

VECTOLUB – Minimal Quantity Lubrication

1-5012-2-US

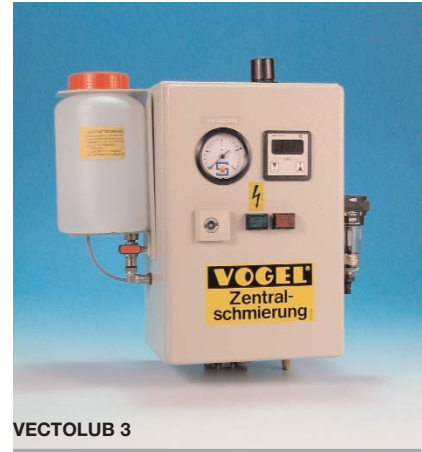
for tools and dies



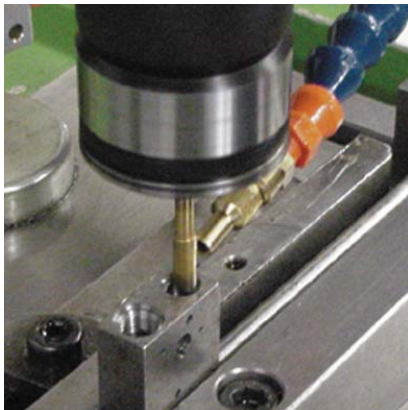
VECTOLUB 1



VECTOLUB 2



VECTOLUB 3



External minimal quantity lubrication (MQL)

Metered lubricant is swirled together with compressed air in a spray nozzle. This produces microdroplets that make their way to the friction point with the carrier air without any mist being formed.

VECTOLUB is the clean alternative to wet machining and the ideal supplement to dry machining. Anhydrous bio-lubricants that can be optimized with additives for the respective machining process are used instead of conventional aqueous coolants (emulsions, solutions).

VOGEL MQL pays off, because the workpiece and environment stay dry.

More machining power – longer tool lives

No disposal costs for chips and coolants

100% lubrication at the beginning and no dripping when the machining is finished.

Clean air to breath and a clear view of the machining operations.



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VECTOLUB - Function and Components of the Systems

A pneumatically actuated, positive-displacement micropump (max. pump frequency 3 pulses/s) delivers the lubricant (starting at 3 mm³/pulse) through the inner capillaries of a coaxial tube into a spray nozzle.

The low-pressure carrier air conducted through the tube is swirled in the nozzle. As a result, the metered quantity of oil is broken down into microdroplets that then make their way with the carrier air to the friction point without forming any mist. A closed layer of lubricant is formed as a result of these microdroplets' small size.

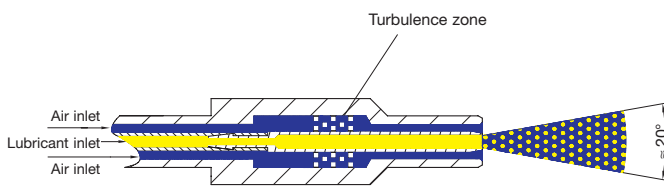


Diagram of a nozzle + coaxial connection

The advantages of minimal quantity lubrication

- Higher machining performance (higher speeds when cutting and parting).
- Better surface finish thanks to lower (friction-induced) temperature.
- Long tool life, mainly when high-frequency machining is involved.
- Exact adjustment of delivery rate saves lubricant.
- The lubricant is consumed during the machining process. No residue is left on the workpiece or chips. No disposal of lubricant residue, no degreasing of parts and chips.
- Greater safety and environmental hygiene at the workplace. No mist, clean air to breath.
- Fast amortization of the system in just a few months.

A Vectolub system consists of

- the oil/air components
- the spray nozzles

The oil/air components are

- a pneumatically or electrically actuated control-loop valve to control the unit
- individually regulatable pneumatic pumps to meter out the lubricant
- an electrically or pneumatically actuated pulse generator to control the pump
- control devices: pressure gauges and pressure switches for the carrier air
- control equipment: carrier-air pressure regulators
- lubricant reservoir with lubricant level check

These components are installed in a unit or in correspondingly prepared housings

- in keeping with the number of outlet ports required (1 to 24)
- in keeping with the control requirements (choice of various control loops)
- in keeping with the volume required
pump ranges: 0 to 30 mm³/pulse
0 to 90 mm³/pulse
- in keeping with the ambient conditions (without housing, with plastic or metal housing) (cf. "Technical Data" for VECTOLUB 1, 2, 3, 4)

The purpose of the spray nozzles is to generate tiny droplets of lubricant in the desired size and direct them to the lube surface with the help of carrier air. The shape and size of the lubrication pattern are determined by the shape and dimensions of the individual nozzle openings. No oil mist is produced by the internal shape of the nozzles. The nozzles are designed to assure appropriate flow velocities and trouble-free outflow. For example, the air is swirled in a certain zone so that the lubricant droplets are split p into microdroplets (cf. "Technical Data" for the individual nozzles).

The air and oil are fed to the nozzles separately in coaxial tubing systems.

Lubricant for VECTOLUB Systems

This lubricant is a rapidly biodegradable, toxicologically safe product developed especially for use in minimal quantity lubrication systems.

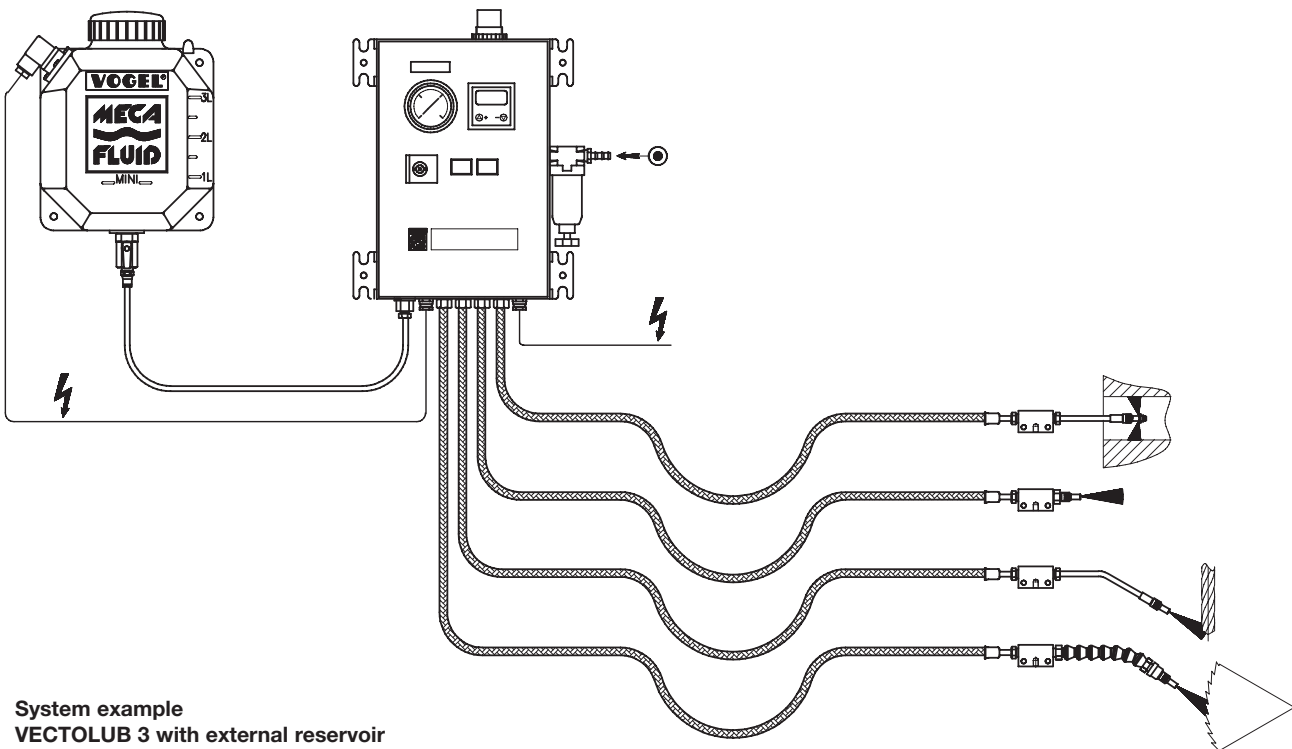
Lubricant type	Can capacity [liters]	Base	DIN 51757	Test to DIN 51562	DIN ISO 2592
			Density at +15 °C [g/ml]	Viscosity at +40 °C [mm ² /s]	Flash point [°C]
LUB200	2, 5 or 60	synth. ester	0.916	36	310

Overview of unit models

	VECTOLUB 1 (after page 4)	VECTOLUB 2 (after page 6)	VECTOLUB 3 (after page 8)	VECTOLUB 4 (after page 10)
Metal housing	-	-	●	●
Plastic housing	-	●	-	●
Number of outlet ports	1 - 2	1 - 4	1 - 4	1 - 24
Controllable metering rate per outlet with thumb wheel [mm ³ /pulse]	0 - 30	0 - 30 0 - 90	0 - 30 0 - 90	0 - 30 0 - 90
with metering ring [mm ³]	- -	3/5/10/15/20/30 30/45/60/90	3/5/10/15/20/30 30/45/60/90	3/5/10/15/20/30 30/45/60/90
Pulse generator	without / pneumatic -	without / pneumatic -	- pneumatic / electronic	without / pneumatic / electronic
Solenoid valve	optional	optional	●	●
Integrated reservoir [liters]	0.3	0.3	-	-
External reservoir [liters]	1/4 /6/10	1/4/6/10	1/4/6/10	4/6/10
Optional	stainless steel version ¹⁾	stainless steel version ¹⁾	stainless steel version ¹⁾	At customer's request ²⁾

1) Parts in contact with the medium are made of stainless steel, i.e. micropumps and adapters

2) Vectolub unit with stainless steel housing;
parts in contact with the medium are made of stainless steel, i.e. micropumps and adapters



System example
VECTOLUB 3 with external reservoir

Notice!

All products from Willy Vogel AG may be used only for their intended purpose. If operating instructions are supplied together with the products, the provisions and information therein of specific relevance to the equipment must be observed as well.

In particular, we call your attention to the fact that hazardous materials of any kind, especially the materials classified as hazardous by EC Directive

67/548/EEC, Article 2, Par. 2, may only be filled into VOGEL centralized lubrication systems and components and delivered and/or distributed with the same after consultation with and written approval from Willy Vogel AG.

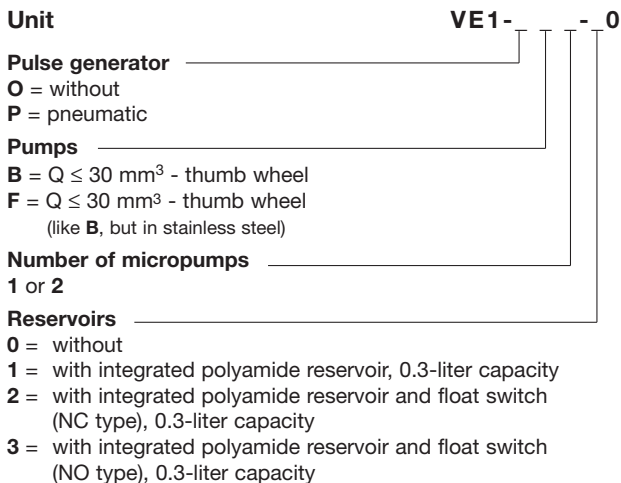
All products manufactured by VOGEL are not approved for use in conjunction with gases, liquefied gases, pressurized gases in solution and fluids with a vapor pressure exceeding normal atmospheric pressure (1013 mbars) by more than 0.5 bar at their maximum permissible temperature.

VECTOLUB 1



Basic model without housing, small space requirements, 1 or 2 outlet ports, with / without integrated reservoir, with / without pulse generator. Stationary installation (with screws) or flexible (movable with magnet). Simple and fast regulation of metered quantity for each outlet port via thumb wheel. Regulation via solenoid valve possible. Pumps of brass or stainless steel. Installation site of nozzles: right on the housing or external with hose connection.

Order numbers



(Reservoirs with 1, 4, 6 or 10 liters have to be ordered separately see pages 14-16.)

Technical data

Number of outlet ports: 1 or 2
 Metering per outlet port: ... 0 - 30 mm³/pulse by thumb wheel
 Each complete revolution makes a change of 5 mm³
 Maximum working frequency: 3 Hz
 Reservoir:
 integrated 0.3 liters
 external 1, 4, 6, 10 liters
 with / without float switch for monitoring of lubricant level
 Materials: plastics, aluminum, brass, FPM seals
 Compressed air: dry and filtered air, 4-7 bars
 Voltage: see ¹⁾ voltage key (IP 65 - CE mark)
 Maximum eff. viscosity of lubricant: 400 mm²/s
 Operating temperature: -10 to +60 °C
 Individual regulation of air throughput for each outlet port.
 Air consumption per outlet port: 50 NI/min

Dimensions

Sizes cf. Fig. 1 and 2
 Weight approx. 1 kg

See page 12 for spray nozzles.

Order example

VECTOLUB 1 unit with pneumatic pulse generator, 2 outlet ports and integrated reservoir:
 Order No.: **VE1-PB2-10**

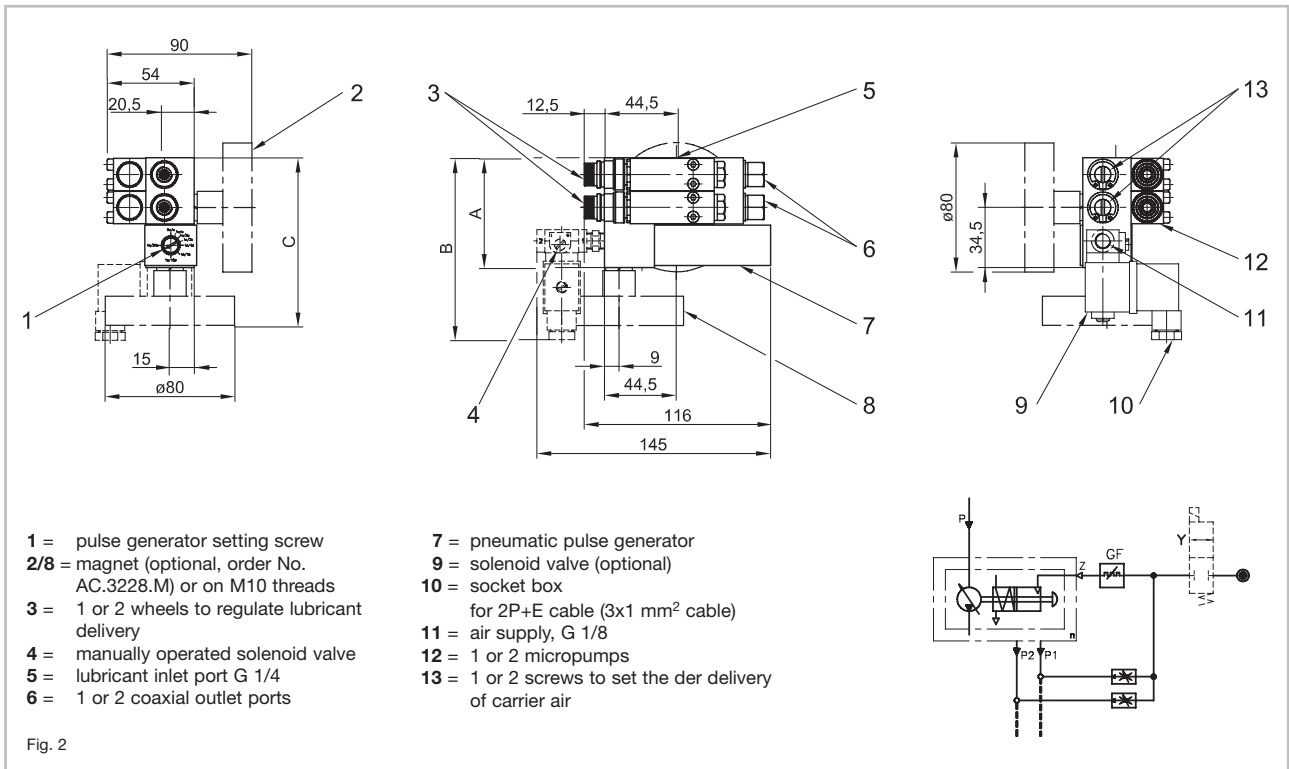
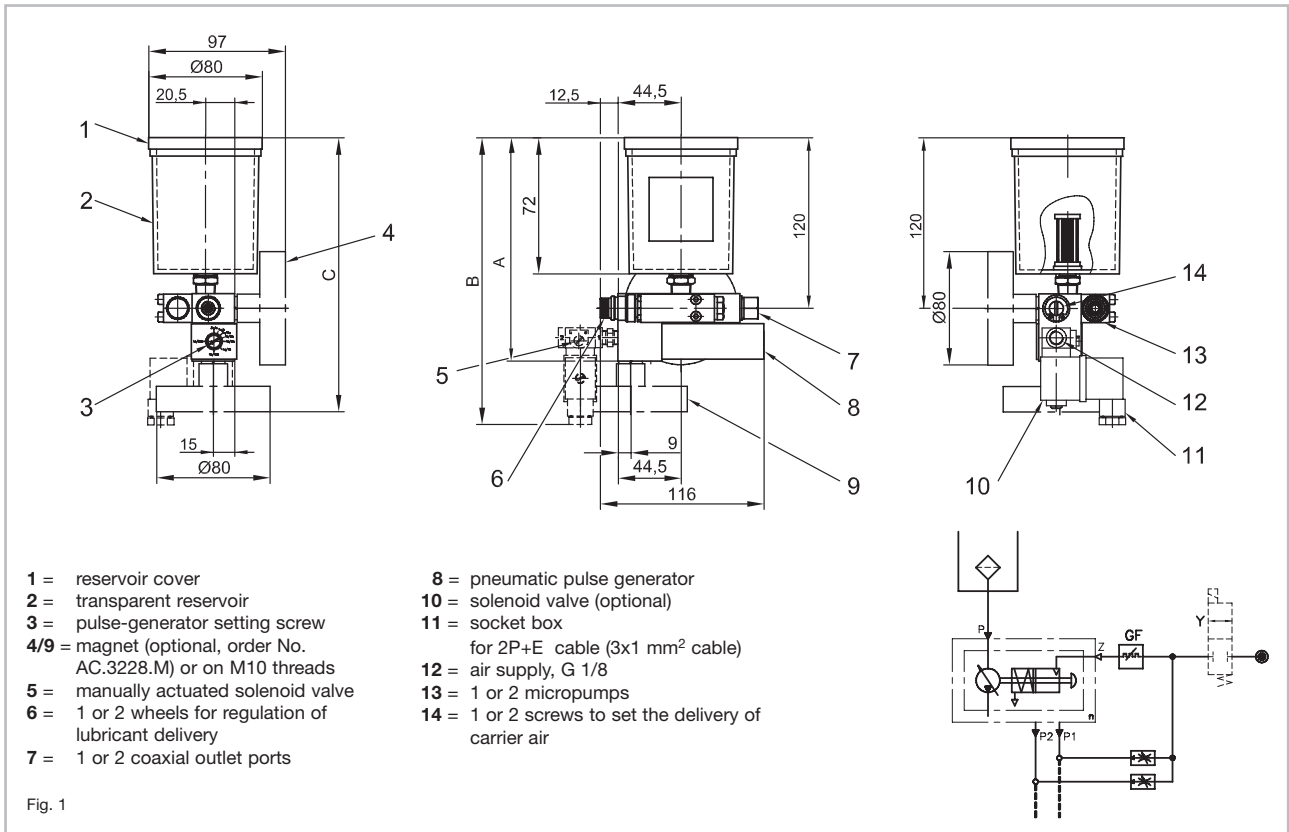
Magnet order No.: **AC-3228-M**
 for mobile attachment (weight: approx. 0.5 kg)

Solenoid valve order No.: **AC-4220+ ...1)**
 Max. pressure: 7 bars
 Approx. weight: 0.2 kg

¹⁾ Voltage keys

- 924** = 24 V DC
- 423** = 24 V 50/60 Hz
- 931** = 48 V DC
- 008** = 48 V 50/60 Hz
- 429** = 115 V 50/60 Hz
- 428** = 230 V 50/60 Hz
- 927** = 72 V DC

VECTOLUB 1



Dimensions in mm

Version	Reservoir	Number of pumps	Dimensions ≈ [mm]		
			A	B	C
Fig. 1	with	1	160	205	195
		2	180	225	215

Version	Reservoir	Number of pumps	Dimensions ≈ [mm]		
			A	B	C
Fig. 2	without	1	47.5	92.5	83.5
		2	68	113	104

VECTOLUB 2



Compact model with plastic housing,
 1 to 4 outlet ports,
 with / without integrated reservoir,
 with / without pneumatic pulse generator.
 Simple and fast regulation of metered quantity for each outlet port via thumb wheel or metering ring.
 Control system with solenoid valve possible.
 Pumps of brass or stainless steel.

Order numbers

Unit

Pulse generator

O = without
P = pneumatic

Pumps

A = $Q \leq 30 \text{ mm}^3$ - metering rings
B = $Q \leq 30 \text{ mm}^3$ - thumb wheel
C = $Q \leq 90 \text{ mm}^3$ - metering rings
D = $Q \leq 90 \text{ mm}^3$ - thumb wheel
E = $Q \leq 30 \text{ mm}^3$ - metering rings
 (like **A**, but stainless steel)
F = $Q \leq 30 \text{ mm}^3$ - thumb wheel
 (like **B**, but stainless steel)

Number of micropumps

1, 2, 3, 4

Reservoirs

0 = without
1 = with integrated polyamide reservoir, 0.3-liter capacity
2 = with integrated polyamide reservoir and float switch (NC type), 0.3-liter capacity
3 = with integrated polyamide reservoir and float switch (NO type), 0.3-liter capacity

(Reservoirs with 1, 4, 6 or 10 liters have to be ordered separately, see pages 14-16.)

VE2- - 0

Technical data

Number of outlet ports: 1 to 4

Metering per outlet port pump model **A, B, E, F**: 0-30 mm³/pulse
 pump model **C, D**: 0-90 mm³/pulse

Change in volume:

per revolution with thumb wheel . . . pump model **B, F**: 5 mm³
 pump model **D**: 15 mm³
 per metering ring . . . pump model **A, E**: 3-5-10-15-20-30 mm³
 pump model **C**: 30-45-60-90 mm³

Maximum working frequency: 3 Hz

Reservoirs:

integrated 0.3 liters
 external 1, 4, 6, 10 liters

with / without float switch for monitoring of min. lubricant level

Materials: plastic, aluminum, brass, FPM seals

Compressed air: dry and filtered air, 4-7 bars

Voltage: cf. ¹⁾ voltage key
 (IP 65 - CE mark)

Maximum eff. viscosity of lubricant: 400 mm²/s

Operating temperature: -10 to +60 °C

Air consumption per outlet port: 50 Nl/min (metering $\leq 30 \text{ mm}^3$)
 100 Nl/min (metering $\leq 90 \text{ mm}^3$)

Dimensions

Sizes see Fig. 3

Weight approx. 2.6 to 3 kg

See page 12 for spray nozzles.

Order example

VECTOLUB 2 unit without pulse generator, with 2 outlet ports, with micropumps adjustable by thumb wheel – volumetric range $\leq 90 \text{ mm}^3$ /pulse and integrated reservoir:

Order No.: **VE2-OD2-10**

Solenoid valve

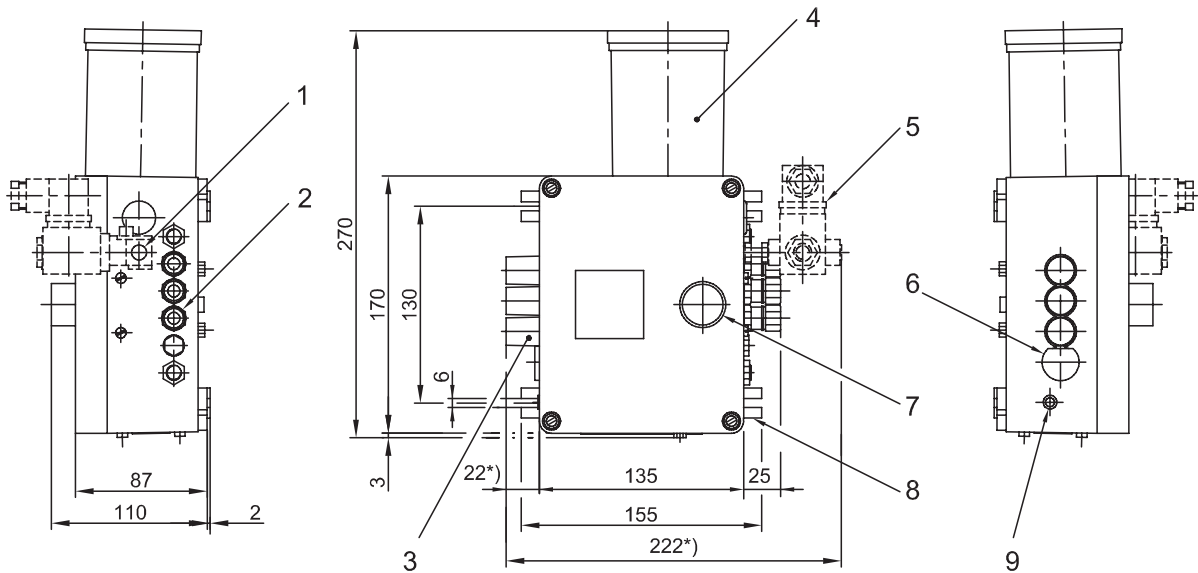
Order No.	Max. pressure [bars]	Approx. weight. [g]
AC-4226+ ...¹⁾	7	175
AC-4219+ ...¹⁾	4	175

The **AC-4226** solenoid valve can be used for a maximum of 4 pump elements, 30 mm³ each, or 2 pump elements, 90 mm³ each. The **AC-4219** must be used when 3 or 4 90 mm³ pump elements are involved. Please note: Install upstream pressure control valve (P max. 4 bars).

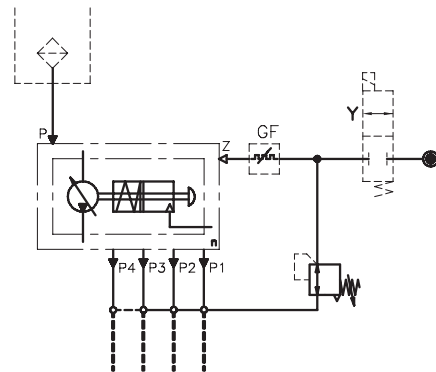
1) Voltage keys:

- 924** = 24 V DC
- 423** = 24 V 50/60 Hz
- 931** = 48 V DC
- 008** = 48 V 50/60 Hz
- 429** = 115 V 50/60 Hz
- 428** = 230 V 50/60 Hz
- 927** = 72 V DC

VECTOLUB 2



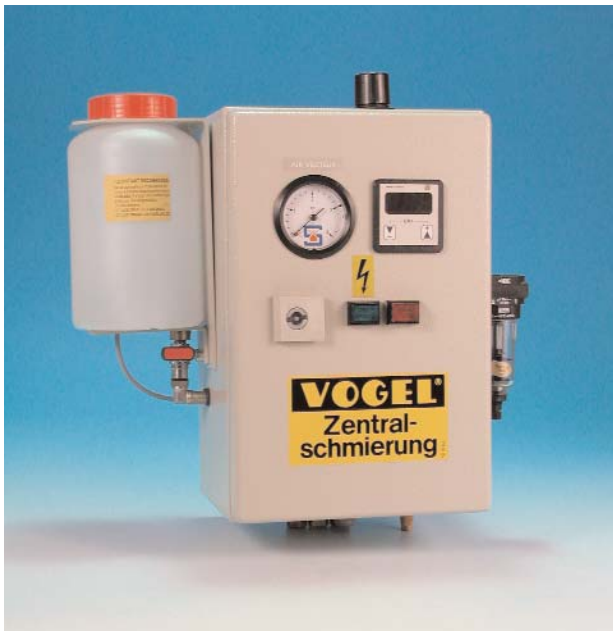
*) Dimensions of version with metering ring.
 Dimensions of version with thumb wheel + 9 mm



- 1 = M10x1 or G 1/8 air supply in the case of a solenoid valve
- 2 = 1 to 4 coaxial outlet ports
- 3 = Protective caps for metering rings or thumb wheel
- 4 = Transparent reservoir, 0.3 l
- 5 = Solenoid valve (optional)
- 6 = Screw plug
(or 4th micropump)
- 7 = Pressure control valve (0 to 3 bars)
- 8 = 4 fastening strips
- 9 = 6 mm diam. access opening for pulse generator (screwdriver)

Fig. 3

VECTOLUB 3



Model with metal housing,
 1 to 4 outlet ports,
 with / without integrated reservoir,
 with pneumatic or electronic pulse generator.
 Simple and fast regulation of metered quantity for each
 outlet port via thumb wheel or metering ring.
 Pumps of brass or stainless steel.

Technical data

Number of outlet ports: 1 to 4
 Metering per outlet port pump model **A, B, E, F**: 0-30 mm³/pulse
 pump model **C, D**: 0-90 mm³/pulse
 Change in volume:
 per revolution with thumb wheel . . . pump model **B, F**: 5 mm³
 pump model **D**: 15 mm³
 per metering ring . . . pump model **A, E**: 3-5-10-15-20-30 mm³
 pump model **C**: 30-45-60-90 mm³
 Maximum working frequency: 3 Hz
 Reservoirs:
 integrated (with float switch) 1 liter
 external 4, 6, 10 liters
 with / without float switch for monitoring of min. lubricant level
 Materials: plastic, aluminum, brass, FPM seals, steel
 Compressed air: dry and filtered air, 4-7 bars
 Voltage: 115 V, 50/60 Hz; 230 V, 50/60 Hz; 24 V DC
 Maximum eff. viscosity of lubricant: 400 mm²/s
 Operating temperature: -10 to +60 °C
 Air consumption per outlet port: 50 NI/min (metering 0 ≤ 30 mm³)
 100 NI/min (metering 0 ≤ 90 mm³)

Dimensions

Sizes see Fig. 4 and 5
 Weight approx. 9 kg

See page 12 for spray nozzles.

Order numbers

Unit _____ **VE3-** _____ **- 0+** _____

Pulse generator _____

P = pneumatic
E = electronic

Pumps _____

A = Q ≤ 30 mm³ - metering rings
B = Q ≤ 30 mm³ - thumb wheel
C = Q ≤ 90 mm³ - metering rings
D = Q ≤ 90 mm³ - thumb wheel
E = Q ≤ 30 mm³ - metering rings
 (like **A**, but stainless steel)
F = Q ≤ 30 mm³ - thumb wheel
 (like **B**, but stainless steel)

Number of micropumps _____

1, 2, 3, 4

Reservoirs _____

0 = without
1 = with integrated polyamide reservoir and
 float switch, 1-liter capacity *)
 (Reservoirs with 4, 6 or 10 liters have to be ordered separately,
 see pages 14-16.)

Voltage keys _____

924 = 24 V DC
429 = 115 V, 50/60 Hz
428 = 230 V, 50/60 Hz
 Further voltages on request.

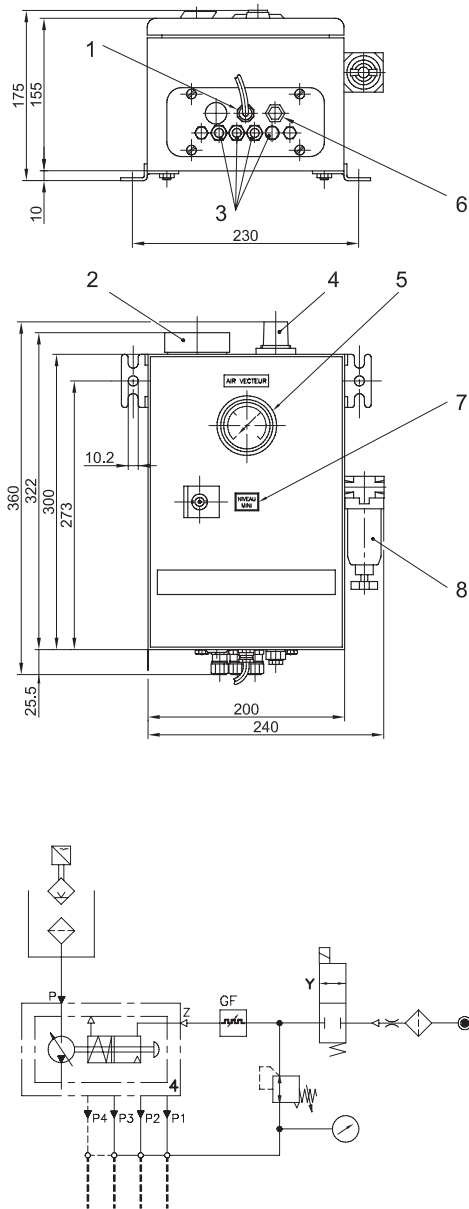
*) only for units with
 pneumatic
 pulse generator

Order example

VECTOLUB 3 unit with pneumatic pulse generator, with 4 outlet
 ports, without reservoir, micropumps adjustable in increments
 by metering rings – volumetric range ≤ 30 mm³/pulse,
 voltage 115 V, 50/60 Hz:
 Order No.: **VE3-PA4-00+429**

VECTOLUB 3

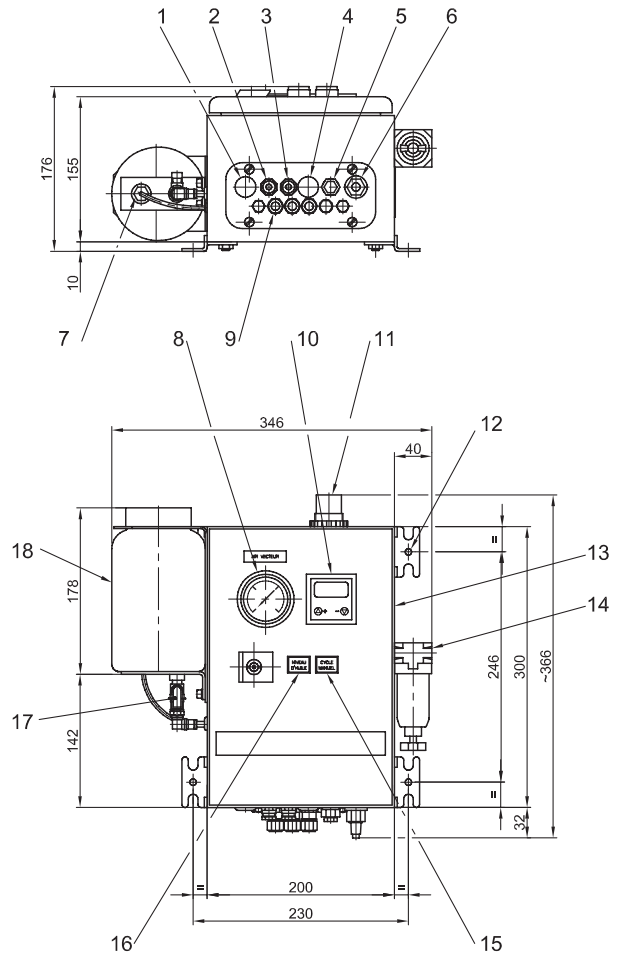
Version with integrated reservoir and pneumatic pulse generator



- 1 Cable gland for 2P+E cable, 3x1 mm²
- 2 Lubricant inlet screw
(only on version with integrated 1 l reservoir)
- 3 1-4 coaxial outlet ports
medium: hollow needle for 2.5x0.5 diam. tubing; air: M10x1
- 4 Pressure control valve (0 to 3 bars)
- 5 Pressure gauge
- 6 Oil drain screw
- 7 Red indicator light (min. oil level)
- 8 Air inlet filter (G ¼ opening)

Fig. 4

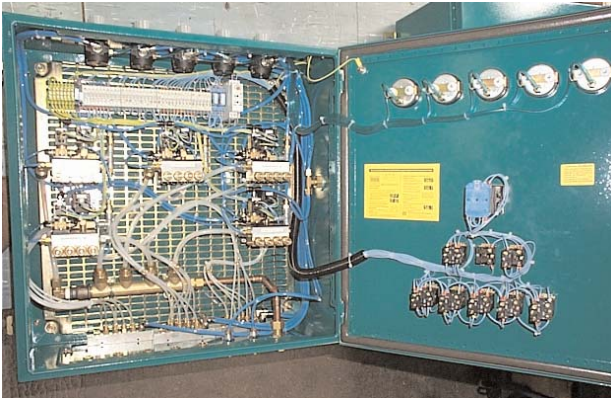
Version with integrated reservoir and electronic pulse generator



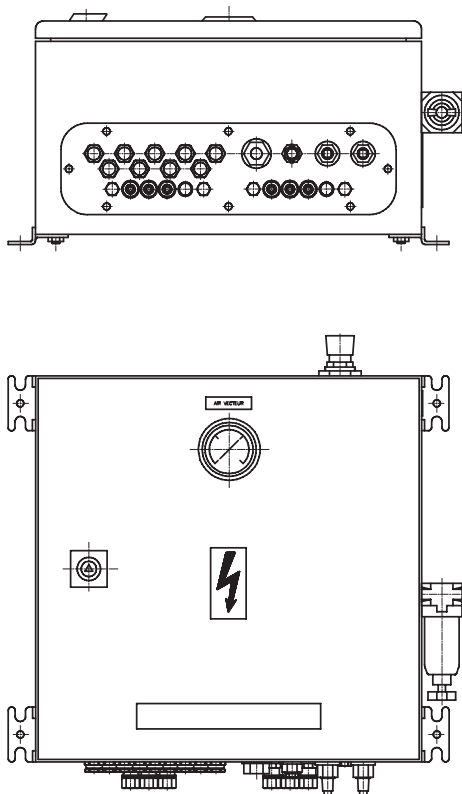
- 1 Lubricant supply M10x1 (for 6x1 diam. tubing in case of external reservoir)
- 2 Power supply - 2P+E (3x1 mm² cable)
- 3 Machine contact input - 2P (2x1 mm² cable)
- 4 Float switch input - 2P (2x1 mm² cable) in case of external reservoir
- 5 Oil drain screw
- 6 Valve venting with silencer
- 7 Float switch
- 8 Pressure gauge (0 to 4 bars)
- 9 1-4 coaxial outlet ports
medium: hollow needle for 2.5x0.5 diam. tubing; air: M10x1
- 10 Pulse generator, electronic
- 11 Pressure control valve (0 to 3 bars)
- 12 4 fastening strips, 10 mm diam.
- 13 Housing for 1 to 4 micropumps
- 14 Air inlet filter (G 1/4 opening)
- 15 Intermediate lubrication, manual
- 16 Red indicator light (min. oil level)
- 17 Stopcock
- 18 Reservoir, 1 liter

Fig. 5

VECTOLUB 4



This Group involves customer-specific switchgear cubicles.
 Metal or plastic housing, 1 to 24 outlet ports, with pneumatic or electronic pulse generator.
 Simple and fast regulation of metered quantity for each outlet port via thumb wheel or metering rings.
 Pumps of brass or stainless steel.



Practical example

Technical data

- Number of outlet ports: 1 to 24
- Metering per outlet port: pump model **A, B, E, F**: 0-30 mm³/pulse
 pump model **C, D**: 0-90 mm³/pulse
- Change in volume:
 - per revolution with thumb wheel . . . pump model **B, F**: 5 mm³
 pump model **D**: 15 mm³
 - per metering ring . . . pump model **A, E**: 3-5-10-15-20-30 mm³
 pump model **C**: 30-45-60-90 mm³
- Maximum working frequency: 3 Hz
- Reservoirs, integrated or external: 0.3, 1, 4, 6, 10 liters
 (or +)
- Materials: plastic, aluminum, brass, FPM seals, steel
- Compressed air: dry and filtered air, 4-7 bars
- Voltage: 115 V, 50/60 Hz; 230 V, 50/60 Hz; 24 V DC
 Further voltages on request
- Maximum eff. viscosity of lubricant: 400 mm²/s
- Operating temperature: -10 to +60 °C
- Air consumption per outlet port: 50 NI/min (metering ≤ 30 mm³)
 100 NI/min (metering ≤ 90 mm³)

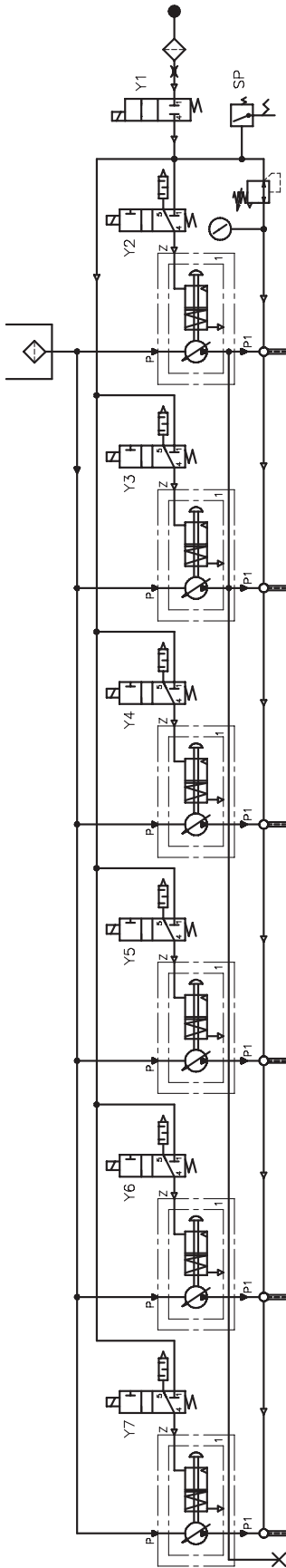
Additional functions

- Independent actuation of each pump element
 - modular functions of lubricating unit.
 - pump elements controlled by manually actuated, pneumatic switches.
 - automatic control of pump elements by solenoid valves actuated by the machine's control system to meet the load.
- Group actuation of pump elements
 - possibility to actuate two or more groups of pump elements by two or more pneumatic or electronic pulse generators (different lubricants).
- Control unit for cycle
 - of the lubricating time
 - of the interval time
- Special models that
 - meet certain regulations.
 - meet special environmental conditions (e.g. stainless steel).

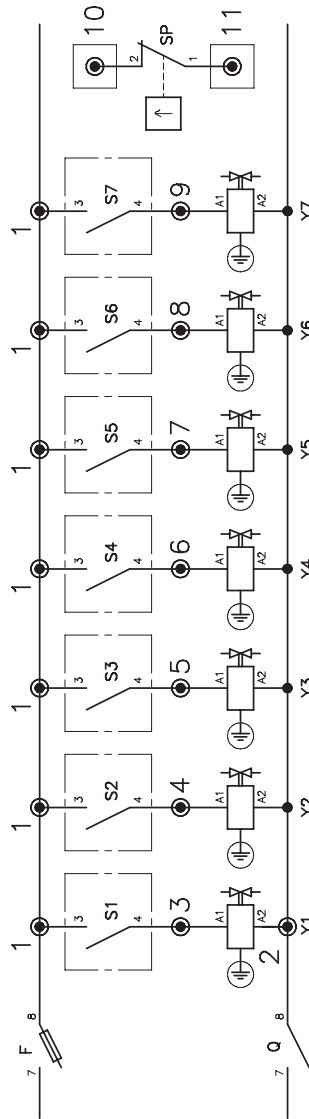
See page 12 for spray nozzles.

VECTOLUB 4

Dimensions in mm



Hydraulic layout



Electric circuit diagram

- S1 = Carrier-air control valve
- Y1 = Carrier-air valve 2/2 NC (P = 2 VA / 1.6 W)
- S2 = Lubricating-valve control contact, circuit 1
- Y2 = Lubricating valve, circuit 1 – 3/2 NC (P = 2 VA / 1.6 W)
- S3 = Lubricating-valve control contact, circuit 2
- Y3 = Lubricating valve, circuit 2 – 3/2 NC (P = 2 VA / 1.6 W)
- S4 = Lubricating-valve control contact, circuit 3
- Y4 = Lubricating valve, circuit 3 – 3/2 NC (P = 2 VA / 1.6 W)
- S5 = Lubricating-valve control contact, circuit 4
- Y5 = Lubricating valve, circuit 4 – 3/2 NC (P = 2 VA / 1.6 W)
- S6 = Lubricating-valve control contact, circuit 5
- Y6 = Lubricating valve, circuit 5 – 3/2 NC (P = 2 VA / 1.6 W)
- S7 = Lubricating-valve control contact, circuit 6
- Y7 = Lubricating valve, circuit 6 – 3/2 NC (P = 2 VA / 1.6 W)
- SP = Pressure switch (5 bars)
- F = Disconnector with fuse
- Q = Disconnector

Nozzles and connecting hoses

The exactly metered quantity of oil is converted into micro-droplets in the nozzle and delivered to the contact surface with pinpoint accuracy. That keeps oil mist from forming. All the parameters (oil or air delivery rate, air pressure) can be adjusted on the unit.

Various nozzles can be chosen from to fit the size and shape of the contact surface:

circular jet nozzle

20 mm diam. sprayed surface at 50 mm distance*
(angle: approx. 20°)

wide jet nozzle

20 x 40 mm sprayed surface at 50 mm distance*
(angle: approx. 40°/60°)

annular jet nozzle

sprayed surface H = 15 mm with a diam. of 50 mm*

*) Test conditions:

- Air pressure 1 bar, oil: LUB200 - viscosity 90 mm²/s at 18 °C.
- Use of micropump: 5 mm³/pulse - 3 pulses/s

2 series of nozzles are available:

- volumetric range 0 to 30 mm³ and 0 to 90 mm³
- Each nozzle has 2 coaxial inlet ports
- for oil and air.

The connection between the unit and nozzle is established with flexible tubing equipped with a coaxial capillary line.

The various mounting possibilities permit optimal alignment of the nozzle with the contact surface:

- nozzle with flexible copper tubing and mounting block
- nozzle with articulated tubing and mounting block
- nozzle installed directly in mounting block
- special nozzle for band saw

Technical data

Temperature range: -10 to +60 °C

Materials

- Nozzle: brass
- Flexible tubing: copper
- Articulated tubing: POM
- Mounting block: aluminum
- Connection point: galvanized steel and brass

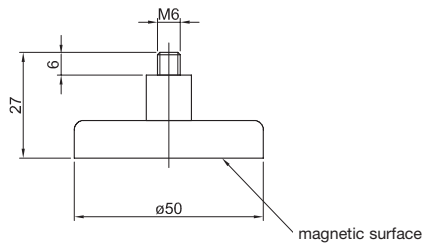
Coaxial lines (air tube and capillary oil line)

Order No.	oil quantity/pulse	approx. weight [kg]
F10A- 000-BPC	up to 30 mm ³	0.2 to 0.6
F12A- 000-BPC	up to 90 mm ³	0.3 to 0.9

- 1 = length 1.00 m
- 2 = length 2.00 m
- 3 = length 3.00 m
- 4 = length 4.00 m
- 5 = length 5.00 m

Magnetic foot for mounting block

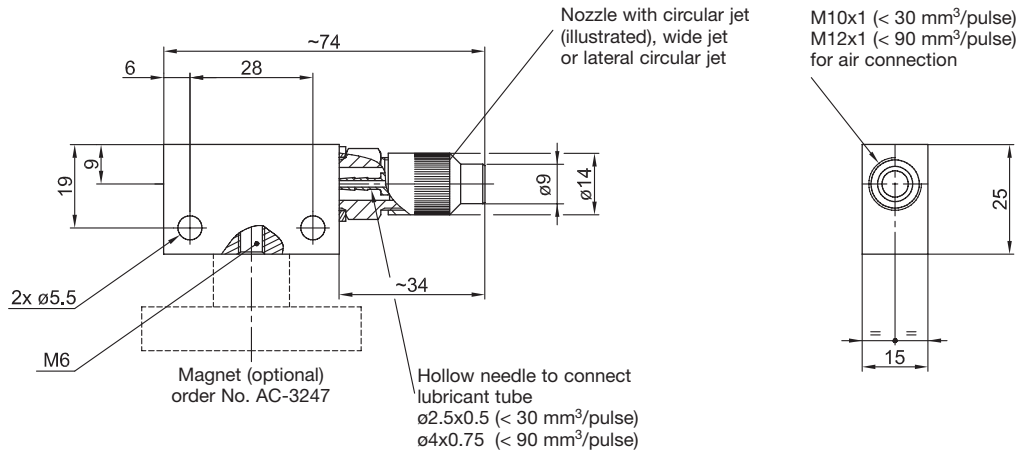
Order No. **AC-3247**



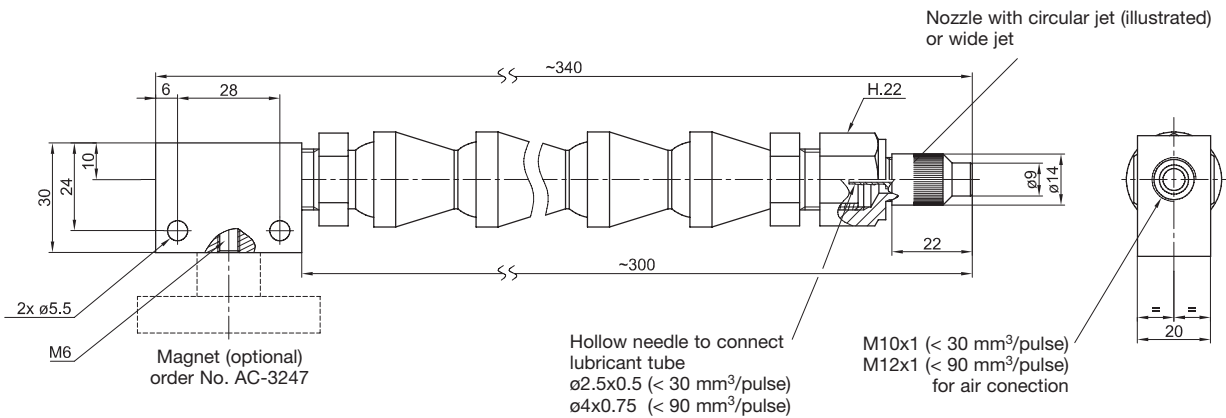
Overview of different types of connections

Type	Output-range [mm ³ /pulse]	Spray nozzle					Special application: Band saw order No.
		Circular jet order No.	Wide jet order No.	Lateral circular jet order No.	Annular jet order No.		
Spray block	0 to 30	AC-3539-C	AC-4255-C	AC-3659-C	-	-	
	30 to 90	AC-3539-GD-C	-	-	-	-	
Block and articulated tube	0 to 30	AC-3252-C	AC-4256-C	-	-	-	
	30 to 90	AC-3252-GD-C	-	-	-	-	
Block and flexible copper tubing	0 to 30	AC-3184-C	AC-3485-C	AC-3657-C	AC-3874-C	AC-3889	
	30 to 90	AC-3184-GD-C	-	-	-	-	

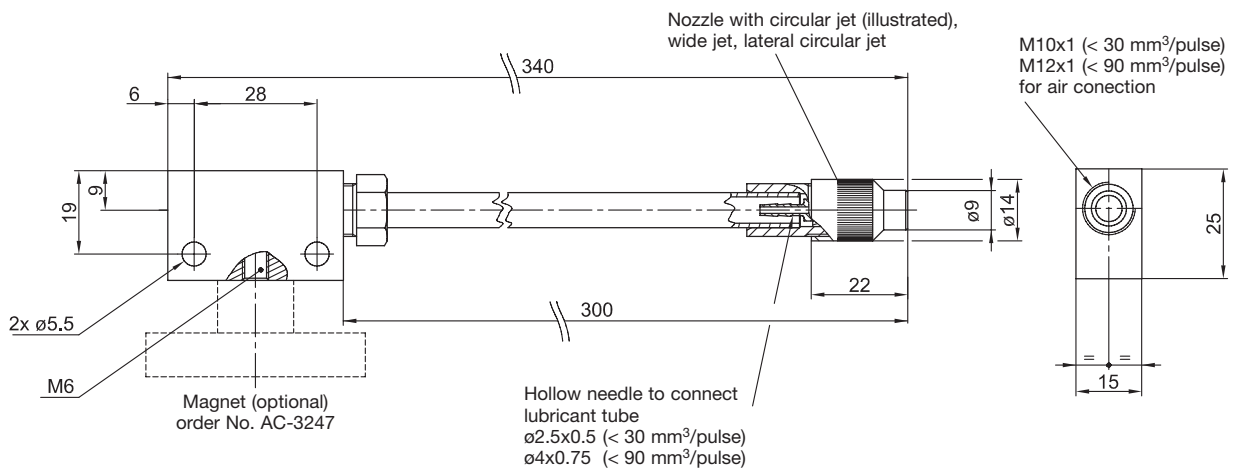
Example: spray block (see page 12 for order numbers)



Example: Block and articulated tubing (see page 12 for order numbers)



Example: Block and flexible copper tubing (see page 12 for order numbers)



Reservoirs

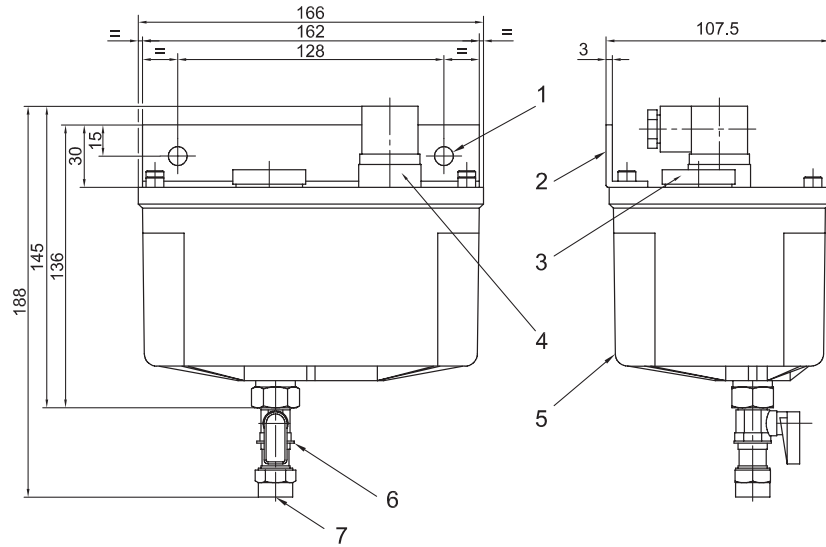
Material: polyethylene (PE) polyamide (PA) or metal

- Stopcock to close reservoir outlet when work is done on the lubrication system.
- Visual oil-level check
- Float switch for minimum level of lubricant

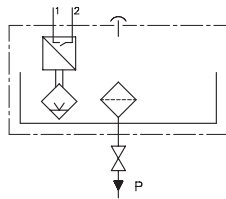
Order No.	Reservoir capacity [liters]	Material	Float switch	Stopcock	Inlet filter [µm]	Outlet filter [µm]	Operating temperature [°C]	Max. weight approx. [kg]
TK-179-V TK-179-VM	1	PA	– ●	●	–	55	–10 to +60	0.65
TK-350-V TK-350-VMC	3.5	PE	– ●	●	280	200 / 220	–10 to +60	0.12
TK-602-V TK-602-VM	6	PA6	– ●	●	400	200 / 220	–10 to +60	0.33
TK-840-V TK-840-VM	10	aluminum	– ●	●	–	200 / 220	–10 to +60	0.76

Technical data of float switch				
	Reservoirs			
	TK-179-VM	TK-350-VMC	TK-602-VM	TK-840-VM
Function	Opens at min. level	Opens at min. level	At min. level contact 1-2 opens and contact 1-3	At min. level contact 1-2 opens and contact 1-3
Type of contact (magnetic contact)	NC type	NC type	changeover	changeover
Max. switching voltage [V AC/DC]	240	250	250	250
Max. switching current [A]	0.25	0.5	0.7	0.7
Max. switching capacity [VA]	10	10	50	50
Temperature range [°C]	–10 to +60	–10 to +60	–10 to +60	–10 to +60
Eff. viscosity [mm ² /s]	< 400	< 400	< 1500	< 1500
Contact gap [mm] DIN 43650 (ISO 4400)		18	18	18
Socket box rotatable by	90°	90°	180°	180°
Type of enclosure (EN 60529)	IP 65	IP 65	IP 65	IP 65
Insulation class (VDE 0110-1/89)	C	C	C	C

Reservoirs

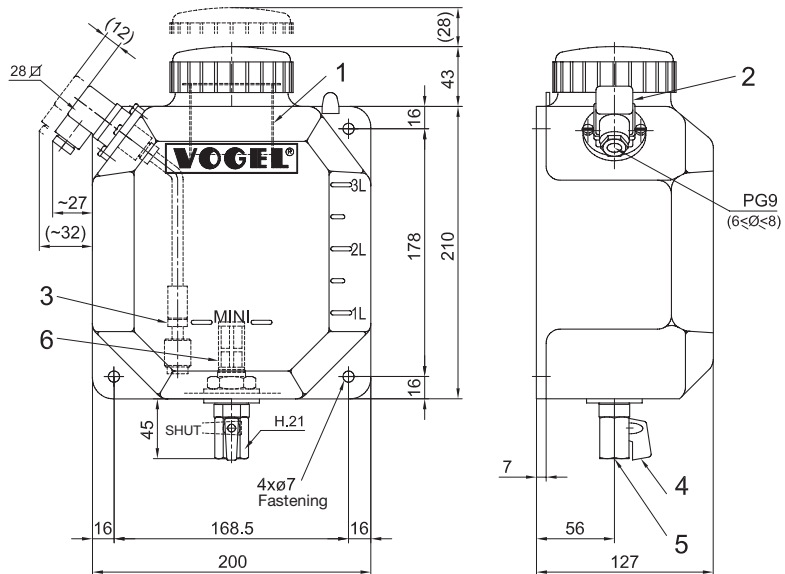


Hydraulic layout TK-179-VM

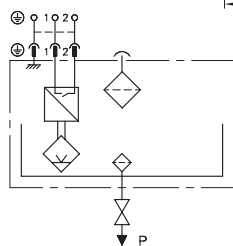


TK-179-V
TK-179-VM

- 1 Fastening holes, $\varnothing 9$
- 2 Mounting bracket
- 3 Filler plug
- 4 Float switch connected by rotatable socket box, conduit thread 9 – for 2P+E cable (with TK-179-VM only)
- 5 Transparent pan
- 6 Stopcock
- 7 Output M10x1, equipped with a filter – 55 μ m



Hydraulic layout TK-350-VMC

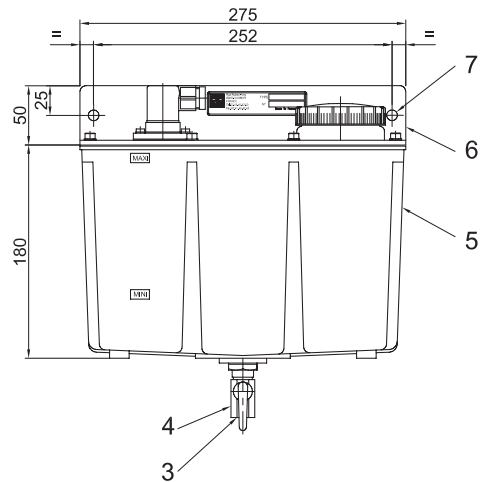
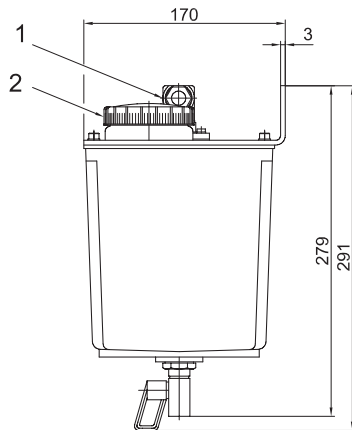


TK-350-V
TK-350-VMC

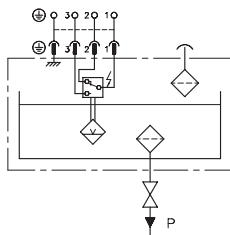
- 1 Filler filter
 - 2 Socket box, rotatable *) connection, conduit thread 9 for 2P+E cable
 - 3 Float switch *)
 - 4 Stopcock
 - 5 Outlet: G1/4, 9 deep
 - 6 Outlet filter
- *) with TK-350-VMC only

Dimensions in mm

Reservoirs

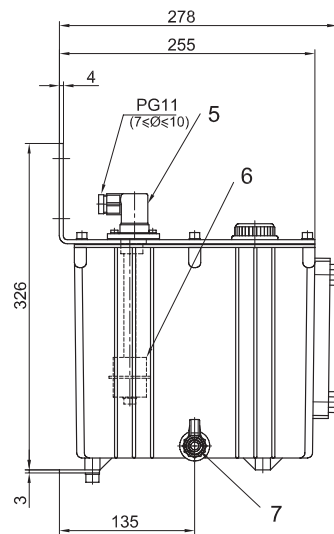
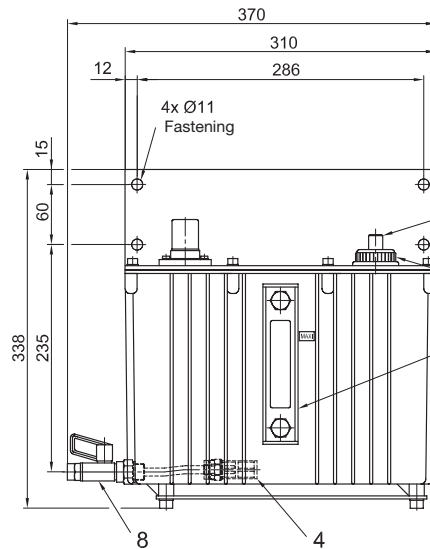


Hydraulic layout TK-602-VM

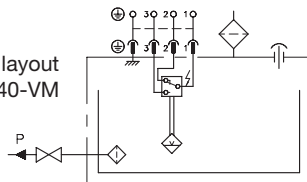


- 1 Float switch (with TK-602-VM only)
- 2 Filler plug
- 3 Outlet G 1/4
- 4 Stopcock connection with rotatable socket box, conduit thread 11
- 5 Pan
- 6 Mounting bracket
- 7 2 fastening holes ø9

TK-602-V
TK-602-VM



Hydraulic layout TK-840-VM



- 1 Ventilation and venting
- 2 Filler screw *)
- 3 Oil sight glass
- 4 Outlet filter
- 5 Socket box
- 6 Float switch *)
- 7 Outlet: G 1/4, 9 deep
- 8 Stopcock

*) with TK-840-VM only

TK-840-V
TK-840-VM



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