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**Scope of validity:**  
ORLEN Unipetrol Doprava s.r.o.  
and  
ORLEN Unipetrol RPA s.r.o.

## AIR BREATHING APPARATUS MSA M1

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## List of changes

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**Warning:** Change proceedings take place pursuant to Directive 821.

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## 1 Purpose

The work procedure specifies the usage manner of the MSA M1 breathing apparatus, which has been designed for work in environments with suffocating, toxic or other harmful substances or in environments with less than 19% of oxygen in the air.

## 2 Scope of validity

The document applies to the following designated companies:

ORLEN Unipetrol Doprava s.r.o.     ORLEN Unipetrol RPA s.r.o.

This procedure is binding for all employees that conduct activities on the premises of Chempark Záluží.

## 3 Terms, definitions and abbreviations

FB	- Fire Brigade of ORLEN Unipetrol RPA s.r.o.
BA	- Breathing apparatus
BA user	- Employee who has the right to use a breathing apparatus for the protection of his/her airways while working.
Standby box	- Red, 160 cm high box with stored BAs or a resuscitation apparatus, furnished with a brief manual.
BA centre	- Breathing apparatus centre of IS STAR, s.r.o., which services breathing equipment for ORLEN Unipetrol RPA s.r.o. on a contractual basis.
Polluted area	- Environments that contain toxic, suffocating or other harmful substances or environments with less than 19% of oxygen in the air.

## 4 MSA M1 breathing apparatus

### 4.1 Description of the apparatus function

BA MSA M1 is an air overpressure apparatus with an open breathing circuit. Inhaled air is drawn from a composite pressure bottle with a volume of 4.7 or 6.8 liters and with a pressure of 300 bar (30 MPa), which is fixed to a back carrier. BA MSA M1 works on the principle of a two-level air system. Upon opening the bottle valve, the air flows into the first level reduction valve. The air is then led via the high-pressure branch line to a manometer, which shows the remaining air volume in the bottle. The pressure of the air that passes through the reduction valve is reduced to a pressure of 0.6 MPa – 0.9 MPa and led via a medium-pressure hose to the lung demand valve.

Pressure reduction of the second level takes place using the lung demand valve connected to the mask. The design of the lung demand valve includes a startup system that is initiated upon the first inhalation. It means that whenever the lung demand valve becomes connected to the mask, the lung demand valve is automatically set upon the first inhalation. The controller of this function located in the side of the lung demand valve can be used for starts upon first inhalation at any time. When the BA user inhales, an underpressure is formed in his/her mouth, which is carried into the lung demand valve under the membrane. The membrane moves in the direction of the underpressure and pushes on the inner valve of the lung demand valve. The necessary volume of air flows in the mask proportionately to the inhalation strength. Even upon a maximal inhalation, the lung demand valve maintains the internal mask area in overpressure, thus preventing penetration of the surrounding unbreathable air under the mask facepiece. In the end of the inhalation, the underpressure expires and the membrane returns to its initial position, while the valve closes the air intake. An overpressure is created in the mask upon exhalation. It opens the mask exhalation valve and the exhaled air escapes to the surrounding atmosphere. Should the lung demand valve malfunction, the bypass valve is used. Once open, it ensures a continuous air flow to the mask regardless of the operation of the lung demand valve.

The combination of a manometer and whistle allows the BA user to visually and acoustically monitor the volume of air in the pressure bottle. The whistle (warning signal) is located on the reduction valve, making sure the BA user hears the acoustic warning even in the noisiest environments. The whistle starts whistling when the pressure in the bottle drops to

between 60 – 50 bar (6 – 5 MPa – red part of the scale, which represents a warning signal for leaving the contaminated space) and it does not stop whistling until the pressure drops to 10 bar (1 MPa).

#### 4.1.1 Basic technical parameters

**Table 1: Weight and technical parameters of the composite carbon pressure bottles**

Volume ( l )	Operation pressure (MPa)	Air volume ( l )	Weight of the empty bottle (kg)	Diameter (mm)
6.8	30	2,040	4.5	155
9	30	2,700	5.7	178

- Breathing apparatus weight (without the composite bottle) 5.2 kg
- Value of the reduced (median) pressure 0.6 – 0.9 MPa
- Static pressure of the lung demand valve 100 – 390 Pa
- Pressure when opening the exhalation valve 420 – 600 Pa
- Whistle operation pressure 6 – 5 MPa , volume 90 dB
- Pressure when releasing the safety valve 1.1 MPa – 1.15 MPa

#### 4.1.2 Other parameters

**Table 2: EXAMPLE – indicative protection time of the apparatus based on the bottle volume for a light physical activity:**

Volume (in l)	Operation pressure (MPa)	minutes (approximately)
6.8	30	50
9	30	65

- operating temperature - 30 to + 60° C
- storage - 30 to + 60° C
- relative humidity 0% to 90 %

#### Warning:

The apparatus must be stored in a clean environment, out of reach of the sunlight and high temperatures.

## 4.2 Description of individual parts and function of the MSA M1 breathing apparatus

### 4.2.1 The MSA M1 respirator consists of the following parts:

- back carrier
- shoulder and side straps
- reduction valve with a warning signal

- composite pressure bottle with a bottle valve
- manometer
- medium-pressure hose with a outlet for a second BA user
- M1 – AS – B LGDV lung demand valve
- G1 mask

#### 4.2.1.1 Back carrier “M1”

The carrier is made of thermally resistant polyamide material, it is very light and ergonomically shaped. Its design allows for a simple hose installation and safe use. The carrier also includes a special rubber holder with a universally adjustable Velcro strap and a buckle for fastening the bottle.

#### 4.2.1.2 Shoulder and side straps

The carrying (shoulder) straps are easily adjustable using quick-fastening buckles. The buckles are made of metal. The side straps are terminated by two plastic buckles that fit into each other.

#### 4.2.1.3 Reduction valve with a warning signal

The reduction valve is fastened at the bottom part of the carrying panel. It ensures permanent air intake into the lung demand valve and manometer. It also includes a connector for a compressed air bottle and a safety valve, which prevents a hazardous overpressure in the medium-pressure hose in case the reduction valve malfunctions (at a pressure higher than 1.1 – 1.2 MPa).

An important part of the reduction valve is a whistle. The whistle makes a warning signal with an intensity of 90 dB when the air pressure in the bottle drops to 60 – 50 bar (6 – 5 MPa). The whistle is on until the pressure drops to 10 bar (1 MPa).

#### 4.2.1.4 Composite pressure bottle with a valve

It is a composite pressure bottle that is formed by an aluminum core, braided with carbon and glass fibers, and a brass bottle valve. Bottles with volumes of 6.8 and 9 liters with a bottle valve (controlling wheel in the valve axis) are used on the premises of Chempark Záluží. The bottles are filled to a pressure of 30 MPa.

#### 4.2.1.5 Manometer

The manometer measures the air pressure in the bottle and displays it on the scale with a range of 0 – 400 bar (0 MPa – 40 MPa). Individual levels are divided every 50 bar (5 MPa). Each main zone is further divided into 5 parts. A warning area between 0 – 60 bar (0 – 6 MPa) is marked on the manometer by red color. The dial is furnished with a fluorescent color for better readability under reduced visibility. The manometer is equipped with a protective rubber cover and an overpressure valve, which allows for a safe release of excessive pressure in case the internal manometer mechanism malfunctions.

#### 4.2.1.6 The M1 – AS – B LGDV lung demand valve with a bypass valve and rinse (shower) button

The lung demand valve supplies the BA user with a sufficient air volume as needed (based on his/her inhalation). At the same time, it maintains an overpressure in the internal mask area, which is slightly higher than the pressure in the surrounding atmosphere. The casing of the lung demand valve provides for a sufficient protection against impacts and damages. The lung demand valve is fastened to the mask by a simple snap-in mechanism. A part of the lung demand valve is formed by a bypass valve (allows for an additional, regulated and continuous air flow, regardless of the operation of the lung demand valve) and a rinse-shower button (it provides yet additional air dose based on the given BA user - he/she himself/herself obtains the necessary dose by pressing the button).

#### 4.2.1.7 Mask

The MSA G1 made of natural rubber consists of facepiece and inner half-mask, panoramic polycarbonate eye piece, valve chamber with a quick-fastening connector, 5 fastening straps and a rubber strap for hanging the mask on your neck. All straps are furnished with self-tightening clamps. The internal part of the mask houses an exhalation valve and sound membrane for communication purposes.

## 4.3 Operation the MSA M1 apparatus

### 4.3.1 General principles for working with BA MSA M1

- a) Employees wearing BA MSA M1 must not work alone
- b) Obligation to work wearing BA MSA M1 in a group of at least two people (each of them with his/her own BA). When it is not possible for technical or other reasons, additional two employees with BA must be prepared. Each group of employees with BA is overseen by an authorized employee (visual or acoustic connection and inspection of the planned work time with BA).

### 4.3.2 Putting the apparatus into operation, inspection and service during operation

Prior to every use of the apparatus, all functions should be checked - so-called user inspection.

The user inspection must also be conducted when borrowing BA **MSA M1** at the BA centre rental shop and also always immediately prior to the commencement of the work with BA and after every pressure bottle exchange (see Directive 422).

### 4.3.3 User inspection

- a) Fully open the bottle valve by slowly turning it counterclockwise. When the apparatus starts getting under pressure, the whistle will start blowing. Read the pressure on the manometer. The initial pressure in the bottle must be 270 – 300 bar (27 – 30 MPa). Should the pressure be lower, the apparatus must not be used and must be returned to the BA centre department.
- b) An exception to this rule is the use of standby BA placed in the "red standby boxes" when saving lives and assets when there is a delay hazard. Nevertheless, the bottle pressure must be at least 200 bar (20 MPa).

#### 4.3.3.1 High-pressure tightness test

Close the bottle valve (you need to pull the controlling wheel away from the bottle) and monitor the manometer for 1 minute. During this time, the pressure on the manometer must not drop by more than 1 MPa. Should the drop be bigger, it means that there is a leak in the system and the apparatus must not be used. It must be returned to BA centre, where it will be replaced by a different one.

### 4.3.4 Putting the mask on

- a) Hold your breath, put your chin in the mask and pull the mask straps over your head. Tighten them well.
- b) The mask must be put on properly. Tighten the mask bottom straps first, followed by the upper straps and, at the end, center straps.
- c) To prevent mask fogging when the apparatus is used in a cold weather, for example, at temperature below 0 °C, make sure the inner half-mask fits you well.
- d) Push the eye piece to your face (making sure the mask sits properly on your face).
- e) Tighten the bottom and upper tightening straps again.
- f) Start breathing slowly
- g) Upon your first deep inhalation, overpressure is automatically activated (your first inhalation must be deeper).
- h) Watch the manometer and keep breathing slowly. Make sure the whistle starts whistling at 60 – 50 bar (6 – 5 MPa).
- i) When the manometer shows 0, the mask clings to your face.
- j) Hold your breath for 5 seconds. If the mask is well clung to your face, it means it is all right. If you also get air from the outside when inhaling, there must be a leak somewhere.
- k) If the mask does not properly seal, open the bottle valve and adjust the mask on your face in accordance with points d) and e). Close the bottle valve and repeat the procedure pursuant to points g) to j).
- l) Should you not find any leaks, open the bottle valve completely and breath normally.
- m) **The apparatus must not be used if there are any leaks!!**

- n) Test the proper function of the bypass valve.
- o) Turn the bypass valve by 1/4 of a turn in the clockwise direction and make sure a continuous air dose is flowing into the mask. If everything is in order, close the bypass valve.

**If you can breath normally, the apparatus is in order.**

**Warning:**

***Should you locate any other defect or should you have any doubts about the breathing apparatus reliability, immediately return the apparatus to BA centre, where it will be exchanged for another one.***

#### 4.3.4.1 Putting the apparatus on

- a) Completely loosen both shoulder straps using the adjustment buckles.
- b) Take the right strap into your right hand and flip it over your right arm.
- c) Slide your left hand under the left strap and slide the strap on your left shoulder.
- d) Tighten the shoulder straps by pulling them up and subsequently tightening the bottom ends of both straps.
- e) Buckle the back belt to the belt clamp with the "MSA" sign and tighten it symmetrically.
- f) Slide the rubber strap from the mask over your head and hang it on your neck.

#### 4.3.5 Apparatus operation

- a) The BA user must put his/her operational BA on prior to entering the given contaminated area.
- b) The bottle valve must be fully open. The safety mechanism ensures that the valve cannot accidentally close.
- c) While using the apparatus, you need to continuously monitor the air pressure in the pressure bottle on the manometer. Should the handle on the manometer drop quickly, immediately leave the contaminated area.
- d) To leave the contaminated area without an unnecessary hurry, sufficient air supplies are needed. Do not wait until the warning whistle starts whistling.
- e) When you hear the warning whistle, quickly leave the contaminated area.
- f) Take the mask off only once you leave the contaminated area.
- g) Return the apparatus to BA centre when you are done with your work.

#### 4.3.6 Apparatus troubleshooting

##### 4.3.6.1 The supplied air volume drops while working with BA MSA M1

- a) Check if the bottle valve is fully open
- b) Check the pressure on the manometer, observing how much air you still have available.
- c) The approximate apparatus protection time (in minutes) can be calculated by multiplying the water volume of the bottle and the pressure (bar), which is currently showed on the manometer, and dividing this result by 30 (average air consumption in liters per minute).
- d) When air is available, open the bypass valve, thus releasing a continuous air flow into the mask. Breath normally.
- e) Immediately leave the contaminated area.
- f) Return the apparatus to BA centre.
- g) Should you not have any air available, but should there be another employee with BA MSA M1 near you, quickly disconnect the lung demand valve from your apparatus (while constantly keeping the mask on) and connect it to his/her apparatus into the connector for the second BA user (shoulder outlet).
- h) Carefully leave the contaminated area together.
- i) Return the apparatus to BA centre.



#### 4.3.6.2 Functional failures

Immediately leave the contaminated area upon any functional failure. Return the apparatus to BA centre and notify BA centre employees about the given apparatus malfunction or dysfunctionality.

#### 4.3.7 Activity termination – putting the apparatus away

- a) Untighten the fastening straps on the mask using the buckles.
- b) Inhale deeply and release the start button of the lung demand valve (it is the red button on the side of the lung demand valve).
- c) Take the mask off your head.
- d) Unbuckle the belly straps – by pushing the buckles in the direction towards your belly.
- e) Untighten the shoulder straps using the quick-tightening buckles.
- f) Take the mask strap off your neck.
- g) Slide your arms out of the shoulder straps and carefully place the apparatus on a flat surface.
- h) Close the bottle valve (for bottles with a straight valve, pull the wheel out and turn it in the clockwise direction).
- i) Release the air from the breathing apparatus (the apparatus must not be transported or carried when under pressure).
- j) Depressurize BA – open the bypass valve on the lung demand valve and watch the manometer.
- k) When the manometer handle shows 0 and there is no air flowing from the lung demand valve anymore, close the bypass valve.

#### 4.3.8 Apparatus cleaning

- a) The apparatus must be clean from coarse dirt after each use. Wipe the entire apparatus using a rag. When necessary, use lukewarm water with a detergent for the cleaning.
- b) The apparatus must not be cleaned using the cleaning agents specified under Point 4.4, i).

##### 4.3.8.1 Replacing the composite pressure bottle

- a) Composite pressure bottles must be always replaced outside of contaminated areas (unbreathable environment).
- b) Make sure that the bottle valve is closed (in the clockwise direction).
- c) Release air from the apparatus air system.
- d) Open the bypass valve (thus releasing some air from the system), and monitor the pressure drop on the manometer. When the manometer pointer shows 0 and there is no air flowing from the lung demand valve, close the bypass valve.
- e) Untighten the fastening Velcro bottle strap and open the buckle. The strap can be loosened if needed - by simultaneously pulling the safety pin on the buckle away from the bottle.
- f) Disconnect the bottle from the reduction valve by turning the fast-closing cap (connection nut) in the clockwise direction.
- g) The remaining air is not supposed to be released from the bottle – the bottle must not be left completely empty (there must be at least 0.05 bar pursuant to ČSN 07 8304).
- h) Insert the full replacement pressure bottle in the carrier
- i) Level the bottle valve to the same level as the level of the reduction valve.
- j) Connect the bottle to the reduction valve by turning the fast-closing cap (connection nut) in the counterclockwise direction.
- k) Set the tightening belt, making sure you leave a reserve for a comfortable and easy closing of the buckle.
- l) Secure the tightening belt with a Velcro.

- m) The apparatus function must be inspected (user control) before being used after every bottle exchange pursuant to Paragraph 4.3.3.

#### 4.3.8.2 Disconnecting the lung demand valve from the mask

Disconnect the lung demand valve from the mask by simultaneously pressing the black and red buttons.

#### 4.3.8.3 Connecting the lung demand valve to the mask

Connect the lung demand valve to the mask at any position by just snapping it on.

### 4.4 Occupational safety and hygiene

- a) The MSA M1 breathing apparatus can only be used by employees who are authorized to use breathing apparatus (BA) for the protection of their airways and who have been demonstrably trained in the operation of this breathing apparatus at BA centre.
- b) General training conditions, conditions for borrowing respiration equipment, work in BA and locations of the standby BA are specified in Directive 422. When working with BA MSA M1, the workers must proceed in compliance with the safety regulations (and especially in compliance with the principles for the use of personal protection equipment), Directive 465 and other related safety regulations.
- c) Employees who use BA MSA M1 must comply with the mask tightness conditions. Beard, sideburns or glasses can have a negative impact on the mask tightness on the face. Hair must not be under the facepiece.
- d) The apparatus should not come into contact with corrosive and caustic substances, which could damage it.
- e) In environments where the BA users could be exposed to a risk of absorption of toxic or otherwise hazardous substances through skin, which could cause irritation or poisoning, it is necessary to use appropriate protective clothes. When the used protective clothes are of an overpressure design, the connection of this clothes must correspond to the connection for BA MSA M1.
- f) For environments with physical hazards, such as extreme heat or cold or probability of coming into contact with fire, the apparatus should not be used without an appropriate protective cover.
- g) Employees must put their operational BA on prior to entering the given contaminated area.
- h) Should you have any doubts about the reliability of a given breathing apparatus during work, leave the contaminated area immediately and return the apparatus to BA centre.
- i) Do not use benzene or degreasing liquids, such as perchlorate, organic solvents, abrasive cleaning agents, etc. for cleaning the apparatus from coarse dirt particles (prior to returning it to BA centre).
- j) Use lukewarm water with a detergent instead.
- k) Repairs and common maintenance of BA MSA M1 can only be conducted by trained BA centre employees.
- l) Should the MSA M1 breathing apparatuses be transported by transportation means (car, trailer, manual cart), such means must be furnished for the transport by a clean rubber mat. During the transport, the respirators must be secured against sliding on the transportation platform. It is recommended that all extra pressure bottles should be transported in a wooden crate or in some other manner, however, always in a position, in which the bottles are firmly secured against vibrations, sliding or even falling.
- m) When handling the bottles, all related safety measures must be observed.
- n) When the BA are stored at a worksite, they must be placed in standby boxes and secured by seals. The given authorized employee is responsible for permanent accessibility, cleanliness and integrity of the box using seals (pursuant to Directive 422).

## 5 Responsibility

Activity	BA user	Managerial employee	BA centre	Article number
Apparatus operation	R/A	I	C	4.3
User inspection	R/A		C	4.3.3
Apparatus cleaning	R/A		R/A	4.3.8
Complying with the general principles for working with BA MSA G1	R/A	A/C	C	4.3
Complying with occupational safety and hygiene	R/A	A/C	C	4.4
Conducting maintenance and tests of the MSA M1 apparatuses	C	I	R/A	4.4.k

Explanatory notes:

- R** - RESPONSIBLE - performer
- A** - ACCOUNTABLE - is fully accountable if not conducted
- C** - CONSULT – included in the process
- I** - INFORM - is kept informed

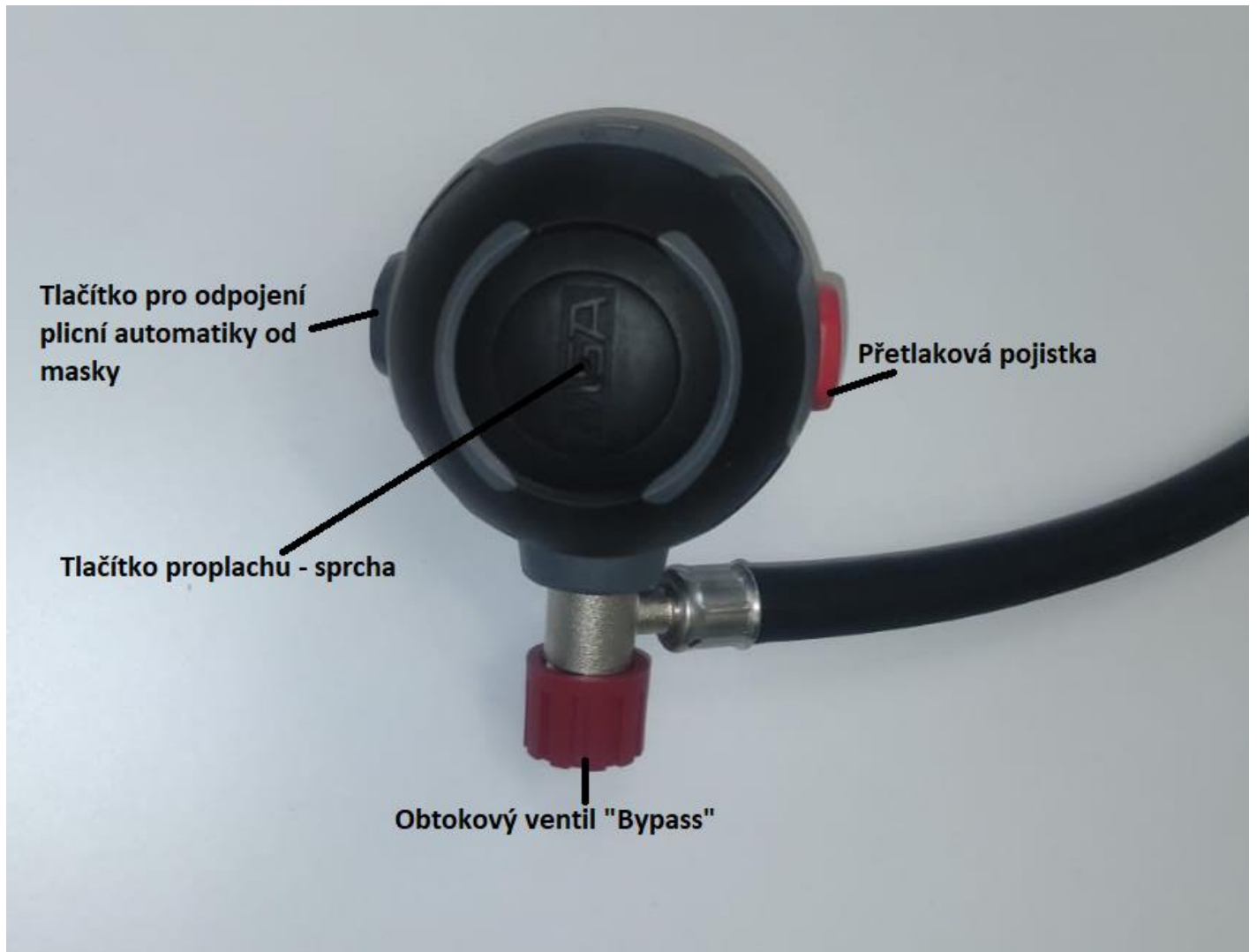
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## **Appendix A MSA M1 breathing apparatus - details**

### **Appendix A.1 Overall view of the M1 respirator without bottle and without mask:**



## Appendix A.2 Detail of the M1 – AS – B LGDV lung demand valve



### Appendix A.3 Detail of the bottle with a controlling wheel in the valve axis



#### Appendix A.4 Detail of the MSA G1:

