

# MKD-DUAL

Minimal lubrication  
for near dry-working systems

## User and Maintenance Manual

Original Translation

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## 1. INTRODUCTION

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This manual refers to the *MKD-Dual for near Dry-working systems*.

You can find additional copies and newer revisions of this document from our website <http://www.dropsa.com>. Alternatively contact one of our *Sale Offices*.

This *User and Maintenance Manual* contains important information on health and safety issues for the personnel.

It is recommended to attentively read this manual and carefully keep it in good condition so that it is always available to personnel requiring to consult it.

## 2. GENERAL DESCRIPTION

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*MKD-Dual* has been designed mostly for middle-high target – this sophisticated technology of generation of a ultra thin aerosol mixture allows the flow of micro-parcels (< 1µm size) through the spindle and the machine tool, avoiding the wear of the mixture.

### 2.1 MINIMAL LUBRICATION

Generally, lube-cooling substances are used in the milling and turning of metal materials.

Mostly the work site is exposed to the flow of an oil-water mixture.

The *MKD-Dual minimal lubrication system* is different from the traditional systems because it can generate a thin film of aerosol mixture which is brought directly inside the machine tool, for example, via the machine spindle toolpost of a work site.

(With the optimal adjustment of oil, the oil quantity dosed will not leave any residue.)

#### ADVANTAGES:

- Cycle time reduction: from 25% up to 80%.**
- cut in lubricant consume**
- long life of the machine tool**
- better part finishing.**

### 2.2 STRUCTURE AND FUNCTIONING

*Please refer to drawing on page 4.*

A compressed air supply with a pressure of 6 bar (88.2 psi) is necessary. The compressed air supply must be connected to the air inlet (1) and regulated via manual regulation valve (2).

Due to the oil valve (10) the oil destined for the aerosol mix can be regulated.

The oil valve is integrated within a flowmeter which can give a set output. It can be adjusted manually or automatically. The adjustment of oil quantity is visible from the flowmeter.

The air valve (3) regulates the volume of air in the aerosol. To increase the flow it is necessary to pull the handle outwards away from the unit, and whilst holding it in that position, rotate the handle clockwise. To decrease the flow pull the handle and rotate anti-clockwise. It is possible to read the air pressure on the pressure gauge.

The extra air valve ( for extra flow ) (4), allows more air into the aerosol if/when necessary. This way there is a guarantee that a sufficiently high flow of air is in the aerosol mix. Even the extra air valve is adjustable in the same manner as the air valve. It is also possible to read the air pressure from the pressure gauge.

**WARNING: Additional air pressure must always be 1.5 bar (22.05 psi) lower than the aerosol pressure.**

On the side of the reservoir there is a clear tube and this can be used to view the oil level in the reservoir. The low and high levels are also clearly marked on the reservoir.

***The Dual unit is provided with two outlets which can be supplied with electro-pneumatically controlled ball valves.***

When fitted with electro-pneumatic ball valves (option), these can be installed for simultaneous use via the machine operating controls. In this way, it is possible to control ON and OFF functions as well as phasing of the aerosol jet.

### 2.3 SAFETY AND SERVICE

The DUAL dry-working system must be installed and operated in accordance with the instructions and parameters described on the User Manual. The MKD-Dual may only be used in metal cutting and it must not be used for aims different from the ones agreed by the manufacturer. The manufacturer is not liable for any damage caused by improper use or wrong operation of the appliance. In order to comply with the safety regulations the following precautions are applied:

- Disconnect and insulate each supply source before system start-up.
- Discharge system pressure before installing or maintenance.
- Ensure all supply lines and electric connections are insulated from the system and cannot be used during installing and machine start-up.

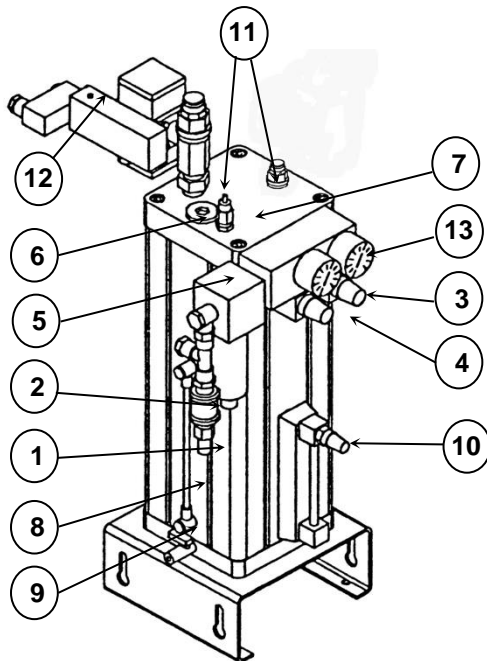
- **For internal lubrication, only perform those cutting processes which are suitable for dry operation.**
- The general rules and safety regulations for machinery and appliances using compressed-air also apply for the *MKD-Dual* and must be observed under all circumstances.
- Before any machine start-up, verify that the compressed-air connection and the regulation valves are in proper condition.
- Human beings or animals must NOT come into contact with the aerosol spray; in particular avoid spraying into the eyes or directly inhaling the aerosol.
- Avoid sparks or open flames come into contact with the aerosol spray.
- For safe operation, the *MKD-Dual* may only be installed and operated in accordance with the manufacturer's instructions.
- Before lubricant refilling, the *MKD-Dual* must be disconnected from its compressed-air supply under all circumstances; the pressure reservoir must be pressure-free (manometer needle points to "ZERO").
- In the case of damage to the appliance or a defect occurring, disconnect the machine from the compressed-air supply IMMEDIATELY either by closing regulation valve (2) or by opening the quick-release coupling of the connecting pipe.
- Repairs, replacement of spare parts and any other interventions to the *MKD-Dual* are ONLY to be carried out AFTER having contacted our after-sales service.
- Before maintenance and/or cleaning of the *MKD-Dual*, ALWAYS disconnect it from the compressed-air supply and decompress the pressure reservoir (manometer needle points to "ZERO").
- Defective *MKD-Dual* units must NOT be put into operation.
- Old and worn out *MKD-Dual* units must be made unfit for further use IMMEDIATELY, and then be disposed of properly.

### 3. TECHNICAL SPECIFICATIONS

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<b>Air supply</b>	MAX 6 bar (88.2 psi)
<b>Air inlet pipe</b>	Ø6÷10 mm (0.23÷0.4 in.)
<b>Aerosol outlet pipe</b>	Ø10÷16 mm (0.4÷0.6 in.)
<b>Reservoir Capacity</b>	1,8 litres (0.40 galls)
<b>Electro-pneumatic ball valve power supply</b>	24VDC 200mA

## 4. MACHINE COMPONENTS



Pos.	Description
1	Compressed-air inlet
2	Open close manual valve
3	Aerosol regulation valve
4	Additional Air pressure regulation valve
5	Surplus water outlet
6	Refilling plug
7	Safety valve
8	Refilling level indicator
9	Oil outlet tap
10	Flowmeter
11	Aerosol outlets
12	E-valv.
13	Pressure gauge

## 5. UNPACKING AND INSTALLING THE MACHINE

### 5.1 UNPACKING

Once a suitable location has been found to install the unit, remove the machine from the package. Check the unit has not been damaged during transportation or storage. No particular disposal procedures are necessary as package materials are no dangerous for health or environment. However, package should be disposed of in accordance with regulations that may be in force in your area or state.

### 5.2 INSTALLATION

There are two ways of installing the *MKD-Dual* unit:

1. The appliance is tightly bolted onto the casing of the machine tool. In this case, make absolutely sure that it is not exposed to extreme oscillations or vibrations.
2. The *MKD-Dual* may also be mounted beside the machine tool. Make sure that the site of installation is suitable. For example, the appliance must not be mounted where vehicles (such as fork lifters etc) are likely to pass, in order to avoid damage to pipelines.

In addition, please observe the following recommendations:

- For faultless operation, the unit **must** under all circumstances **be installed in a perfectly vertical position**
- NEVER allow the *MKD-Dual* to stand on its head; its operating elements must always be at the top
- The *MKD-Dual* unit should be mounted in a place where the oil refill inlet is at all times EASILY ACCESSIBLE for maintenance and lubricant refill.

**The operator of the appliance will be responsible for any damage caused by improper installation of the MKD-Dual unit.**

#### 5.2.1 SOLENOID VALVE CONNECTION

Connect the solenoid valve to the aerosol outlet (11). To deliver the quantity of lubricant proportionate to machine tools hole nozzles with different-sized holes can be supplied. (For more info, please contact our Engineering Dept.)

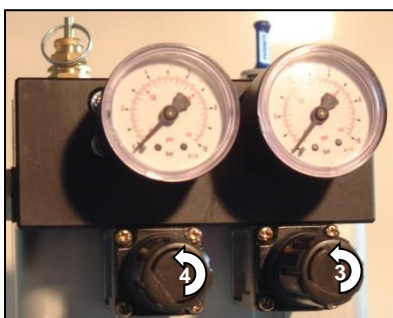
#### 5.2.2 CONNECTING THE COMPRESSED-AIR SUPPLY

**WARNING: Proper connection to the compressed air supply must be carried out by QUALIFIED PERSONNEL only.**



Connect the *MKD-Dual* air inlet (1) to the compressed-air supply.

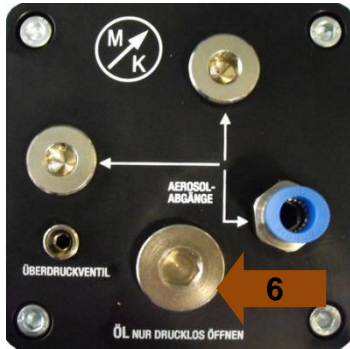
**For safety reasons, NEVER let the compressed-air system EXCEED a pressure of 6 bar (88.2 psi)!**



Prior to connecting, make sure that main air valve — the manually adjustable regulation valve — and the regulation valves (3) and (4), are all CLOSED (turned anti-clockwise).

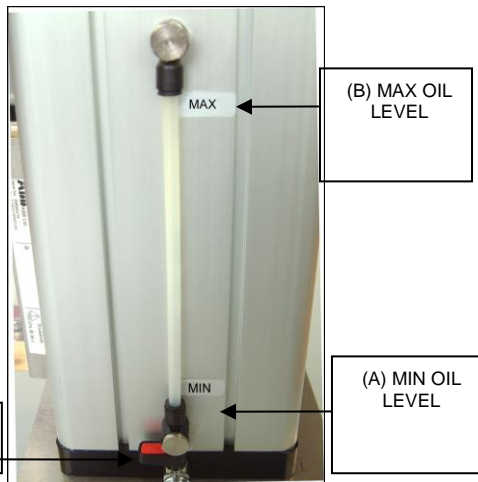
Regulate the aerosol regulation valve (3) between 6 and 8 bar (88.2÷117.6 psi) and the air pressure valve (4) between 0 and 2 bar (0÷29.4 psi).

## 5.2.3 REFILL



### 5.3.1 REFILLING FOR THE FIRST TIME

When refilling for the first time, make sure that the container of the *MKD-Dual* unit is not already under pressure (the needle of the manometer must point to "ZERO"). Open the screw cap to pour the lubrication oil into the lubricant inlet (6). Do NOT exceed the "Maximum" mark on the indicator column (8).



### 5.3.2 REFILL

When the level has dropped to the "Minimum" mark on indicator column (8), refill the *MKD-Dual* with lubricant. If the unit has already been in operation, the container must be depressurized before refilling. Now proceed as described above under 5.3.1.1 "Filling for the first time"

### WARNINGS:

- For safety reasons, ALWAYS disconnect the *MKD-Dual* from the compressed-air supply BEFORE refilling.
- When refilling, do not exceed the "maximum" filling mark on indicator column (8)!

### IMPORTANT:

Make sure that you use the SAME OIL when refilling. If you want to refill with an oil different from the one previously used, please contact the supplier/ manufacturer first to find out if it is compatible. It is advised first to drain off the old oil from the container by opening the oil outlet tap (9) and letting it drip out (into a bowl or tin); Then refill the *MKD-Dual* with the new lubricant oil up to the "maximum" mark. The unit can now be operated again.

NOTE: We accept no claims resulting from damage caused by using incompatible lubricants without previous correct and thorough cleaning, or caused by using aggressive and/or unsuitable detergents (cleaning agents)

### Recommended lubricant:

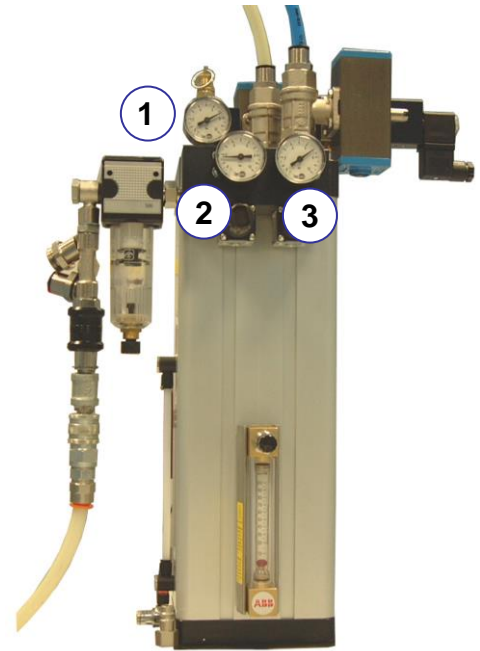
Part. No	
3226664	MK 150 20 lt.
3226665	MK 100 28.5 lt
3226666	High Performance 29 lt
3225465	MK Stainless 20 lt



### 5.3 Pressure Gauge setup

There are 3 manometers on the MKD:

- |                       |  |
|-----------------------|--|
| <b>Manometer (1):</b> | Measures the pressure on the outlet (equals internal)  |
| <b>Manometer (2):</b> | Measures pressure on inlet to Venturi.                 |
| <b>Manometer (3):</b> | Measure additional air pressure on the Venturi Outlet. |



The following conditions must occur during all machining operations when aerosol is expected at the tool tip.

1. Outlet Pressure must be at least 1.5 bar less than the Venturi Inlet Pressure. If this does not occur despite regulations of both pressure regulators then the delivery outlets to the tool – or the tool tip itself is too small for the system to operate. Modifications to the delivery line and/or tooling may be required.  
If the orifices within the tool have a diameter 3 - 4 mm, the difference of pressure must be 3 - 4 bar. In this case the MKD generates the maximum quantity of aerosol.  
If the orifices within the tool have a diameter 1 mm, the difference of pressure must be about 0.3 - 0.5 bar. In this case the MKD automatically self-adjusts the optimal pressure.
2. Venturi Inlet Pressure must be at least 1.5 bar greater than the Auxiliary Air Pressure.
3. The auxiliary air pressure can be used to increase the amount of pure air mixed with the aerosol at the delivery line to the tool as long as the 1.5 bar differential is maintained during all machining operations.
4. The Left pressure regulator can be used to vary the Auxiliary air line.

The pressures shown on the gauges when there is no aerosol operational has no meaning and can be ignored.

### 5.4 TUBING AND NOZZLES

The recommended tubing is 12 mm external diameter for as much of the system as possible.

When using the MKD as an external lubrication device rather than a thru-the-tool a minimum of 2.5 mm nozzle size is recommended.

Nozzles between 2.5 mm and 4 mm can be experimented to see which gives the best results for each particular application.

The length of the conduit must be maintained as short as possible. The longer the conduit length the more the pressure drop at the end point. The conduit run internal on the machine should be as straight as possible especially avoiding any tight bends and fittings ( such as elbows connectors ) as this may cause precipitation of the oil in the pipe. In the case this is not possible , the bends should be no more than 200 mm.

The conduit line should be flat and avoid slanting. Downward bends should be avoided as much as possible as in this case, if the machine is switched off, the oil can accumulate at these low points. The inlet of the aerosol or rotating tool should be applied in parallel. In case of mounting it perpendiculary , it may happen, that the oil is separated by the air by the centrifugal force. This particulary may happen when using tools with small dimensions or with high rotating speeds.

## 6. INSTRUCTIONS FOR USE



**WARNING:** Operate the equipment only with the voltage indicated on the product label and within the specific operating parameters.

*MKD-Dual* observes the same general regulations of the traditional lube-cooling systems.

### 6.1 *MKD-Dual* REGULATIONS

- Air quantity via the air pressure regulation valve and manometer (4).
- Aerosol via aerosol mixture regulation valve and manometer (3).
- Oil quantity via flowmeter regulation valve (10).

### Auto-Adaptive

The auto-regulation is one of the most special characteristics of *MKD-Dual* you will not find on other machine on the market. Generally aerosol generators are based on the Venturi principle: a non linear aerosol mixture is generated at low speed air flow. This will determine a low quality of the mixture itself. To solve the problem, *MKD-Dual* is provided with an auto-regulation system which optimises the process through an automatic adjustment of the micro-oil mist depending on the air flow – this means best aerosol quality with any kind of cutting machine tool and a considerable time saving (no complex regulation required).

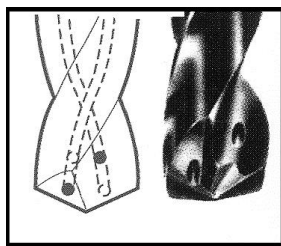
### 6.2 MACHINE OPERATION – BASIC PRINCIPLES

*Please refer to drawing on page 4.*

- a. Close regulation valves (3) and (4) by turning anti-clockwise.
- b. Close flowmeter regulation valve(10) by turning clockwise.
- c. Connect the compressed-air pipe to the air inlet (1).
- d. Mount the machine tool.
- e. Open the following valves:
  - Manually adjustable regulation valve (2) for compressed-air
  - Electro-pneumatic ball valve for aerosol inlet(s)
  - Flowmeter regulation valve(10)
- f. Use aerosol pressure regulator (3) to set a pressure of 2 bar (29.4 psi); pressure can be increased up to a maximum of 6.0 bar (88.2 psi), if required.
- g. Use the air pressure regulator (4) and manometer for additional air supply pressure, if required. Air pressure must be 1.5 bar (22.05 psi) lower than the aerosol pressure.

### 6.3 INTERNAL LUBRICATION

The *MKD-Dual* minimum lubrication system is used mainly for internal lubrication processes, whereby the aerosol is transported to site by spindles and the machine tool is equipped with cooling channels:



**In this context, please observe the following instructions:**

- The spindle must be suitable for dry-working
- The manufacturer may already have fitted some spindles with safety valves (i.e. back-pressure) which could not respond to the relatively low operating pressures of the *MKD-Dual*. Such valves need to be modified; please contact Dropsa.
- Verify that there are no transversal cuts or cracks on the lubricant delivery piping, which could cause presence of lubricant in cracks and no correct oil quantity to the cut-points.
- LET US HELP YOU in selecting suitable machine tools for internal minimum lubrication.
- On its way to the tooling site, there should be no excessive bends (kinks) or narrowings (changes in diameter) in the transport line for the lubricant; otherwise, the liquid can collect in these areas and thus prevent enough aerosol from reaching the tooling site.
- With machine tool set in work position and motionless spindle, check to see that the aerosol is not de-mixed on its way through the line; the spray should come out in the form of a fine mist.



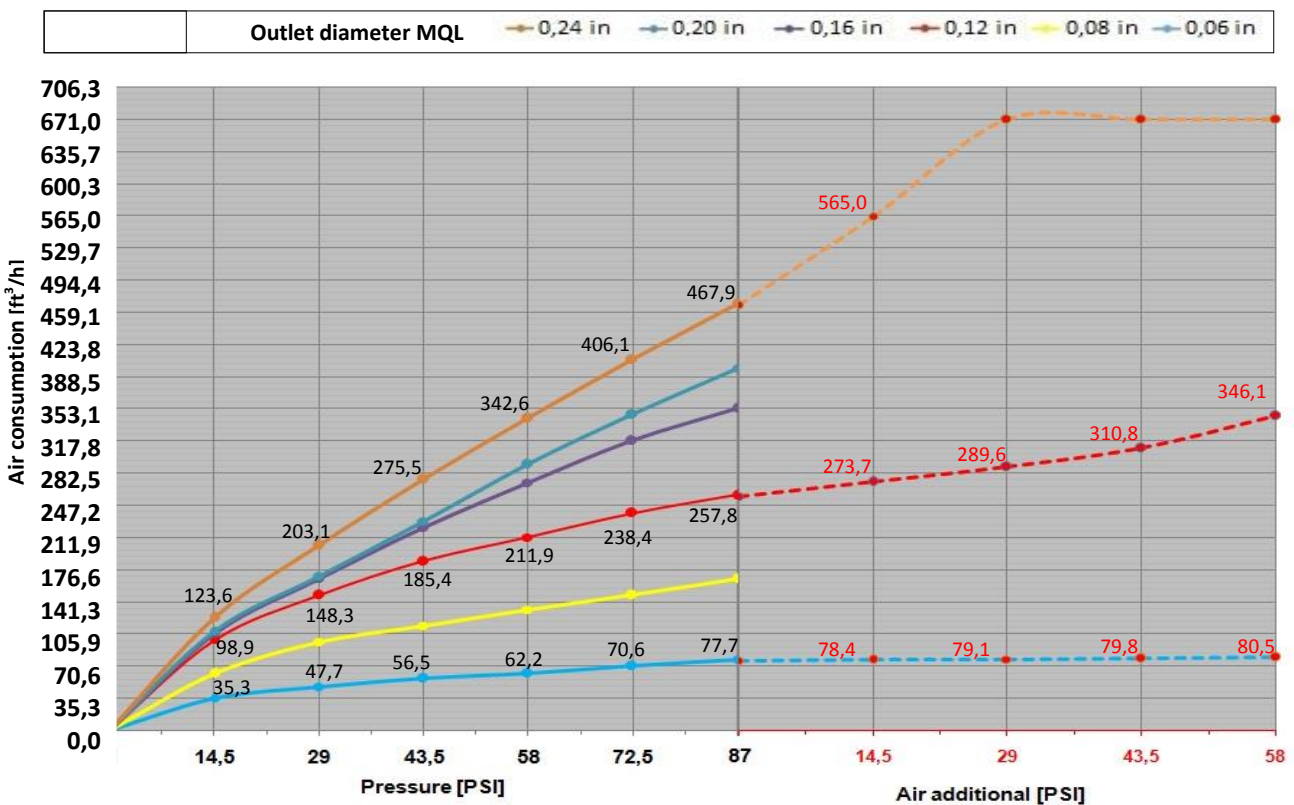
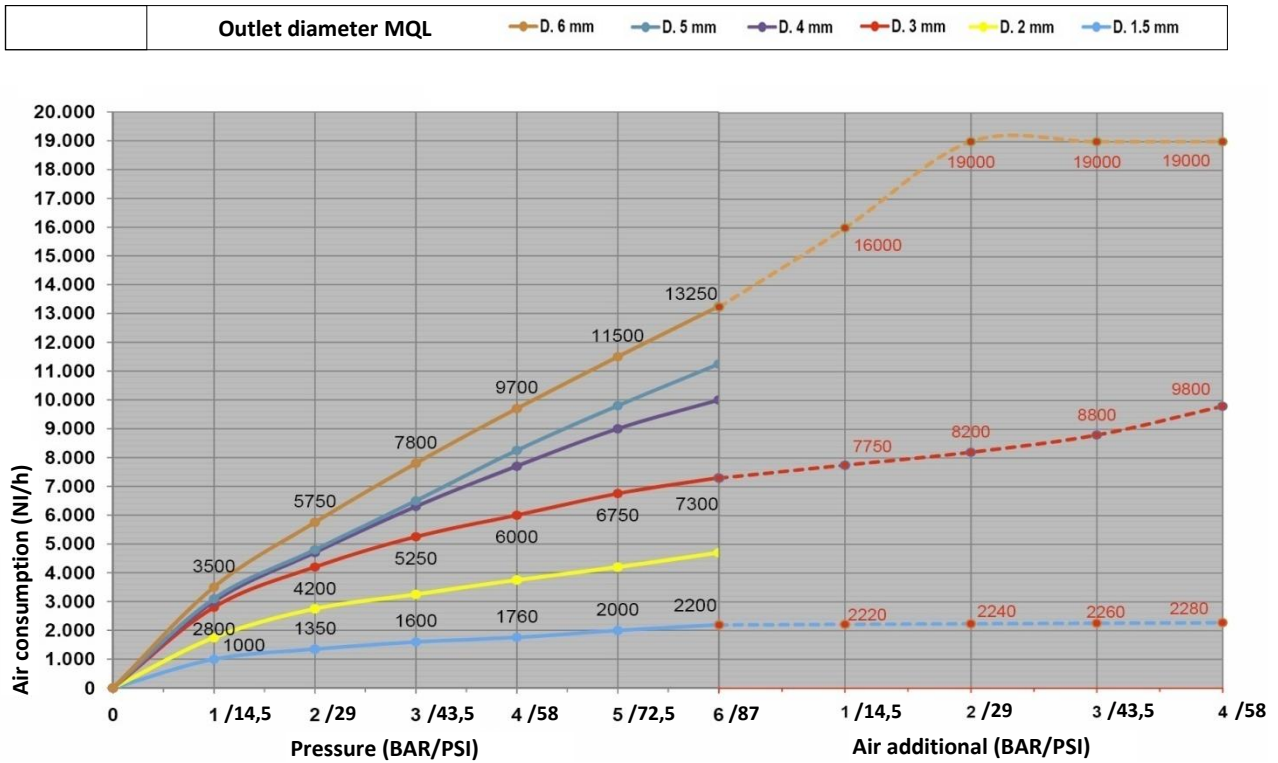
- The clean piece to be tooled must be held at a maximum distance of 40 mm (1.57 in.) from the spray outlet; a fine film of lubricant should cover it.
- The quantity of aerosol must be suitable to the working process involved. Regulation of lubricant/oil flow is also possible via control valve (10)

**Note:** The MKD-Dual is also capable of effective lubrication through very small (capillary) cooling channels; in such cases, it may be necessary to increase aerosol pressure.

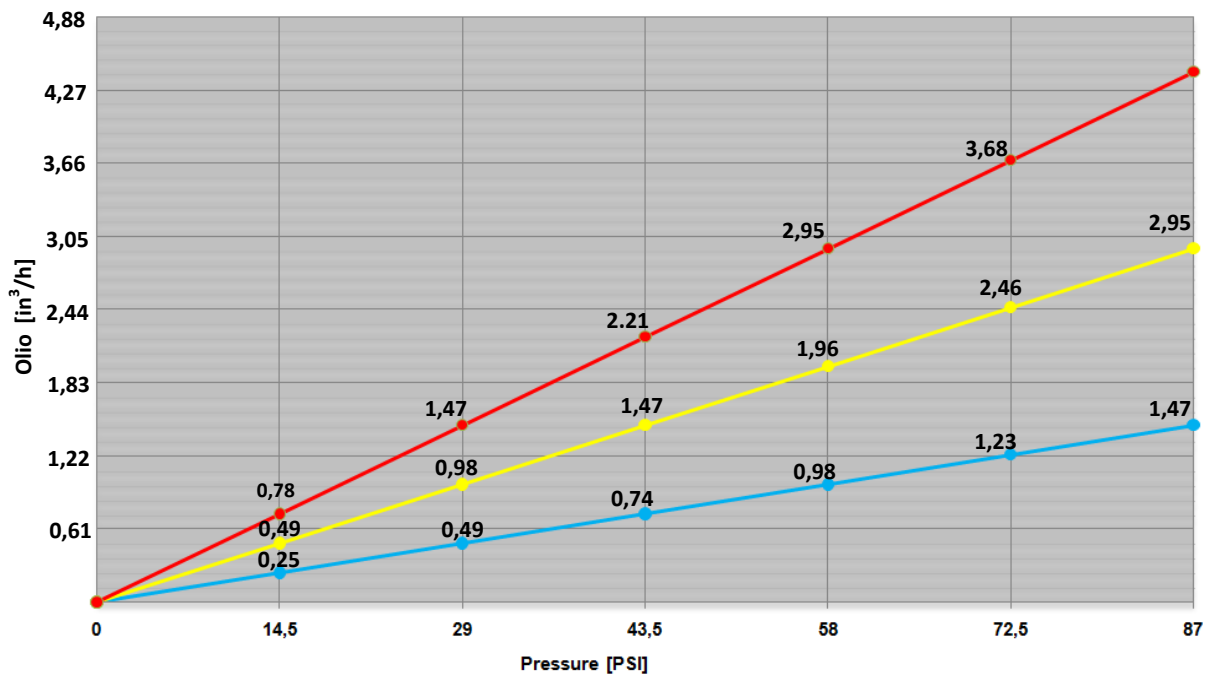
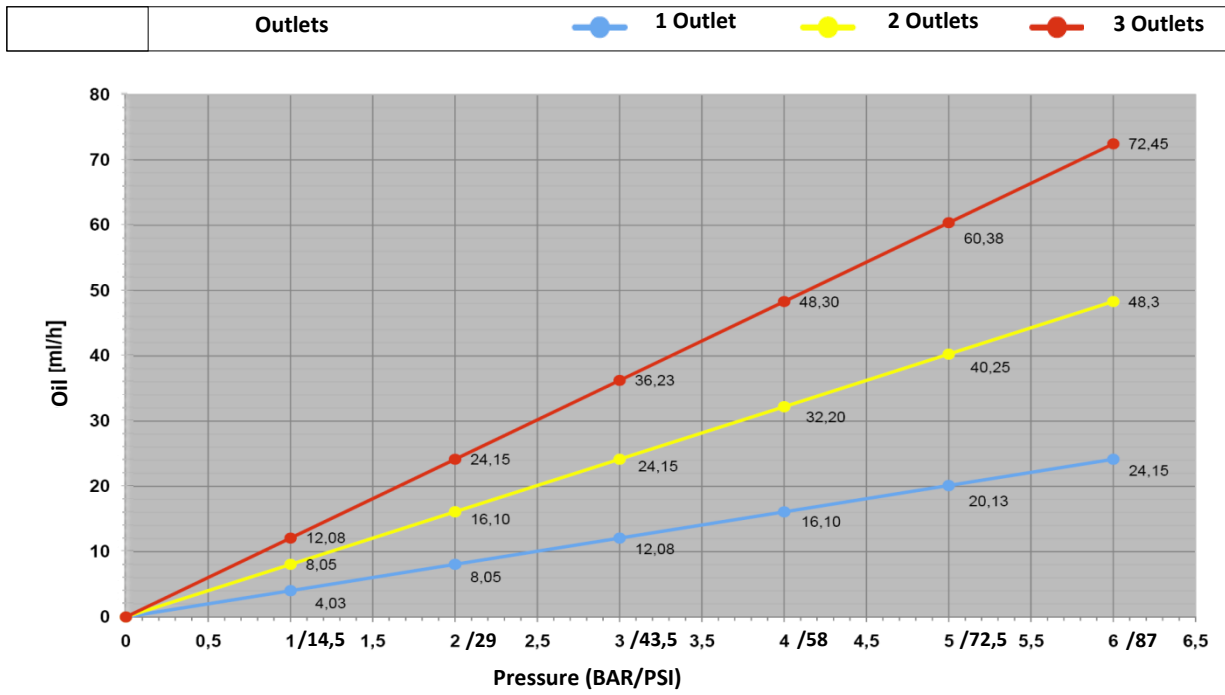
### 6.4 APPROXIMATE CONSUMPTION

The information in the following charts refer to work-test conditions with Venturi Inlet Pressure set at 2 bar (29,4 psi) and Auxiliary Air Pressure set at 6 bar (88,2 psi).

#### 6.4.1. AIR CONSUMPTION WITH SINGLE OUTLET

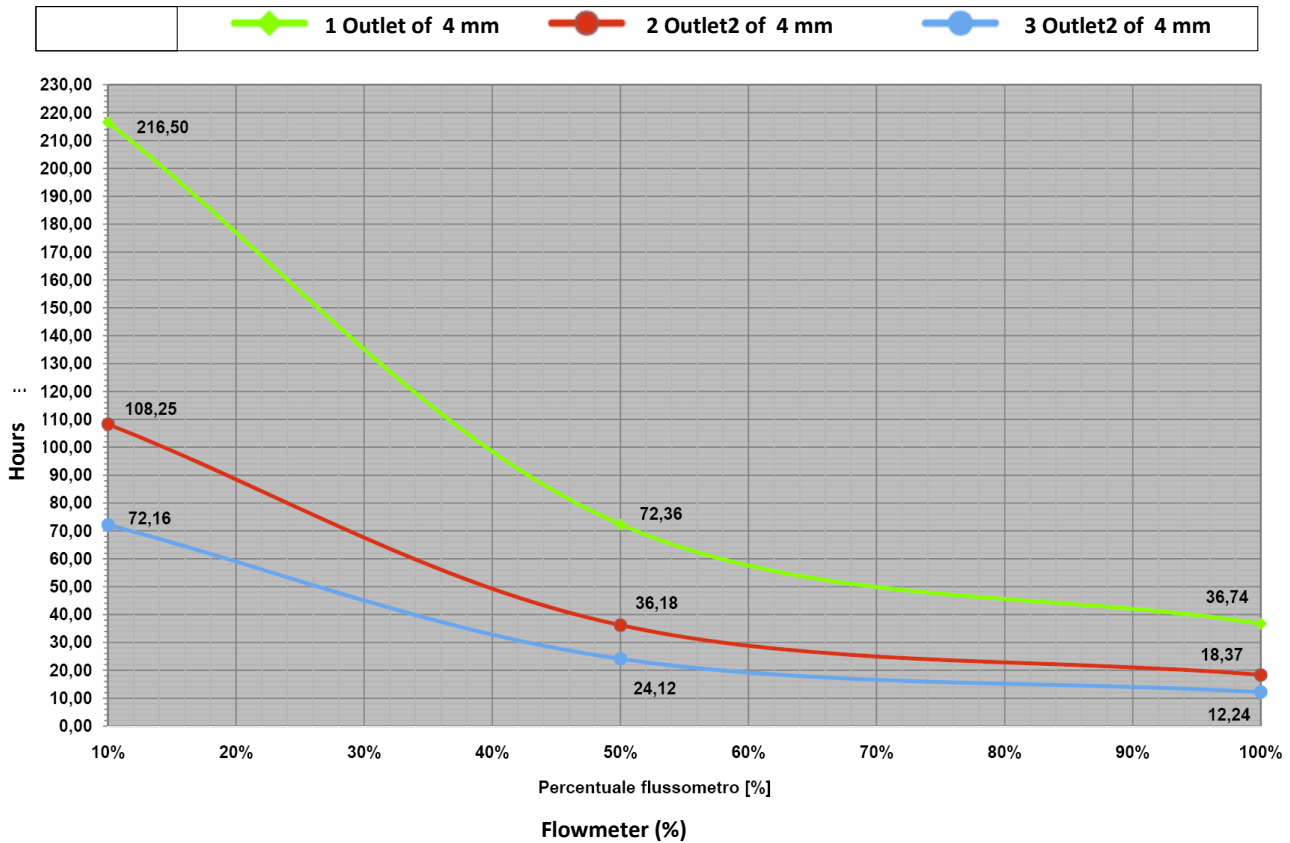


### 6.4.2. OIL CONSUMPTION –2 mm diameter Flow Meter at 100%



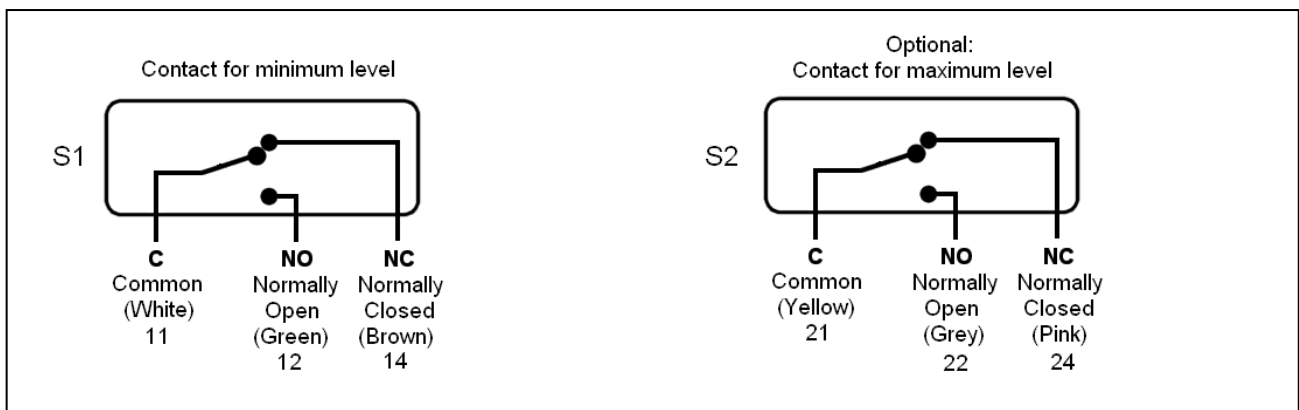
### 6.4.3. CONSUMPTION TIME

For 1,8 litre (0.39 gallons)



### 6.5. ELECTRICAL CONNECTIONS FOR LOW LEVEL

The following diagram shows how to connect the low-level and the high level sensors ( optional ) :



## 7. MAINTENANCE PROCEDURE

The machine does not require any special tool for check or maintenance tasks. However, it is recommended the use only of appropriate and in good conditions tooling, protective devices (gloves) and clothing (D.Lgs. 81/2008 to avoid injury to persons or damage to machine parts).

**WARNING: Prior to any maintenance, be sure that the power, hydraulic and pneumatic supplies are off.**

### 7.1 EXTERNAL CLEANING

To clean the *MKD-Dual* unit:

- Disconnect the compressed-air supply.
- Clean with a damp cloth; do NOT use a metallic brush!
- Do NOT use running water
- Do NOT use aggressive cleaning agents, detergents or chemicals etc.
- After wiping externally the machine, use a soft cloth to dry the *MKD-Dual*.
- Mount the unit back in place. Do NOT connect the *MKD-Dual* to the compressed-air supply UNTIL all other connections have been carried out.

## 7.2 INTERNAL CLEANING

Under normal operation, no internal cleaning is necessary. In the event of deposits (i.e. oil mud) in the machine or piping it is necessary to change the lubricant, proceeding as follows:

- Disconnect the *MKD-Dual* from the compressed-air supply.
- All outlet lines must be completely depressurised.
- Open the oil outlet tap (9).
- Collect the escaping oil in a suitable bowl or tin, and dispose of it properly (according to waste removal regulations).
- Close the outlet tap (9). Refill the unit with the new lubricant (approx. 2 lt – 0.44 gals - as described under Section 5.3.1).
- The *MKD-Dual* can now be put into operation (see *Ch. 6. Instructions for Use*).

**We assume no responsibility for any damage caused by the use of detergents or other cleaning agents!**

## 8. DISPOSAL

During maintenance or disposal of the machine care should be taken to properly dispose of environmentally sensitive items. Refer to local regulations in force in your area.

When disposing of this unit, it is important to ensure that the identification label and all the other relative documents are also destroyed.

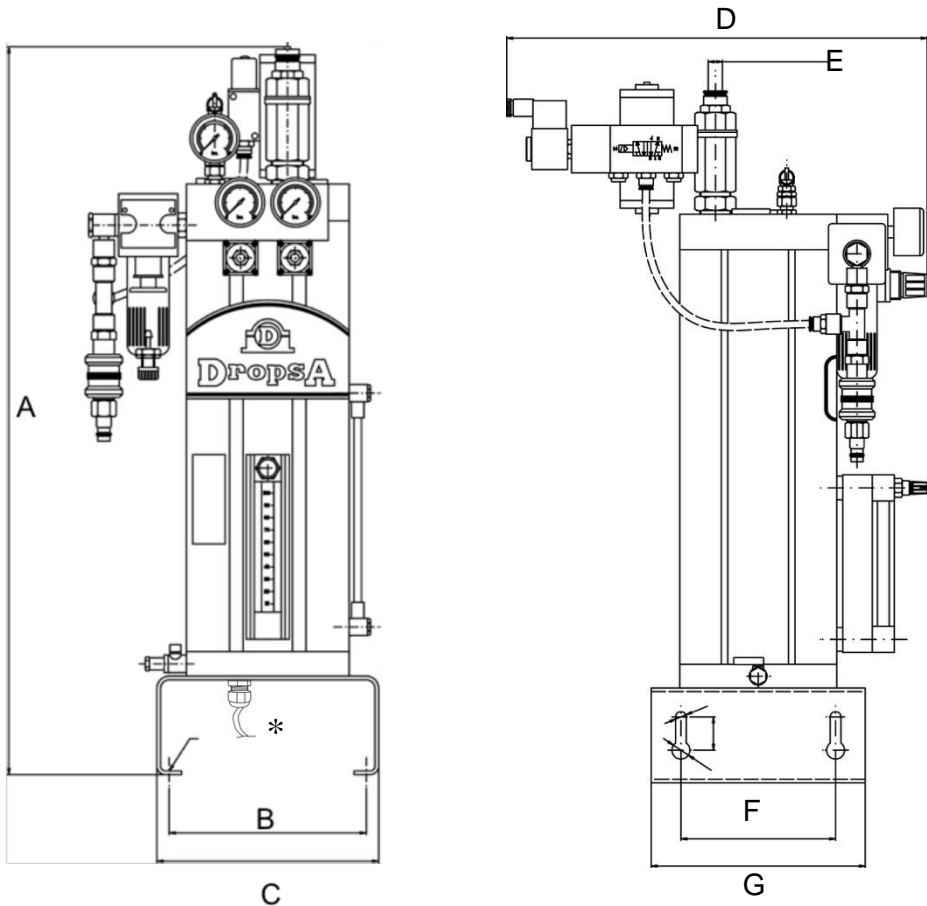
## 9. ORDERING INFORMATION

Part. No.	Description
3135086	MKD- Dual with minimum level and with electro-valve
3135088	MKD- Dual with minimum level, without electro-valve
3135089	MKD- Dual with minimum level and maximum level

ACCESSORIES	
Part No.	Description
3155187	Electro-valve
3155270	Pressure adjustment valve
0020691	Pressure gauge 0-10 bar
3155286	condensate drain
3155287	safety valve
3155288	Flow control valve

CONSUMABLE	
Part No.	Description
3226664	Oil Unitek MK 150 20lt. (42 pt)
3226665	MK 100 28.5 lt
3226666	High Performance 29 lt
3225465	MK Stainless 20 lt

## 10. DIMENSIONS



DIMENSIONS MM (INCHES)	
A	600 (23,62)
B	160 (6,29)
C	180 (7,08)
D	360 (14,17)
E	Push in tube Ø 12 mm
F	130 (5,11)
G	180 (7,08)

\* ELECTRICAL CONNECTIONS  
FOR MINIMUM AND  
MAXIMUM LEVEL

## 11. HANDLING AND TRANSPORTATION

Prior to shipping, the equipment is carefully packed in a cardboard package. On receipt, check that the package is not damaged. Then, storage the machine in a dry location.

## 12. OPERATING HAZARDS



It is necessary to read and understand the possible hazards and risks involved when using lubrication machines. The operator must know the machine functioning through the user manual.

### **Power supply**

Any type of intervention must not be carried out before the unplugging of the machine from power supply. Make sure that no one can start it up again during the intervention. All the installed electric and electronic equipment, reservoirs and basic components must be grounded.

### **Flammability**

The lubricant generally used in lubrication systems is not normally flammable. However, it is advised to avoid contact with extremely hot substances or naked flames.

### **Pressure**

Prior to any intervention, check the absence of residual pressure in any branch of the lubricant circuit as it may cause oil sprays when disassembling components or fittings.

### **Noise**

Pump does not produce excessive noise, less than 70 dB(A) .