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AIR LINE BREATHING APPARATUS – MSA DSL-P

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1 Purpose

The work procedure determines the use of the air line breathing apparatus MSA DSL-P, which has been designed for long-lasting works in environments that contain suffocating, toxic or other harmful substances and/or in environments with less than 19% of oxygen in the air, particularly in the areas where the movement of BA users is restricted, i.e. in places where interventions with standard BA (bottle carried on the back) is made significantly harder.

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 issue replaces:

- Work procedure 20, "Air line breathing apparatus – MSA DSL-P", Edition 2, from 1. 12. 2020.

This procedure should be binding for all employees that use the MSA DSL-P breathing apparatus at individual worksites or facilities of ORLEN Unipetrol RPA s.r.o.

3 Terms, definitions and abbreviations

FB	- Fire Brigade of ORLEN Unipetrol 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 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 DSL-P air breathing apparatus

4.1 Description of the apparatus function

BA MSA DSL-P is an air overpressure apparatus with an open breathing circuit. Inhaled air is drawn from composite pressure bottles with a volume of 6.8 liters (or 9 liters) with a pressure of 300 bar (30 MPa), which are located in a special cart with wheels.

4.1.1 Inhalation

The apparatus is completely under pressure, the bottle and control valves are open, the discharge valves are closed, the overpressure system of lung demand valve (bypass and fuse) is turned off and the mask sits on the face of the given BA user.

During the first inhalation, the BA user has to exert such an underpressure that it opens the overpressure lung demand valve. This system then switches to the overpressure mode. Upon a standard inhalation, the overpressure value under the mask decreases, the lung demand valve opens and the necessary volume of air from the medium-pressure area starts flowing into the mask. Simultaneously with drawing the air from the medium-pressure area of the breathing apparatus, the pressure in this area decreases. The reduction valve reacts to the pressure drop by opening its high-pressure valve and compressed air from the pressure bottles flows to the medium-pressure area of the apparatus. Towards the end of the given inhalation, the overpressure under the mask increases to the value

of the closing pressure of the lung demand valve. The lung demand valve closes, upon which the reduction valve on the apparatus cart closes as well (with a slight delay).

4.1.2 Exhalation

When exhaling, the BA user must create such an overpressure under the mask that it opens the mask exhalation valve. The valve remains open during the entire exhalation time. At the moment the pressure drops to the level of the mask exhalation valve closing pressure, the valve closes and the exhalation is completed.

4.1.3 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 bottles) approximately 25 kg
- Value of the reduced (median) pressure 0.6 – 1.0 MPa
- Static pressure of the lung demand valve 100 – 390 Pa
- Pressure when opening the exhalation valves 400 - 500 Pa
- Operation pressure of the (warning signal) of the whistle 6 – 5 MPa, volume 90 dB
- Pressure when releasing the safety valve 1.1 – 1.2 MPa

4.1.4 Other parameters

Table 2: EXAMPLE – indicative protection time of the apparatus based on the bottle volume for a **relatively calm use**:

Volume (in l)	Operation pressure (MPa)	minutes (approximately)
2 x 6.8	30	100
2 x 9	30	130

- 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 DSL-P breathing apparatus

4.2.1 Basic parts of the MSA DSL-P apparatus

- Cart on wheels with a telescopic handle
- Reduction valve with manometers and a warning signal
- Two composite pressure bottles with a bottle valve
- Belt of the BA carrier with a medium-pressure quick coupler
- High-pressure connection hose with discharge valves
- Disconnectable winch with a medium-pressure hose
- AutoMaXX-AS-B-G lung demand valve
- Ultra Elite-PS-MaXX mask

4.2.1.1 Cart on wheels with a telescopic handle

The basic cart element is a pressure bottle holder, structure of which can hold two air pressure bottles with a volume of 6.8 l (or 9 l). Two high-pressure flexible connection hoses are connected to the bottle valves. The hoses are furnished with discharge valves, which bring compressed air to the fixed pressure distribution mechanism of the cart. The fixed pressure distribution line is connected to the control panel, which is furnished with a reduction valve with a warning signal, manometer of the input pressure and manometer of the reduced pressure. To make its handling easier, there are two wheels at the bottom of the cart. Transporting is also made easier by using a telescopic handle.

4.2.1.2 Reduction valve with manometers and a warning signal

The reduction valve is located on the control panel. It ensures permanent air supplies via the hose system on the winch and the quick coupler on the belt of the BA carrier, all the way to the lung demand valve. There are two manometers here - one for high and the other one for reduced pressure. An important part of the reduction valve is a whistle, which is installed between the manometers. 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 stays on until the pressure drops to 10 bar (1 MPa).

4.2.1.3 Composite pressure bottles with a valve

It is a composite pressure bottle that is formed by an aluminum core, braided with carbon 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. They are filled to a pressure of 30 MPa.

4.2.1.4 Belt with a fast coupler

The leather belt is equipped with a metal buckle and a fast coupler for connecting the hose of the lung demand valve.

4.2.1.5 High-pressure flexible connection hoses with discharge valves

These hoses are connected to the pressure bottle valves. They bring compressed air to the fixed pressure distribution system of the carrier.

The discharge valves are used for releasing air pressure in the high-pressure connection hoses. They are used when replacing individual pressure bottles while BA MSA DSL-P is in operation.

!!! However, replacing individual pressure bottles while BA MSA DSL-P is in operation is prohibited on the premises of CHEMPARK Záluží due to the risks occurred when replacing the bottles. It is thus possible to only replace both bottles at the same time when the working BA MSA DSL-P user is outside of the given contaminated area.

Replacement of individual pressure bottles while BA MSA DSL-P is in operation can be only done by FB employees in the case of an intervention or when practicing this activity.

4.2.1.6 Disconnectable winch with a medium-pressure hose

It is located on the cart frame and it can be dismantled if necessary (repair, maintenance, etc.). The medium-pressure hose is used for bringing air to the fast coupler on the belt. Its handling (winding and unwinding) is done using a handle.

4.2.1.7 The AutoMaXX-AS-B-G 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 that allows for an additional, regulated and continuous air flow, regardless of the operation of the lung demand valve, and a rinse (shower) button that provides yet additional air dose based on the given BA user - he/she himself/herself obtains the necessary dose by pressing the button.

The length of the lung demand valve hose is extended to 1.5 m in order to allow for an improved mobility of the BA MSA-DSL-P user.

4.2.1.8 Mask

The MSA Auer mask (Ultra Elite type) made of special black 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 DSL-P apparatus

4.3.1 General principles for working with BA MSA DSL-P

a) Employees wearing BA DSL-P must not work alone!

Should an employee work with BA MSA DSL-P, it is necessary to provide a sufficient number of people for:

- monitoring the employee with BA MSA DSL-P
- safeguarding and, if necessary, rescuing the employee with BA MSA DSL-P
- continuous monitoring of the BA MSA DSL-P condition and air supplies in the pressure bottles
- monitoring the worked hours of the employee with BA MSA DSL-P

The exact number of the persons should be determined by the recipient considering the given particular activity and work location as a part of issuing the given work permit pursuant to Directive 465, however, there must be at least a two-member group (one user in BA MSA-DSL-P and one securing BA user with his/her own BA MSA AUER AirGo)!

b) Securing FB employees can also use BA MSA AUER AirMaXX eXXtreme.

4.3.2 Putting the apparatus in operation and user inspection

Prior to every use of the apparatus, the BA user should inspect all the apparatus functions - by conducting the so-called user inspection.

The user inspection must also be conducted when borrowing BA MSA DSL-P 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).

4.3.2.1 User inspection

Both bottle valves and both control valves are gradually open by turning the wheel of the bottle valve in the counterclockwise direction. When the apparatus starts getting under pressure, the warning signal will sound. Read the pressure on the manometer. The initial pressure in the bottles must be 270 – 300 bar (27 – 30 MPa). Should the pressure be lower, the apparatus must not be used and must be returned to BA centre.

1) High-pressure tightness test

Close the bottle valve and monitor the manometer for 1 minute. During this time, the pressure on the high-pressure manometer must not drop by more than 10 bar (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.

2) Warning signal test

By gradually releasing the pressure via the bypass, test if the warning signal whistles in a timely manner, i.e. that it notifies the given BA user early enough to leave the contaminated area. The warning signal should sound within the range of 50-60 bar (5-6 MPa) on the high-pressure manometer. Should the signal sound late – below 50 bar (5 MPa), the given BA MSA DSL-P must not be used.

3) Mask tightness test

Put the mask on your face and seal it. If you cannot breath (BA is currently without pressure), it means the mask is in order and seals well.

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 warning signal starts sounding at 60 – 50 bar (6 – 5 MPa).
- i) When the manometer shows 0 bar (0 MPa), 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.

4.3.3 Putting the apparatus on

- a) Using the handle, gradually (one of the two securing employees) unwind the hose wound on the drum as needed, making sure the working employee can comfortably put the leather belt around his/her waste and buckle it up. Observe the correct fastening - the incoming hose leads to the ground on the right side
- b) Grab the lung demand valve with the mask, leading from the quick coupler on the belt, by your hand in a way that ensures free movement during an intervention
- c) Slide the rubber strap from the mask over your head and hang it on your neck.
- d) Put your chin in the mask and pull the mask straps over you head. Tighten them well.
- e) As soon as the mask is sealed on your face, the overpressure system is automatically activated by inhalation
- f) Once activated, the BA user breathes normally and can conduct work or intervention with the MSA- DSL-P breathing apparatus, which means that his/her colleagues unwind the hose for him/her for easy movement, while the person with the mask goes to the area where he/she will work.

4.3.4 Apparatus operation, inspection and service during operation

- a) The BA user must have his/her BA MSA DSL-P operational, included the mask on his/her face, already prior to entering the contaminated area.
- b) All valves (two bottle valves and two control valve) must be fully open and returned by ½ a turn. The safety mechanism of the pressure bottle valves prevent their accidental closing.
- c) When using the apparatus, the securing BA users must continuously monitor the air pressure in the pressure bottles on the manometer, cooperate and communicate with the working BA MSA DSL-P user. The manometer is installed on the cart and the BA MSA DSL-P user cannot see the current air supplies.
- d) Should the warning signal sound, the securing BA users should inform the working BA MSA DSL-P user to immediately terminate his/her work and to leave the contaminated area
- e) The BA MSA DSL-P user can remove his/her mask only once he/she leaves the contaminated area.
- f) Return the apparatus to BA centre when you are done with your work.

4.3.5 Apparatus troubleshooting

4.3.5.1 Decreased air volume supplies while working with BA MSA DSL-P

- a) Make sure the bottle valves are sufficiently (fully and returned by ½ of a turn) 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 have no air available and should there be another employee with BA MSA AUER AirGo near you (in the case of FB members of Unipetrol RPA, BA MSA AirMaXX eXXtreme), inhale deeply and immediately disconnect the lung demand valve from the fast coupler of your apparatus on the belt (while keeping the mask on your face) and connect it to the apparatus of the other BA user, particularly to the given side connector (to the second connector on the distributor in the case of BA MSA AUER AirMaXX eXXtreme).
- h) Carefully leave the contaminated area together.
- i) Return the apparatus to BA centre.

4.3.5.2 Functional failures

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

4.3.6 Activity termination and putting the apparatus away

- a) Untighten the fastening straps on the mask using the buckles.
- b) Inhale deeply and remove the mask from your head.
- c) Deactivate the overpressure system by releasing the overpressure safety pin (red button on the side of the lung demand valve).
- d) Keep the mask hanging on your neck for now using the suspension rubber strap.
- e) Open the buckle on the leather belt and remove the mask strap from your neck.
- f) With the help of your colleagues and using the handle, wind the medium-pressure hose back on the drum. Next, fasten the leather belt over the drum, thus making sure the hose cannot spontaneously unwind. The mask with the lung demand valve remains connected to the fast coupler on the leather belt.
- g) Close the bottle and control valves (for bottle valves, pull the wheel out while turning it in the clockwise direction).
- h) Depressurize BA MSA DSL-P (the apparatus must not be transported or carried under pressure) - open the bypass valve on the lung demand valve and monitor the high-pressure manometer.
- i) When the manometer pointer shows 0 bar (0 MPa) and there is no air flowing from the lung demand valve anymore, close the bypass valve.
- j) Now place the mask back to the bag and secure the mask with the lung demand valve using the belt on the bag, thus making sure it cannot become damaged while being handled (transferred or carried).

4.3.7 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, j).

4.3.8 Replacing the composite pressure bottles

- a) The composite pressure bottles can only be replaced outside of the contaminated area and always together. Changing the bottles while in operation is prohibited (see Point 4.2.1.5.), i.e. the working BA user must leave the contaminated area before the pressure bottles can be replaced.
- b) Make sure that the bottle valves are closed (in the clockwise direction).
- c) 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 bar (0 MPa) and there is no air flowing from the lung demand valve, close the bypass valve.
- d) Release the bottle holder in the cart frame, thus making it possible to remove them without any problem.
- e) Disconnect the bottles from the high-pressure connection hoses by turning the connection nut.
- f) The remaining air must not be released from the bottles - the bottles must not remain completely empty!
- g) Insert full replacement bottles in the cart and screw the connection nuts of the flexible, high-pressure hoses on them.

- h) Using the nuts, tighten the pressure bottle holders, making sure they are secured for any kind of work or handling.
- i) The apparatus function must be inspected (user control) before being used after every bottle exchange pursuant to Paragraph 4.3.2.1.

4.3.9 Disconnecting the lung demand valve from the mask

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

4.3.10 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 BA MSA DSL-P can only be used by employees who are authorized to use breathing apparatuses (BA user) for the protection of their airways, who are medically competent and who have been demonstrably trained in the operation of this breathing apparatus at the 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 DSL-P, 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 DSL-P 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 AUER AirGo and BA MSA AUER AirMaXX eXXtreme.
- 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 the BA centre.
- i) Do not use degreasing liquids, such as benzene, perchlorethylene, organic solvents, abrasive cleaning agents, etc. for cleaning the apparatus from coarse dirt particles (prior to returning it to the BA centre).
- j) Use lukewarm water with a detergent instead.
- k) Repairs and common maintenance of BA MSA DSL-P can only be conducted by trained BA centre employees
- l) Should the MSA DSL-P 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 vibrations and sliding on the transportation platform. All extra pressure bottles can only 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) The given authorize employee is responsible for permanent accessibility, cleanliness and integrity of the box and seal.

5 Responsibility

Activity	BA user	Managerial employee	Respirator technology center	Article number
Apparatus operation	R/A	I	C	4.3.
User inspection	R/A		C	4.3.2.1
Apparatus cleaning	R/A		R/A	4.3.7
Complying with the general principles for working with BA MSA AUER DSL-P	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 DSL-P apparatus	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

[RACI matrix with comments](#) (pursuant to the “Improving efficiency of the processes and their optimization” policy)

6 List of related documents

Directive 422 Respirator technology service and use
Directive 465 Work permit

Appendix A MSA DSL-P air breathing apparatus – details

Appendix A.1 Overall view of the AUER DSL-P air apparatus



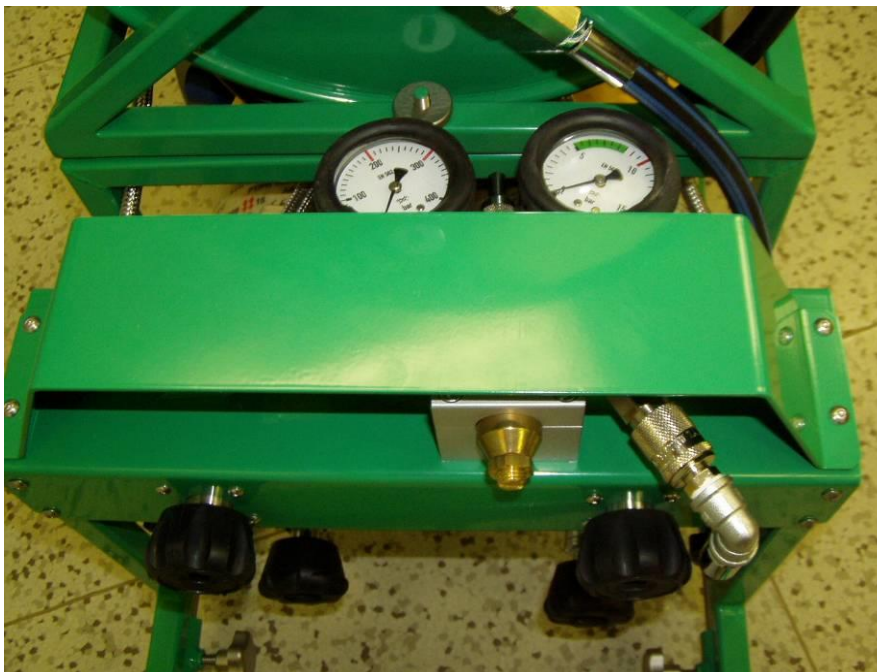
Appendix A.2 Front view of the AUER DSL-P air apparatus



Appendix A.3 Rear view of the AUER DSL-P apparatus



Appendix A.4 Detail of the control panel of the AUER DSL-P apparatus



Appendix A.5 Detail of the AutoMaXX-AS-B-6 lung demand valve



Appendix A.6 Bottle detail with a straight opening valve (wheel)



Appendix A.7 Detail of the Ultra Elite-PS-MaXX mask

