Minimal quantity lubrication (MQL) SKF LubriLean

Product series DigitalSuper

Extended product range with enhanced performance and state-of-the-art communication
The innovative technology of the SKF LubriLean DigitalSuper makes it possible to use minimal quantity lubrication (MQL) for a wide range of cutting applications.

The unit’s innovative generation of aerosol, combined with a powerful integrated control unit, constantly provides an optimal supply of oil for the machining process, even in case of unfavourable pressure ratios caused by the application (deep-hole drilling) or by small diameter cooling ducts.

The LubriLean DigitalSuper stands out due to its performance as well as for its very user-friendly operation.

SKF LubriLean can replace the centralized cooling system in many machining processes. It assists customers in reducing costs of cooling system operation and maintenance, enables higher metal-cutting speed, increases the machining surface quality, extends the tool’s service life and lowers the passive impact on the environment.

### Advantages:
- Usable in nearly all production processes (optimally defined droplet size of 0.5 μm)
- Short response times (tool changes)
- No moving parts (thus wear-free)
- Specially suitable for small tools and high cutting speeds
- Simple integration in machine tool systems (retrofits, standard)
- Aerosol transport through lines as long as 20 m
- Continuous and homogenous aerosol flow
- No energy consumption for aerosol production

### Applications:
- Machining centers
- Turning centers
- The DigitalSuper 2 is available mainly for use on machining centers with double spindles or on turning machines with two turrets.
- The DigitalSuper with Bypass-Control (BPC) is for use in advanced drilling tasks such as deep-hole drilling with small tool diameters (<5 mm).

### Application finder DigitalSuper

<table>
<thead>
<tr>
<th>Product series</th>
<th>Machining center</th>
<th>Machining center</th>
<th>Turning center</th>
<th>Protocol</th>
<th>PROFINET</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Regular tools</td>
<td>Deep-hole drilling Ø &lt; 5 mm</td>
<td></td>
<td>PROFIBUS</td>
<td>PROFINET</td>
</tr>
<tr>
<td>UFD10-1-100000</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td></td>
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</tr>
<tr>
<td>UFD10-1-110000</td>
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<td>•</td>
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<td></td>
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<tr>
<td>UFD10-1-101000</td>
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<td>•</td>
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<td></td>
</tr>
<tr>
<td>UFD10-1-111000</td>
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<tr>
<td>UFD10-1-200000</td>
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<tr>
<td>UFD10-1-210000</td>
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<td>UFD10-1-201000</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>UFD10-1-211000</td>
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<td>•</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>UFD20-1-100000</td>
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<td>•</td>
<td>•</td>
<td></td>
<td></td>
</tr>
<tr>
<td>UFD20-1-101000</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Cutting processes

Milling and drilling processes

Two spindles

DigitalSuper devices with two aerosol generators work with machine centers with two spindles
Aerosol generation

SKF LubriLean is based on the Venturi effect principle, supplying lubricant in aerosol form to the cutting point without a pump element. It provides the minimum quantity of lubricant that the metal-cutting process requires for lubrication between the tool and workpiece.

A special system of nozzles in the reservoir turns the lubricant and compressed air into a fine aerosol with a homogenous droplet size of roughly 0.5 μm. Due to its small particle size, the aerosol passes through rotating spindles on machining centers or winding ducts in the turrets on modern turning centers all the way to the cutting site without any separation of the aerosol en route.

Reliable machining is assisted by the transportation of nearly loss-free aerosol.

A number of aerosol generators in the product can be combined flexibly to produce the required aerosol for different machining processes.

Communication interface

Modern machining centers with a large number of tools require individual control of the aerosol quantity by way of a stored program controller (SPC). This is possible with the LubriLean DigitalSuper system. The aerosol quantity and composition required for the respective tool and cutting tasks are set by the transmission of program numbers to the DigitalSuper using M or H commands from the machine’s control system.

A PROFIBUS or PROFINET interface conforming to HPC specifications permits easy system integration.

The LubriLean DigitalSuper comes with comprehensive interfaces to support PC-based, machine-independent system diagnoses.

Deep-hole drilling

The active Bypass-Control (BPC) has been developed for advanced drilling tasks such as deep-hole drilling with small tool diameters (<5 mm).

The increasing drilling depth restrains the aerosol throughput during these machining tasks, making it more difficult to bring the required amount of lubricant to the cutting edge of the tool. Due to inappropriate internal pressure conditions, the decreasing air throughput results in decreasing aerosol generation.

The active Bypass-Control works against this physical effect. To make this happen, a Y-fitting splits the aerosol flow at the end of the aerosol line, as close as possible to the spindle ( → Fig. 3, page 4).

One part of the split aerosol flow is led through the spindle to the tool, and the other part is led through a bypass valve back to the refilling reservoir or into the exhaust system of the customer’s machine.

During the machining process, the bypass valve is closed and opened, depending on the pressure conditions in the MQL system. This results in consistent aerosol generation and a reliable and homogenous supply to the tool during the entire drilling process.
Product range

SKF offers an easy-to-configure MQL system. The UFD10 series comes with one aerosol generator and PROFINET or PROFINET protocol (→ Fig. 1). Additionally, you can order a filling pump system (→ Fig. 2) and a Bypass-Control (→ Fig. 3). A combination of both is possible (→ Fig. 4), depending on your application.

Fig. 1

MQL System DigitalSuper with one aerosol generator
PROFIBUS UFD10-1-100000
PROFINET UFD10-1-200000

Fig. 2

MQL System DigitalSuper with one aerosol generator, filling pump and optional refilling reservoir
PROFIBUS UFD10-1-101000
PROFINET UFD10-1-201000

Fig. 3

MQL System DigitalSuper with one aerosol generator and Bypass-Control
PROFIBUS UFD10-1-110000
PROFINET UFD10-1-210000

Fig. 4

MQL System DigitalSuper with one aerosol generator, Bypass-Control, filling pump and optional refilling reservoir
PROFIBUS UFD10-1-111000
PROFINET UFD10-1-211000
The UFD20 series comes with two aerosol generators and PROFINET protocol (→ Fig. 5). Additionally, you can order a filling pump system (→ Fig. 6).

**Description for figures 1–6**

1. Aerosol generator
2. MQL internal control unit
3. Pressurized air inlet
4. Power
5. Aerosol line
6. Communication protocol
7. Filling pump
8. Refilling reservoir (→ accessories)
9. Bypass-Control unit
10. Y-splitter
11. Bypass- / wetting-out valve
12. Bypass throttle
13. Ball valve
14. Rotary unit
15. Spindle
16. Tool holder
17. Tool
18. Machine tool control
19. Separator

⚠️ **CAUTION**

The important information on product usage located on the back cover applies to all systems described in this brochure.
## Technical data

### Technical data for all models

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lubricant</td>
<td>→ accessories, page 15</td>
</tr>
<tr>
<td>Reservoir capacity</td>
<td>1.2 l</td>
</tr>
<tr>
<td>Metered aerosol quantity per outlet</td>
<td>3–400 ml/h</td>
</tr>
<tr>
<td>Operating temperature</td>
<td>+10 to 40 °C (+50 to 104 °F)</td>
</tr>
<tr>
<td>Operating air pressure</td>
<td>4–10 bar (48–145 psi)</td>
</tr>
<tr>
<td>Air consumption per aerosol generator</td>
<td>10–500 Nl/min</td>
</tr>
<tr>
<td>Voltage per control unit</td>
<td>24 V DC ±20%</td>
</tr>
<tr>
<td>Protection class acc. DIN EN 60529</td>
<td>IP 54</td>
</tr>
<tr>
<td>Mounting position</td>
<td>vertical, connections downwards</td>
</tr>
<tr>
<td>Connections for aerosol line</td>
<td>Plug-in connector for plastic tubes 12x1</td>
</tr>
<tr>
<td>Lubricant refilling: suction line</td>
<td>Plug-in connector for plastic tubes Pa11/12 plastic tube 10x1.5</td>
</tr>
<tr>
<td>Return line / reservoir draining</td>
<td>Plug-in connector for plastic tubes Pa11/12 plastic tube 10x1.5 G1/2</td>
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<tr>
<td>Bypass valve, 20 bar</td>
<td></td>
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</tbody>
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### Technical data for specific models

<table>
<thead>
<tr>
<th>Model</th>
<th>UFD10-1-10X000</th>
<th>UFD10-1-20X000</th>
<th>UFD10-1-11X000</th>
<th>UFD10-1-21X000</th>
<th>UFD20-1-10X000</th>
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</thead>
<tbody>
<tr>
<td>Type of protocol (FELDBUS)</td>
<td>PROFIBUS</td>
<td>PROFINET</td>
<td>PROFIBUS</td>
<td>PROFINET</td>
<td>PROFIBUS</td>
</tr>
<tr>
<td>Bypass-Control</td>
<td>-</td>
<td>-</td>
<td>●</td>
<td>●</td>
<td>-</td>
</tr>
<tr>
<td>Number of aerosol generators</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Recommended air pressure</td>
<td>6 bar (87 psi)</td>
<td>6 bar (87 psi)</td>
<td>10 bar (145 psi)</td>
<td>10 bar (145 psi)</td>
<td>6 bar (87 psi)</td>
</tr>
<tr>
<td>Weight with filled aerosol generator</td>
<td>30 kg (66 lb)</td>
<td>33 kg (72 lb)</td>
<td>36 kg (79 lb)</td>
<td>36 kg (79 lb)</td>
<td>40 kg (88 lb)</td>
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How to configure

Order code

<table>
<thead>
<tr>
<th></th>
<th>0</th>
<th>1</th>
<th>0 0 0</th>
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</thead>
<tbody>
<tr>
<td>U</td>
<td>F</td>
<td>D</td>
<td></td>
</tr>
</tbody>
</table>

MQL device DigitalSuper

Number of aerosol generators
10 = one for one spindle
20 = two for two spindles

Generation
1 = First generation

Type of protocol
1 = PROFIBUS
2 = PROFINET

Machining scope
0 = without Bypass-Control (for machining with regular tools)
1 = with Bypass-Control (for full machining range including deep-hole drilling)

Filling pump (For filling reservoir see accessories, pages 13–14)
0 = without
1 = with

Features
0 = without

Order example

UFD10-1-210000
- DigitalSuper
- One aerosol generator
- First generation
- PROFINET
- With Bypass-Control
- Without filling pump
- Without additional features

Aerosol generator

Bypass-Control

PROFINET connection
Installation drawings

DigitalSuper with one aerosol generator
PROFIBUS UFD10-1-101000

3x aerosol outlets
min. one outlet to the lubrication point open

DigitalSuper with one aerosol generator
PROFINET UFD10-1-201000
MQL System DigitalSuper with one aerosol generator and Bypass-Control
PROFIBUS UFD10-1-111000

Included in delivery:
Coaxial valve – UFZ.0434 (→ page 12)
Y-fitting – UFZ.0421 (→ page 15)
Bypass throttle – UFZ.0423 (→ page 15)

DigitalSuper with two aerosol generators
PROFIBUS UFD20-1-101000

Profibus-DP connecting cable 0,2 m
24 V DC power supply
Y-distributor, 0,3 m cable
Screw plug for manual filling hexagon socket 12 mm
3× aerosol outlets
min. one outlet to the lubrication point open
3× aerosol outlets
max. one outlet to the lubrication point open
Accessories

Aerosol monitor AM1000

The aerosol monitor AM1000 monitors the supply of the aerosol in a LubriLean system. Preferably located in the aerosol’s path just upstream of the machining site.

An optical measuring process is used to provide a yardstick for the number of oil droplets per respective volume. This analog value can be transmitted for evaluation via a customary 4 to 20 mA interface, e.g. to the machine’s control system.

Alternatively, the aerosol monitor can be connected to the minimal quantity lubrication system via a CAN-BUS interface. All relevant analog variables like air throughput, aerosol density, inlet and internal reservoir pressure are detected and passed on to the machine tool via the optimal PROFIBUS interface.

After an MQL machining process has been run, the representative analog value measured during the process can be stored in the machine tool’s control system. Deviations from this value indicate changes in the overall MQL system and can be investigated before production quality deteriorates.

This helps to increase process reliability and to avoid poor surface qualities or even broken tools.

Another important control feature, the sensor transmits an additional calculated variable – the equivalent internal coolant-duct diameter of the tool in use. The characterization of a tool’s flow resistance by way of its internal coolant-duct diameter has proved to be practicable since the program numbers to be set were determined as a function of the internal coolant duct.

Technical data

<table>
<thead>
<tr>
<th>Order number</th>
<th>AM1000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Medium</td>
<td>Aerosol for MQL applications</td>
</tr>
<tr>
<td>Typical droplet ∅</td>
<td>0.5–5 µm</td>
</tr>
<tr>
<td>Max. permissible pressure</td>
<td>10 bar</td>
</tr>
<tr>
<td>Max. throughput</td>
<td>800 Nl/min</td>
</tr>
<tr>
<td>Operating temperature</td>
<td>0 to +60 °C</td>
</tr>
<tr>
<td>Protection class per DIN EN 60529 (housing)</td>
<td>IP 65</td>
</tr>
<tr>
<td>Operating voltage</td>
<td>24 V DC ±25%</td>
</tr>
<tr>
<td>Power consumption at rest</td>
<td>max. 60 mA</td>
</tr>
<tr>
<td>Power consumption under load</td>
<td>max. 80 mA</td>
</tr>
<tr>
<td>Mounting position</td>
<td>upright, as illustrated</td>
</tr>
</tbody>
</table>

Accessories for AM1000

- Teach adapter: UFZ.U00-137
- BUS cable, 10 m: UFZ.0370
- BUS cable, 6 m: UFZ.0369
- BUS cable, 4 m: UFZ.0375
- BUS cable, 2 m: UFZ.0368
- BUS cable, 1 m: UFZ.0374
- T-connector M12×1*: UFZ.0373
- Cordset, 5 m: 179-990-600
  - single-ended M12×1 female connector and molded cable: 179-990-601
  - single-ended M12×1 female, right-angle connector and molded cable: 179-990-600

* for continuation of Data-BUS line for use with two AM1000 at UFD20-X
Accessories

Ball valves

**Ball valve 2/2-way**

- Order number: UFZ.U00-128
- Max. operating pressure: 100 bar, 1450 psi

**Ball valve 3/2-way**

- Order number: UFZ.U00-041
- Max. operating pressure: 100 bar, 1450 psi
Accessories

Valves

2/2 way coaxial valve
Order number: UFZ.U00-161
Max. operating pressure: 0–20 bar, 0–290 psi

Lubricant refilling station
Refilling station with pump unit and reservoir, 15 liters for UFD10-X and UFD20-X models
Order number: MF5-BW16-58+299
Input voltage: 360–440V, 50Hz, 430–530V, 60Hz
FPM sealing

Order number: UFZ.U00-157
tubing, connection parts
Accessories

Lubricant reservoirs

Reservoir, 30 liters for UFD10-X and UFD20-X models
Order number: UFD.70.000

Reservoir, 6 liters for UFD10-X models
Order number: KW6-S11

Medium: Oil on a petroleum or synthetic basis
Compatible with: Plastics, FPM sealings, Copper, Copper alloys

Float switch for monitoring of critical lubricant level with advance warning

S = Suction port
R = Return oil line
with push-to-connect fitting for Ø10 tubing
Accessories

Lubricant reservoirs

**Reservoir, 15 liters for UFD10-X models**
- Order number: BW16-S22
- Suction port (S): 1 and 3

**Reservoir, 15 liters for UFD20-X models**
- Order number: BW16-S23
- Suction port (S): 1 and 4
- Return line (R): 2 and 3
- Float switch for monitoring of critical lubricant level with advance warning

*) Ports 1, 2, 3, 4 = suction port or return line with push-to-connect fitting for ∅10 tubing

**Reservoir, 30 liters for UFD20-X models**
- Order number: BW30-S17
- Float switch for monitoring of critical lubricant level with advance warning

S = suction port with push-to-connect fitting for ∅10 tubing
R = oil return line with push-to-connect fitting for ∅10 tubing
## Accessories

### Hoses and fittings

<table>
<thead>
<tr>
<th>Designation</th>
<th>Order number</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aerosol hose 12x1*</td>
<td>UFZ.0027</td>
<td></td>
</tr>
<tr>
<td>Screw union</td>
<td>UFZ.0081</td>
<td>Max. operating pressure = 20 bar (290 psi)</td>
</tr>
<tr>
<td>to connect aerosol hose – ball valve</td>
<td></td>
<td>Plug-in connection releasable</td>
</tr>
<tr>
<td>Y-fitting 12/12/12</td>
<td>UFZ.0421</td>
<td></td>
</tr>
<tr>
<td>Bypass throttle for recirculation reservoir</td>
<td>UFZ.0435</td>
<td>Ø d = 1 mm</td>
</tr>
<tr>
<td></td>
<td>UFZ.0427</td>
<td>Ø d = 1,5 mm</td>
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<tr>
<td></td>
<td>UFZ.0436</td>
<td>Ø d = 2 mm</td>
</tr>
<tr>
<td>Bypass throttle for active BPC</td>
<td>UFZ.0424</td>
<td>Ø d = 1 mm</td>
</tr>
<tr>
<td></td>
<td>UFZ.0423</td>
<td>Ø d = 1,5 mm</td>
</tr>
<tr>
<td></td>
<td>UFZ.0422</td>
<td>Ø d = 2 mm</td>
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</table>

* Please indicate length in running meters when ordering.

## Lubricants

<table>
<thead>
<tr>
<th>Lubricant</th>
<th>Order number</th>
<th>Can size</th>
<th>Base</th>
<th>DIN 51757 Density at +20 °C</th>
<th>Test to DIN 51562 Viscosity at +40 °C</th>
<th>DIN ISO 2592 Flash point</th>
</tr>
</thead>
<tbody>
<tr>
<td>LubriOil</td>
<td>OEL-...-LUBRIOL*</td>
<td>2,5; 5; 10</td>
<td>fatty acid ester</td>
<td>0,92</td>
<td>47</td>
<td>265 509</td>
</tr>
<tr>
<td>LubriFluid F100</td>
<td>OEL-...-LUBRI-F100*</td>
<td>2,5; 5; 10</td>
<td>higher alcohol</td>
<td>0,84</td>
<td>25</td>
<td>184 363,2</td>
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</table>

* Please add the desired can size to the order number. Example: OEL5-LUBRIOIL
Important information on product usage

SKF and Lincoln lubrication systems or their components are not approved for use with gases, liquefied gases, pressurized gases in solution and fluids with a vapor pressure exceeding normal atmospheric pressure (1 013 mbar) by more than 0.5 bar at their maximum permissible temperature.