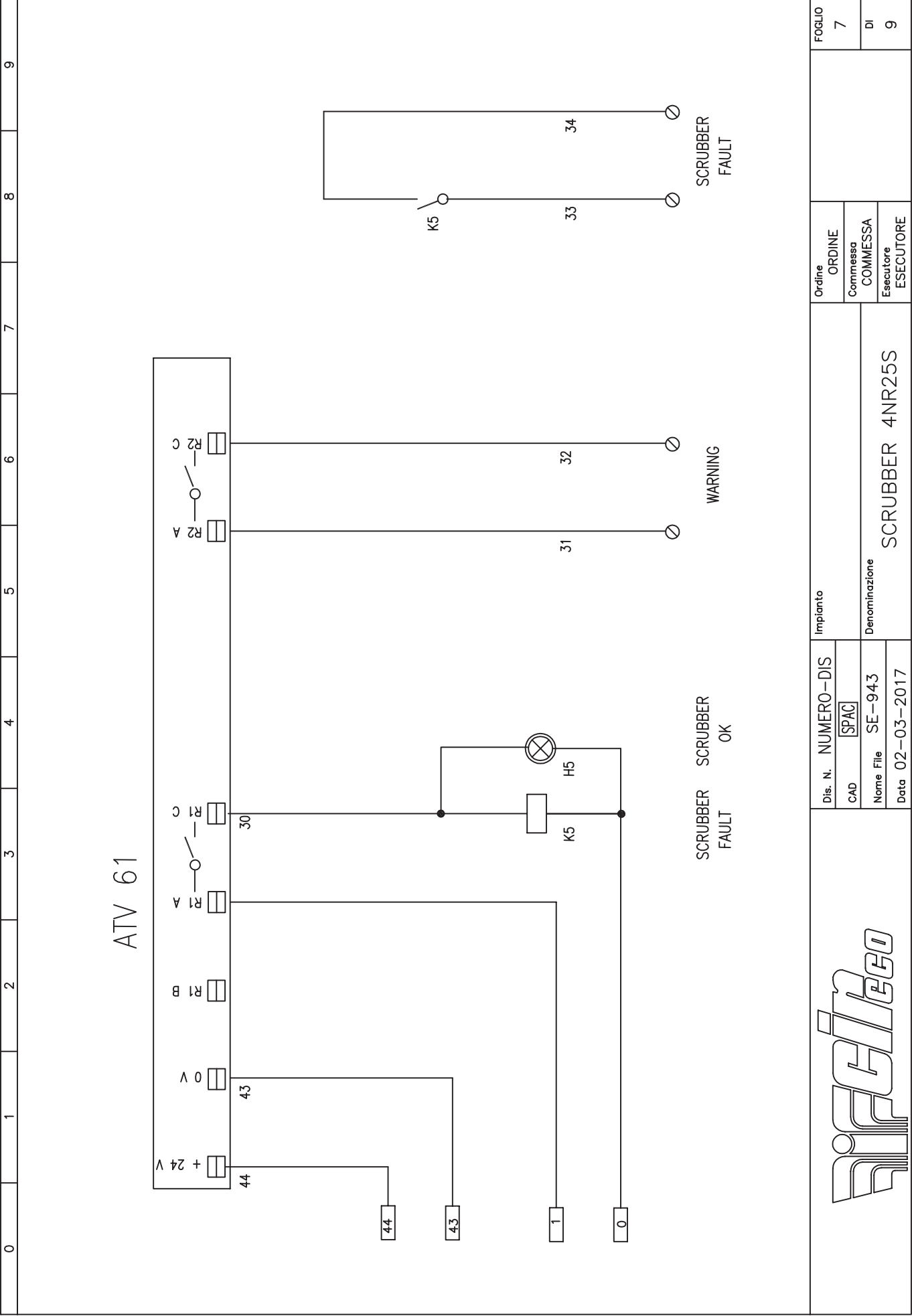


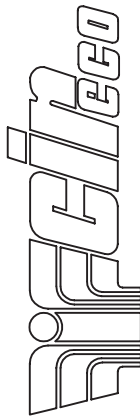


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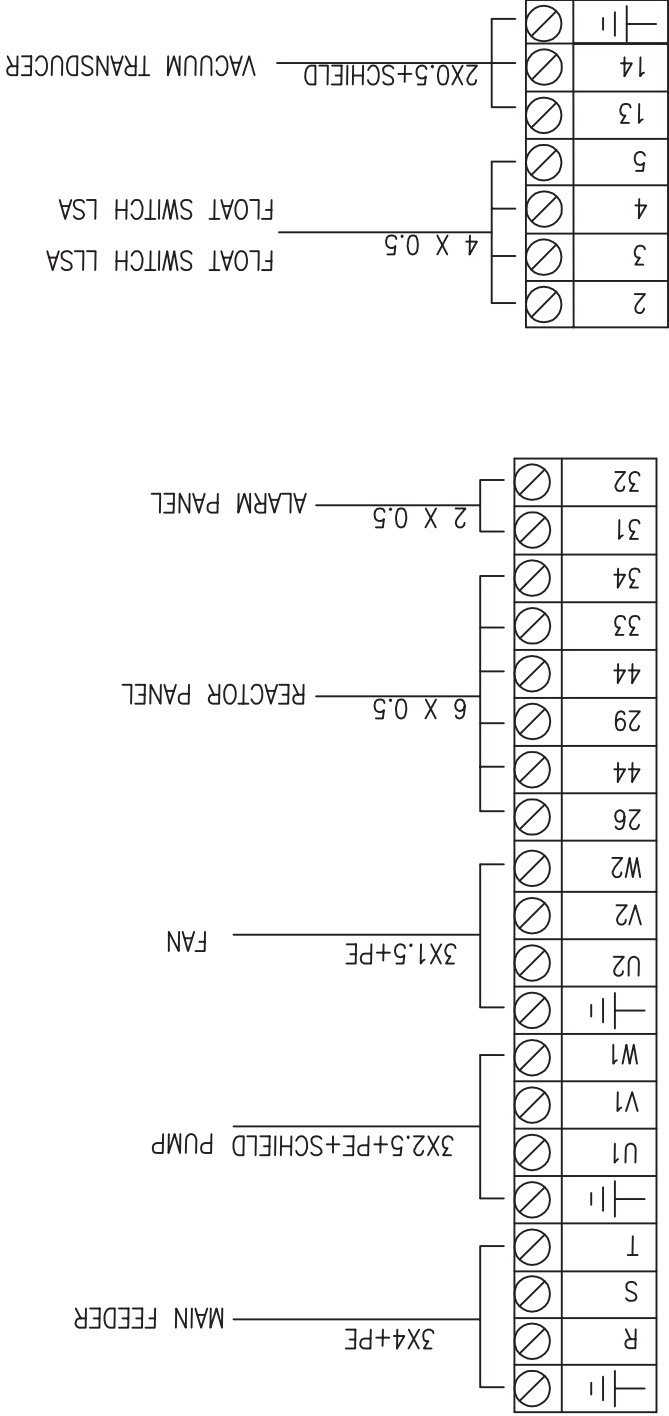




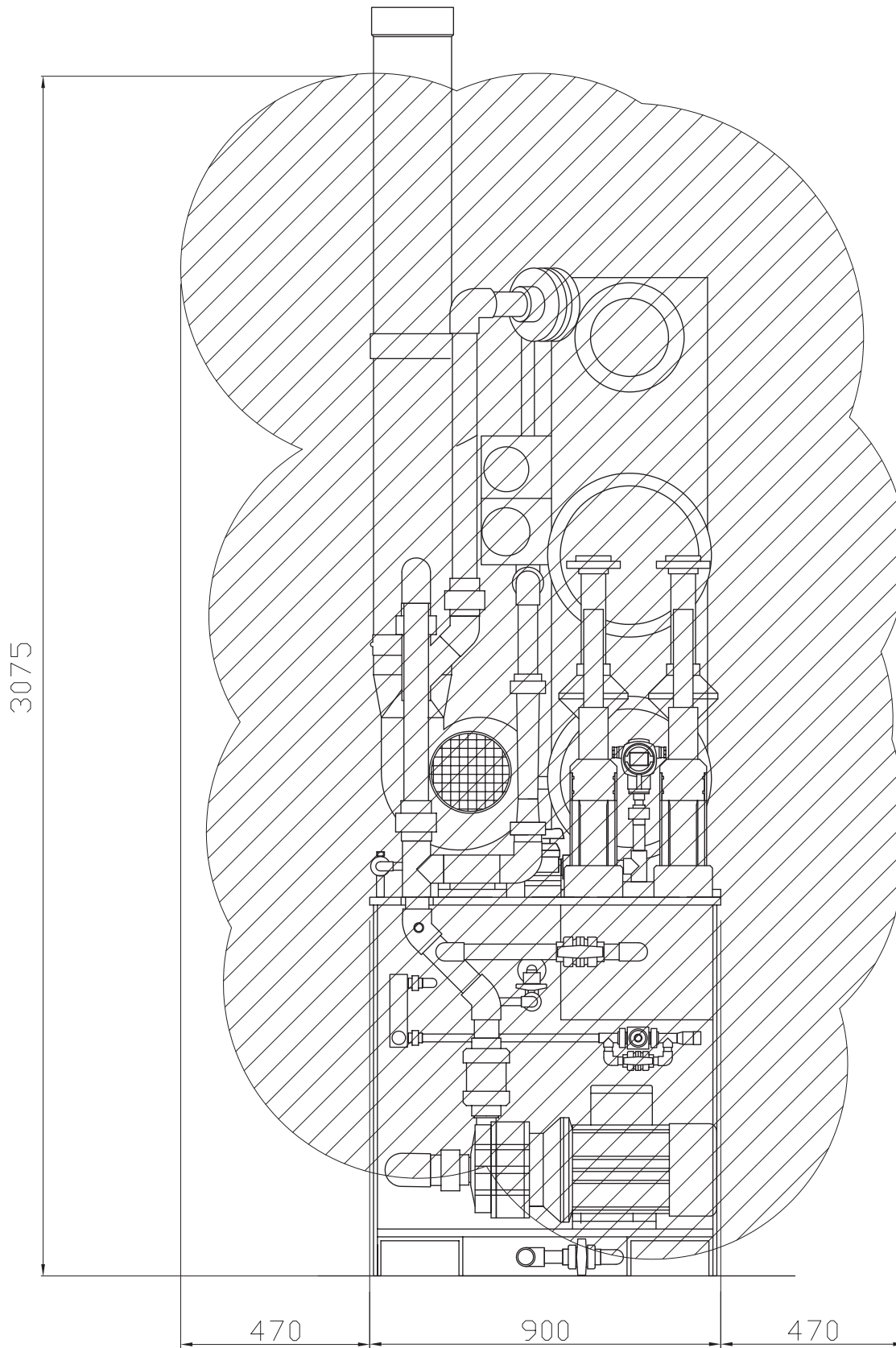


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0		1		2		3		4		5		6		7		8		9	

—		R	S	T	—	U1	V1	W1	—	U2	V2	W2	26	44	29	44	33	34	31	32			
3X4+PE		MAIN FEEDER		3X2.5+PE+SCHIELD		PUMP		3X1.5+PE		FAN		6 X 0.5		REACTOR PANEL		2 X 0.5		ALARM PANEL		2X0.5+SCHIELD		VACUUM TRANSDUCER	
2		3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24

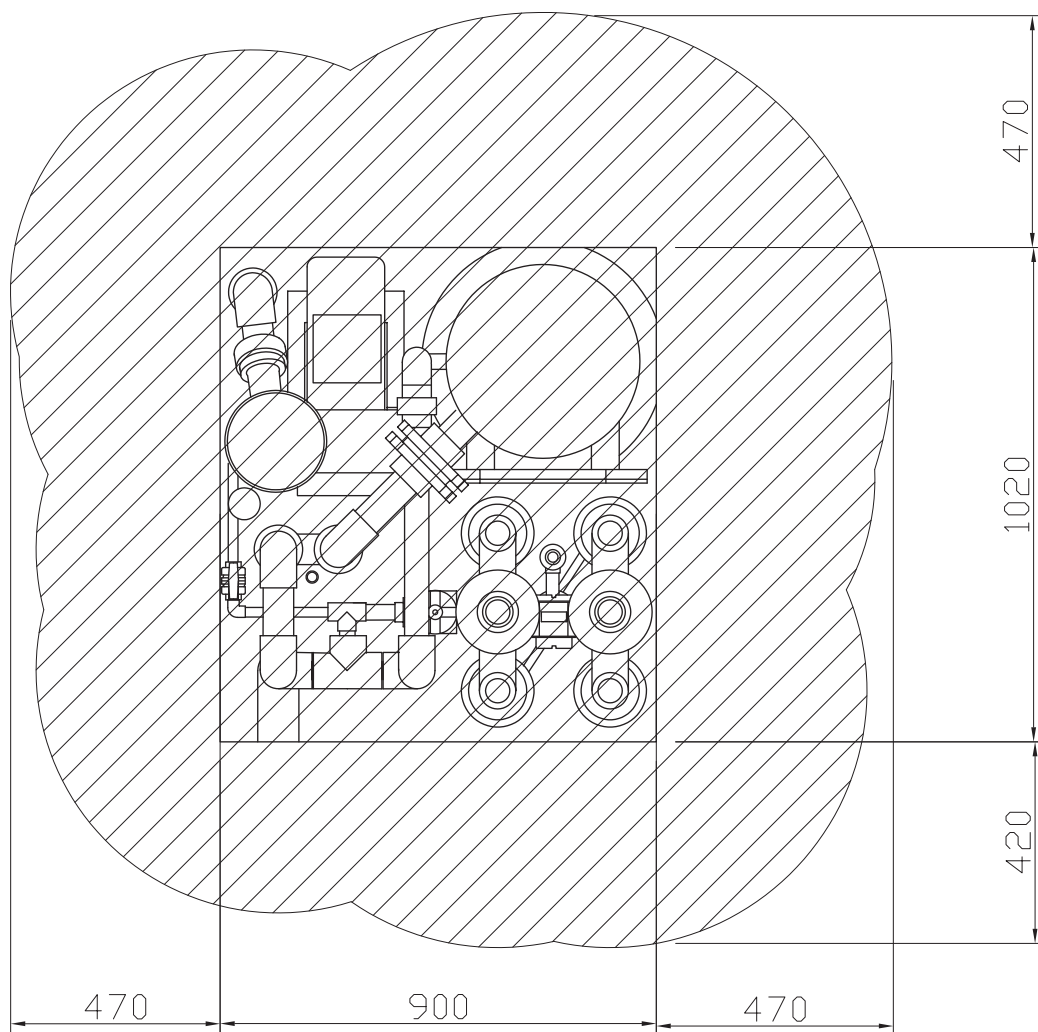


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<div><div><div>INVERTER KEYBOARD</div><div><div><div><div><div><div></div><div></div></div></div><div></div></div></div><div>MAIN SWITCH</div></div><div><div><div><div><div></div><div></div></div><div>S1</div></div><div><div><div><div><div></div><div></div></div><div>H1</div></div><div><div><div><div><div></div><div></div></div><div>H3</div></div><div><div><div><div><div></div><div></div></div><div>H5</div></div><div><div><div><div><div></div><div></div></div><div>H2</div></div><div><div><div><div><div></div><div></div></div><div>H4</div></div><div><div><div><div><div></div><div></div></div><div>P1</div></div></div></div><div><div><div><div><div></div><div></div></div><div>N2</div></div><div>FLOW METER</div></div></div></div></div><div><div>S1 = SCRUBBER OFF/ON</div><div>P1 = BELL CLEANING</div><div>H1 = FAN (GREEN)</div><div>H2 = WATER MAKE UP (BLUE)</div><div>H3 = WATER LEVEL (RED)</div><div>H4 = EMPTY TANK (RED)</div><div>H5 = SCRUBBER OK (GREEN)</div></div></div></div></div></div></div></div></div></div></div></div></div></div>									
58X80X30 cm									
<div><div><div><div><div><div></div><div></div></div><div>Ariango</div></div></div><div><div><div>Dis. N.</div><div>NUMERO-DIS</div></div><div><div>CAD</div><div>SPAC</div></div><div><div>Nome File</div><div>SE-943</div></div><div><div>Data</div><div>02-03-2017</div></div></div><div><div>Impianto</div><div>SCRUBBER 4NR25S</div></div><div><div>Ordine</div><div>ORDINE</div></div><div><div>Commessa</div><div>COMMESSA</div></div><div><div>Esecutore</div><div>ESECUTORE</div></div></div><div><div>Foglio</div><div>9</div></div><div><div>DI</div><div>9</div></div></div>									



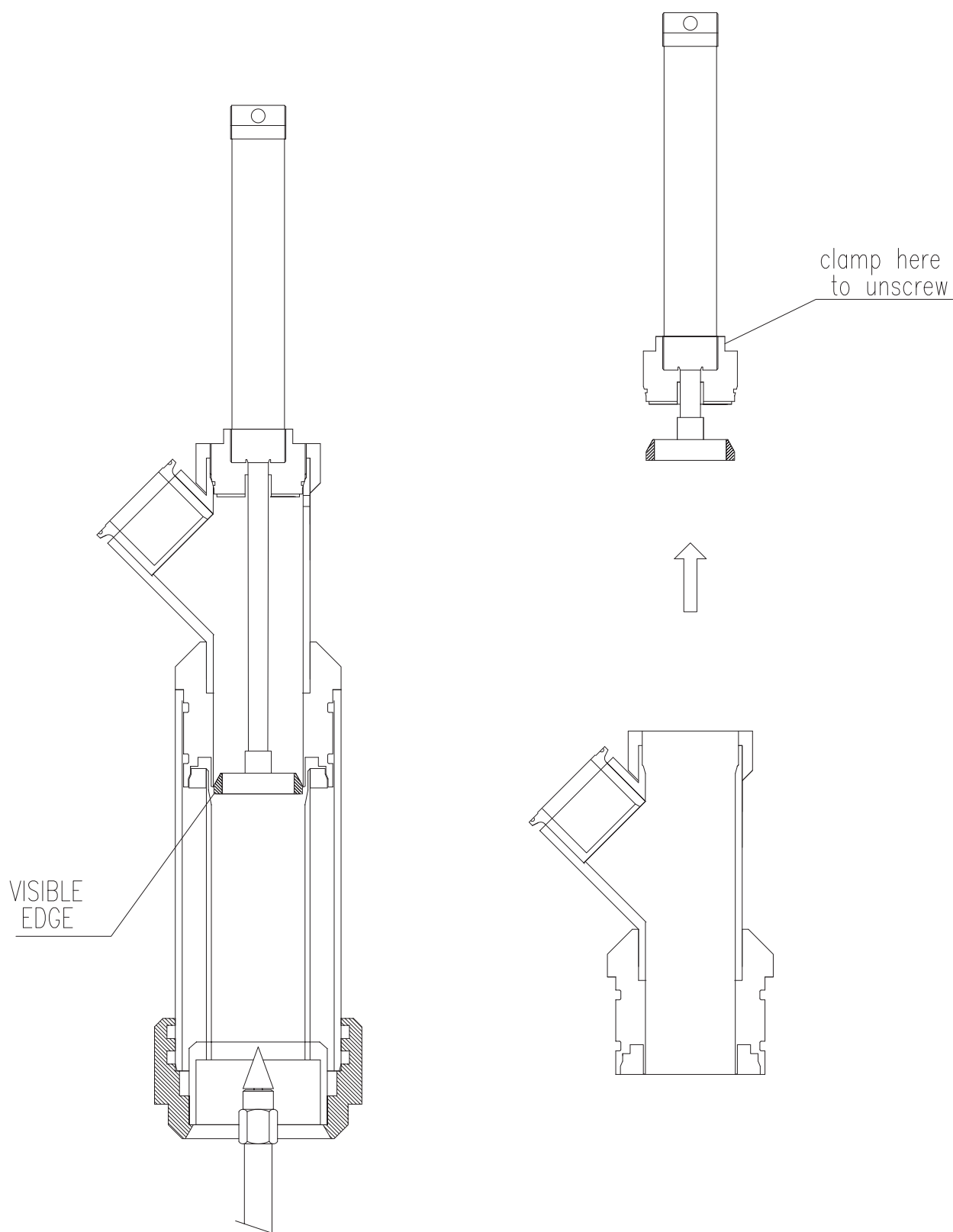
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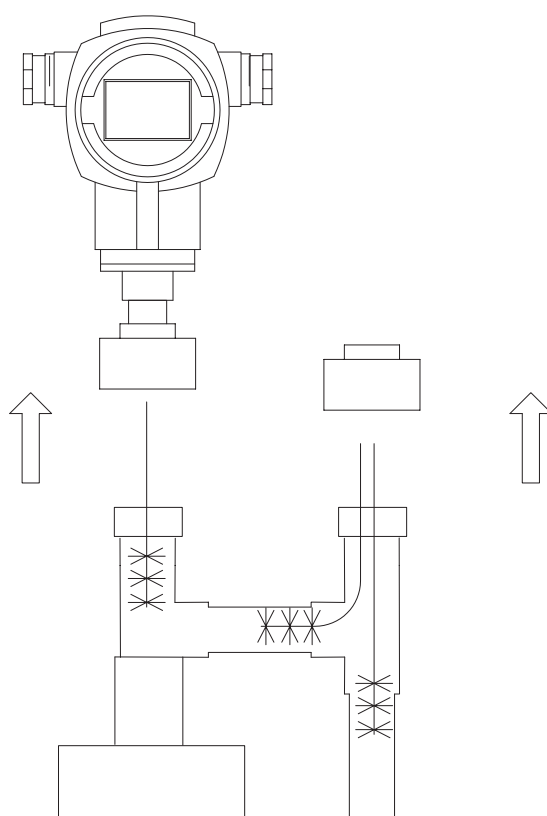
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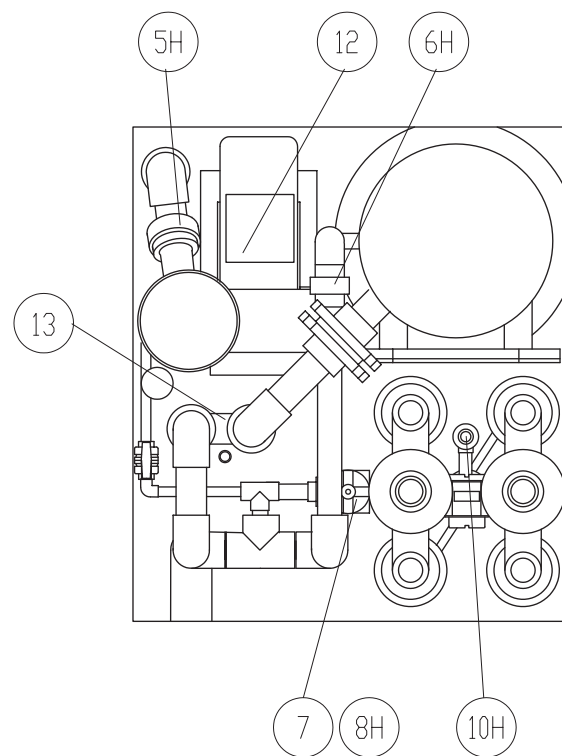
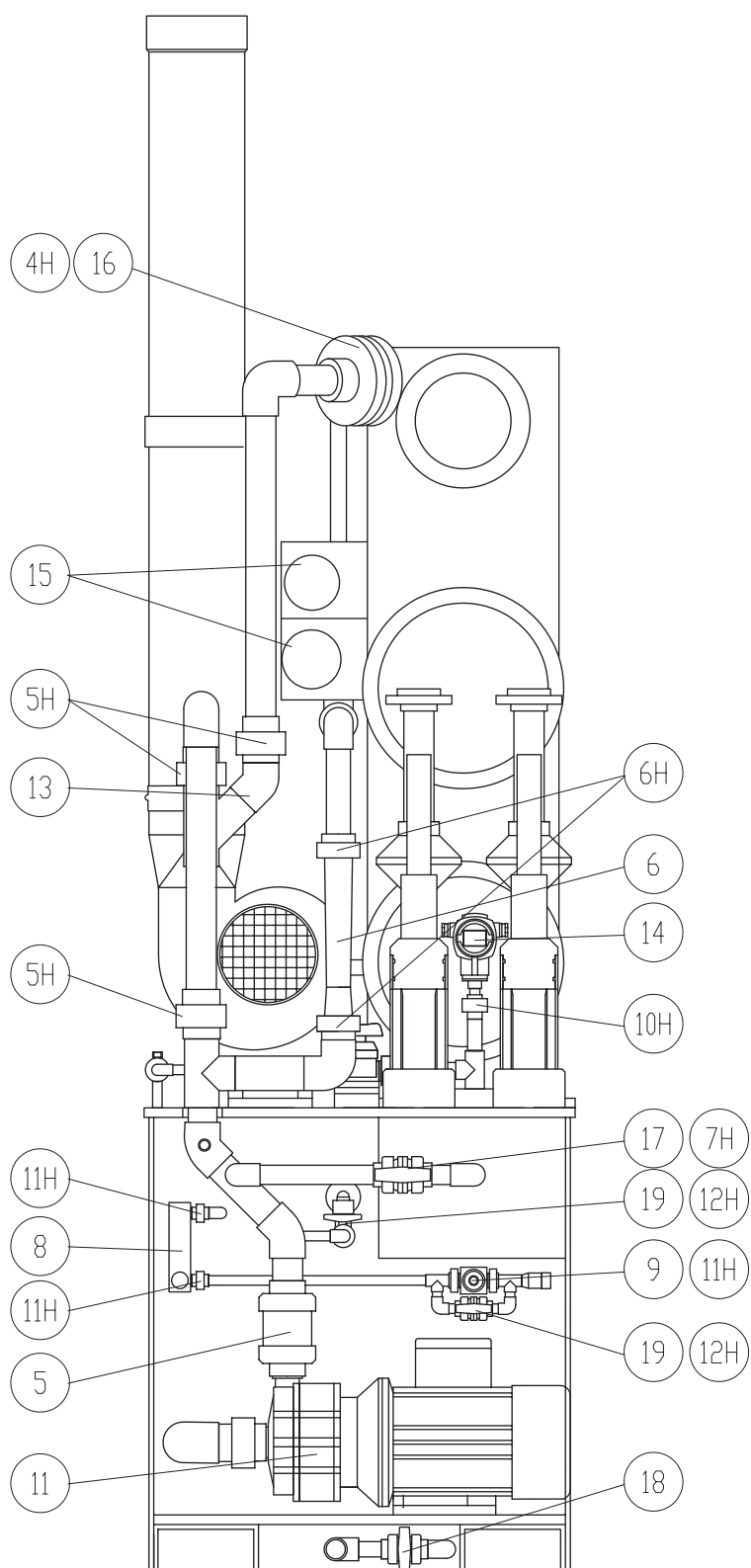
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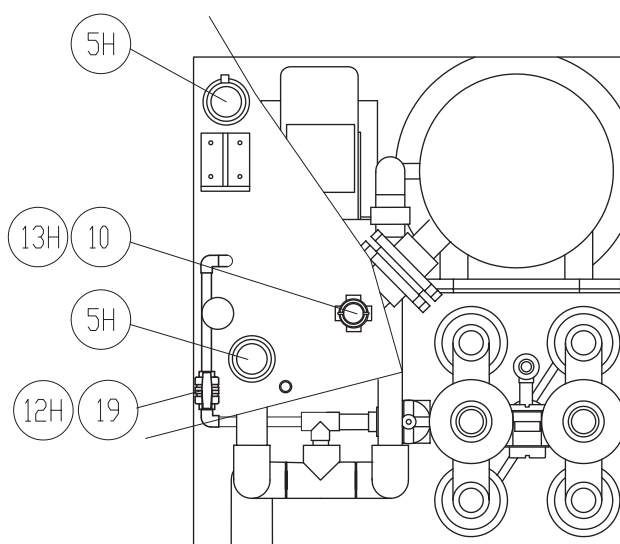
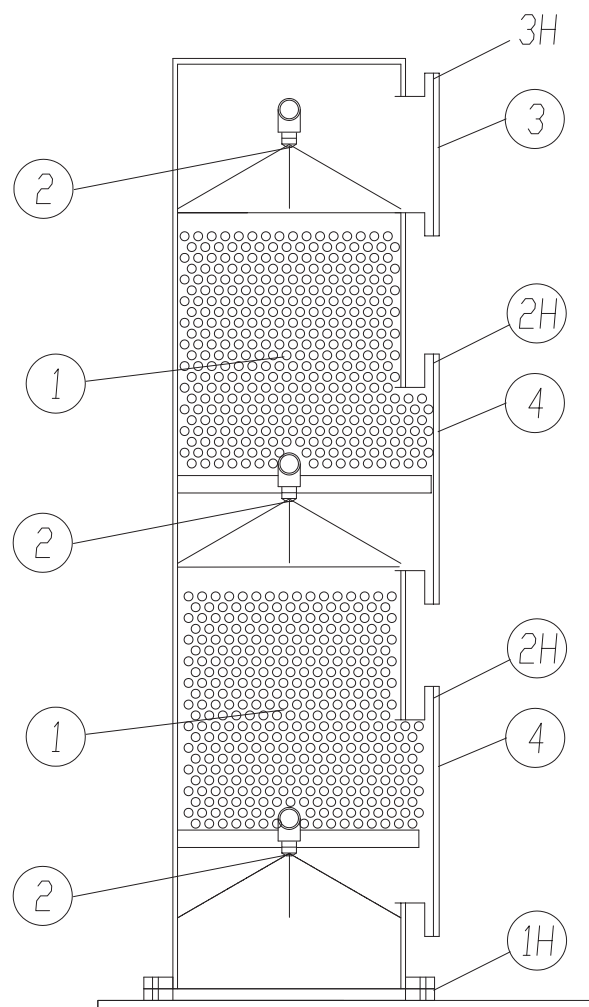




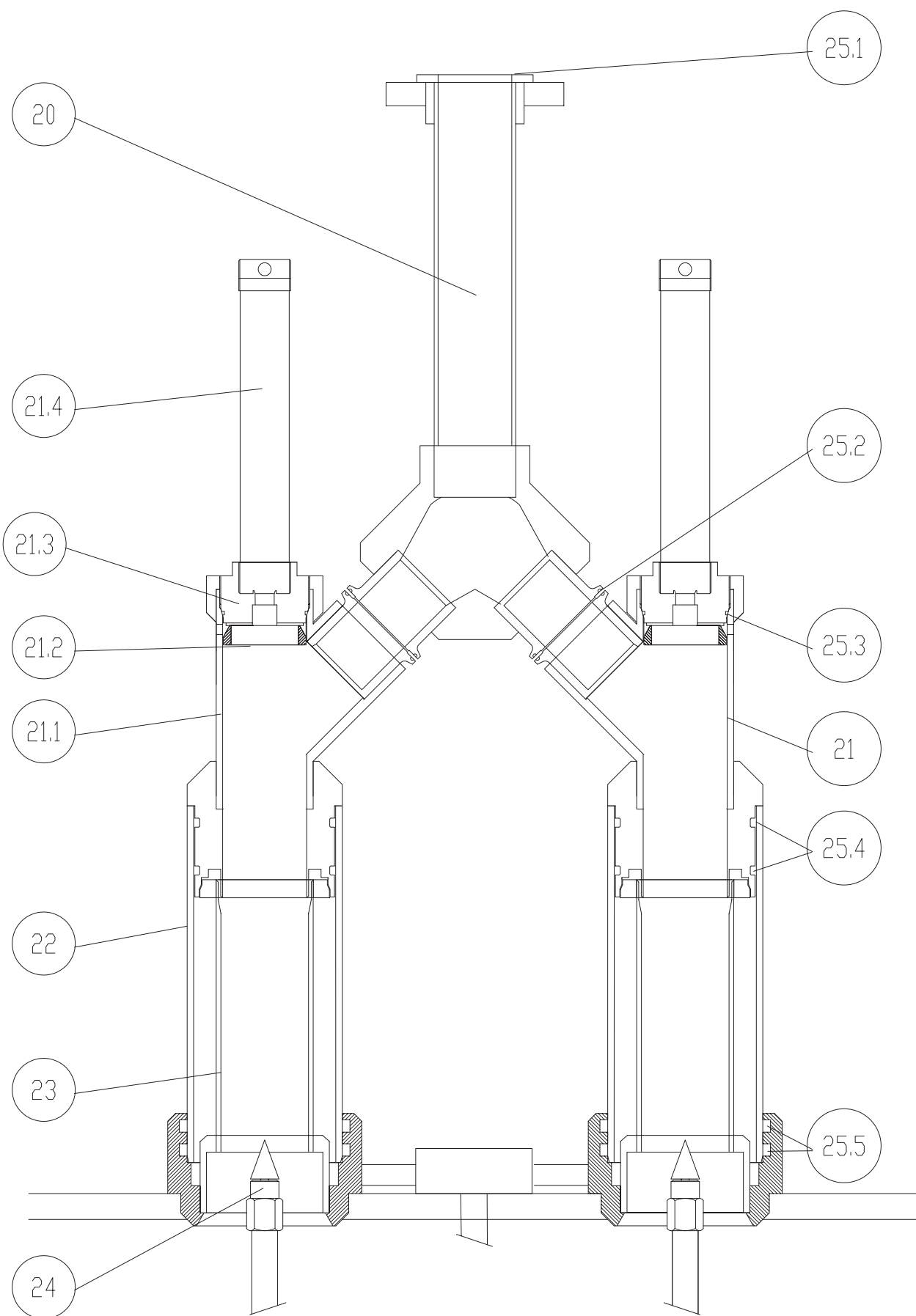
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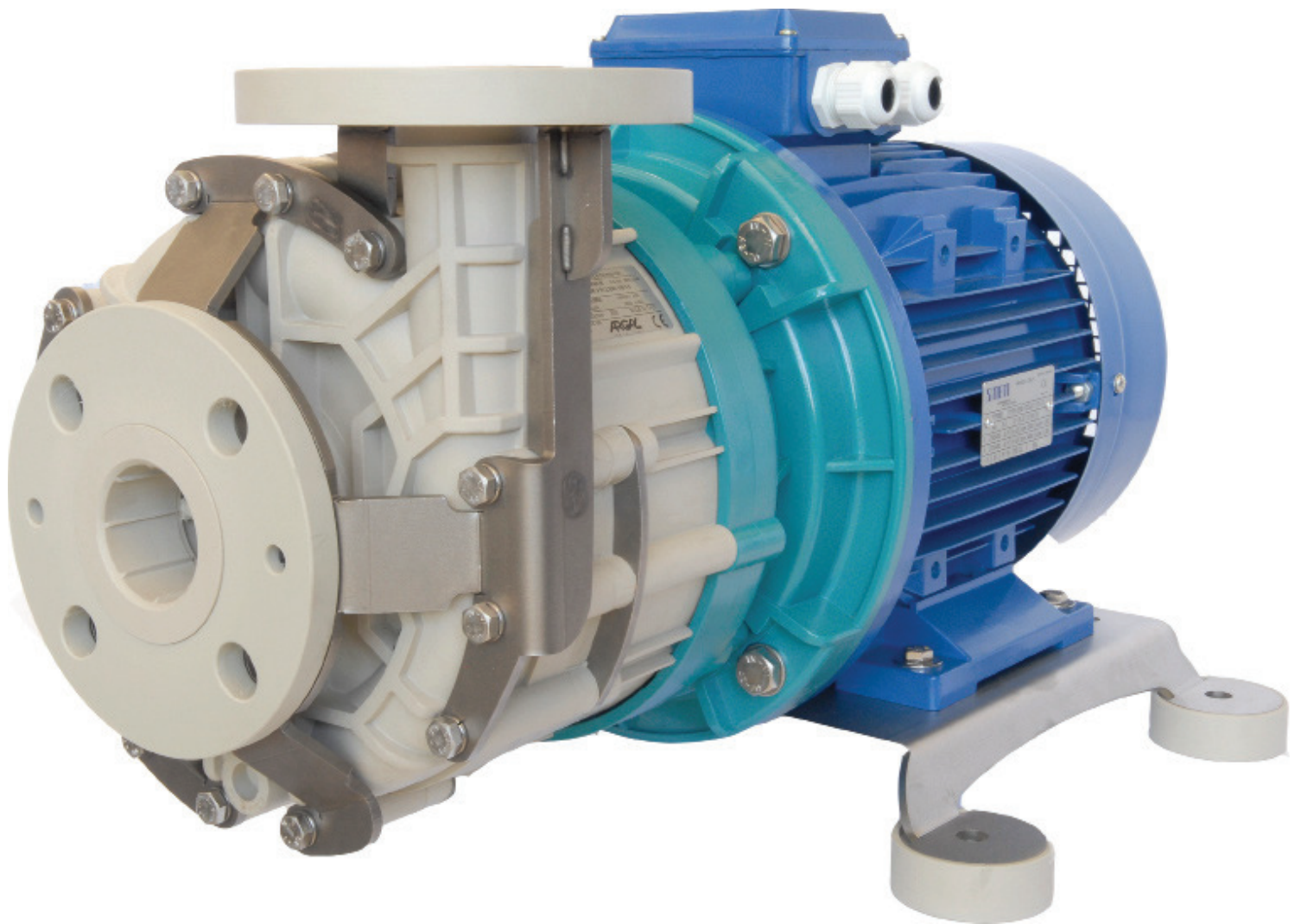


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ARGAL

USE MANUAL

TMR G3



Part number _____

DEALER

for Maintenance





date of commissioning:

position / system reference:

service:

3	– IDENTIFICATION CODE
4	– DISASSEMBLING SEQUENCE
5	– HYDRAULIC PARTS LEGEND
6	– MOTOR PARTS LEGEND
7	– GENERAL NOTES
8	– OPERATING PRINCIPLE
8	– MOTOR
9	– DRY RUNNING SURVEY
9	– INSTRUCTIONS ON INSTALLATION AND USE
9	– INSTALLATION
11	– SHUTDOWN
10	– START-UP
9	– TRANSPORT
11	– USE
11	– MAINTENANCE
11	– DISMANTLING
12	– INSPECTION
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14	– SAFETY RISKS
15	– IMPROPER USE
15	– INSTALLATION AND START-UP PERSONNEL
15	– MAINTENANCE AND OPERATIONAL PERSONNEL
15	– PERSONNEL RESPONSIBLE FOR REPAIRS
15	– WASTE DISPOSAL
16	– OPERATING FAULTS AND POSSIBLE CAUSES
17	– TECHNICAL DATA

IDENTIFICATION CODE

Pump data					Motor data		
range	model	execution (materials)		internal structure	rpm	power	phase
TMR	<input type="checkbox"/> 20.15	<input type="checkbox"/> WR (polipropilene PP)		<input type="checkbox"/> R1 (C/Al ₂ O ₃)	<input type="checkbox"/> 1450	<input type="checkbox"/> 0.18 kW	<input type="checkbox"/> 1 (monofase)
	<input type="checkbox"/> 20.20	<input type="checkbox"/> GF (etilene-cloro trifluoro etilene E-CTFE)		<input type="checkbox"/> X1 (SiC/Al ₂ O ₃)	<input type="checkbox"/> 2900	<input type="checkbox"/> 0.25 kW	<input type="checkbox"/> 3 (trifase)
	<input type="checkbox"/> 20.27	<input type="checkbox"/> GX (etilene-cloro trifluoro etilene E-CTFE) 		<input type="checkbox"/> N1 (CFF+PTFE/Al ₂ O ₃)	<input type="checkbox"/> 1740	<input type="checkbox"/> 0.37 kW	
	<input type="checkbox"/> 20.36			<input type="checkbox"/> R2 (C/SiC) 	<input type="checkbox"/> 3480	<input type="checkbox"/> 0.55 kW	voltage/EEEx
	<input type="checkbox"/> 30.15	version	connections	<input type="checkbox"/> X2 (SiC/SiC)		<input type="checkbox"/> 0.75 kW	<input type="checkbox"/> 0 (senza motore)
	<input type="checkbox"/> 30.25	<input type="checkbox"/> N normale	<input type="checkbox"/> B (BSP threaded)	<input type="checkbox"/> N2 (CFF+PTFE/SiC) 	standard	<input type="checkbox"/> 1.1 kW	<input type="checkbox"/> N (tensione STD)
	<input type="checkbox"/> 36.30	<input type="checkbox"/> P potenziata	<input type="checkbox"/> N (NPT threaded)		<input type="checkbox"/> E (IEC)	<input type="checkbox"/> 1.5 kW	<input type="checkbox"/> S (tensione speciale)
	<input type="checkbox"/> 21.18	<input type="checkbox"/> S sovrapoten.	<input type="checkbox"/> Z (ISO ANSI JIS flanged)		<input type="checkbox"/> N (NEMA)	<input type="checkbox"/> 2.2 kW	<input type="checkbox"/> E (EEX) 
	<input type="checkbox"/> 21.25					<input type="checkbox"/> 3 kW	
	<input type="checkbox"/> 21.28	O-ring	outside structure			<input type="checkbox"/> 4 kW	
	<input type="checkbox"/> 21.43	<input type="checkbox"/> V (FPM)	<input type="checkbox"/> Integral			<input type="checkbox"/> 5.5 kW	
	<input type="checkbox"/> 31.22	<input type="checkbox"/> E (EPDM)	<input type="checkbox"/> Armoured			<input type="checkbox"/> 7.5 kW	
	<input type="checkbox"/> 31.30	<input type="checkbox"/> K (FFKM)				<input type="checkbox"/> 11 kW	
	<input type="checkbox"/> 31.40						

: ATEX

Year of manufacture	Part number
---------------------	-------------

Each pump is supplied with the serial and model abbreviation and the serial number on the rating plate, which is riveted onto the support side. Check these data upon receiving the goods. Any discrepancy between the order and the delivery must be communicated immediately.

In order to be able to trace data and information, the abbreviation, model and serial number of the pump must be quoted in all correspondence.

RANGE

MODEL

PART NUMBER

clockwise rotation looking at the motor-fan




CENTRIFUGAL PUMP No. _____ Ord. No. _____

TMP 04.04P GX V R2 I E E 3 kW 0.25

PERFORMANCE RPM _____ CAPACITY _____ m³/h

HEAD _____ m

year of manufacture XXXX Via Labirinto 159 BRESCIA ITALY

   N01 Rev.1 05/2005 II 2 G T4

DISASSEMBLING SEQUENCE

TOOLS

Spanner No 13

EXECUTION NOTES

- To facilitate the pump disassembling operations, first disassembly the HYDRAULIC PARTS from the MOTOR PARTS
- unscrew the connections (POS.1)



WARNING! - The disassembly operations of parts magnetically connected involve great opposed forces: keep the MOTOR PARTS fixed on floor during the removing of the HYDRAULIC PARTS.



WARNING! - The interventions must be performed under supervision of qualified personnel.

Before starting remember:

- cut off the power supply from the motor and disconnect the electrical wiring; pull the wires out from the terminal box and isolate their extremities accordingly
- close the suction and discharge valves; open the drain valve
- use appropriate gloves, protective glasses and acid proof-clothing when disconnecting and washing the pump
- disconnect hydraulic connections: leave enough time for the residual liquid to exit the pump casing and atmospheric air to fill the empty volume
- wash the pump before starting maintenance operations
- do not scatter the washing liquid in the environment
- before attempting to dismantle the pump ensure that its motor is disconnected and that it may not be started accidentally
- before the inspection, check that you have spare O-rings ready to hand for re-installing at the end of operations



WARNING! - Operations near the magnets attract the tools. Proceed with caution to avoid damages.

For further details see paragraph "Disassembling"

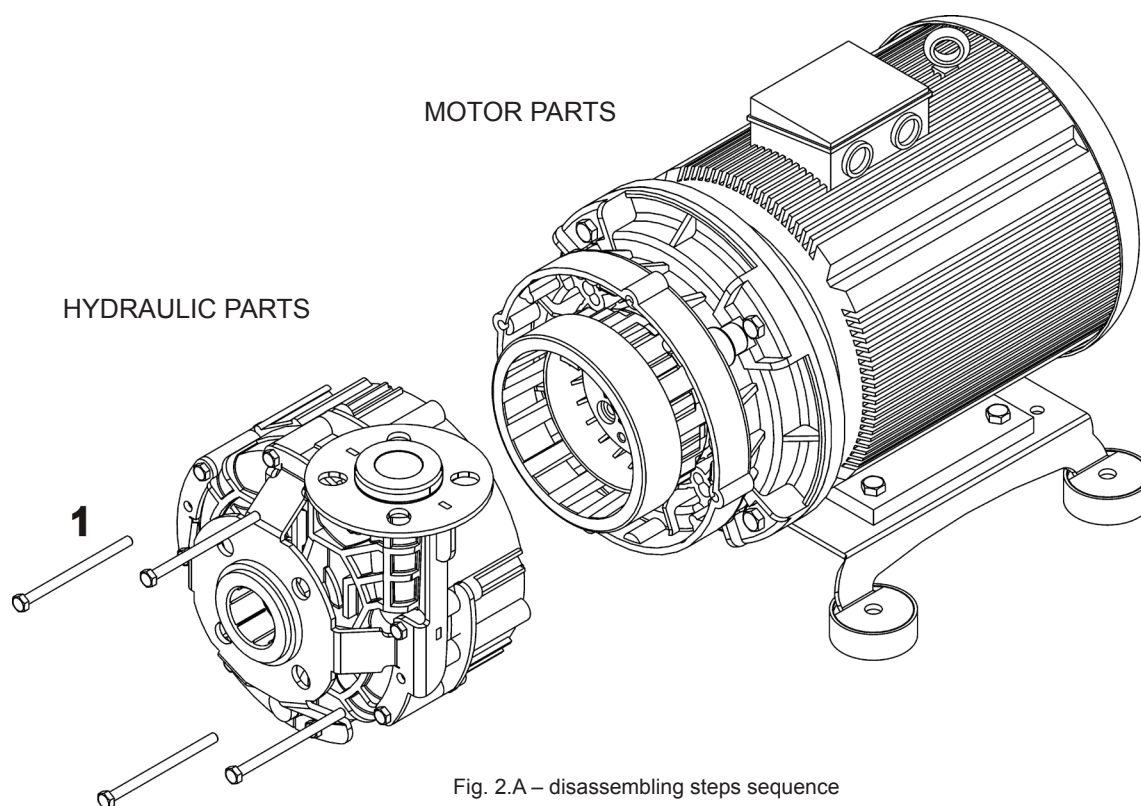


Fig. 2.A – disassembling steps sequence

note	ref	pos.	Part name	Q.ty	Disassembling steps sequence										Spare stock for working years	
					1	2	3	4	5	6	7	8	9	10	2	5
	1	910.1	Connection volute casing/strainer	4	•											

HYDRAULIC PARTS LEGEND

TOOLS

Wrench 13 mm size



EXECUTION NOTES

- **disassembly keeping the pump in vertical position (suction on top)**
- unscrew the connections (POS.2)

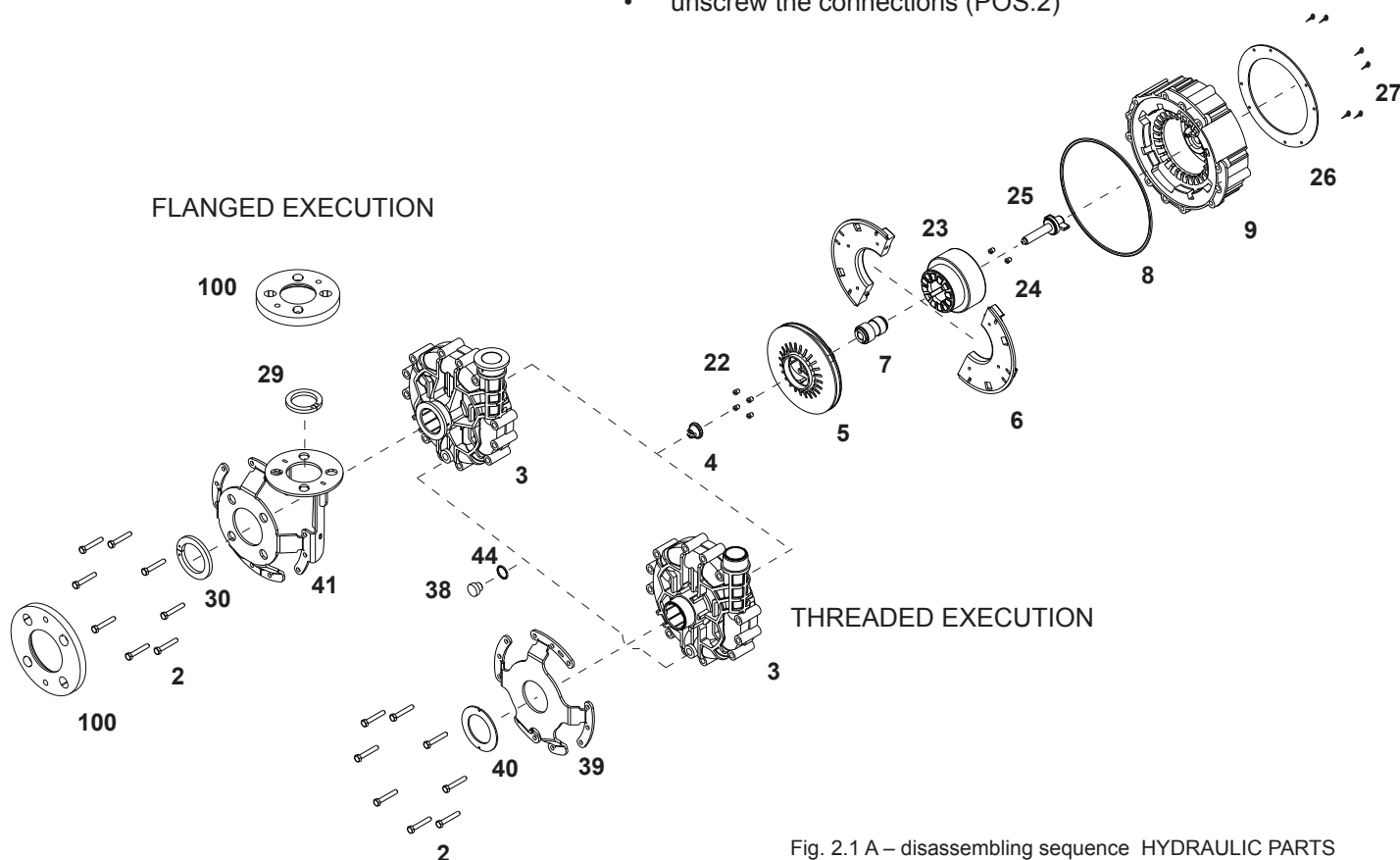


Fig. 2.1 A – disassembling sequence HYDRAULIC PARTS

note	ref	pos.	Part name	Q.ty	Disassembling steps sequence										Spare stock for working years	
					1	2	3	4	5	6	7	8	9	10	2	5
	2	910.2	Connection volute casing/rear casing	8		•										
	3	102	VOLUTE CASING	1			•									1
	4	331	FRONT THRUST BEARING	1				•							1	2
	5	233	IMPELLER	1					•						1	1
	6	134	CENTER SEMI-DISC	2					•							
	7	545	GUIDE BUSHING	1						•					1	2
	8	412	OR VOLUTE CASING	1							•				1	2
	9	162	REAR CASING	1								•				1
	22	910.3	Connection impeller / magnetic core	4				•							4	4
	23	857	MAGNETIC CORE	1					•							
	24	910.4	Connection shaft / rear casing	2							•				2	2
	25	210	SHAFT	1								•			1	1
	26	197	PLATE REAR CASING	1									•			
	27	910.5	Connection rear casing / plate	8								•				
	28	932.1	BACK SEEGER (OUTLET)	1		•										
	30	932.3	BACK SEEGER (INLET)	1		•										
	38	912	DRAIN PLUG (optional)	1	•											
	39	195.1	THREADED ARMOUR	1			•									
	40	922	LOCK NUT	1		•										
	41	195.2	FLANGED ARMOUR	1			•									
	44	412.1	OR DRAIN PLUG (optional)	1		•									1	1
	100	722.1	Outlet flange FF	1	•											
	102	722.1	Inlet flange FF	1	•											

'MOTOR PARTS LEGEND

TOOLS

- Screw driver (Phillips type)
- wrench 13 mm size
- punch $f < 4$ mm

NOTE OPERATIVE

- Unscrew the connections (POS.10)
- Remove the collar from the drive magnet assembly using the punch

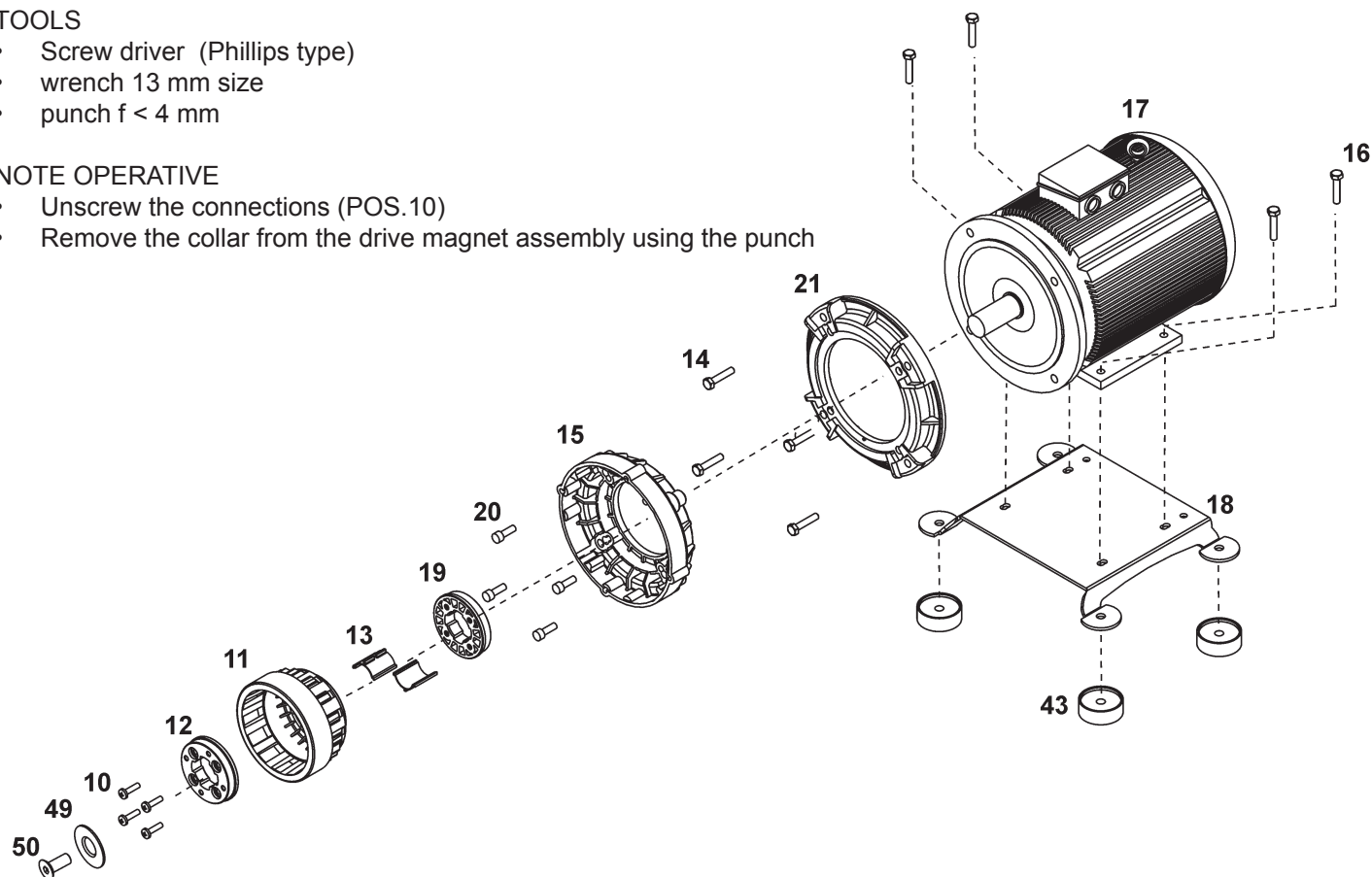


Fig. 2.2 A – disassembling sequence MOTOR PARTS

note	ref	pos.	Part name	Q.ty	Disassembling steps sequence										Spare stock for working years	
					1	2	3	4	5	6	7	8	9	10	2	5
	10	910.6	Connection drive magnet assembly / electric motor	4			•									
	11	855	DRIVE MAGNET ASSEMBLY	1				•								
	12	518.1	FRONT COLLAR (drive magnet assembly)	1					•							1
	13	523	SOCKET	2					•							2
	14	910.7	Connection bracket / electric motor	4						•						
	15	807	BRACKET	1							•					
	16	910.8	Connection electric motor / base	4								•				
	17	800	ELECTRIC MOTOR	1									•			
	18	890	BASE (optional)	1										•		
	19	518.2	BACK COLLAR (drive magnet assembly)	1					•							1
	20	910.9	Connection bracket / motor flange	4							•					
	21	334	MOTOR FLANGE	1								•				
	43	185	PACKING RING (optional)	4										•		
	49	934	SAFETY WASHER	1	•											
	50	910.10	Connection safety screw / motor shaft	1		•										

GENERAL NOTES

“TRM” pumps are designed and built for the transfer of liquid chemical products having a specific weight, viscosity, temperature and stability of state appropriate for use with centrifugal pumps in a fixed installation, from a tank at a lower level to a tank or a pipe to a higher level. The characteristics of the liquid (pressure, temperature, chemical reactivity, specific weight, viscosity, vapour tension) and the ambient atmosphere must be compatible with the characteristics of the pump and are defined upon ordering.

The pump's performance (capacity, head, rpm) is defined upon ordering and specified on the identification plate.

“TMR” and pumps are centrifugal, horizontal, single stage, coupled to a non-synchronous electric motor via a magnetic coupling, with axial inlet and radial outlet for connection to the hydraulic system. They are foot-mounted for floor fixing.

“TMR” pumps are not self priming.

R1-R2 execution “TMR” pumps with bi-directional axial alignment system (patented system) can run dry.

The liquid to be pumped must be clean for the R1-R2-N1-N2 execution, the X1-2 execution may contain solid (% , dimension and solid part hardness must be agreed during the offer).

Clockwise rotation seen from the motor side.

Make sure the chemical and physical characteristics of the liquid have been carefully evaluated for pump suitability.

Verify the compatibility with the physical-chemical characteristics of the liquid.

The specific weight that can be pumped at 25 °C (liquid and environment) referred to max flow (50 e 60 Hz) depend upon the type of construction:

standard construction N (stamped on the rating plate)	1,05	kg/dm ³
powered construction P (stamped on the rating plate)	1,35	kg/dm ³
strong-powered construction S (stamped on the rating plate)	1,80	kg/dm ³

The specific weight that can be pumped at 70°C is about 10% less than that at 25°C one.

The level of cinematic viscosity must not exceed 30 cSt so as not to significantly modify the pump's performance. Higher values up to a maximum of 100 cSt are possible provided that the pump is equipped with suitable impeller to be defined upon ordering.

The maximum continuous working temperature referred to water depends on the choice of materials (specified on the identification plate):

80 °C (176 °F)	execution WR
110 °C (230 °F)	execution GF

The ambient temperature interval is related to the choice of materials (specified on the identification plate):

0 - +40°C (14, 104 °F)	execution WR
-20 - +40°C (-4 , 104 °F)	execution GF

The maximum pressure the pump may be subjected to is 1.5 times the head value developed with the outlet closed.

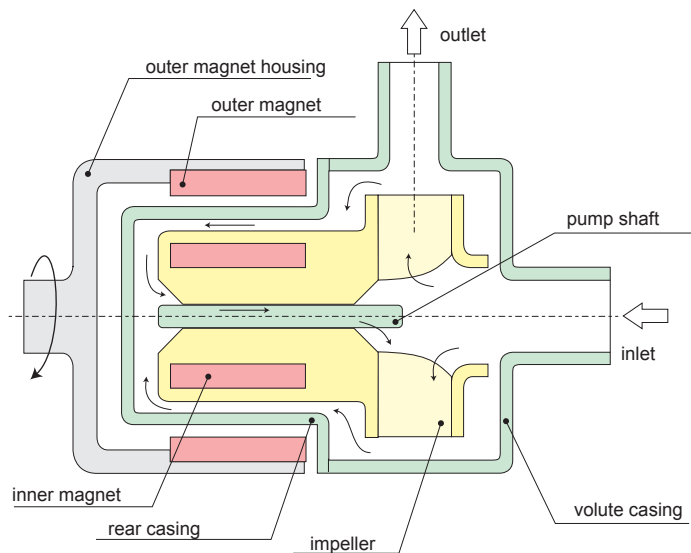
The vapour pressure value of the liquid to be pumped must exceed (by at least 1m w.c) to the difference between the absolute total head (suction side pressure added to the positive suction head, or subtracted by the suction lift) and the pressure drops in the suction side piping (including the inlet NPSHr drops shown on the specific tables).

The pump does not include any non return valve nor any liquid flow control or motor stop device.

OPERATING PRINCIPLE

HYDRAULICALLY alike to all centrifugal pumps, it is equipped with a blade-type impeller rotating within a fixed housing. It has a tangential outlet (or radial with an internal deflector) and, by creating a depression in the center, it allows the liquid to flow from the central suction side. Then, flowing through the impeller's blades, the fluid acquires energy and is conveyed towards the outlet.

MECHANICALLY different from the traditional centrifugal pumps in the impeller motion drive thanks to the magnetic field created between the primary outer magnet and the inner magnet (not visible because housed inside the impeller hub). The magnetic field crosses the plastic parts and the liquid, and firmly couples the two magnet assemblies. When the motor causes the outer magnet to rotate together with its housing, the inner magnet assembly is dragged at the same speed. As a result the impeller, which is integral to it, is maintained in rotation.



The SHAFT, totally within the housing, is not involved in the transmission of rotary motion; its only function is to act as a centering guide and support for the impeller. To this end the components are designed so that a spontaneous cooling circuit (due to a simple effect of pressure) is established to cool the surfaces subject to friction. Periodic inspections prevent the build-up of sediments between the shafts and the guide bushes significantly lengthening their working life.

MOTOR

Electrical connections

The electrical connection to the motor terminal determines the direction of rotation of the motor and can be verified by looking at the cooling fan at the rear of the motor (for the Argal pump this has to rotate clockwise looking at the front end).

With single phase motors the direction of rotation may be reversed by changing the position of the connection plates(fig.1)

With three-phase motors the direction of rotation may be changed by swapping any two of the three conductors independently of the type of connection to the windings(fig.2)

The windings of three-phase motors (e.g. with (a) 230-400 V; (b) 400-600 V) require a delta-connection for lower voltage (230 volts for a ; 400 volts for b)(fig.3)

They require a star-connection for higher voltage (400 volts for a; 690 volts for b)(fig.4)

Star/Delta starting is used when the motor power is above 7.5 kW (10 HP) only in case of frequent starts and short running times, but always when the motor power is above 15kW (20 HP). All this is also to safeguard the structure of the pump.

Protection level

The initials IP are followed by two numbers :

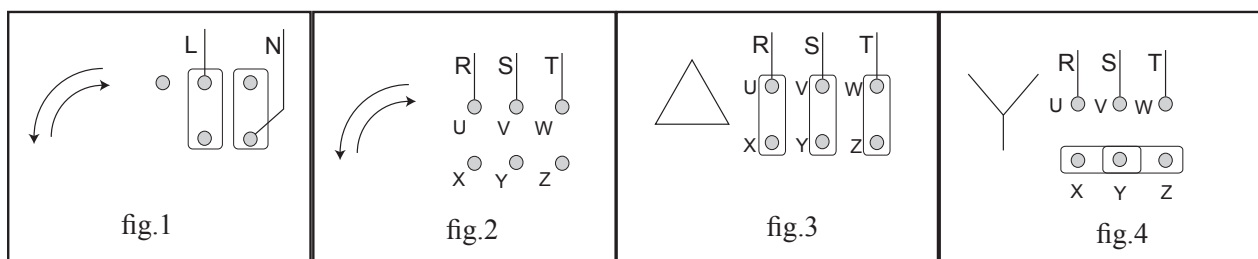
The first number indicates the level of protection against penetration of solid objects and in particular :

- 4 for solids whose dimension is greater than 1mm
- 5 for dust (eventual internal deposits will not harm operation)
- 6 for dust (no penetration)

The second number indicates the protection against the penetration of liquids. In particular:

- 4 for water sprays from all directions
- 5 for jets of water from all directions
- 6 for tidal and sea waves.

According to the IP protection indicated on the identification plate of the motor and to the environmental conditions, arrange for opportune extra protections allowing in any case correct ventilation and rapid drainage of rainwater.



DRY RUNNING SURVEY

Though the pump can run dry (execution R1-R2 with bi-directional axial alignment system), it is therefore suitable to safeguard the pump and the plant to use:

- pressure switch;
- fluxmeter;
- control devices for the motor power absorption.

INSTRUCTIONS ON INSTALLATION AND USE

TRANSPORT

- cover the hydraulic connections
- when lifting the unit do not exert force on the plastic fittings
- lay the pump on its base or fixing plate during transport
- if the road is particularly rough, protect the pump by means of adequate shock absorbing supports
- bumps and shocks may damage important working parts vital for safety and functionality of the machine

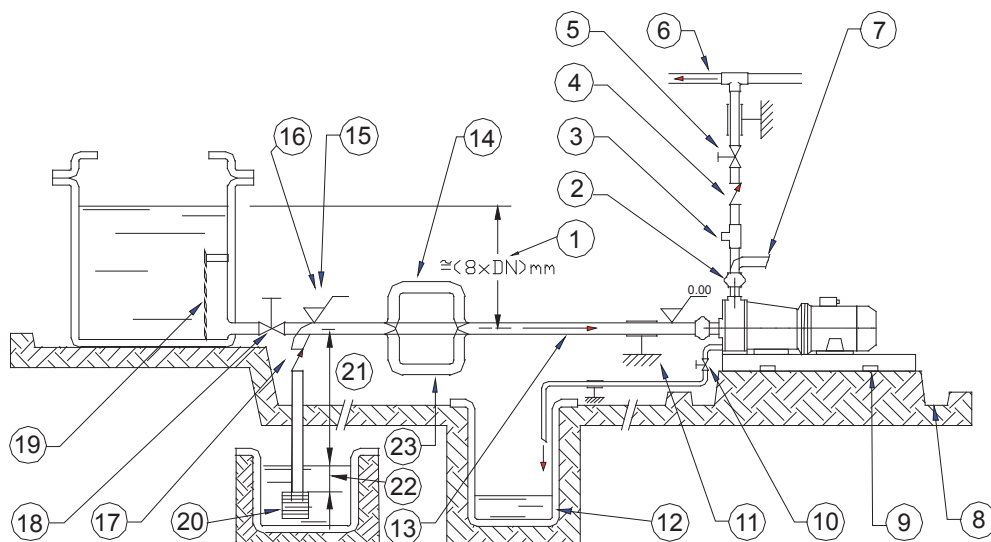
INSTALLATION

clean the plant before connecting the pump

make sure that no foreign bodies are left in the pump. Remove safety caps on the hydraulic connections.

follow the instructions indicated in the following diagram:

- 1) Suction head varies according to flow in order to prevent windage (min. 0.5 m, max. 15% of pump head)
- 2) YES: expansion joint (indispensable with long pipes or hot liquids) and/or anti-vibration facility during discharge and suction; anchored near to pump
- 3) YES: attachment for gauge or safety pressure switch
- 4) YES: check value (especially for long vertical or horizontal pipes; compulsory with parallel pumps).
- 5) YES: adjusting gate valve on outlet
- 6) speed of delivered fluid: 3.5 m/s max. .
- 7) NO: elbow joints (and other parts) on the pump (discharge and suction lines)
- 8) YES: drainage channel around base
- 9) Fix the pump by the fixing holes provided: the supports must be level
- 10) YES: pipe discharge (completely sealed), discharge valve shut during normal operations
- 11) YES: pipe fixing parts
- 12) YES: discharge collection well (does not leak)
- 13) Fluid speed suction: 2.5 m/s
- 14) NO: air pockets: the circuit must be short and straight
- 15) With positive head: tilt of piping towards pump
- 16) With negative suction lift: tilt of piping towards suction tank
- 17) YES: check vale (with negative suction lift)
- 18) YES: gate valve (may also be near pump in the case of long piping)
- 19) YES: strainer (3-5 mm mesh)
- 20) YES: strainer (3-5 mm mesh)
- 21) Suction head, 3 m max. (with check valve 17 plus inlet pipe and pump totally flooded)
- 22) Immersion depth: 0.3 m min.
- 23) YES: overcoming obstacles at lower depths.



- anchor the pump to an adequate base plate having a mass at least 5 times that of the pump
- do not use anti-vibration mounts to fix the pump
- anti-vibration joints are recommended on the pipe connections
- manually verify that all rotating parts are free to turn without abnormal friction by turning the motor cooling fan
- make sure that the power supply is compatible with the data shown on the pump motor identification plate
- connect the motor to the power supply via a magnetic/thermal control switch
- ensure that star-delta starting is implemented for motors whose power is more than 15kW
- install emergency stop devices to switch off the pump in case of low liquid level (floating, magnetic, electronic, pressure-sensitive)
- ambient temperature as a function of the physical-chemical characteristics of the liquid to be pumped and in any case not greater or lower than the interval indicated in the GENERAL HINTS
- other environmental conditions in accordance with the IP protection of the motor
- install a drainage pit to collect any liquid overflow from the base drainage channel due to normal maintenance work
- leave enough free space around the pump for a person to move
- leave free space above the pump for lifting operations
- highlight the presence of aggressive liquids with coloured tags following the local safety regulations
- do not install the pump (made in thermoplastic material) in close proximity to heating apparatus
- do not install the pump in areas subject to solid or liquid matter falling
- do not install the pump in an explosive atmosphere unless the motor and its coupling have been adequately pre-arranged
- do not install the pump in close proximity to workplaces or crowded areas
- install extra protection guards for the pump or persons as the need arises
- install a spare equivalent pump in parallel

START-UP

- verify that the instructions outlined in the INSTALLATION have been followed
- verify that fixing elements(screws and bolts) are closed
- verify the correct direction of rotation (clockwise from the motor side) supplying the motor with short impulses
- ensure that the NPSH available is greater than that required by the pump (in particular for hot liquids, liquids with high vapour pressure, very long suction pipes or negative suction lift)
- close the drain valve (pos. 19); totally flood the suction pipe and the pump
- start the pump with the suction valve completely open and the discharge valve partially closed
- slowly regulate the flow by opening or closing the discharge valve (never the suction valve). Make sure that the power absorbed by the motor does not exceed the rated one indicated on the motor identification plate
- do not operate the pump at the limit values of its performance curve: maximum head (discharge valve excessively closed) or maximum capacity (total absence of drops and geodetic head on the discharge side)
- set the operating point to that for which the pump was requested
- ensure that there are no abnormal vibrations or noise due to inadequate mounting or cavitation
- avoid short and/or frequent starts by properly setting the control devices

Motor power kW;	0,75÷7,5	11÷22	30÷45	55÷315
Max. no. starts/hour 2 - 4 pole;;	20 - 40	10 - 20	6 - 12	2 - 4



• ensure that the temperature, pressure and liquid characteristics are as those specified at the time of order.
WARNING!!! At the start-up be sure that all the internal hydraulic parts are not in CCW rotation (the cooling fan of the motor must stand or CW rotate), to prevent decoupling among magnetic driven parts of the pump; if the CCW rotation is due to the feed-back of the liquid in the discharge side, add a no-return valve in the plant.

USE

- switch automatic control on
- do not activate valves whilst the pump is in operation
- risks of dangerous water hammer effects in case of sudden or improper valve actuation (only trained personnel should operate valves)
- completely empty and wash the pump before using a different liquid
- isolate or empty the pump if the crystallization temperature of the liquid is the same or lower than the ambient temperature
- stop the pump if the liquid temperature exceeds the maximum allowed temperature indicated in the general notes; if the increase is of approximately 20%, check internal parts
- close the valves in case of leaks
- wash with water only if compatible from the chemical point of view. As alternative use an appropriate solvent that will not generate dangerous exothermal reactions
- contact the liquid supplier for information on the appropriate fire precautions
- empty the pump in case of long periods of inactivity (in particular with liquids which would easily crystallize)

SHUTDOWN

- disconnect the motor
- before starting maintenance, turn off the suction and discharge valves

MAINTENANCE

- all these maintenance operations must be performed under the supervision of qualified personnel
- make periodic inspections (2 to 6 months depending on the type of liquid and the operating conditions) on the rotating parts of the pump; clean or replace as necessary
- make periodic inspections (3 to 5 months depending on the type of liquid and the operating conditions) on the functionality of the motor control system; efficiency must be guaranteed
- make periodic inspections (2 to 30 days depending on the type of liquid and the operating conditions) of the in-line and foot filters as well as of the bottom valve
- the presence of liquid below the pump could be a clue to pump problems
- excessive current consumption could be an indication of impeller problems
- unusual vibrations could be due to unbalanced impeller (due to damage or presence of foreign material obstructing its blades)
- reduced pump performance could be due to an obstruction of the impeller or damages to the motor
- motor damages could be due to abnormal friction within the pump
- damaged parts must be replaced with new original parts
- the replacement of damaged parts must be carried out in a clean dry area

DISMANTLING

- Tools required: socket spanner 13-17-19 size, screw driver, punch < 4mm.
- Bolts have right-hand thread
- all these maintenance operations must be performed under supervision of qualified personnel
- cut off the power supply from the motor and disconnect the electrical wiring; pull the wires out from the terminal box and isolate their extremities accordingly
- close the suction and discharge valves and open the drain valve
- use gloves, safety glasses and acid-proof overalls when disconnecting and washing the pump
- disconnect the piping and leave enough time for the residual liquid to exit the pump body and atmospheric air to fill the empty volume
- wash the pump before carrying out any maintenance work
- do not scatter the liquid in the environment
- before attempting to dismantle the pump ensure that its motor is disconnected and that it may not be started accidentally
- before the inspection, check that you have spare O-rings ready to hand for re-installing at the end of operations



WARNING! operations near the magnet attract the tools. Proceed with caution to avoid damage.

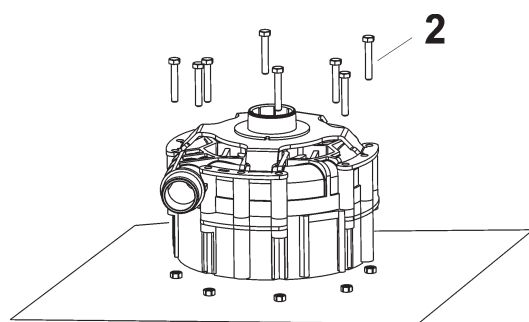


Fig. 9.1 A

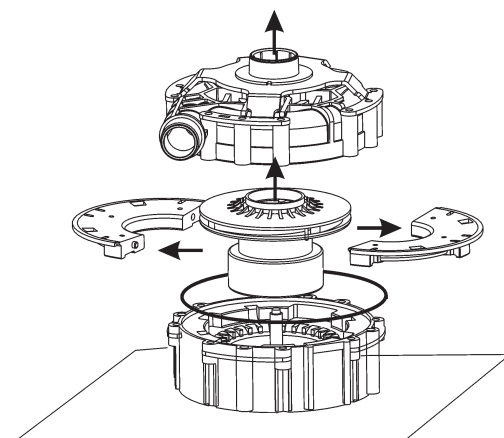


Fig. 9.1 B

- As described on paragraph no. 2 “Disassembling sequence”, unscrew the connections (POS.1) and remove the HYDRAULIC PARTS from the MOTOR PARTS
- Proceed separately to disassembly the HYDRAULIC PARTS or the MOTOR PARTS following the sequence described on paragraph no. 2 “ Disassembling sequence ”.



WARNING! The disassembly operations of parts magnetically connected involve great opposed forces: keep the MOTOR PARTS fixed on floor during the removing of the HYDRAULIC PARTS

- to facilitate the disassembly operations keep the pump in vertical position (suction on top) Fig. 9.1 A



WARNING! During the disassembly of the hydraulic parts do not bump the guide components



WARNING! After the dismantling of the pump casing extract together the impeller and the central disc; extract avoiding radial movements Fig. 9.1 B



WARNING! Before separating the impeller assembly (Fig. 9.1 C - POS. 5) from magnetic core (Fig. 9.1 C - POS. 23), unscrew the 4 plastic lock screws (Fig. 9.1 C - POS.22)

- Armour Dismantling :



WARNING! The volute casing must be already separated from other HYDRAULIC

- for the flanged execution, first disassemble the inlet and outlet seeger (Fig.9.1 D – POS. 29, 30),second rotate the flanged armour with the purpose to disage the inlet end outlet as described in the (Fig. 9.1 D)
- for the threaded execution unscrew the lock nut and disage the armour (FIG.9.1 E – POS.40)
- disassembly the MOTOR PARTS: unscrew the 4 screws inside the drive magnet assembly, POS. 10 in Fig. 9.1 F



WARNING! During the use of screw driver inside the drive magnet assembly you must oppose the magnetic attraction



WARNING! After unscrewing the 4 screw ((POS. 10 in Fig. 9.1 F)) insert the punch $\varnothing < 4\text{mm}$ in one of two extraction holes to remove the collar (POS.19 in Fig. 9.1 G) from the back and to allow the removing of the drive magnet assembly, sockets and collar (Fig. 9.1 H) from the motor shaft.

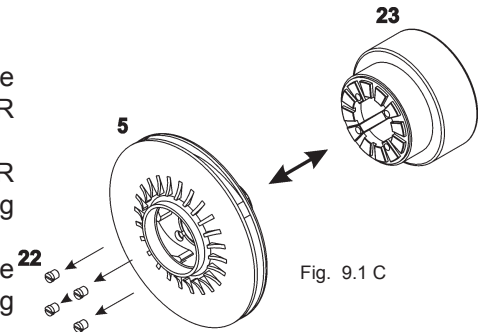


Fig. 9.1 C

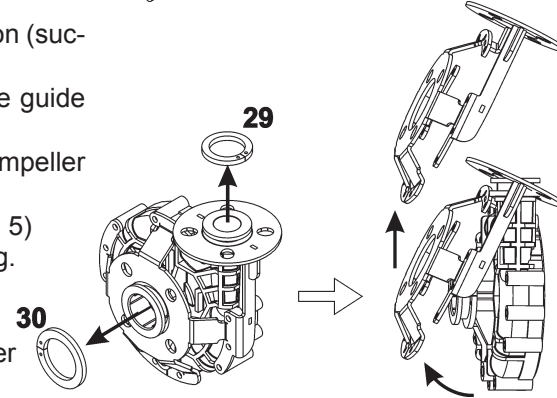


Fig. 9.1 D

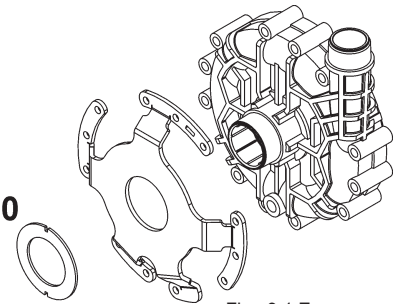


Fig. 9.1 E

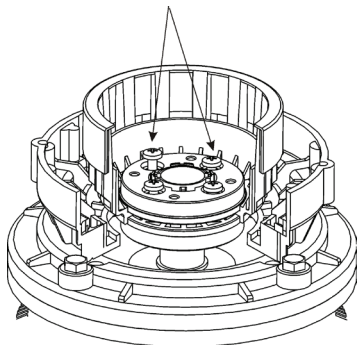


Fig. 9.1 F

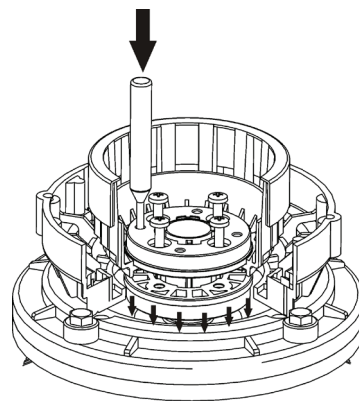


Fig. 9.1 G

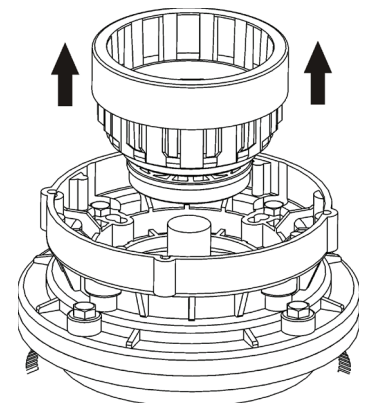


Fig. 9.1 H

INSPECTION

Check:

- the pump shaft for cracks and excessive wear
- guide bushing for excessive wear(@ 5 %)
- counterthrust bushing for cracks or excessive wear
- pump shaft clutch
- that the guide bushing cooling circuit is not blocked
- the impeller, volute and rear chamber for abrasion and corrosion
- that the pressure balancing holes on the impeller blades are not blocked
- for lumps and clusters created by the pumped liquid (especially at the bottom the rear chamber)
- for infiltration of liquid into the chamber containing the inner magnets
- abrasions on the outside surface of the reinforcement chamber due to scratching of the outer magnets

Replace broken, cracked or deformed parts.

Reopen all the blocked pipes and eliminate any chemical agglomeration.

Clean all the surfaces before re-assembly, especially the O-ring seats (risk of drip leaks).

ASSEMBLY

Tools required: size 10-13 socket spanner, screw driver (Phillips drive type)

Bolts have right-hand thread

Bolt torque setting:

M4 M6 M8 M10 M12

(reduce by 25% on plastic parts) Nm 4 14 24 25 40

- all these maintenance operations must be performed under supervision of qualified personnel
- before the inspection, check that you have spare o-ring ready to hand for re-installing at the end of operations
- Proceed separately to disassembly the HYDRAULIC PARTS or the MOTOR PARTS following the backward sequence described on paragraph no. 2 "Disassembling sequence".



WARNING! Assemble the hydraulic parts to the motor parts only after the complete assembling of these two sub-assembly groups

- assembling the hydraulics and the motor parts, oppose the magnetical force keeping the hydraulic parts by the inlet and the outlet connectors
- insert the correct sockets couple (see APPENDIX-A), take care that the groove placed between the socket keys is fitted in the drive magnet assembly, this placement guarantee the correct assembling and the unfitting of the sockets. (Fig. 9.3 A)
- the correct placement of the drive magnet assembly is explained in APPENDIX – A
- insert the collars in the drive magnet assembly tang, see the explanation in Fig. 9.3 B for the correct placement



WARNING! Don't reverse the collars; in the collar POS.19 are visible the brass nuts

- insert the 4 screws in the sites



WARNING! Don't crew completely the 4 before fitting the drive magnet assembly on motor

- insert the assembly group (drive magnet assembly, sockets, collars) on motor shaft
- Check that during fitting of the assembly group the position between the sockets and the drive magnet assembly is unchanged (see APPENDIX –A), screw the 4 screws repeating the sequence E1, E2, E3, E4 (Fig. 9.3 C) applying a torque ≥ 6 N m
- fit the bushing POS.7 (cfr. 2.1 pag. 3) in the impeller as explained in Fig. 9.3 D
- before the fitting take care to align the bushing radial grooves with the key placed in the impeller



WARNING! During the bushing fitting the ambient temperature must be up to 20°C, otherwise eat the impeller at about 40 °C

- during the fitting operation don't hit the bushing
- fit the impeller assembly in the magnetical core
- before fitting align the 4 radial grooves placed on the impeller POS. 5 with the 4 keys placed in the internal diameter of the magnetical core
- after checking that the fitting is well done, insert the 4 plastic screws POS. 22
- assemble the impeller with the semi-disks pos.6 as explained in Fig. 9.3 F
- insert the group (impeller + semi-disks) in the rear casing, during this operation take care of the guide system components, these components are made of materials witch fear hits.
- Insert the o-ring in the site and fit the 8 screws POS. 2 (cfr. 2.1 pag. 3)
- Assemble the motor parts with the hydraulic parts, assembling the hydraulics and the motor parts, oppose the magnetical force keeping the hydraulic parts by the inlet and the outlet connectors

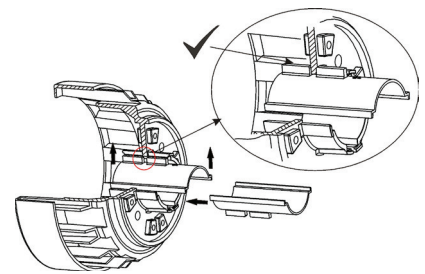


Fig. 9.3 A

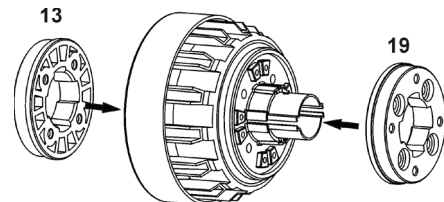


Fig. 9.3 B

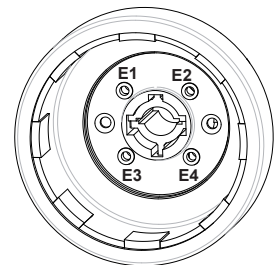


Fig. 9.3 C

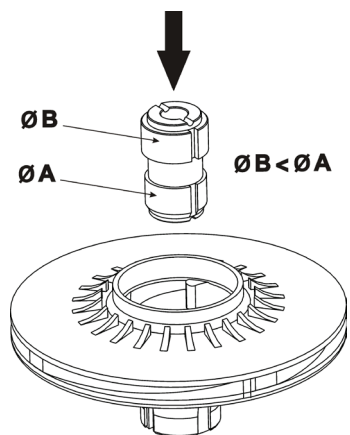


Fig. 9.3 D

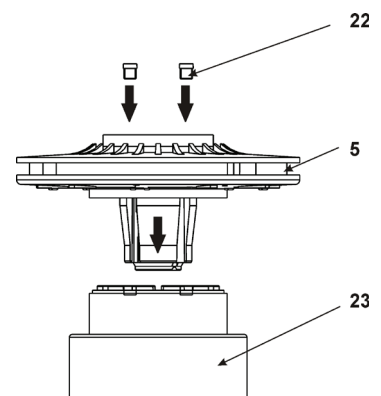


Fig. 9.3 E

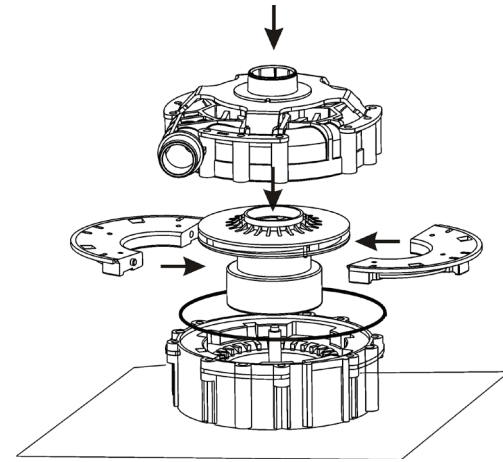


Fig. 9.3 F

SAFETY RISKS



WARNING! MAGNETIC FIELDS. Magnetic pumps contain some of the most powerful magnets in existence. The magnets are positioned on the back of the impeller and the outer magnet housing. The magnetic fields may adversely affect persons fitted with electronic devices (e.g. pacemakers and defibrillators): such persons must not be allowed to handle magnetic pumps and magnetic pump components.



WARNING! MAGNETIC FORCE. Exercise extreme caution and follow instructions carefully during pump assembly/dismantling. Magnetic force attract (cause insertion of) internal and magnetic units, and are therefore a potential source of injury to fingers and hands.



WARNING! CHEMICAL HAZARD. The pumps are designed to pump different types of liquid and chemical. Follow the specific instructions to decontaminate during inspection or maintenance. §



WARNING! Safety risks for personnel mainly arise from improper use or accidental damages. These risks may be of an electrical nature as far as the non-synchronous motor is concerned and may cause injury to hands if working on an open pump. Risks may also arise due to the nature of the liquids pumped. It is therefore of utmost importance to closely follow all the instructions contained in this manual so as to eliminate the causes that may lead to pump failure and the consequent leakage of liquid dangerous for both personnel and the environment.

Risks may also arise from improper maintenance or dismantling practices.

In any case five general rules are important:

- A - all services must be carried out by specialised personnel or supervised by qualified personnel depending on the type of maintenance required
- B - install protection guards against eventual liquid sprays (when the pump is not installed in remote areas) due to an accidental pipe rupture. Arrange for safety basins to collect possible leakage
- C - when working on the pump always wear acid-proof protective clothing
- D - arrange for proper conditions for suction and discharge valve closing during disassembly
- E - make sure that the motor is completely disconnected during disassembly.

Proper design and building of the plants, with well positioned and well marked piping fitted with shut-off valves, adequate passages and work areas for maintenance and inspections are extremely important (since the pressure developed by the pump could give some kind of damage to the plant in case this one should be faulty made or wear and tear-damaged).

It must be stressed that the major cause of pump failures leading to a consequent need to intervene is due to the pump running dry in manually operated plants. This is generally due to:

- the suction valve being open at start-up or
- the suction tank being emptied without stopping

INSTALLATION AND START-UP PERSONNEL

Interventions allowed only to specialised personnel who may eventually delegate to others some operations depending on specific evaluations (technical capability required: specialisation in industrial plumbing or electric systems as needed).

MAINTENANCE AND OPERATIONAL PERSONNEL

Interventions allowed to general operators (after training on the correct use of the plant):

- pump starting and stopping
- opening and closing of valves with the pump at rest
- emptying and washing of the pump body via special valves and piping
- cleaning of filtering elements

Interventions allowed to qualified personnel (technical capacities required: general knowledge of the mechanical, electrical and chemical features of the plant being fed by the pump and of the pump itself):

- verification of environmental conditions
- verification of the condition of the liquid being pumped
- inspections of the control/stop devices of the pump
- inspections of the rotating parts of the pump
- trouble shooting

PERSONNEL RESPONSIBLE FOR REPAIRS

Interventions allowed to general operators under the supervision of qualified personnel:

- stopping of the pump
- closing of the valve
- emptying of pump body
- disconnection of piping from fittings
- removal of anchoring bolts
- washing with water or suitable solvent as needed
- transport (after removal of electrical connections by qualified personnel)

Interventions by qualified personnel (technical capacities required: general knowledge of machining operations, awareness of possible damage to parts due to abrasion or shocks during handling, know-how of required bolt and screw tightening required on different materials such as plastics and metals, use of precision measuring instruments):

- opening and closing of the pump body
- removal and replacement of rotating parts

WASTE DISPOSAL

Materials: separate plastic from metal parts. Dispose of by authorized companies.

IMPROPER USE

The pump must not be used for purposes other than the transfer of liquids.

The pump cannot be used to generate isostatic or counter pressures.

The pump cannot be used to mix liquids generating an exothermal reaction

The pump must be installed horizontally on a firm base.

The pump must be installed on a suitable hydraulic plant with inlet and outlet connections to proper suction and discharge pipes.

The plant must be able to shut off the liquid flow independently from the pump.

Handling of aggressive liquids requires specific technical knowledge

OPERATING FAULTS AND POSSIBLE CAUSES

Pump does not deliver:

- 1.rotates in wrong direction
- 2.suction pipe is excessively long and tortuous
- 3.insufficient geodetic pump head or excessive suction geodetic lift
- 4.air infiltration into the suction pipe or branches
- 5.pump or suction pipe not completely covered by liquid
- 6.impeller channels blocked by impurities
- 7.check valve on discharge pipe jammed
- 8.geodetic system height is greater than maximum potential pump head
- 9.impeller jammed by considerable layer of crystals or by melting of materials for dry rotation.
- 10.bottom valve blocked by mud or other debris
- 11.bottom valve insufficiently immersed
- 12.bottom valve faulty, thereby causing suction valve to empty when pump stops
- 13.magnets release a much greater specific weight and flow rate of liquid than planned
- 14.the magnets release due start-up made while impeller is CCW moving (feed-back of the liquid in the discharge side)

Pump discharge rate or pressure insufficient:

see 01, 02, 03, 04, 05, 06, 10, 11, 12, 13

- 15.system's resisting head is greater than expected
- 16.suction pipe, closing valve and other items have an insufficient nominal diameter
- 17.small geometric pump suction head
- 18.damaged or worn impeller
- 19.liquid viscosity greater than expected
- 20.excessive quantities of air or gas in liquid
- 21.elbow joints, check valves or other items on the outlet port
- 22.liquid (especially if hot) with tendency to change into gaseous state

Pump absorbs too much power:

see 19

- 23.pump operates at greater capacity than expected
- 24.specific weight of liquid is greater than expected
- 25.impurities inside pump create abnormal wear
- 26.electric motor supply voltage is not rated voltage

Pump vibrates and is noisy:

see 25

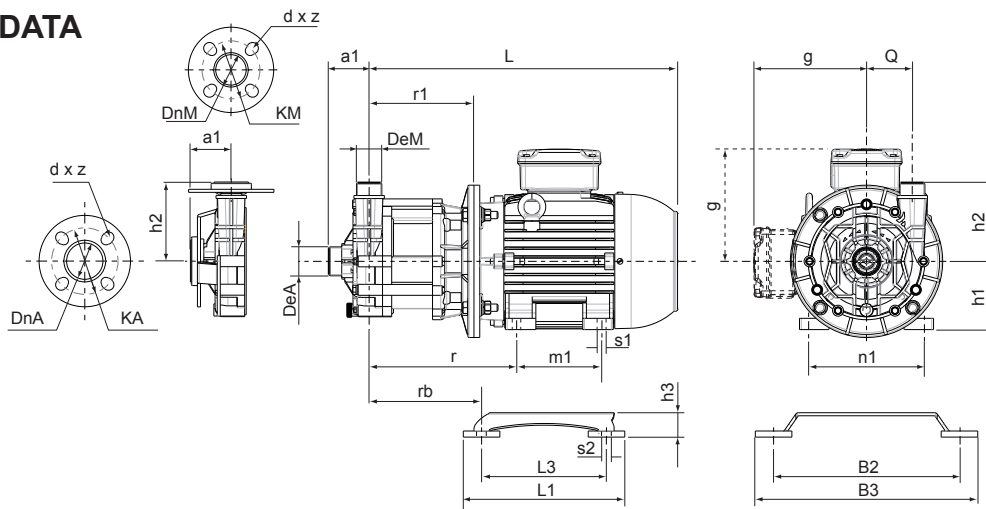
- 27.operates at full capacity (no head)
- 28.pump or pipes inadequately fixed
- 29.eccentric impeller operation because of worn bushes

Pump's internal parts wear out too quickly:

see 25

- 30.liquid excessively abrasive
- 31.recurring cavitation problems (see. 02, 15, 19, 17)
- 32.high tendency of liquid to crystallise or polymerise when pump is not operating.
- 33.pump made of materials that are unsuitable for pumped liquid
- 34.operation with capacity too reduced

TECHNICAL DATA



model			IEC frame	DnA	DnM	DeA	DeM	KA iso / ansi / jis	KM iso / ansi / jis	d x z iso / ansi / jis	a1	L(')	Q	h1	h2	r	r1	rb	m1	n1	s1	g(')	L3	B2	S2	L1	B3	h3
20.15	N	90L	50 - 2"	40 - 1" ½	2"	1" ½	125 / 121 / 120	110 / 98 / 105	18 x 4 / 16 - 19 x 4 / 19 x 4	70	96	160	469	90	244	188	200	125	140	8	142	185	248	14	245	308	55	
	P	100L											512	100		261	198	210	160	155	205	305	265		365			
	S	112M											521	112		268		217	190	168								
20.20	N	100L											512	100		261		210	160	155						205		305
	P	112M											521	112		268	217	190	168									
	S	132SA											578	132		307	218	235	216	181	263	359	333		429			
20.27	N	112M											521	112		268	198	217	140	190	10	168	205		305	265		365
	P	132SA											578	132		307	218	235	216	181	263	359	333		429			
	S	132SB																										
20.36	N	132SA																								456		248
	P	132SB																										
	S	160MA																										
30.15	N	112M											521	112		268	198	217	140	190	10	168	205		305	265		365
	P	132SA											307	218		235	216	181		263		359	333		429			
	S	132SB																										
30.25	N	132SA																	578		132					456		248
	P	132SB																										
	S	160MA																										
36.30	N	132SB											578	132		307	218	235	140	216	10	181	263		359	333		429
	P	160MA											456	248		266	210	254	14	215	335	405	265		365			

model			IEC frame	DnA	DnM	DeA	DeM	KA iso / ansi / jis	KM iso / ansi / jis	d x z iso / ansi / jis	a1	L(')	Q	h1	h2	r	r1	rb	m1	n1	s1	g(')	L3	B2	S2	L1	B3	h3					
21.18	N	100L	50 - 2"	40 - 1" ½	2"	1" ½	125 / 121 / 120	110 / 98 / 105	18 x 4 / 16 - 19 x 4 / 19 x 4	70	96	160	512	100	261	198	210	140	160	10	155	205	305	14	265	365	55						
	P	112M											521	112			268		217		190							168	265	365			
	S	132SA											578	132			307		218		235							216			181	263	359
21.25	N	112M											521	112		268	198	217	216	10	168	205	305		265	365							
	P	132SA											578	132		307	218	235										216	181	263	359	333	429
	S	132SB																															
21.28	N	132SA																	456	248	266	210	254		14	215							
	P	132SB																															
	S	160MA																															
21.43	N	132SB											578	132		307	218	235	140	216	10	181	263		359	333		429					
	P	160MA											456	248		266	210	254	14	215	335	405	265		365								
	S																																
31.22	N	132SA																								578		132	307	218	235	140	216
	P	132SB																															
	S	160MA																															
31.30	N	132SB											578	132		307	218	235	140	216	10	181	263		359	333		429					
	P	160MA											456	248		266	210	254	14	215	335	405	265		365								
	S																																
31.40	N	160MA																								160		456	248	266	210	254	14
	P																																
	S																																

(1) can change for motors of different brands

dimension in mm

MANUFACTURER DATA



Production head and legal office:
Via Labirinto, 159 I - 25125 BRESCIA
Tel: 030 3507011 Fax: 030 3507077

Administration:	Tel: 030 3507019
Export manager:	Tel: 030 3507022
Customer service:	Tel: 030 3507025
Web:	www.argal.it
E-mail:	sales@argal.it

CONTRACTUAL DATA	
medium -----	
conc. % -----	temperature °C -----
capacity m ³ /h -----	head m -----

w.o.	

<input type="text"/>	<input type="text"/>
<input type="text"/>	<input type="text"/>

REV. 14 - 02/13

The INSTRUCTION MANUAL must be delivered to the pump-user , who takes diligent note of it, fills in data for Maintenance Department (page 1), keeps the file for subsequent reference. Possible modifications do not imply updating of the existing manuals

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Level



Pressure



Flow



Temperature



Liquid
Analysis



Registration



Systems
Components



Services



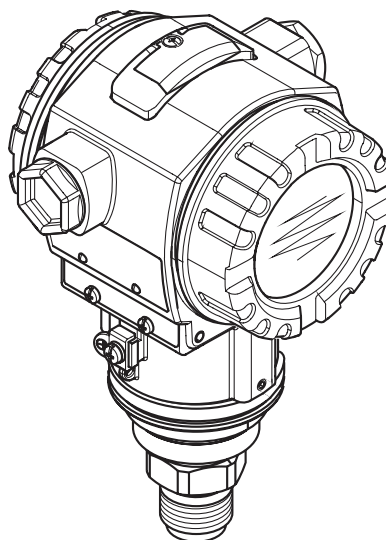
Solutions

Brief Operating Instructions

Cerabar S

PMC71, PMP71, PMP72, PMP75

Process pressure measurement



These are Brief Operating Instructions.

For more detailed information, please refer to the Operating Instructions and the additional documentation on the CD-ROM provided.

These Brief Operating Instructions are not intended to replace the Operating Instructions provided in the scope of supply.

The complete device documentation consists of:

- these Brief Operating Instructions
- a CD-ROM with:
 - the Operating Instructions
 - Technical Information

KA1019P/00/EN/06.09
71095440

Endress+Hauser 

People for Process Automation

3 Wiring



Warning!

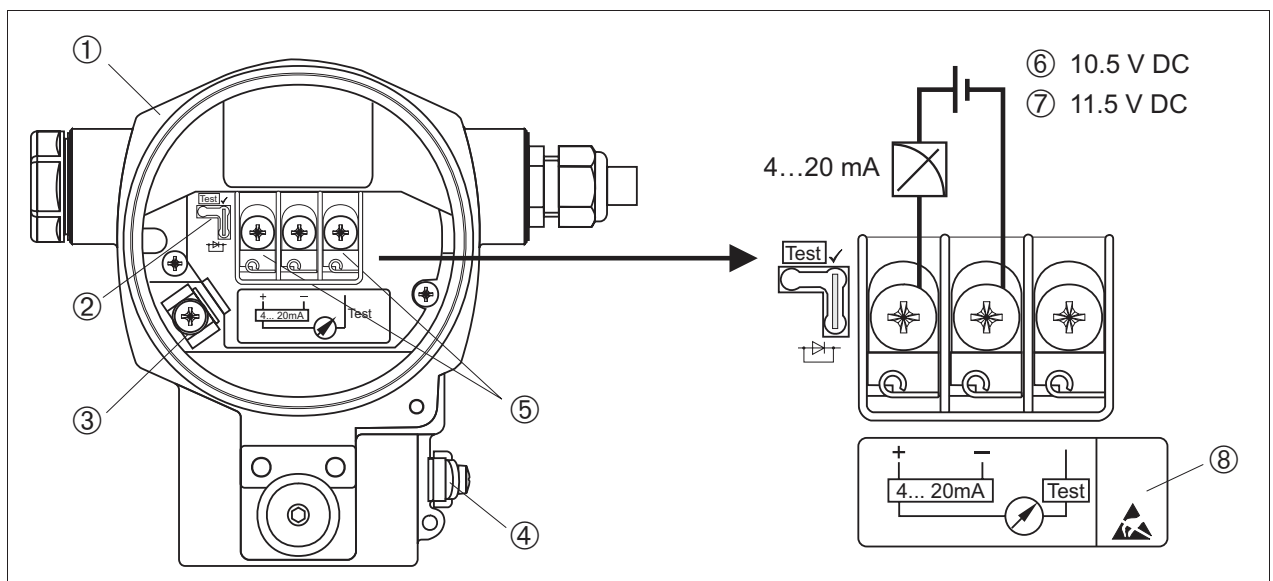
- When using the measuring device in hazardous areas, installation must comply with the corresponding national standards and regulations and the Safety Instructions or Installation or Control Drawings.

3.1 Connecting the device



Note!

- Devices with integrated overvoltage protection must be earthed.
- Protective circuits against reverse polarity, HF influences and overvoltage peaks are installed.
- The supply voltage must match the supply voltage on the nameplate.
- Switch off the supply voltage before connecting the device.
- Remove housing cover of the terminal compartment.
- Guide cable through the gland. Preferably use twisted, screened two-wire cable.
- Connect device in accordance with the following diagram.
- Screw down housing cover.
- Switch on supply voltage.




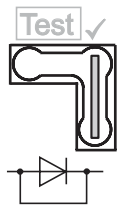
P01-xMx7xxxx-04-xx-xx-xx-001

Fig. 4: Electrical connection 4...20 mA HART → Observe also the following section.
For devices with Harting Han7D or M12 plug see Operating Instructions.

- 1 Housing
- 2 Jumper for 4...20 mA test signal. → See also the following section.
- 3 Internal earth terminal
- 4 External earth terminal
- 5 4...20 mA test signal between plus and test terminal
- 6 Minimum supply voltage = 10.5 V DC, jumper is inserted in accordance with the illustration.
- 7 Minimum supply voltage = 11.5 V DC, jumper is inserted in "Test" position.
- 8 Devices with integrated overvoltage protection are labelled OVP (overvoltage protection) here.

3.2 Connecting the measuring unit

3.2.1 Supply voltage and taking 4...20 mA test signal

Jumper position for test signal	Description
	<ul style="list-style-type: none"> – Taking 4...20 mA test signal via plus and test terminal: possible. (Thus, the output current can be measured without interruption via the diode.) – Delivery status – minimum supply voltage (at the terminals): 11.5 V DC
	<ul style="list-style-type: none"> – Taking 4...20 mA test signal via plus and test terminal: not possible. – minimum supply voltage (at the terminals): 10.5 V DC

3.2.2 Cable specification

- Endress+Hauser recommends using twisted, screened two-wire cables.
- Terminals for wire cross-sections 0.5...2.5 mm²
- Cable external diameter: 5...9 mm

3.2.3 Screening/potential matching

- You achieve optimum screening against disturbances if the screening is connected on both sides (in the cabinet and on the device). If you have to reckon with potential equalisation currents in the plant, only earth screening on one side, preferably at the transmitter.
- When using in hazardous areas, you must observe the applicable regulations. Separate Ex documentation with additional technical data and instructions is included with all Ex systems as standard.

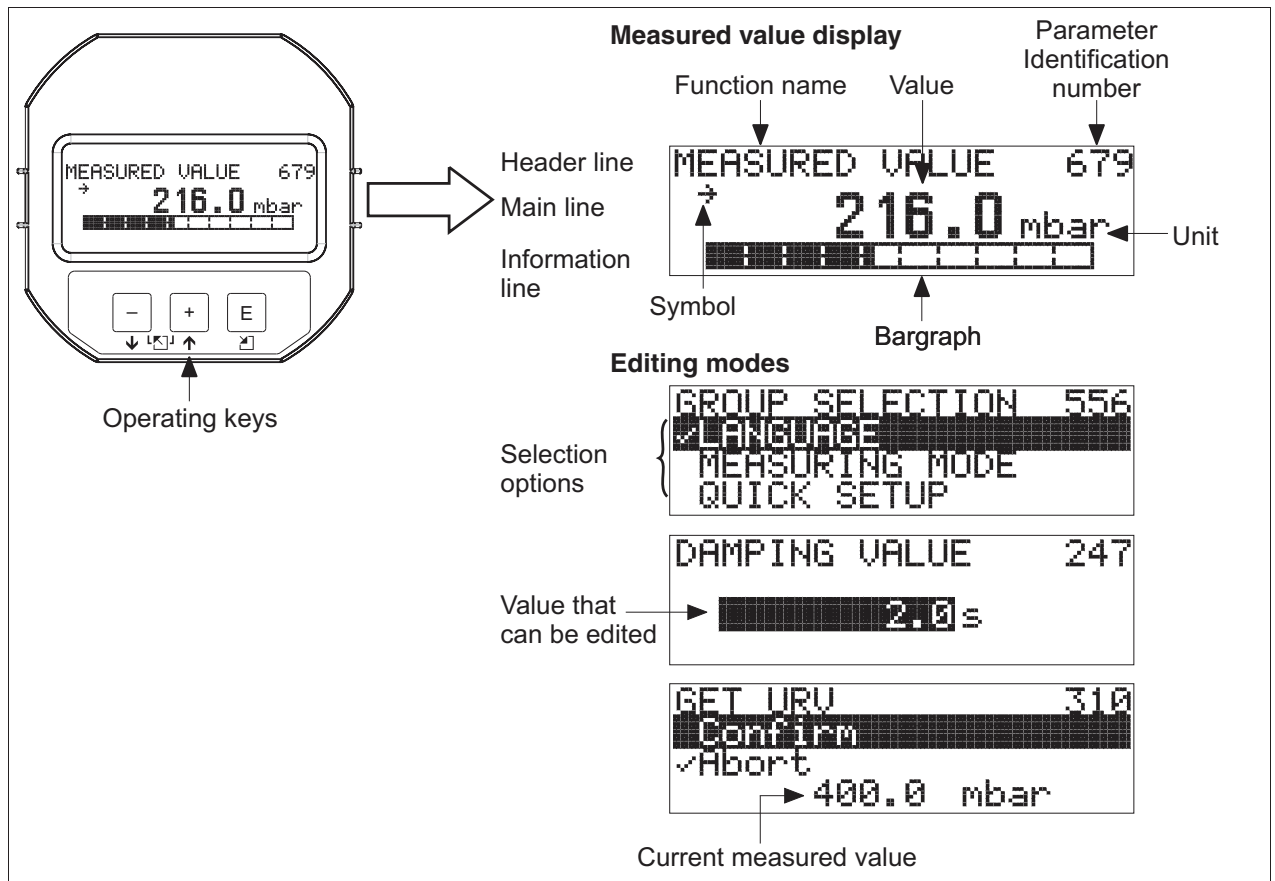
4 Operation

4.1 On-site display (optional)

A 4-line liquid crystal display (LCD) is used for display and operation. The on-site display shows measured values, dialog texts, fault messages and notice messages.







The display of the device can be turned in 90° steps.

Depending on the installation position of the device, this makes it easy to operate the device and read the measured values.



P01-xMx7xxxx-07-xx-xx-xx-001

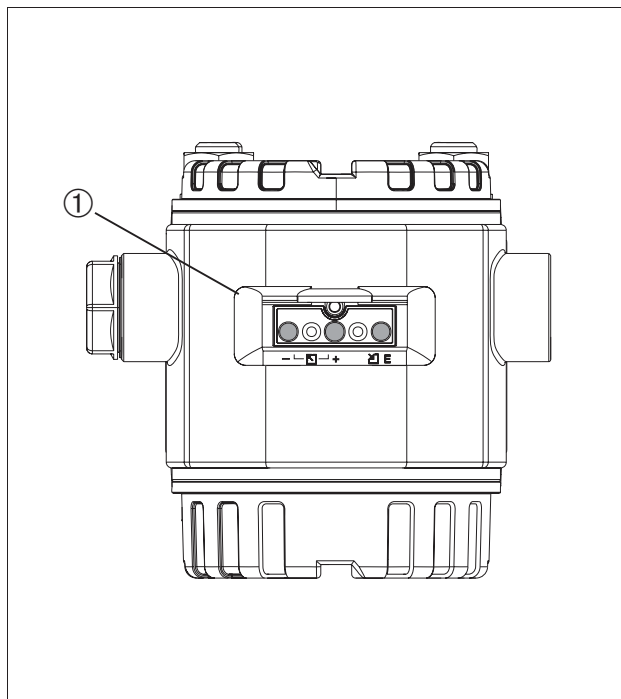
The following table illustrates the symbols that can appear on the on-site display. Four symbols can occur at one time.

Symbol	Meaning
	Alarm symbol – Symbol flashing: warning, device continues measuring. – Symbol permanently lit: error, device does not continue measuring. <i>Note:</i> The alarm symbol may overlie the tendency symbol.
	Lock symbol The operation of the device is locked. Unlock device, → see Page 20, Section 4.4.
	Communication symbol Data transfer via communication
	Tendency symbol (increasing) The measured value is increasing.
	Tendency symbol (decreasing) The measured value is decreasing.
	Tendency symbol (constant) The measured value has remained constant over the past few minutes.

4.2 Operating elements

4.2.1 Position of operating elements

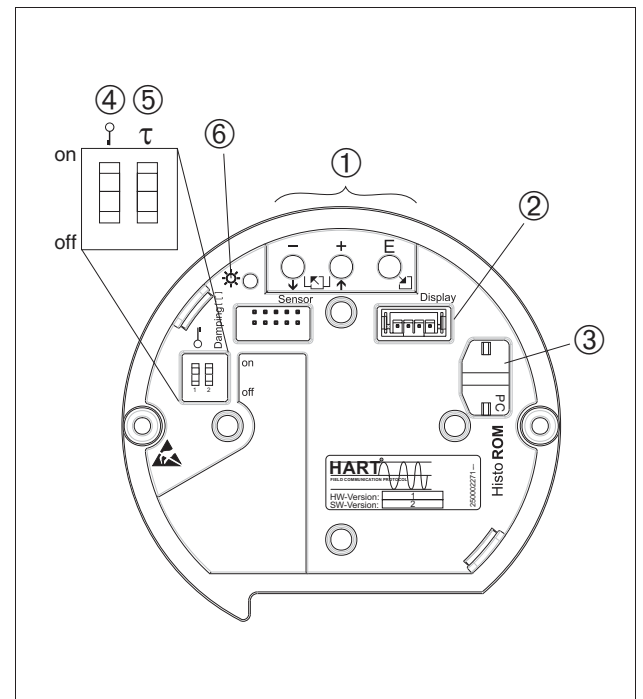
With regard to aluminium housings and stainless steel housing (T14), the operating keys are located either outside the device under the protection cap or inside on the electronic insert. In hygienic stainless steel housings (T17), the operating keys are always located inside on the electronic insert. Additionally, three operating keys are located on the optional on-site display.



P01-PMx7xxxx-19-xx-xx-xx-009

Fig. 5: Operating keys, external

- 1 Operating keys on the exterior of the device under the protective flap













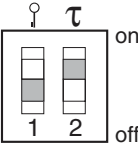
P01-xxxxxxx-19-xx-xx-xx-104

Fig. 6: Operating keys, internal










- 1 Operating keys
2 Slot for optional display
3 Slot for optional HistoROM®/M-DAT
4 DIP-switch for locking/unlocking measured-value-relevant parameters
5 DIP-switch for damping on/off
6 Green LED to indicate value being accepted

4.2.2 Function of the operating elements – on-site display not connected

Press and hold the key or the key combination for at least 3 seconds to execute the corresponding function. Press the key combination for at least 6 seconds for a reset.

Operating key(s)	Meaning
	Adopt lower range value. A reference pressure is present at the device. → See also Page 25, Section 5.2.2 "Pressure measuring mode" or Page 28, Section 5.3.2 "Level measuring mode".
	Adopt upper range value. A reference pressure is present at the device. → See also Page 25, Section 5.2.2 "Pressure measuring mode" or Page 28, Section 5.3.2 "Level measuring mode".
	Position adjustment
 und  und 	Reset all parameters. The reset via operating keys corresponds to the software reset code 7864.
 und 	Copy the configuration data from the optional HistoROM®/M-DAT module to the device.
 und 	Copy the configuration data from the device to the optional HistoROM®/M-DAT module.
 P01-xxxxxxx-19-xx-xx-xx-057	<ul style="list-style-type: none"> – DIP-switch 1: for locking/unlocking measured-value-relevant parameters Factory setting: off (unlocked) – DIP-switch 2: damping on/off, Factory setting: on (damping on)

4.2.3 Function of the operating elements – on-site display connected

Operating key(s)	Meaning
	<ul style="list-style-type: none"> – Navigate upwards in the picklist – Edit the numerical values and characters within a function
	<ul style="list-style-type: none"> – Navigate downwards in the picklist – Edit the numerical values and characters within a function
	<ul style="list-style-type: none"> – Confirm entry – Jump to the next item
 and 	Contrast setting of on-site display: darker
 and 	Contrast setting of on-site display: brighter
 and 	<p>ESC functions:</p> <ul style="list-style-type: none"> – Exit edit mode without saving the changed value. – You are in a menu within a function group. The first time you press the keys simultaneously, you go back a parameter within the function group. Each time you press the keys simultaneously after that, you go up a level in the menu. – You are in a menu at a selection level. Each time you press the keys simultaneously, you go up a level in the menu. <p><i>Note:</i> The terms function group, level and selection level are explained in Section 4.3.1, Page 16.</p>

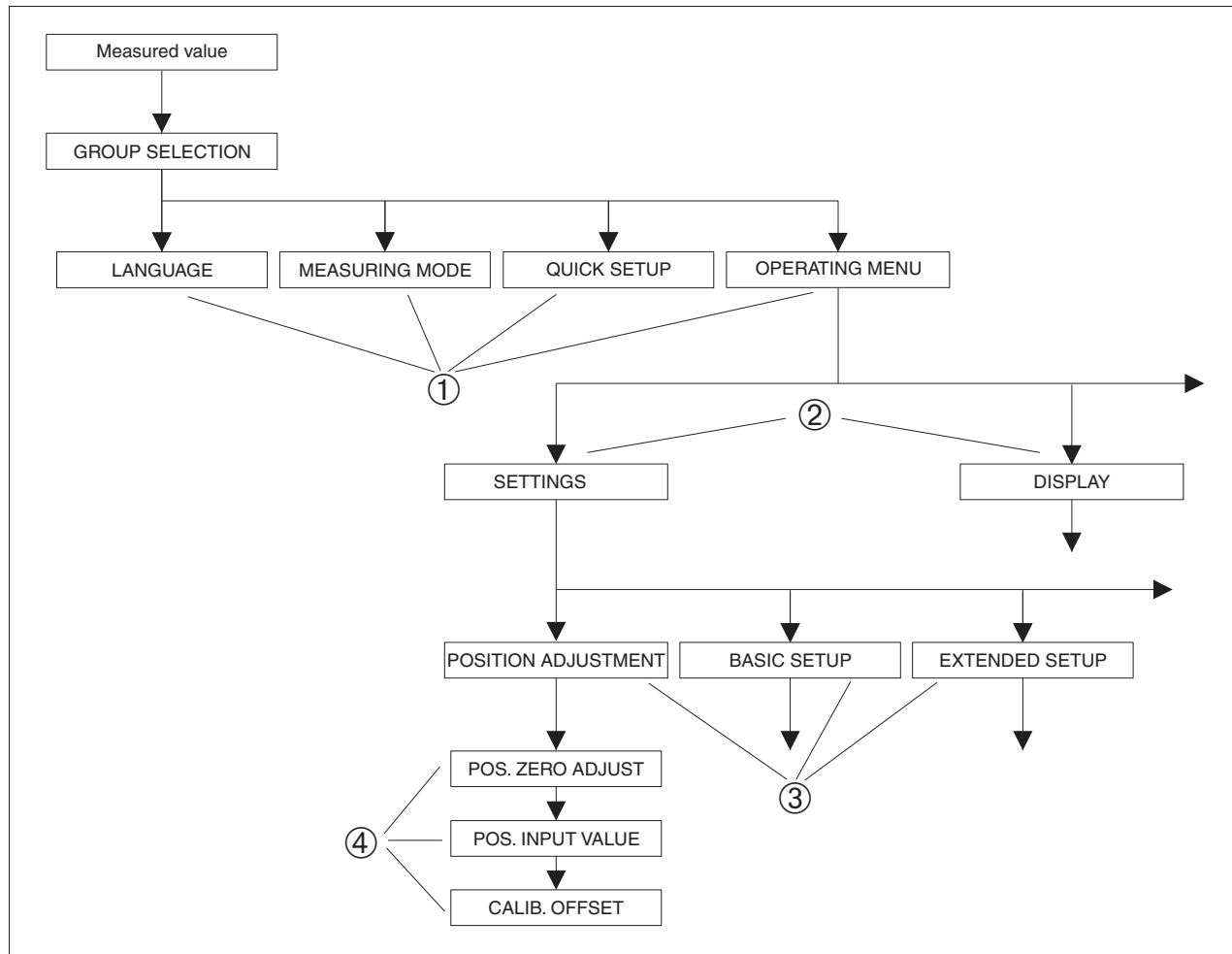
4.3 On-site operation via on-site display

4.3.1 Structure of the operating menu

The menu is split into four levels. The three upper levels are used to navigate while you use the bottom level to enter numerical values, select options and save settings.

→ For the entire menu see CD-ROM, Operating Instructions BA271P.

The structure of the OPERATING MENU depends on the measuring mode selected, e.g. if the "Pressure" measuring mode is selected, only the functions necessary for this mode are displayed.



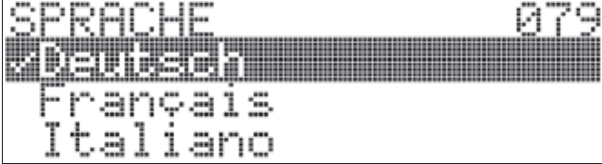
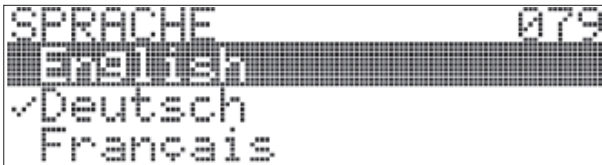
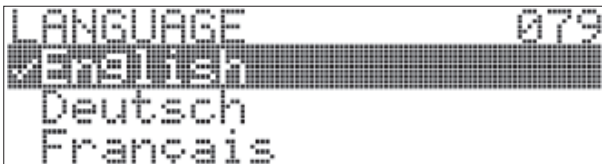
P01-xxxxxxx-19-xx-xx-xx-145

Fig. 7: Structure of the operating menu

- 1 1. Selection level
- 2 2. Selection level
- 3 Function groups
- 4 Parameter

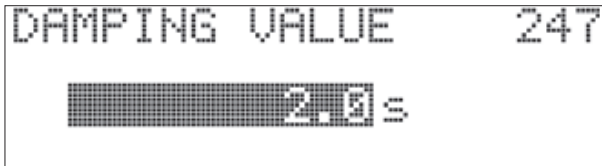
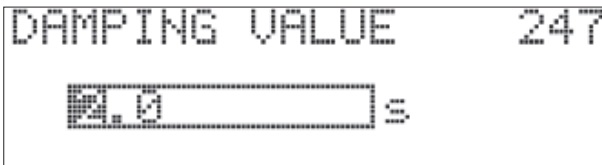
4.3.2 Selecting an option

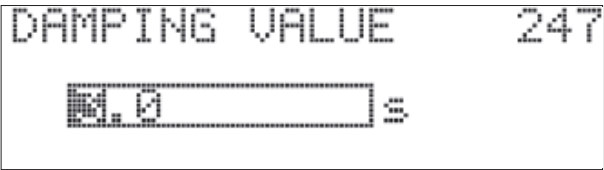
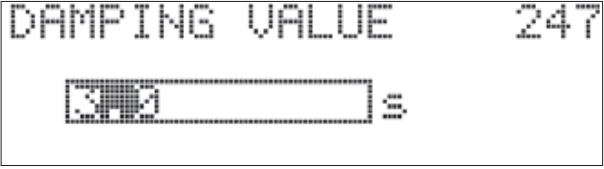
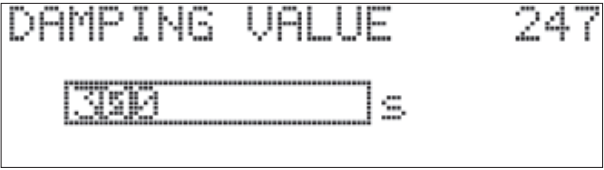
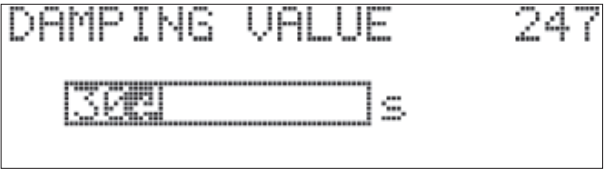
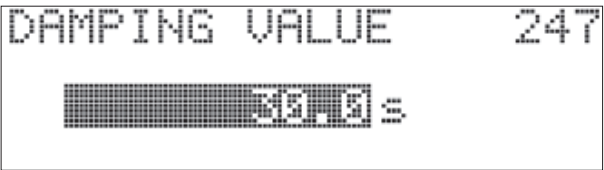
Example: select "English" as the language of the menu.

On-site display	Operation
 <p>SPRACHE 079 ✓Deutsch Français Italiano</p> <p>P01-xxxxxxx-19-xx-xx-xx-017</p>	German is selected as the language. A ✓ in front of the menu text indicates the active option.
 <p>SPRACHE 079 English ✓Deutsch Français</p> <p>P01-xxxxxxx-19-xx-xx-xx-033</p>	Select English with "+" or "-".
 <p>LANGUAGE 079 ✓English Deutsch Français</p> <p>P01-xxxxxxx-19-xx-xx-xx-034</p>	<ol style="list-style-type: none"> Confirm your choice with "E". A ✓ in front of the menu text indicates the active option. (English is now selected as the menu language.) Jump to the next item with "E".

4.3.3 Editing a value

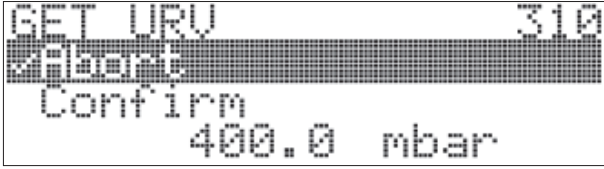
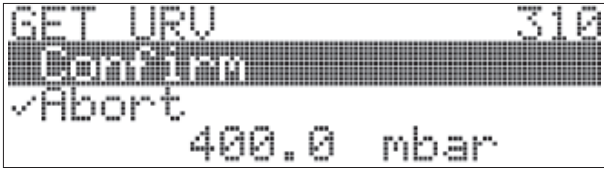
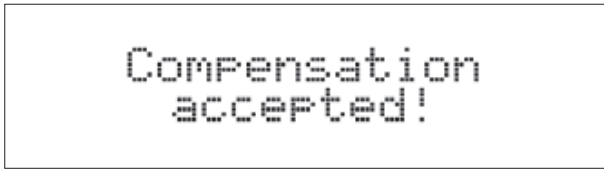
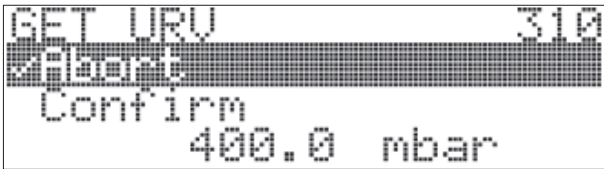
Example: adjusting DAMPING VALUE function from 2.0 s to 30.0 s. → See also Page 15, Section 4.2.3 "Function of the operating elements".

On-site display	Operation
 <p>DAMPING VALUE 247 2.0 s</p> <p>P01-xxxxxxx-19-xx-xx-xx-023</p>	The on-site display shows the parameter to be changed. The value highlighted in black can be changed. The "s" unit is fixed and cannot be changed.
 <p>DAMPING VALUE 247 2.0 s</p> <p>P01-xxxxxxx-19-xx-xx-xx-027</p>	<ol style="list-style-type: none"> Press "+" or "-" to get to the editing mode. The first digit is highlighted in black.

On-site display	Operation
<div><p>P01-xxxxxxxx-19-xx-xx-xx-028</p></div>	<div><div>1. Use "+" to change "2" to "3".</div><div>2. Confirm "3" with "E". The cursor jumps to the next position (highlighted in black).</div></div>
<div><p>P01-xxxxxxxx-19-xx-xx-xx-029</p></div>	<div>The decimal point is highlighted in black, i.e. you can now edit it.</div>
<div><p>P01-xxxxxxxx-19-xx-xx-xx-030</p></div>	<div><div>1. Keep pressing "+" or "-" until "0" is displayed.</div><div>2. Confirm "0" with "E". The cursor jumps to the next position. ↵ is displayed and is highlighted in black. → See next graphic.</div></div>
<div><p>P01-xxxxxxxx-19-xx-xx-xx-031</p></div>	<div>Use "E" to save the new value and exit the editing mode. → See next graphic.</div>
<div><p>P01-xxxxxxxx-19-xx-xx-xx-032</p></div>	<div><div>The new value for the damping is now 30.0 s.</div><div><div>– Jump to the next parameter with "E".</div><div>– You can get back to the editing mode with "+" or "-".</div></div></div>

4.3.4 Taking pressure applied at device as value

Example: configuring upper range value – assign 20 mA to the pressure value 400 mbar.


On-site display	Operation
 <p>P01-xxxxxxxx-19-xx-xx-xx-035</p>	The bottom line on the on-site display displays the pressure present, here 400 mbar.
 <p>P01-xxxxxxxx-19-xx-xx-xx-036</p>	Use "+" or "-" to switch to the "Confirm" option. The active selection is highlighted in black.
 <p>P01-xxxxxxxx-19-xx-xx-xx-037</p>	Use "E" to assign the value (400 mbar) to the GET URV parameter. The device confirms the calibration and jumps back to the parameter, here GET URV (see next graphic).
 <p>P01-xxxxxxxx-19-xx-xx-xx-035</p>	Switch to the next parameter with "E".

4.4 Locking/unlocking operation

Once you have entered all the parameters, you can lock your entries against unauthorised and undesired access.

You have the following possibilities for locking/unlocking the operation:

- Via a DIP-switch on the electronic insert, locally on the display (→ see Page 13, Fig. 7).
- Via the on-site display (optional)
- Via digital communication.

The -symbol on the on-site display indicates that operation is locked. Parameters which refer to how the display appears, e.g. LANGUAGE and DISPLAY CONTRAST can still be altered.

The table provides an overview of the locking functions:

Locking via	View/ read parameter	Modify/write via ¹⁾		Unlocking via		
		On-site display	Remote operation	DIP-Switch	On-site display	Remote operation
DIP-Switch	yes	no	no	yes	no	no
On-site display	yes	no	no	no	yes	yes
Remote operation	yes	no	no	no	yes	yes

- 1) Parameters which refer to how the display appears, e.g. LANGUAGE and DISPLAY CONTRAST can still be altered.

	Locking/Unlocking operation via on-site display or remote operation
Locking operation	<ol style="list-style-type: none"> 1. Select INSERT PIN NO. parameter, Menu path: GROUP SELECTION → OPERATING MENU → OPERATION → INSERT PIN NO. 2. To lock operation, enter a number for this parameter between 0...9999 that is ≠100.
Unlocking operation	<ol style="list-style-type: none"> 1. Select INSERT PIN NO. parameter. 2. To unlock operation, enter "100" for the parameter.

5 Commissioning



Warning!

- If a pressure smaller than the minimum permitted pressure is present at the device, the messages "E120 Sensor low pressure" and "E727 Sensor pressure error - overrange" are output in succession.

-
- If a pressure greater than the maximum permitted pressure is present at the device, the messages "E115 Sensor overpressure" and "E727 Sensor pressure error - overrange" are output in succession.
 - Messages E727, E115 and E120 are "Error"-type messages and can be configured as a "Warning" or an "Alarm". These messages are configured as "Warning" messages at the factory. This setting prevents the current output from assuming the set alarm current value for applications (e.g. cascade measurement) where the user is consciously aware of the fact that the sensor range can be exceeded.
 - We recommend setting messages E727, E115 and E120 to "Alarm" in the following instances:
 - The sensor range does not have to be exceeded for the measuring application.
 - Position adjustment has to be carried out that has to correct a large measured error as a result of the orientation of the device (e.g. devices with a diaphragm seal).

5.1 Position adjustment

Due to the orientation of the device, there may be a shift in the measured value, i.e. when the container is empty, the measured value parameter does not display zero. There are three options to choose from when performing position adjustment.

(Menu path: GROUP SELECTION → OPERATING MENU → SETTINGS → POSITION ADJUSTMENT)

Parameter name	Description
POS. ZERO ADJUST (685) Entry	<p>Position adjustment – the pressure difference between zero (set point) and the measured pressure need not be known. (A reference pressure is present at the device.)</p> <p>Example:</p> <ul style="list-style-type: none"> – MEASURED VALUE = 2.2 mbar – Correct the MEASURED VALUE via the POS. ZERO ADJUST parameter with the "Confirm" option. This means that you are assigning the value 0.0 to the pressure present. – MEASURED VALUE (after pos. zero adjust) = 0.0 mbar – The current value is also corrected. <p>The CALIB. OFFSET parameter displays the resulting pressure difference (offset) by which the MEASURED VALUE was corrected.</p> <p>Factory setting: 0</p>
POS. INPUT VALUE (563) Entry	<p>Position adjustment – the pressure difference between zero (set point) and the measured pressure need not be known. (A reference pressure is present at the device.)</p> <p>Example:</p> <ul style="list-style-type: none"> – MEASURED VALUE = 0.5 mbar – For the POS. INPUT VALUE parameter, specify the desired set point for the MEASURED VALUE, e.g. 2 mbar. ($\text{MEASURED VALUE}_{\text{new}} = \text{POS. INPUT VALUE}$) – MEASURED VALUE (after entry for POS. INPUT VALUE) = 2.0 mbar – The CALIB. OFFSET parameter displays the resulting pressure difference (offset) by which the MEASURED VALUE was corrected. $\text{CALIB. OFFSET} = \text{MEASURED VALUE}_{\text{old}} - \text{POS. INPUT VALUE}$, here: $\text{CALIB. OFFSET} = 0.5 \text{ mbar} - 2.0 \text{ mbar} = -1.5 \text{ mbar}$ – The current value is also corrected. <p>Factory setting: 0</p>
CALIB. OFFSET (319) Entry	<p>Position adjustment – the pressure difference between zero (set point) and the measured pressure is known.</p> <p>Example:</p> <ul style="list-style-type: none"> – MEASURED VALUE = 2.2 mbar – Via the CALIB. OFFSET parameter, enter the value by which the MEASURED VALUE should be corrected. To correct the MEASURED VALUE to 0.0 mbar, you must enter the value 2.2 here. ($\text{MEASURED VALUE}_{\text{new}} = \text{MEASURED VALUE}_{\text{old}} - \text{CALIB. OFFSET}$) – MEASURED VALUE (after entry for calib. offset) = 0.0 mbar – The current value is also corrected. <p>Factory setting: 0</p>

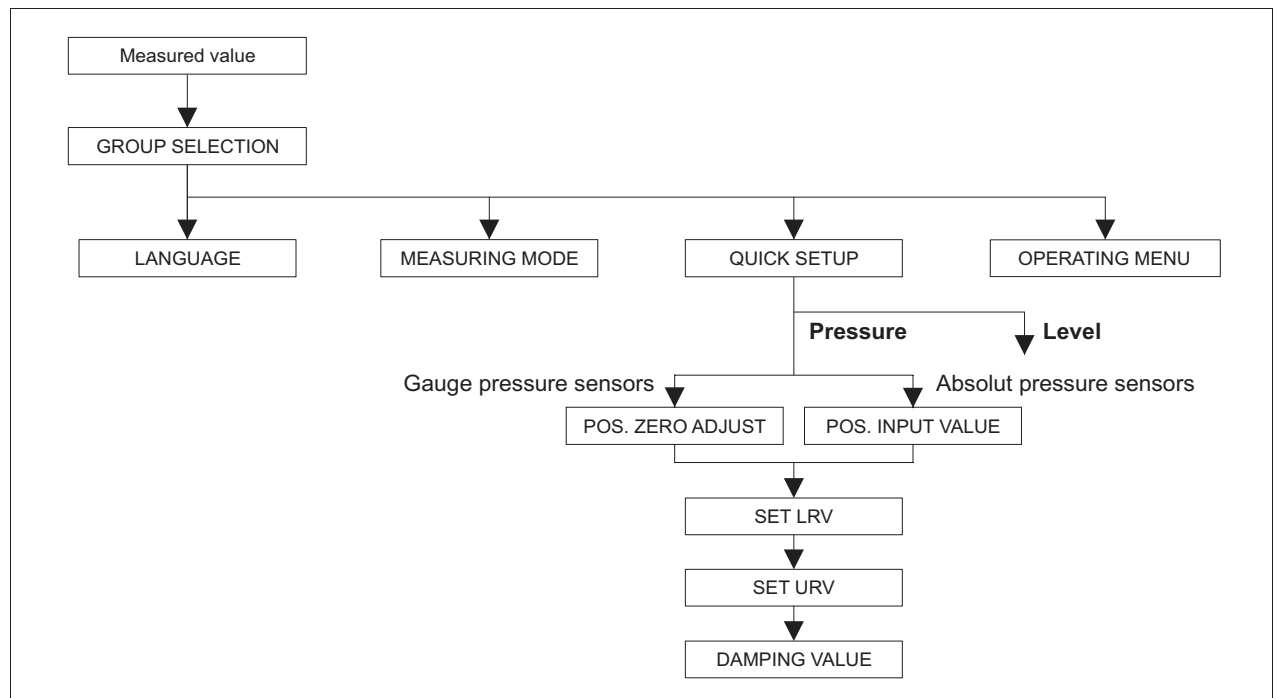
5.2 Pressure measurement

5.2.1 Quick Setup menu for Pressure measuring mode – on-site display



Note!

See also Page 15, Section 4.2.3 "Function of the operating elements" and Page 16, 4.3 "On-site operation via on-site display".



P01-PMx7xxxx-19-xx-xx-xx-046

Fig. 8: Quick Setup menu for Pressure measuring mode

On-site operation
Measured value display On-site display: Switch from the measured value display to GROUP SELECTION with .
GROUP SELECTION Select MEASURING MODE.
MEASURING MODE Select "Pressure" option.
GROUP SELECTION Select QUICK SETUP menu.
POS. ZERO ADJUST (gauge pressure sensors) Due to orientation of the device, there may be a shift in the measured value. You correct the MEASURED VALUE via the POS. ZERO ADJUST parameter with the "Confirm" option, i. e. you assign the value 0.0 to the pressure present.
POS. INPUT VALUE (absolute pressure sensors) Due to orientation of the device, there may be a shift in the measured value. For the POS. INPUT VALUE parameter, specify the desired set point for the MEASURED VALUE.

On-site operation**SET LRV**

Set the measuring range (enter 4 mA value).

Specify a pressure value for the lower current value (4 mA value). A reference pressure does not have to be present at the device.

SET URV

Set the measuring range (enter 20 mA value).

The pressure for the upper current value (20 mA value) is present at device. With the "Confirm" option, you assign the upper current value to the pressure value present.

DAMPING TIME

Enter damping time (time constant τ). The damping affects the speed at which all subsequent elements, such as the on-site display, measured value and current output react to a change in the pressure.

5.2.2 On-site operation – on-site display not connected

If no on-site display is connected, the following functions are possible by means of the three keys on the electronic insert or on the exterior of the device:

- Position adjustment (zero point correction)
- Setting lower range value and upper range value
- Device reset, → see also Page 14, Section 4.2.2 "Function of the operating elements", Table.



Note!

- The device is configured for the Pressure measuring mode as standard. You can switch measuring modes by means of the MEASURING MODE parameter.
- The operation must be unlocked. → See Page 20, Section 4.4 "Locking /unlocking operation".
- The pressure applied must be within the nominal pressure limits of the sensor. See information on the nameplate.

Carry out position adjustment. ¹⁾		Setting lower range value.		Setting upper range value.	
Pressure is present at device.		Desired pressure for lower range value is present at device.		Desired pressure for upper range value is present at device.	
↓		↓		↓	
Press "E"-key for 3 s.		Press "-"-key for 3 s.		Press "+"-key for 3 s.	
↓		↓		↓	
Does the LED on the electronic insert light up briefly?		Does the LED on the electronic insert light up briefly?		Does the LED on the electronic insert light up briefly?	
Yes	No	Yes	No	Yes	No
↓	↓	↓	↓	↓	↓
Applied pressure for position adjustment has been accepted.	Applied pressure for position adjustment has not been accepted. Observe the input limits.	Applied pressure for lower range value has been accepted.	Applied pressure for lower range value has not been accepted. Observe the input limits.	Applied pressure for upper range value has been accepted.	Applied pressure for upper range value has not been accepted. Observe the input limits.

1) Observe "Warning" on Page 20.