

# Operation & Maintenance Pressure guard MULTI 2

240201\_150109:3 EN



QMT 8XXXXXXXXXXXXXXXXX

## Table of Contents

General instructions	3
Ensure the following	3
Construction	3-4
Flowschart	4
Diagram of pressure drop	5-6
Spare gas cylinder - information	6
OPERATING INSTRUCTIONS: Operating	7-8
OPERATING INSTRUCTIONS: alarm / reserve gas operation	9
Reference scheme	10
Spare gas cylinders - gas volumes	10
Care and Maintenance	11
Installation	12-22
Note	22
Warning	22
Wiring diagram	23
Marking & manufacturing control	23
Spare parts	23

## General instructions

The instructions are for the people who are to handle the pressure switch to receive information about its function and structure.

Read the instructions with the device in place so that you can quickly and easily find all the controls. The pressure switch is part of the central gas system, and it is therefore covered by the rules regarding inspections and controls specified in EN ISO 7396-1 and national standard SIS HB 370. The unit may not be put into operation until a safety inspection has been carried out and a medical use permit has been issued.

Make sure the instructions are easily accessible. If needed, more copies can be ordered from Qmt-tech.

## Ensure the following

- Personnel in the departments where pressure monitors are set up must be informed about and trained in what applies when connecting spare gas cylinders.
- The medical gases must not come into contact with oil, grease or the like. These substances become extremely flammable on contact with certain gases and can start explosive fires.
- Hands, tools and equipment must be clean and free of grease.
- In order for Qmt-tech's warranty conditions to apply, the purity requirements must be complied with.
- Leak detectors used on gas fittings must be free of substances that can react with oxygen. It must also not contain ammonium compounds (ammonia) as these can cause cracking in brass details.
- Settings, repairs and service should be performed by Qmt-tech service technicians.
- According to SIS HB 370 and EN ISO 7396-1, alarms must be installed for the pressure switch.

## Construction

In the event of temporary interruptions in the gas supply from the emptying or compressor plant, it must be possible to establish an emergency supply of gas from a gas cylinder or gas from a fixed reserve gas system over the unit. For this purpose, the pipe packages of the apparatus are as standard equipped with non-confusing and color-coded gas outlets, to which spare gas cylinders can be connected.

As an option, the appliance's pipe package can be equipped with a valve and manometer for a fixed backup gas system. As an option, units with a fixed backup gas supply can also be equipped with a valve position indicator.

For standard alarms connected to the unit Masterwatch Ultra.

Qmt-tech's TRV MULTI 2 can be delivered in a housing for surface mounting or for flush mounting. The unit consists of a pipe package, one package for each gas. The dimension of the pipe packages is 22 mm. Other dimensions are optional. The size change takes place outside the box. The unit is delivered for 2-5 gases.

Note: For optional position indication on fixed backup gas supply, the cable ducts must be dimensioned for up to 4 cables per gas.

Each pipe package is equipped with:

- Shut-off valve, type ball valve
- Non-replaceable gas outlet for connecting spare gas cylinders. (Single is standard and double spare gas outlets on one or more gases are optional.)
- Manometer for incoming gas pressure
- Manometer for outgoing gas pressure
- Pressure sensor (standard) or signal manometer (optional) for outgoing gas pressure

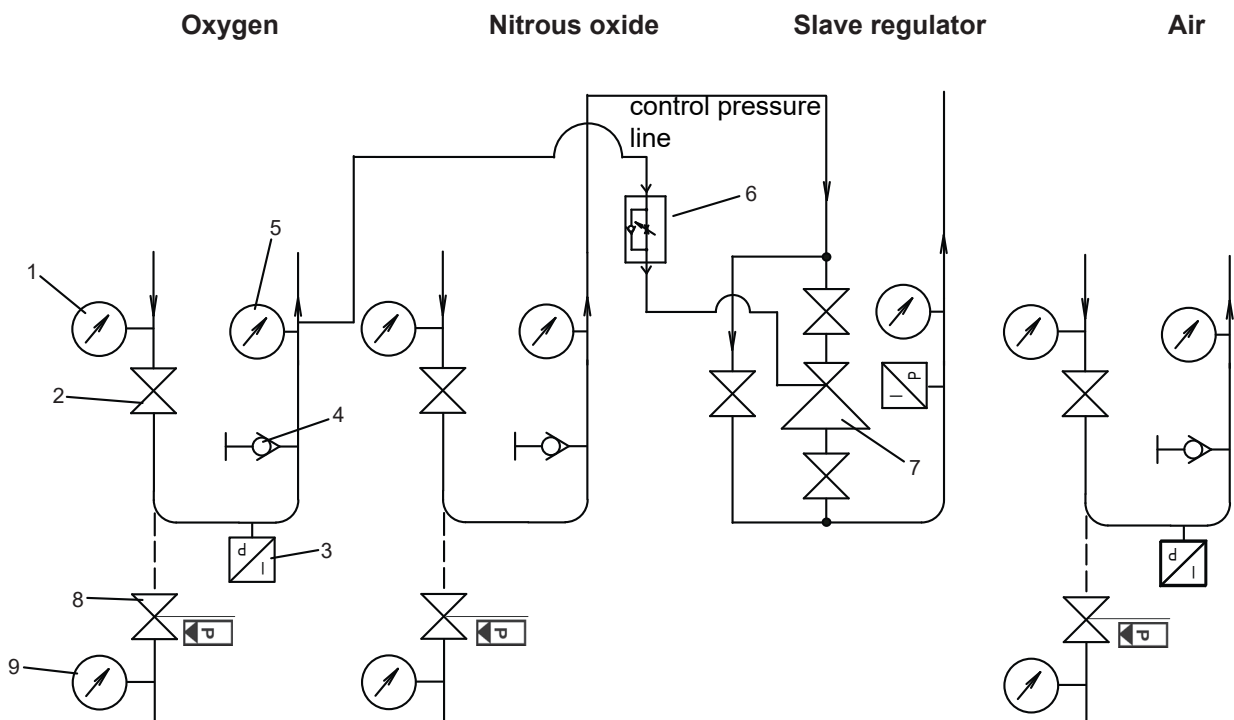
One of the pipe packages is also provided with a slave regulator which reduces the pressure of the gas leaving this pipe package by about 1.0 bar, in relation to the pressure of the gas which controls the slave regulator. When servicing or replacing the slave controller, this can easily be switched off and bypassed.

Optional, applies to fixed backup gas system

- Valve for fixed spare gas system.
- Manometer for incoming pressure from a fixed reserve gas system.
- Microswitch for valve position indication.

### Flow chart

Flow chart Pressure switch MULTI 2 for 3 gases Slave control of nitrous oxide controlled by oxygen.



- 1 Manometer for inlet pressure
- 2 Shut-off valve
- 3 Pressure sensor / signal manometer
- 4 Gas-specific gas outlet for backup gas supply (single outlet standard) Manometer for outlet pressure
- 5 Manometer for outlet pressure
- 6 Throttle valve
- 7 Slave regulator

Optional, applies to fixed reserve gas supply

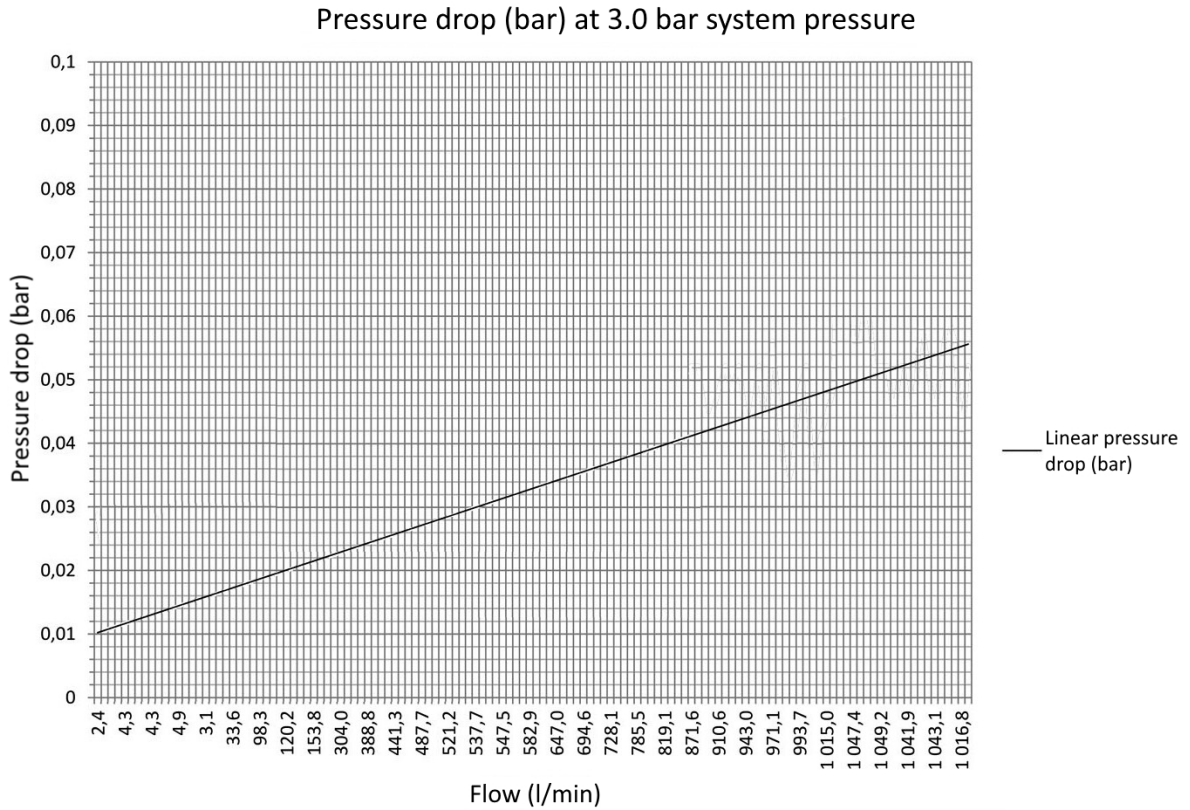
- 8 Emergency supply valve (Optional: with microswitch for valve position indication)
- 9 Manometer for incoming backup gas pressure

The pressure switch is connected to the distribution system with 15 mm (slave regulator) and 22 mm copper pipe. The unit supplies the gas outlets to connected departments. Since the operating pressure of the respiratory oxygen controls the nitrous oxide pressure emanating from the pressure switch, over the built-in slave regulator, the withdrawal volumes for nitrous oxide depend on the operating pressure of the respiratory oxygen.

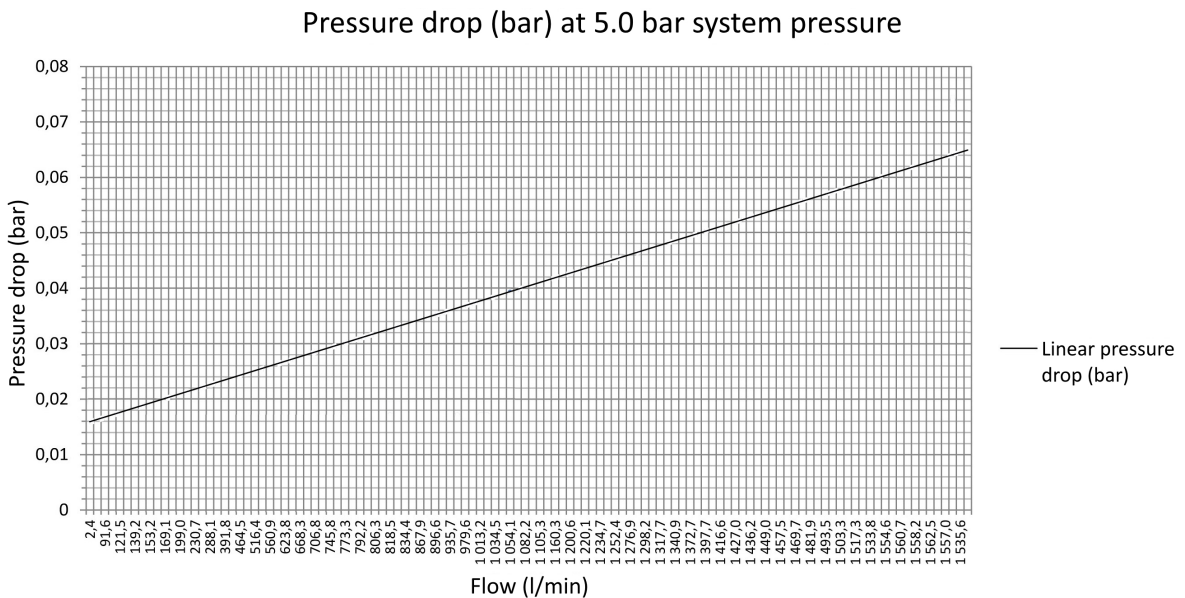
Diagram of pressure drop package

Sample gas: Nitrogen  
 Inlet pressure: See diagram  
 Temperature: 23

Linear pressure drop 2-3 bar

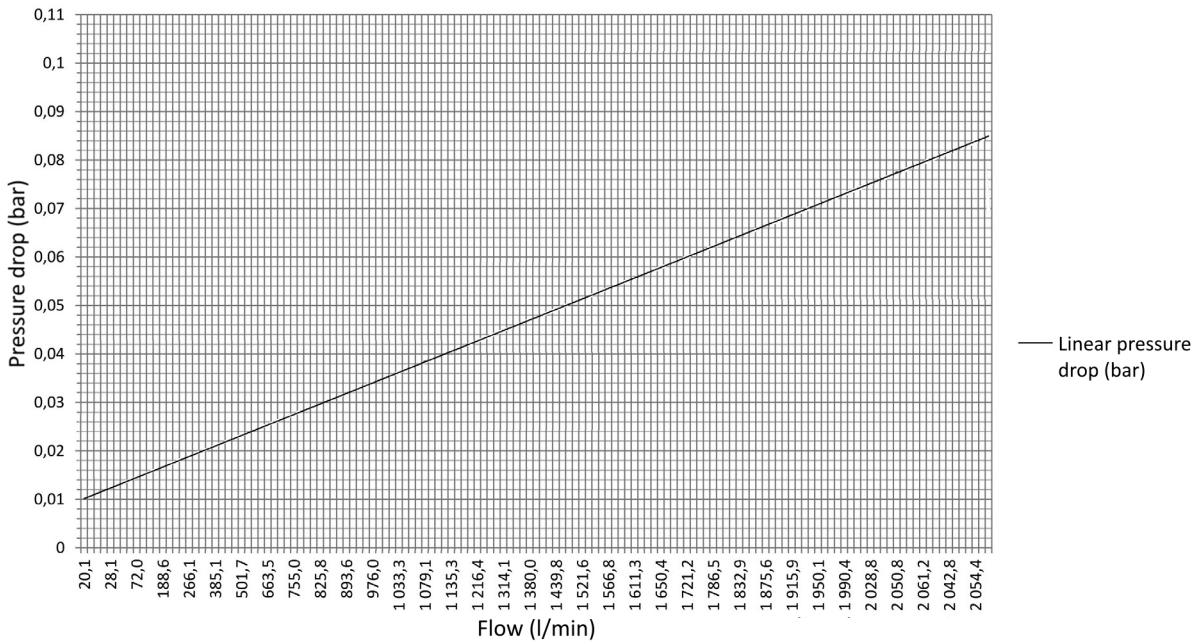


Linear pressure drop 2-5 bar



Linear pressure drop 2-7 bar

Pressure drop (bar) at 7.0 bar system pressure



Spare gas cylinders - information

In the event of temporary interruptions or malfunctions in the gas supply, spare gas cylinders may be connected to the appliance's gas outlet. The regulators with two-stage control on the gas cylinders must be preset to the current operating pressure for each gas. The gas cylinders must be arranged so that they comply with the recommendations and local regulations that exist. When it becomes necessary to connect the spare gas cylinders in an emergency, this must be done in accordance with this manual.

The regulators must be equipped with color-marked hoses with fitted male quick-connectors in accordance with current standards. Ensure that the bottle valve and other equipment are protected from contamination.

Before mounting the bottle regulator, the bottle valves must be flushed with a short open / close torque before the bottles are taken into the department. Keep in mind that the cleaning flush jet must not be directed at any person and that it should take place in the open air.

**Warning:**

The cylinder valve must always be opened slowly. If these are opened too quickly, parts of the cylinder valve or other parts of the system can ignite spontaneously by the energy released at high gas velocities.

When disconnecting the gas cylinder from the appliance, close the cylinder valve before removing the gas connection. Be sure to keep the coupling part of the hose as close as possible during release and while the gas is being released from the hose. This prevents whiplash during pressure equalization.

Procedures for checking the spare gas cylinders must be established so that it is known with certainty that they are approved for their purpose.

**Pressure switch with slave control of nitrous oxide controlled by oxygen**

Operating mode setting

- Put the pressure switch in the normal operating position, all shut-off valves in the vertical position (open) and all emergency supply valves, if any, in the horizontal position (closed) and the red bypass valve in the slave regulator in the horizontal position (closed). Check that the throttle valve is open (unscrewed).
- Check that the manometers for the inlet pressure, for each gas, show the pressure determined for the central gas system.
- For nitrous oxide: Open the red valve and check that the manometer shows the operating pressure determined for the central gas system.  
The system pressure on nitrous oxide before the pressure switch must be approximately 0.05 MPa (0.5 bar) lower than the pressure of the breathing oxygen.
- Check that the emergency supply is ok, either by providing spare gas cylinders or by the fixed reserve gas supply gauge showing the operating pressure determined for the central gas system.

Control of slave regulator function

- Close the red valve and release gas over a nitrous oxide outlet in a room.
- The manometer should now show a pressure that is about 1.0 bar lower than the respiratory oxygen pressure.
- Close the valve for incoming respiratory oxygen.
- Close the emergency shut-off valve for nitrous oxide and respiratory oxygen to all rooms except one.
- Lower the pressure for respiratory oxygen after the pressure switch to 1.0 bar.
- Release nitrous oxide from the gas outlet in this room until the flow is zero.
- If the nitrous oxide is not shut off, lower the respiratory oxygen pressure until closure is obtained.
- Read the respiratory oxygen pressure on the control manometer when the nitrous oxide is switched off. The respiratory oxygen pressure must show a pressure of at least 0.20 bar.
- Check that the nitrous oxide gauge in the pressure switch shows zero.
- Close the nitrous oxide shut-off valve to the room where the gas discharge was made.
- Carefully open the valve for respiratory oxygen and increase the pressure to 1 bar.
- Read the operating pressure for nitrous oxide on the manometer in the pressure switch.
- Increase the respiratory oxygen pressure gradually by 1 bar until full operating pressure is reached. Note all pressure changes.
- Read and note the outgoing nitrous oxide operating pressure for each increase in respiratory oxygen pressure.
- Check that the readings for nitrous oxide are approximately 1.0 bar lower than the respiratory oxygen pressure.

**Warning: If nitrous oxide is supplied with the bypass valve (red knob) in the open position, there is no slave control of the operating pressure.**

### Control of pressure sensor / signalgauge

- Close the incoming valve for the gas to be tested.
- Reduce the pressure by releasing gas through the gas outlet until a low pressure alarm is generated.
- Note the alarm level.
- High level alarm can only be performed by connecting a gas cylinder with adjustable regulator. NOTE! If the system has been flushed with the intended medical gas, be sure to use that gas.
- Connect the cylinder regulator to the gas outlet on the gas to be tested.
- Increase the pressure until an alarm is generated. Note the alarm level.
- NOTE! Remember to lower the pressure on the tested gas after disconnecting the cylinder regulator.

### Control of reserve gas supply from gas cylinder reserve

- Check that the operating pressure of the gas cylinder reserve pressure regulators is the same as the incoming operating pressure to the appliance.
- Close the shut-off valve for the gas to be tested.
- Connect the gas cylinder hose nipple to the gas outlet.
- Slowly open the gas cylinder reserve cylinder valve.
- Take out gas consumption downstream of the pressure monitor and check that the pressure remains within the established level.
- Return the appliance to normal operating mode (see Operating mode setting).
- Do the same on remaining gases.

### Control of reserve gas supply from fixed reserve gas system

- Check that the incoming pressure from a fixed backup gas system is the same as the incoming operating pressure to the appliance.
- Close the shut-off valve for the gas to be tested.
- Open the emergency supply valve.
- Take out gas consumption downstream of the appliance and check that the pressure stays within the set level.
- Return the appliance to normal operating mode (see Operating mode setting).
- Do the same on remaining gases.

When all tests have been performed, the pressure switch must be reset to the normal operating position (see Operating mode setting), when the bypass valve is horizontal and the service valves are in the vertical position.

**NOTE!** After completion of the test and safety inspection, the "bypass valve" must be sealed with the accompanying seal and seal wire according to Figure 1.

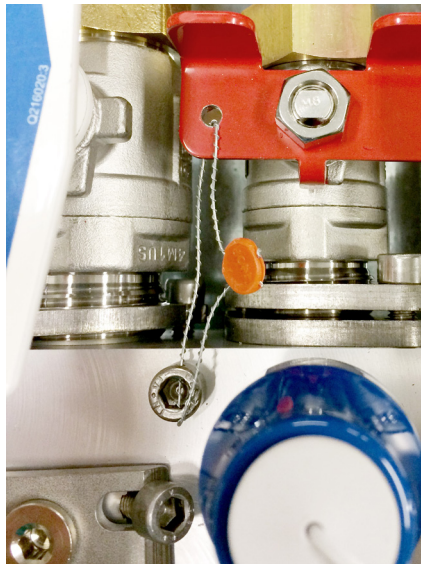


Bild 1



## **OPERATING INSTRUCTIONS: Alarm / backup gas operation**

Alarms are triggered when the pressure of one or more of the gases distributed by the pressure monitor passes above or below the set limit positions.

### **In case of alarm:**

- Acknowledge acoustic alarm.
- Check which gas has generated the alarm.
- If the alarm has been triggered, backup gas supply must be connected immediately.
- Note: If the alarm has been triggered for nitrous oxide, the pressure for respiratory oxygen must also be checked. This is because the operating pressure of the respiratory oxygen controls the pressure of the nitrous oxide.

### **Connection of reserve gas from gas cylinder**

- Connect the gas hose from the spare gas cylinder regulator to the intended gas outlet.
- Close the valve for incoming line to the current gas.
- Open the bottle valve slowly.
- Check that the correct operating pressure has been obtained by acknowledging the alarm unit. (See Operating Instructions, next to the appliance or on the inside of the appliance door.)
- Incorrect operating pressure may be due to a malfunction in the slave controller. This can be bypassed by opening the bypass valve. The manometer should now show a pressure that is approximately 0.05 MPa (0.5 bar) below the operating pressure of the oxygen.
- Contact the operations manager.

**Important: If nitrous oxide is fed with the bypass valve in the open position, there is no slave control of the operating pressure.**

### **Replacement of spare gas cylinder**

- Close the valve on the gas cylinder.
- Disconnect the hose from the gas outlet. Be sure to keep the coupling part of the hose as close as possible during release and while the gas is being released from the hose. This prevents whiplash during pressure equalization.
- Connect the new gas cylinder to the gas outlet.
- Slowly open the cylinder valve on the new gas cylinder.
- Check that the correct operating pressure has been obtained by acknowledging the alarm unit. (See Operating Instructions next to the appliance or on the inside of the appliance door.)

### **Connection of reserve gas from a fixed reserve gas system**

- Close the incoming valve for the intended gas.
- Open the incoming valve from the backup supply system.
- Check that the correct operating pressure has been obtained by acknowledging the alarm unit. (See Operating Instructions, next to the appliance or on the inside of the appliance door.)  
Incorrect operating pressure may be due to a malfunction in the slave controller. This can be bypassed by opening the bypass valve. The manometer should now show a pressure that is approximately 0.05 MPa (0.5 bar) below the operating pressure of the breathing oxygen.
- Contact the operations manager.

**Important: If nitrous oxide is fed with the bypass valve in the open position, there is no slave control of the operating pressure.**

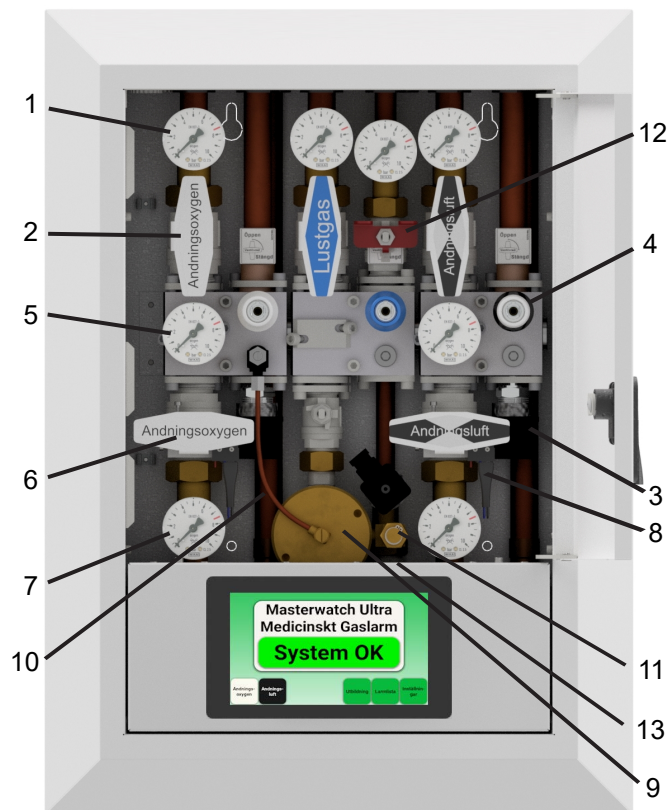
### **Spare gas supply operation**

**Important: Check the section Spare gas cylinders - gas volumes, for information on available gas volumes.**

**See also separate Operation & Maintenance for Alarms**

## Referensschema

- 1 Inlet pressure manometer
- 2 Inlet shut-off valve
- 3 Pressure sensor (standard) or signal gauge (optional)
- 4 Gas outlet (reserve gas connection)
- 5 Outlet pressure manometer
- 6 Emergency supply valve
- 7 Manometer for incoming reserve gas pressure
- 8 Position sensor (optional)
- 9 Slave regulator
- 10 Pressure pipe to slaveregulator
- 11 Service connection
- 12 Valve for bypassing slave regulator
- 13 Shut-off valve



## Spare gas cylinders - gas volumes

### Gas volumes in gas cylinder

The size designation of a gas cylinder is in liters of liquid volume. This size is stamped in the shoulder of the bottle, under the bottle valve. Gas bottles for respiratory oxygen, respiratory and instrument air normally maintain a pressure of 20 MPa (200 bar) when full.

To calculate the available gas volume, do the following:

#### For oxygen and air

The high pressure regulator is read and reduced with outgoing pressure. This is then multiplied by the volume value of the bottle.

Example:

High pressure manometer	120 bar
Outgoing pressure	4,5 bar
Bottle volume	40 liter

$$\text{Available gas volume} = (120 - 4.5) \times 40 = 4620 \text{ liters}$$

Required residual gas pressure varies depending on the flow and regulator type of the spare gas cylinders. A practical value can be that about 20 bar is left. This means that the available gas volume according to the example becomes  $(120 - 20) \times 40 = 4000$  liters

#### For nitrous oxide

Nitrous oxide, when compressed, is in liquid form. Therefore, you determine the amount of nitrous oxide present in a bottle, by weighing the bottle without a regulator and from that value subtract the dead weight that appears from stamping in the bottle's shoulder. The gas volume is then calculated on the basis that 1 kg of nitrous oxide during extraction and expansion to atmospheric pressure produces 550 liters of gas. As long as there is liquid gas left in the bottle, the high pressure manometer shows a constant pressure of 50 bar at room temperature. When the pressure starts to drop, there is no liquefied gas left and the available volume can be calculated in the same way as for respiratory oxygen.

During the conversion from liquefied gas to gas phase, condensation or hoarfrost can form on the bottle and pressure regulator, this is completely normal.

Qmt-tech recommends that nitrous oxide bottles be replaced when the pressure has dropped to about 40 bar.

## Care and Maintenance

Pressure monitors MULTI 2 must be exercised annually and safety tested. Pressure monitors MULTI 2 are covered by rules for annual operation inspection and inspection according to SIS HB 370. In order for Qmt-tech's warranty conditions to apply, a service technician appointed by Qmt-tech must perform annual inspection and every three years perform a more comprehensive service where also wear parts and sealing material are replaced. If no faults are detected, the device is approved for another year of operation. Spent product is returned or returned to an authorized recycling company.

During the annual operation inspection, it is checked that:

- No leakage has occurred in the appliance.
- The valves are not slow to turn. The valves must be exercised (turned) and checked.
- The function of the pressure sensors / signal manometers is ok.
- The gas outlets are not leaking and that they work satisfactorily. O-rings are replaced if necessary or at the latest every three years from the date of installation.

**Important:** When testing the system for pressure, the bypass valve (8) must be open to ensure that all components are tested. The bypass valve must be set to the closed position after testing and the valves for servicing the slave controller must be in the vertical position.

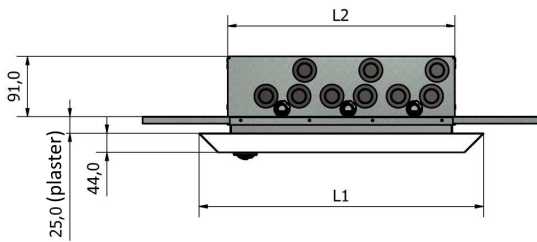
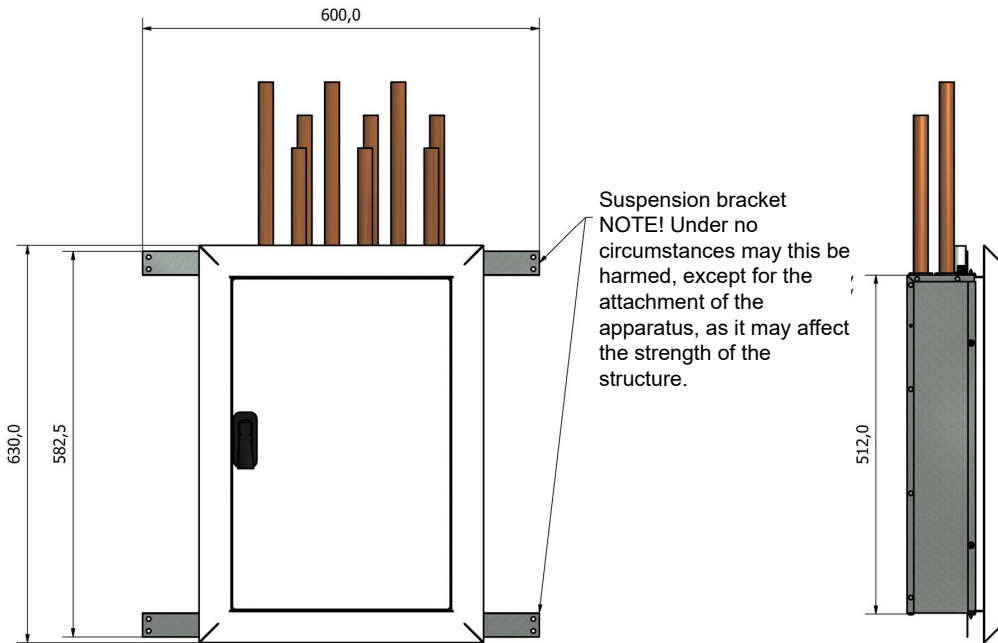
The function of the slave controller is checked as follows.

- Check that no nitrous oxide consumption takes place in the pressure switch's operating area.
- Simulate a nitrous oxide consumption of about 10-20 liters per minute.
- Read the manometer.
- Open the bypass valve (8).
- Outgoing nitrous oxide pressure should now rise to approx. 0.05 MPa (0.5 bar) below the respiratory oxygen pressure.
- Close the bypass valve (8), and check the nitrous oxide gauge. The value should be about 1.0 bar below the operating pressure for respiratory oxygen.
- If the above result is not obtained, the slave controller must be replaced. Whereupon a new safety test takes place.

### **Replacement of slave regulator**

To be performed only by a Qmt-tech authorized service technician.

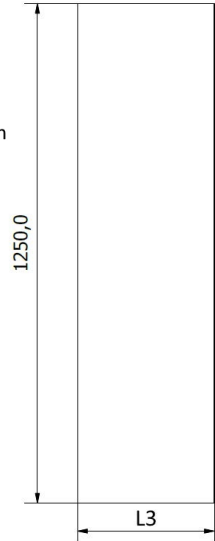
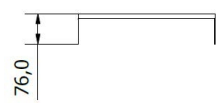
Recessed mounting



			With fixed reserve gas supply on nitrous oxide		
gases	L1	L2	gases	L1	L2
2	360	244	2	460	344
3	460	344	3	560	444
4	560	444	4	660	544
5	660	544	5	-	-

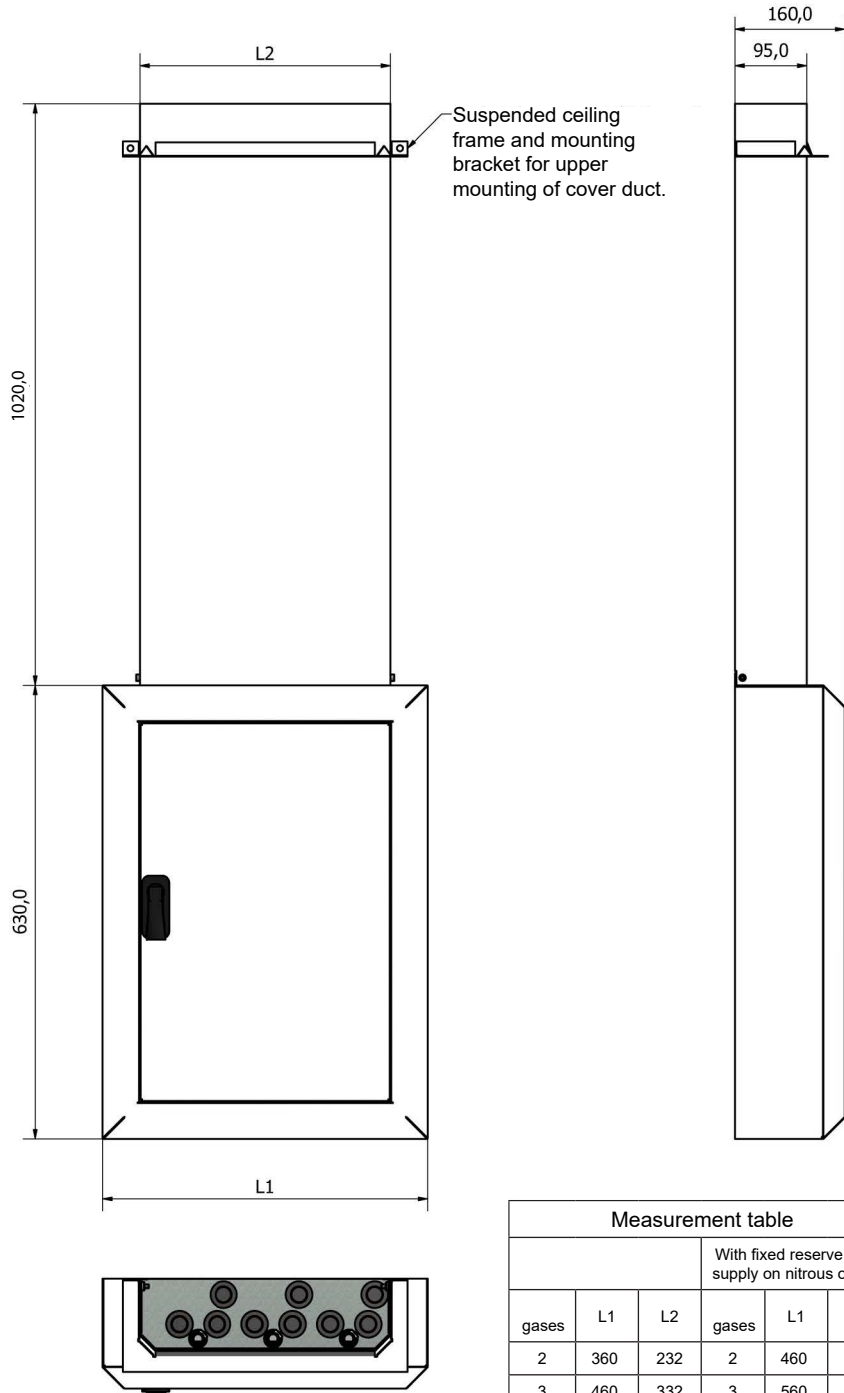
Measured nail protection

gases	L3
2	242
3	342
4	442
5	542



**Surface mounting**

The length of the duct corresponds to a unit mounted on the center height (knob center main shut-off valve) 1500 mm above the floor and with a standard height for ceilings 2700 mm.

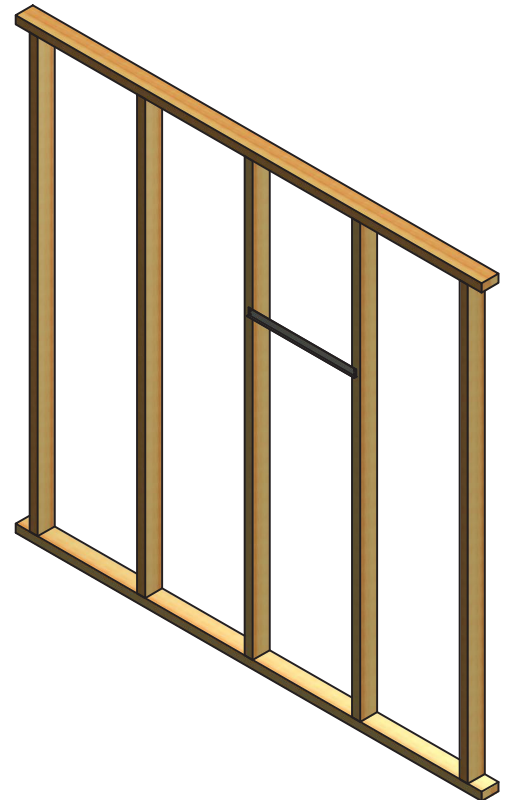
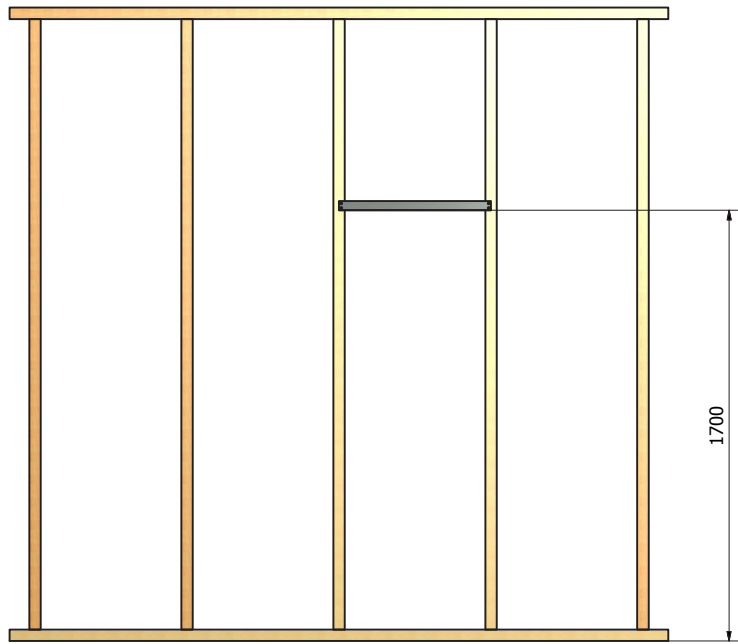


Measurement table					
			With fixed reserve gas supply on nitrous oxide		
gases	L1	L2	gases	L1	L2
2	360	232	2	460	332
3	460	332	3	560	432
4	560	432	4	660	532
5	660	532	5	-	-

### **Assembly instructions**

- a) Mount the upper mounting bracket in the wall studs. If the pressure monitor is to be mounted at a center height of 1500 mm from the floor, the mounting bracket must be mounted at a height of 1700 mm from the floor.
- b) Hang the pressure monitor on the mounting bracket and fasten it with the supplied screws.  
NOTE! The screws must be screwed in from the inside of the box.
- c) Mount the lower mounting bracket and screw it to the wall bolts and to the Pressure Monitor.
- d) Solder the copper pipes. NOTE! Remember to use shielding gas during soldering.
- e) Mount the VP pipe sockets in the Pressure Monitor and mount the VP pipes.
- f) Thread the three power cables through the VP pipes. For connection of the electrical cables, see separate wiring diagram.
- g) Measure dimensions A, B, C & D according to the sketch. Dimension A will be approx. 1190 mm from the floor if the upper mounting bracket was mounted at a height of 1700 according to point a). Dimension C shall be reduced by 10 mm and dimension D shall be increased by 20 mm.
- h) Note the dimensions from point g) on the plasterboard and divide it according to the sketch.
- i) Fit the lower plasterboard.
- j) Mount the upper plasterboard.
- k) Fit the right plaster part.
- l) Fit the left plaster part.
- m) Note the dimensions from point g) on gypsum board no. 2, the outer gypsum board and cut out the hole.
- n) Fit the outer plasterboard.
- o) Mount the front frame to the pressure monitor. NOTE! The frame must be mounted after filling, sanding and painting the walls.

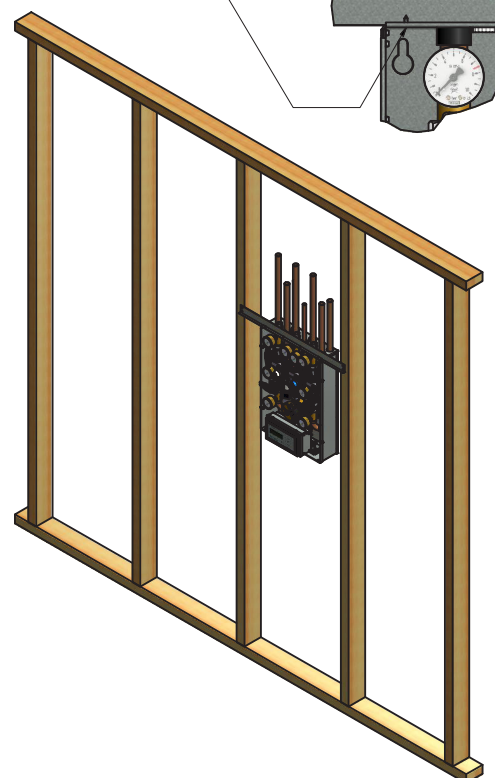
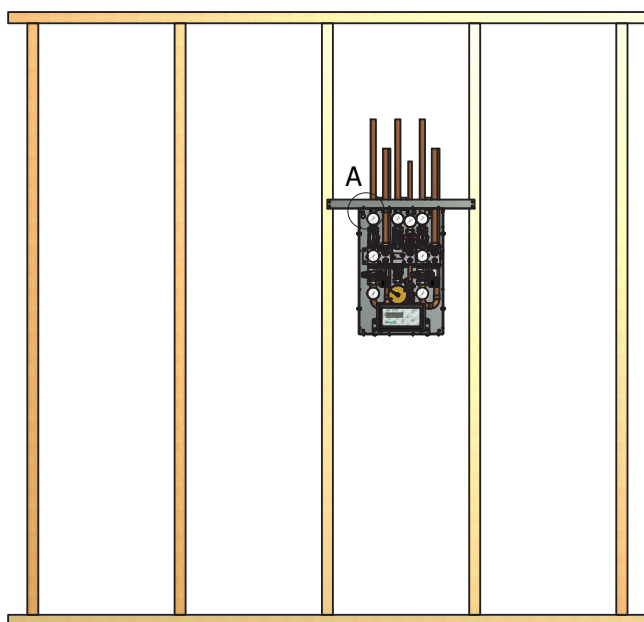
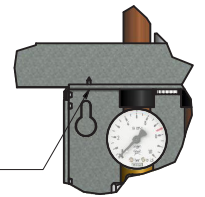
a)



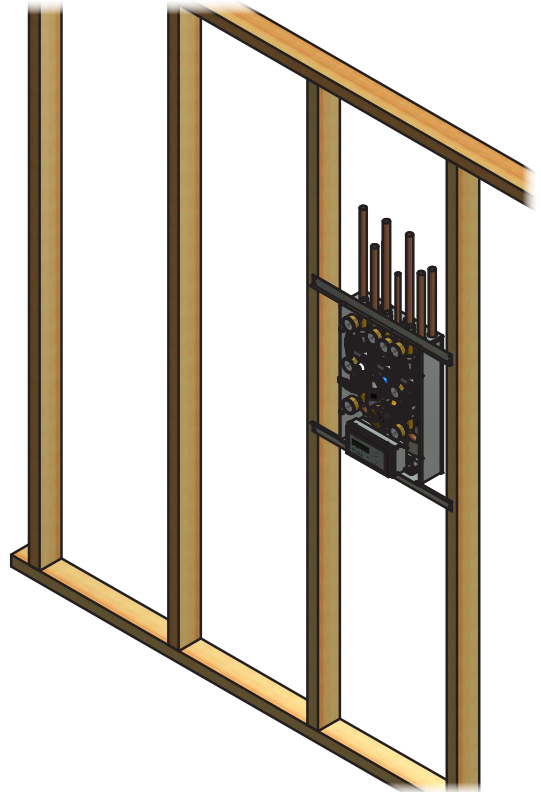
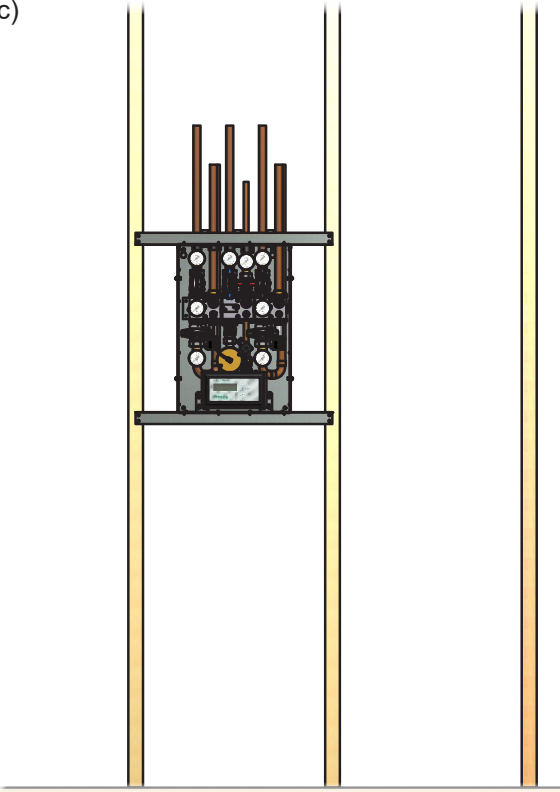
b)

NOTE! The screws must have a countersunk head and be mounted from inside the box!

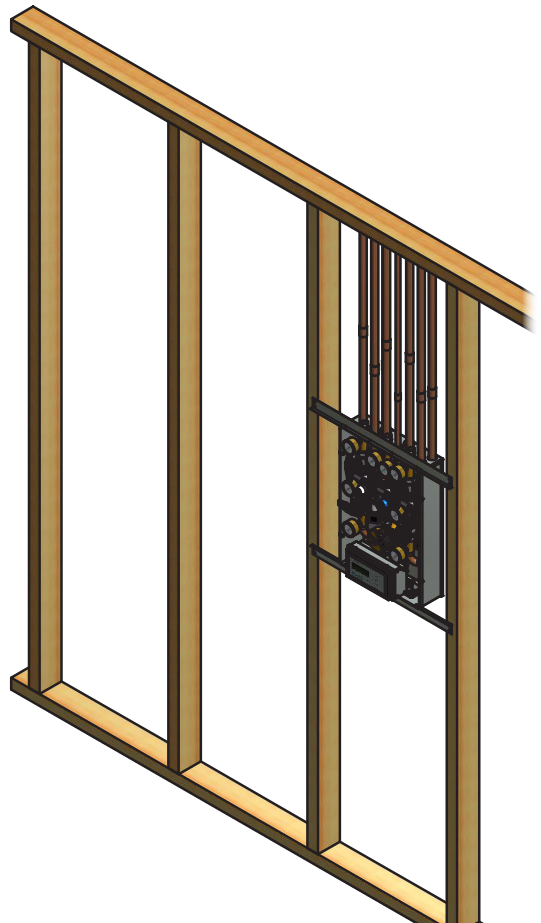
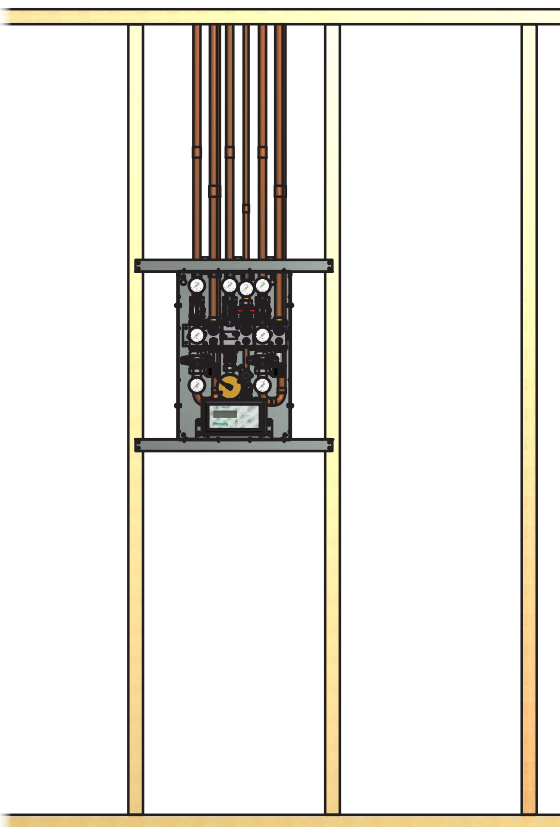
A ( 1 : 3 )



c)

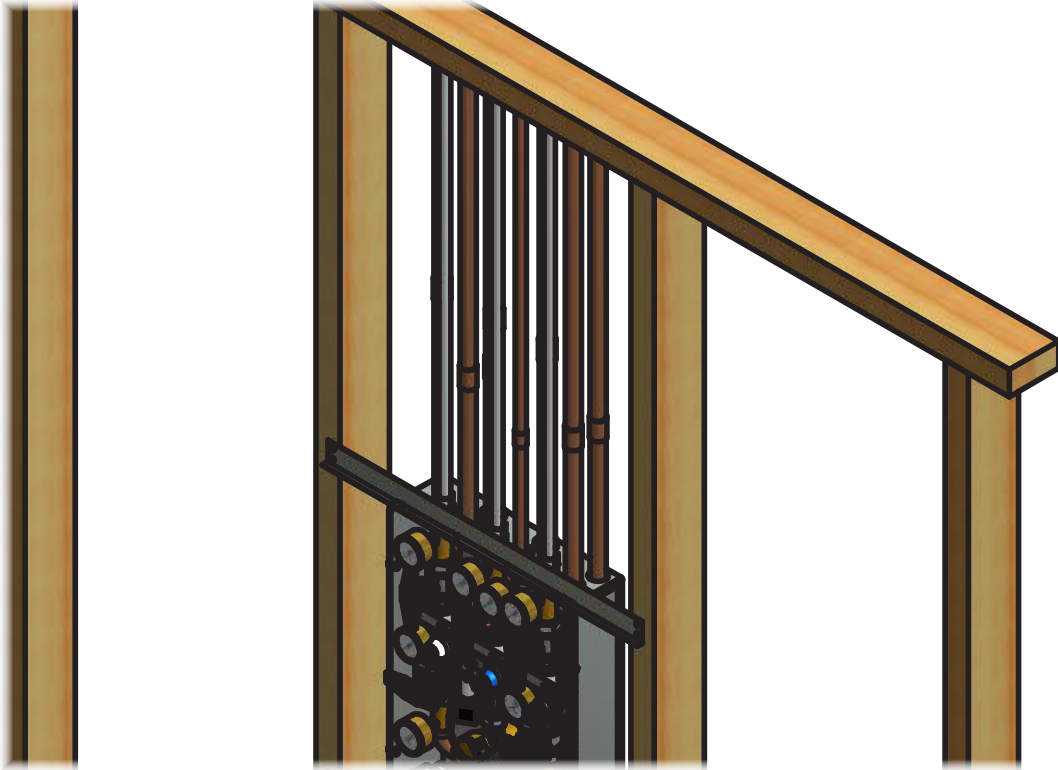


d)



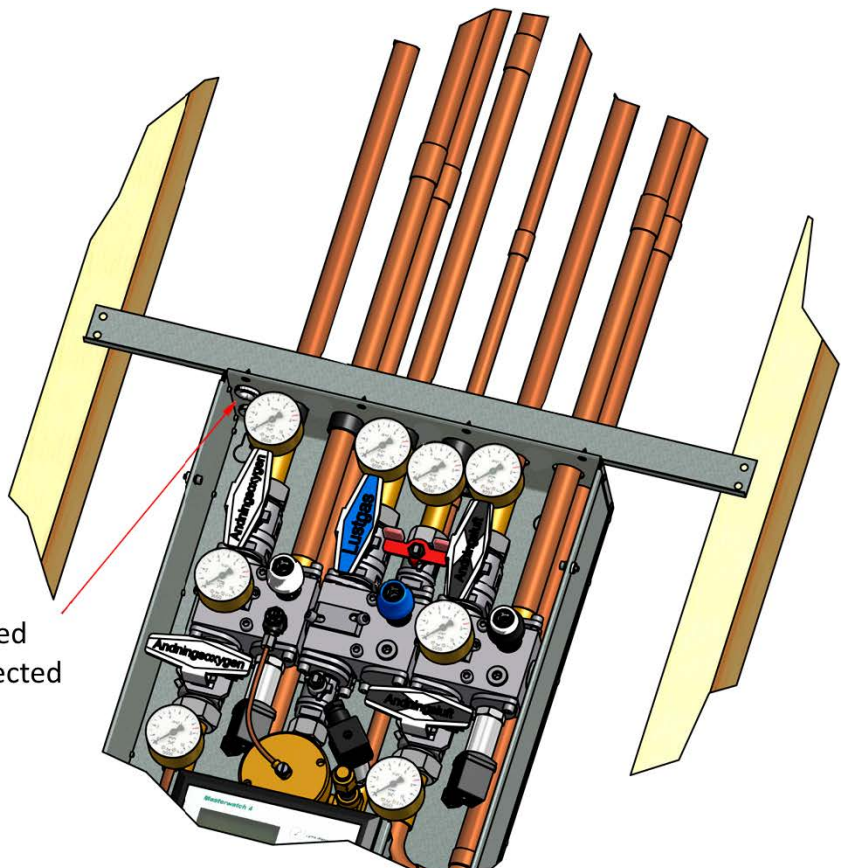


e)



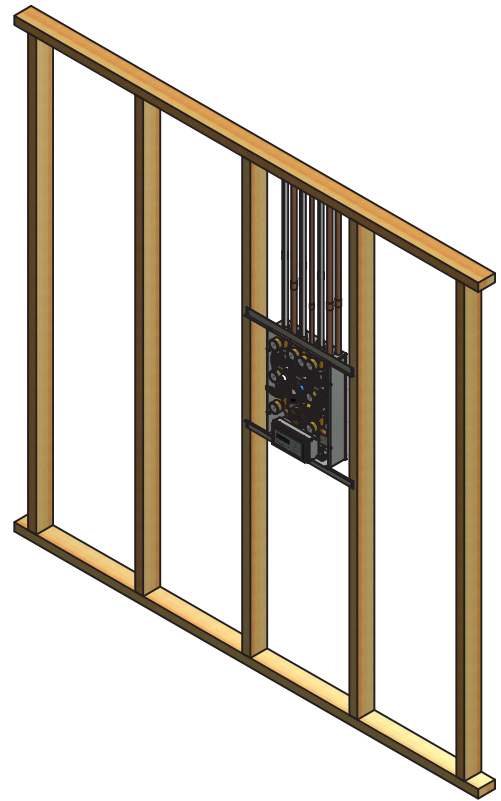
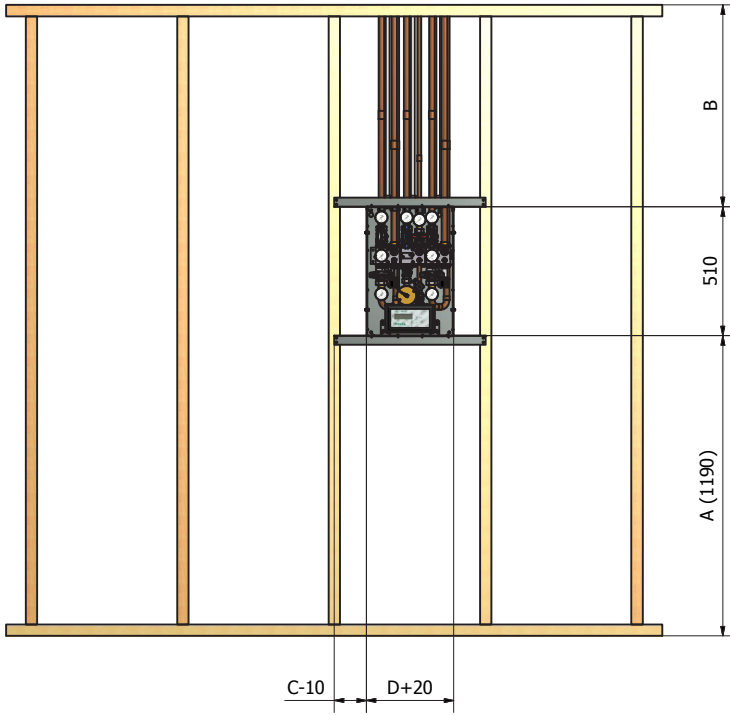
f)

the electrical cables are routed  
in these cable glands and connected  
to relevant equipment.  
see separate wiring  
diagram for the alarm.

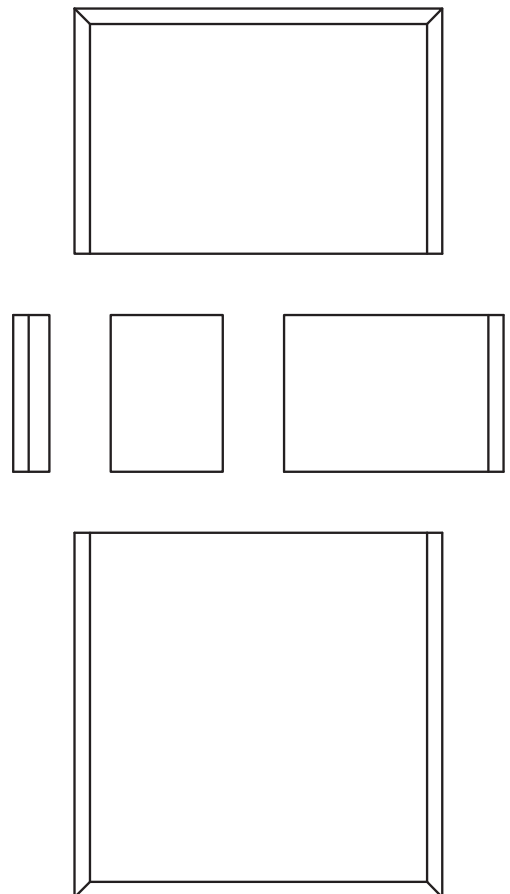
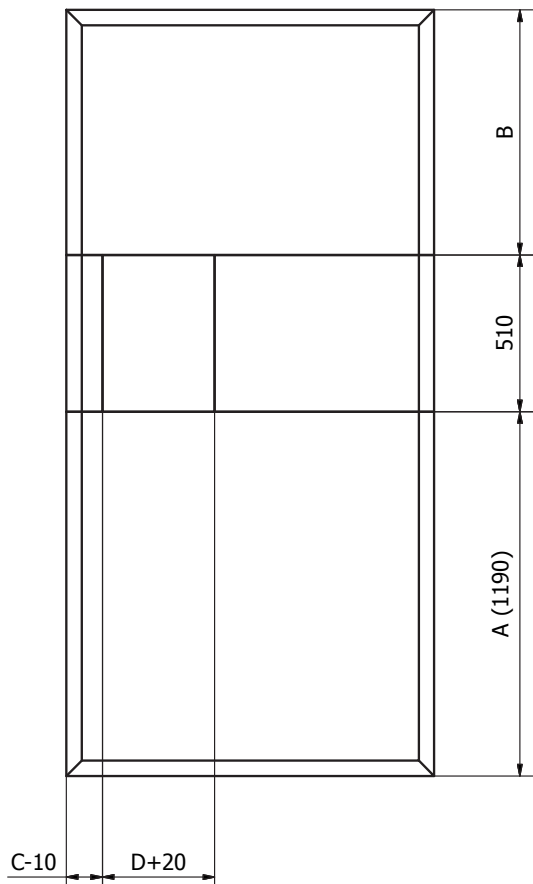


g)

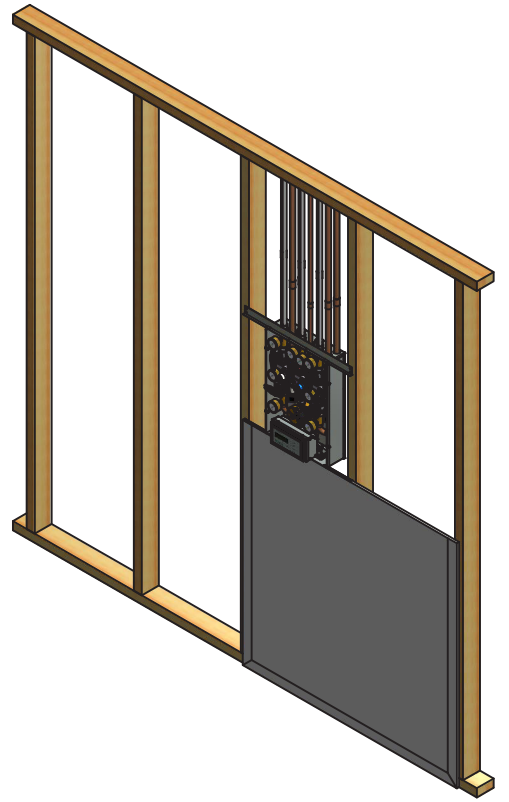
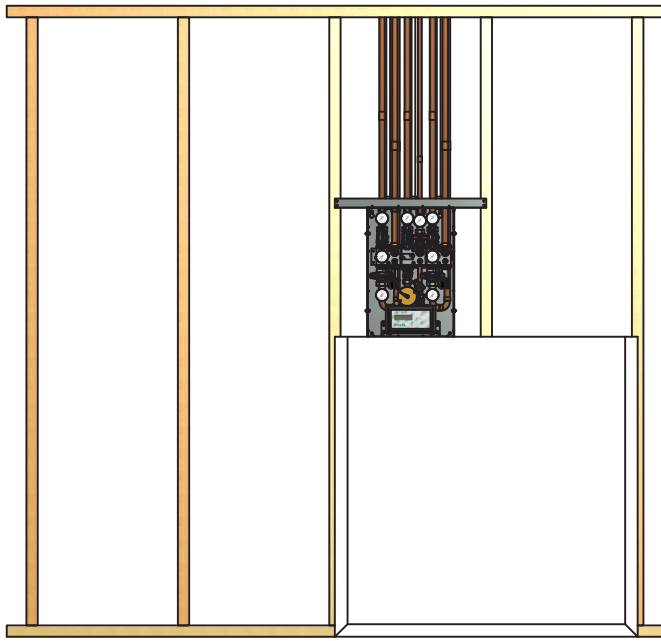
Dimensions are given in millimeters



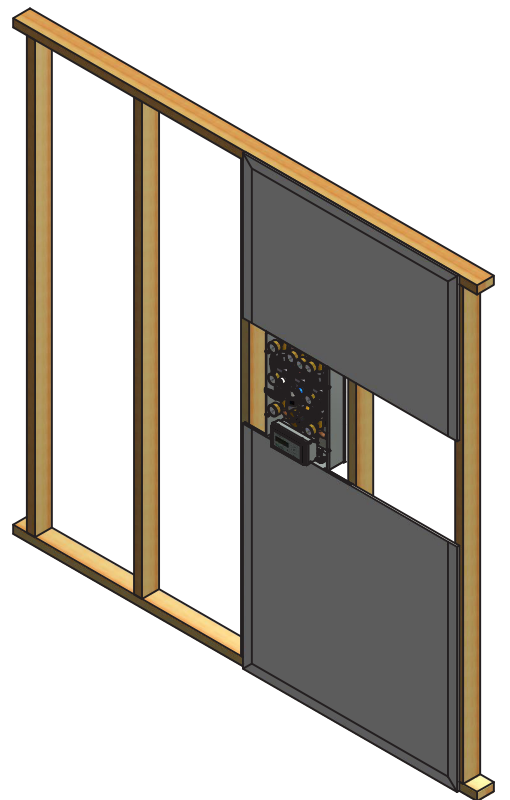
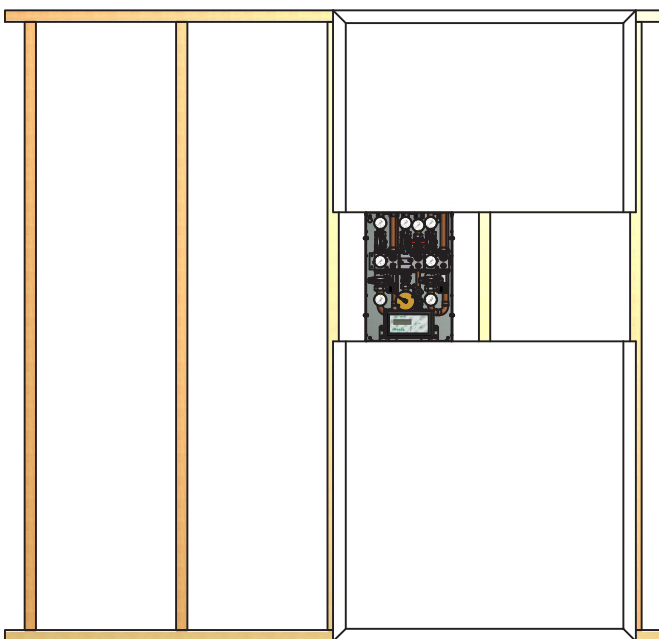
h)



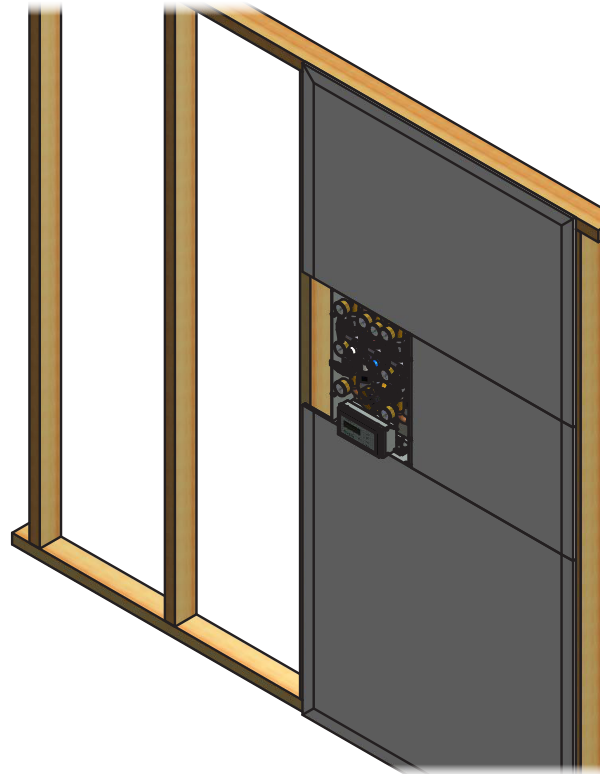
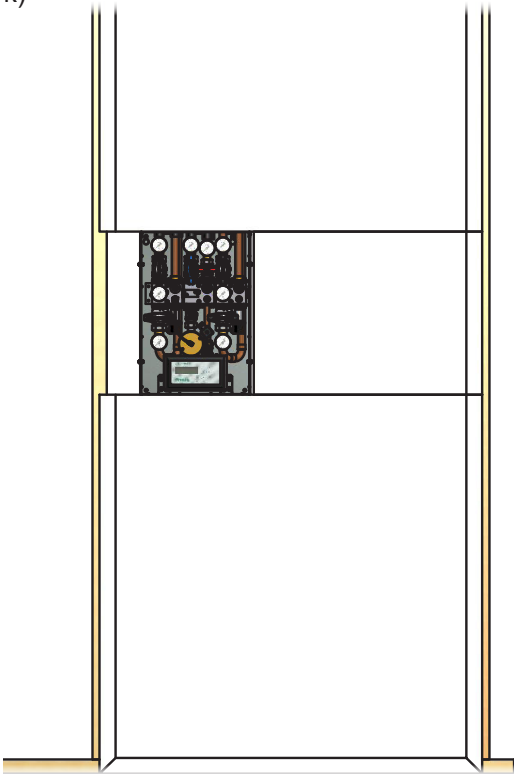
i)



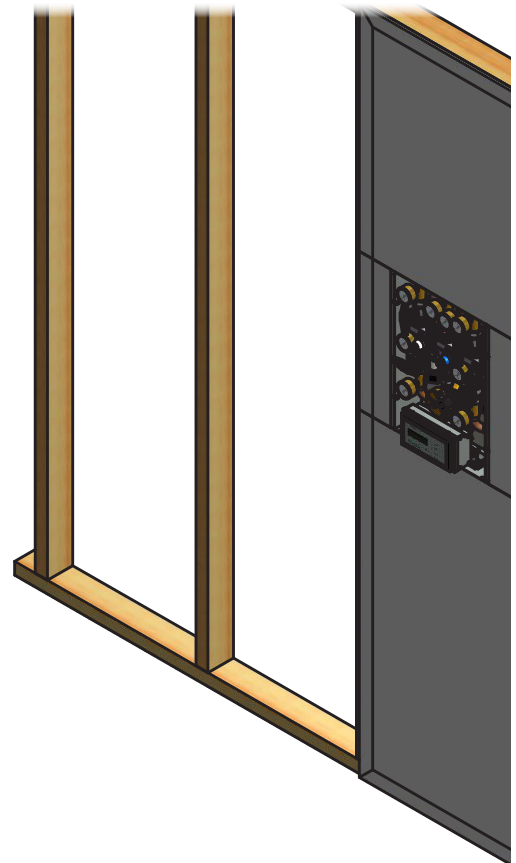
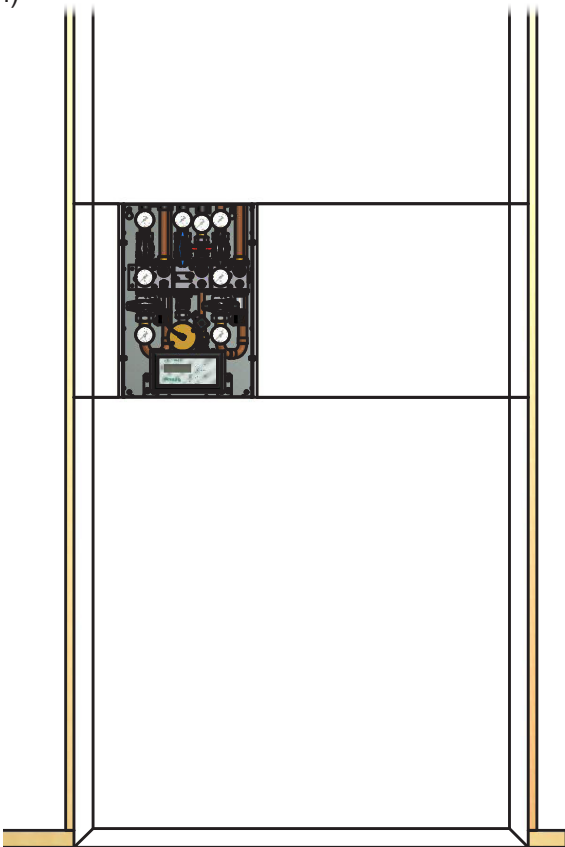
j)



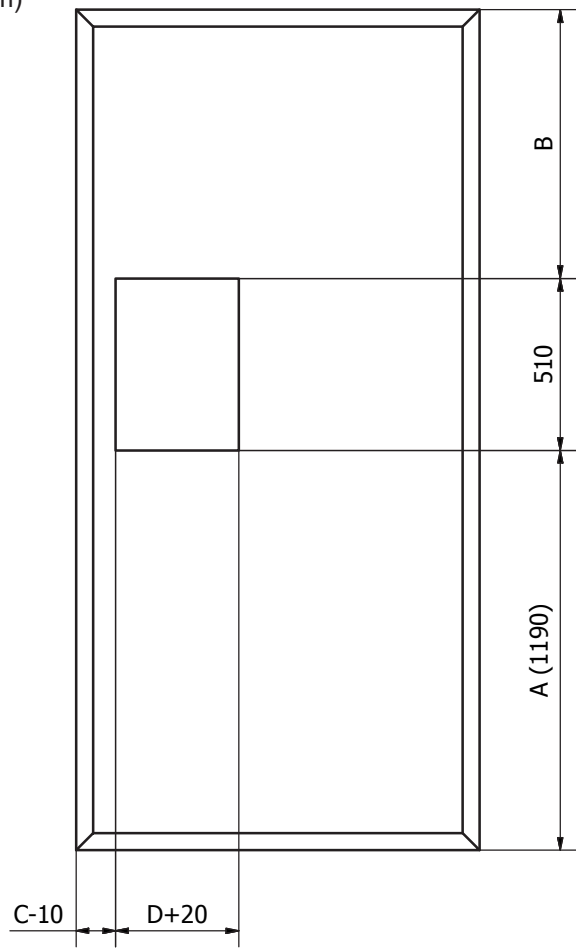
k)



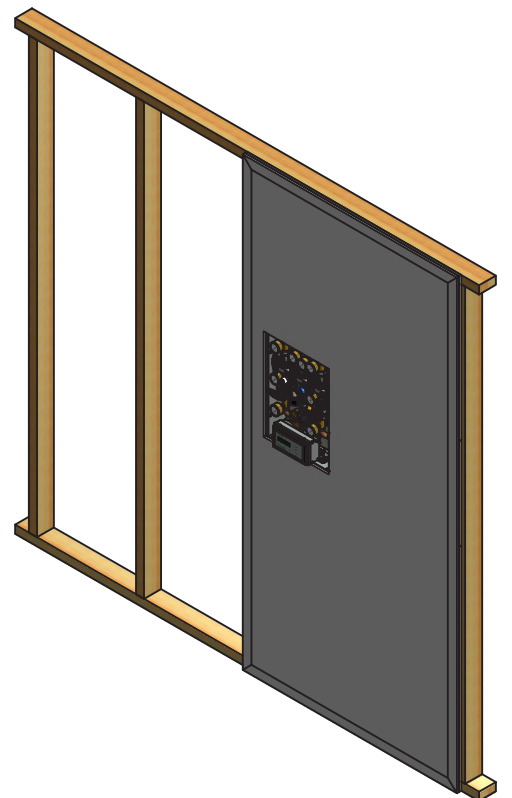
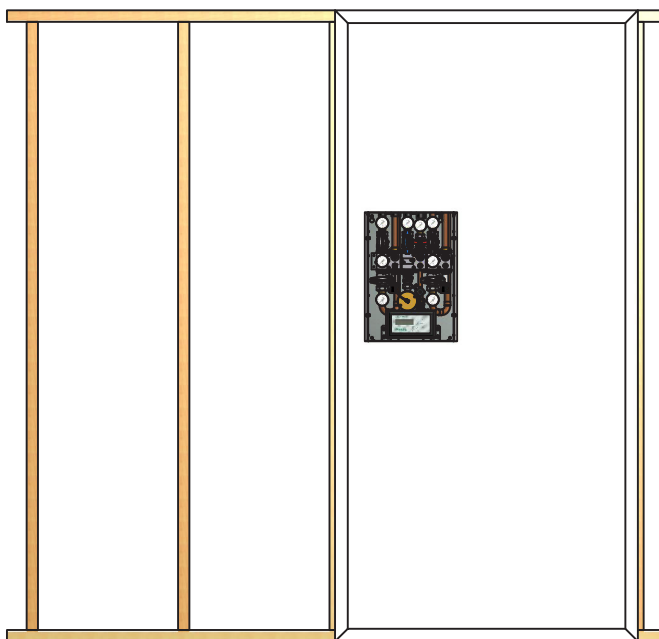
l)



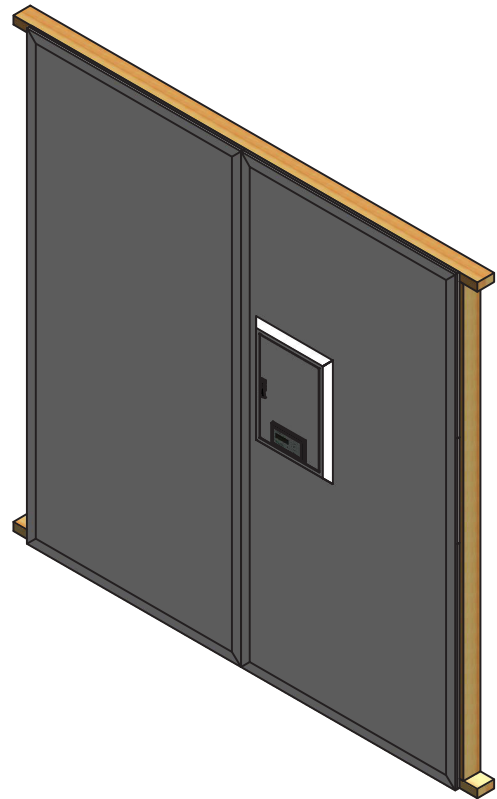
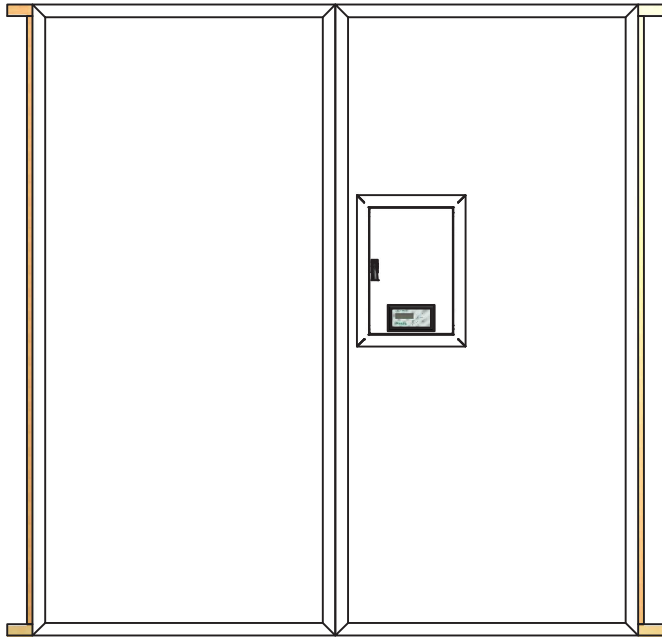
m)



n)



o)



#### Note

- The installer must have the required product knowledge and skills in shielding gas soldering, and have undergone soldering testing according to EN ISO 13585 and EN 13134. Soldering must be done with shielding gas, without flux and with at least five percent silver phosphor copper solder, article number QMT 7200812.
- The valve housings in the appliance must not be exposed to temperatures exceeding 100 ° C. As far as it
- pipe length delivered is not cut, shielding gas soldering may take place without removing the valve body. Should cutting occur, the valve must be disassembled and the soldering distance (QMT 7600XX) used during the soldering operation.
- The installer must ensure that the correct gas and function are achieved through safety testing and that the system complies with EN ISO 7396-1 and national standard SIS HB 370.
- The system must be safety inspected before commissioning in accordance with current standards.
- During pressure testing of the medical gas system, the slave regulator must be temporarily disconnected, otherwise it risks damage. This is most easily done by opening the bypass valve and closing the incoming and outgoing service valve.

#### Warning

The use of shielding gas in medical gas systems must be carefully planned and separated from the rest of the system. After soldering and testing is completed, the system is flushed with the medical gas (= drug) to be contained in the system, to prevent personal injury. See SIS HB 370 and the hospital's instructions. Valves must not be exposed to temperatures exceeding 100 ° C, either during installation or operation. Should this happen or suspect that this has happened, the valve must be replaced and the system cleaned. In the event of a fire or after a fire, the system must be decontaminated in the affected parts. Do not install the product if the sealing plugs are removed, as it may be contaminated and unsafe to install in medical gas systems.

Look at Masterwatch Ultra documentation for more information

### Labeling & Manufacturing control

Each individual is marked with a data plate containing the serial number, date and the tester's signature. The marking can be found on the base plate, see picture next to it for appearance. Manufacturing control takes place according to an established protocol where the entire unit and its parts are checked according to the commissioning instructions (see Operating Instructions). The pressure monitor is also leak-tested at a pressure of 8 bar.

The manufacturing plate of the data plate is a number unique to the unit, which enables traceability of its constituent details.



### Spare parts

Contact Qmt-tech to order spare parts.



**Address**  
Amerikavägen 6  
393 56 KALMAR, Sweden

**Phone**  
+46(0)480 44 02 00

**Fax**  
+46(0)480 44 00 10

**Website/ e-mail**  
www.qmt3.se  
info@qmt3.com