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Information on operating fluids

(previous name “Notes on Operating Materials”)

CNC Lathes

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Note on applicability

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A word on copyright

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General Information

The applicable local rules and directives must be observed for the handling of operating fluids. Personal protective equipment must be worn when handling operating fluids in order to avoid damages to health. This applies in particular to direct skin contact.

Use of a fume exhaust is recommended to prevent the inhalation of harmful substances.

Only the operating fluids specified in the user documentation must be used.

Additives such as alcohols, glycols, biocides, anti-corrosion agents, high-pressure and anti-wear additives must be used only after consulting the respective vendor. Any warranties for damages to the machine that are found to be caused by interaction of different operating fluids are rejected.
Make sure that suitable combinations of cooling lubricant and bed way oil or fluid grease are selected and that they are properly maintained and serviced.

Selection, use, and maintenance of operating fluids are the operator's responsibility.

Water-polluting substances

The operation of lathes partially requires the use of water-polluting substances.
The installation site of the lathe must therefore be secured such that in case of failures, none of these substances can enter the ground water. If the installation site has no sufficient floor protection, the following precautions must be taken:

- Use lathes including system components in a containment device only. The size of the containment device depends on the released amount of fluid in case of failure.
- Secure the conveying and handling area against splattering and dripping losses.

Disposal of used operating fluids

The disposal of auxiliary materials, coolants, and lubricants must follow the applicable local regulations and directives.

Cooling lubricants

General notes on cooling lubricants

Cooling lubricants are used to dissipate the heat generated during machining from the machining area. They also reduce friction between the tool and the workpiece and keep the machining area free of chips.

Synthetic, ester oil-containing, biological cooling lubricants may be used.
In general, the responsibility for the cooling lubricant used lies with the operator/owner or cooling lubricant manufacturer.

The warranty (liability) does not cover damage to the machines caused by the use of unsuitable lubricants and cooling lubricants. This also applies to the lack of monitoring of operating fluids and auxiliary materials.

The list "**List of emulsions and cutting oils used at INDEX**" can be used for the procurement of suitable lubricants and cooling lubricants. See the list at the end of this section.

When selecting the cooling lubricant, compatibility with other operating fluids should be checked and ensured!

In general, the following criteria apply to cooling lubricants:

- Check cooling lubricants regularly.
- Cooling lubricants must not resinify.
- Cooling lubricants must not contain any abrasive residues, such as: Corundum or CBN (cubic, crystalline boron nitride).
- Cooling lubricant must not corrode, harden or wash off other lubricants used.
- Cooling lubricants should remain fully effective even after long periods of use.
- Cooling lubricants should be resistant to oxidation and emulsification.
- Cooling lubricants must not damage seals or wipers made of materials such as nitrile rubber (NBR), polyurethane (PUR) and fluoroelastomers (FKM).
- Cooling lubricants must not attack the two-component paints and sealing materials commonly used in mechanical engineering.

When handling hazardous substances, the current hazardous substance regulations and technical rules for hazardous substances (TRGS) should be observed.

The regulations and directives of the respective country of operation apply.

If anything is unclear, consult with the respective cooling lubricant manufacturer on site.

The cooling lubricants used must not contain any ingredients such as chlorine, active sulfur, etc. These can cause damage to the machine (e.g., corrosion, component failure, seal degradation, etc.)! The machine owner/operator or the cooling lubricant manufacturer must ensure the compatibility of the ingredients.

Cooling lubricants used must be chemically compatible with other media used in the machine (e.g., hydraulic fluid and lubricating oil).

The machine owner/operator or the cooling lubricant manufacturer must ensure this compatibility. If necessary, this should be checked with appropriate mixing tests.

Procurement of suitable cooling lubricants.

A cooling lubricant compatibility test kit for an insertion test can be purchased from the **INDEX**-Werke **iXshop**.
It contains materials and EUTs, e.g., cables, wipers, which are used on the machine.
The test conditions and evaluations are the responsibility of the machine owner/operator or the cooling lubricant manufacturer.

iXshop	Name	Order number
	Cooling lubricant compatibility test kit	12133644 (Stand 01.11.23)

Cooling lubricants serve as corrosion protection during machining. Follow the rules of the cooling lubricant manufacturers on mixing ratio, concentration monitoring, and pH.

The designations and properties of cooling lubricants are standardized according to DIN or ISO.
Cooling lubricants must be certified for their use and meet the environmental and health regulations.

The testing must comply with the VDI 3035 standard. The VDI 3397 Sheet 2 standard must also be observed in this context. It describes measures to maintain quality, improve processes, and reduce waste and wastewater.

When switching the cooling lubricant to another product or changing the manufacturer, the cooling lubricant system must be completely flushed and cleaned with this cooling lubricant. This also applies if the manufacturer is changed.

When needed, only new or reconditioned cooling lubricant must be replenished. The reconditioned cooling lubricant must have the same technical characteristics as new cooling lubricant. This applies in particular to the portion and the size of the particles contained.

In machines operated with cooling lubricant, cooling lubricant, lubricating oil and hydraulic fluid may be mixed.

Foaming

Foaming of the cooling lubricant emulsion can be diminished by additives.

Improper handling

Improper handling can infect the cooling lubricant with bacteria and fungi.

Always eliminate/rinse off cleaning agent residues.
Leftover food, cigarettes or similar items may not be thrown into the chip area.

This would result in:

- increased risk of corrosion
- clogging of cooling lubricant lines
- resolving of paint and plastic parts
- skin rashes or allergic reactions

Water-miscible cooling lubricants (emulsions)

Valid for all single-spindle lathes

General Information

The use of unsuitable water-miscible cooling lubricants can cause considerable damage to the machine and is the responsibility of the Machine owner/operator or the cooling lubricant manufacturer!
The same applies to the chemical compatibility between the media.

The condition of the cooling lubricant must be checked by visual inspection in the cooling lubricant tank. There must be no closed oil layer on the resting emulsion, as this would cause severe growth of bacteria.

The use of emulsion as a cooling lubricant requires frequent and intensive maintenance. This is the only way to ensure consistent quality, high availability and value retention of the lathes.

Follow the instructions of the cooling lubricant manufacturer.

Important test parameters include:

- Concentration
- pH
- Bacterial count
- Fungi
- Mixing ratio

The cooling lubricant emulsion must meet the specifications of the cooling lubricant manufacturer (see datasheet) at any time during its use.
Also the test parameters and test intervals as specified by the manufacturer must be observed.

Electrostatic extraction system

An electrostatic extraction system is designed for the extraction and filtration of oil mist - to a limited extent also for emulsion mist.

An emulsion (water-miscible cooling lubricant) is basically an electrically conductive medium. Make sure that the absolute oil content in the emulsion is above 5%.

If the oil content falls below the specified percentage, the operation of the electrostatic precipitator may be impaired, particularly in high pressure applications.

Preparation water / water hardness

- The preparation water must have drinking water quality.
- The total hardness* of the water must be 1.79 to 3.57 mmol/l (10 °dH to 20 °dH).
- Softer water increases the tendency to foam.
- Harder water impairs the physical stability of the cooling lubricant emulsion and leads to deposits.

The proportion of electrolytes, such as chlorides, and the nitrate content are also of major importance. Among other things, these ingredients adversely affect the stability and corrosion protection of a cooling lubricant emulsion.

(*Note country-specific conversions)

Non-water-miscible cooling lubricants (cutting oils)

Valid for all INDEX lathes

General Information

INDEX multi-spindle lathes must always be operated with non-water-miscible cooling lubricants (cutting oils)!
The use of water-based cooling lubricants (emulsions) causes considerable damage to the machine. This is then the responsibility of the operator/owner or the cooling lubricant manufacturer!!!
The same applies to the chemical compatibility between cutting edges and hydraulic fluids.

Cooling lubricants (cutting oils) that are not water-miscible must be chemically compatible with the **HLPD ISO VG 32** hydraulic fluid specified for **INDEX** machines! The machine owner/operator or the cooling lubricant manufacturer should check and ensure this compatibility with appropriate mixing tests if necessary.

When using cutting oils, fire prevention measures must be taken. This lies in the responsibility of the machine operator. The operator must specify and implement appropriate measures required for this purpose. These include comprehensive operational fire protection or an automatic fire extinguishing system (optional).

Non-water-miscible cooling lubricants (cutting oils) must have the following physical properties:

Viscosity class according to ISO 3448:1992	Viscosity at 40 °C according to DIN EN ISO 3104	Flash point measured with Cleveland open cup method acc. to ISO 2592	Evaporation loss at 250 °C (Noack) acc. to CEC L-40 -93	max. allowed operating temperature $T_{max.}$ °C
ISO VG 10	9.0 - 11.0 mm^2/s	> 155 °C	< 60 %	50°C
ISO VG 15	13.5 - 16.5 mm^2/s	> 190 °C	< 25 %	
ISO VG 22	19.8 - 24.2 mm^2/s	> 200 °C	< 15 %	

List of emulsions and cutting oils used at INDEX

Manufacturer	Product name	Emulsion	Cutting oil
Zeller & Gmelin	Multicut Ultra 10		x
Zeller & Gmelin	Zubora 67 H Plus	x	
Blaser	Blasomill 22		x
Blaser	Blasomill GT22		x
Blaser	B-Cool 755	x	
Blaser	Skytec H600	x	
Castrol	Variocut G600 HC		x
Castrol	Syntilo 9913	x	
Castrol	Hysol SL 45 XBB	x	
Kluthe	HAKUFLUID 150	x	
Petrofer	Isocut LG 10 S		x
Total	Valona MS 5020 HC		x

Coolants

Water quality and water treatment

Coolants serve as a transport medium for heat within cooling units (e.g., heat exchangers). It should not be confused with cooling lubricant.

When refilling, only fill with the specified coolant (label on the coolant tank/cooling unit). If there is no label, top up with the coolant already used.

Pressure, temperature and flow rate must be observed when using an external (operator-side) coolant supply. This information is included in the user documentation for the respective machine.

Check the coolant concentration before replenishing.

Before refilling with a new coolant, carefully clean **the entire cooling unit** and rinse it several times with clean water.

Mixing different coolants may trigger biological/chemical reactions and cause consequential damage to components.

Such biological-chemical reactions have usually also direct impact on the machine (e.g., due to increased corrosion).

Coolant that has changed due to biological-chemical reactions – "gone off" – does no longer meet the required properties and must be completely replaced.

When preparing the coolant from concentrate and water, be sure to use demineralized water only.

Limits*

– Appearance	clear, no sediment
– pH 0 °C)	7.5 … 9.0
– Electrical conductivity (20 °C)	< 250 ms/m^3
– Total hardness*	< 20 °dH (3.57 m/mol)
– Chloride	< 50 g/m^3
– Organic impurities	< 1000 ^{1}/ml
– Sulfate	< 25 ppm
– Max. particle size	< 0.05 mm

(*Note country-specific conversions)

Machines with external coolant supply

Water circuit for external water supply

The cooling circuit must contain an anti-corrosion agent for preservation and a biocide against algae and slime bacteria.
If prescribed by the cooling system manufacturer, the coolant circuit must also contain an anti-freeze agent.

With an external coolant supply, pre-filtration (filter fineness ≤ 0.2 mm) must be ensured.

Machines with cooling unit

Water circuit

The coolant circuit is a semi-open system with mixed material application such as steel, stainless steel, brass, copper, rubber, plastic. It usually consists of a cooling unit near the machine, which is connected to the machine's cooling water system via two rubber hoses.

When refilling the system, antifreeze (down to -15 °C) must be added. If the manufacturer's instructions require it, a rust inhibitor for preservation and a biocide against algae and slime bacteria must also be added.

Water treatment

When initially filling or refilling with cooling water, be sure to add an anti-freeze agent to the water. To ensure the correct mixing ratios, we recommend using a ready mixture that can be obtained from the machine manufacturer. Adding an anti-freeze agent ensures sufficient protection both against freezing and corrosion.

The protective agent for the initial filling of the water circuit (machine with cooling unit) is supplied with the machine.

Hydraulic fluid

Hydraulic fluid is used as coolant in cooling circuits, in addition to power transmission in hydraulic elements.

Cooling lubricant may enter the hydraulic fluid circuit due to technical circumstances. The hydraulic fluid must therefore be able to accommodate a small amount of cooling lubricant or coolant. However, this must not impair its hydraulic properties.

Possible harmful interactions between different hydraulic fluids must be avoided. When changing manufacturers or between different products from the same manufacturer, the hydraulic fluid in the reservoir (tank) must be extracted.
This applies even if the new hydraulic fluid has the same specification as the previously used hydraulic fluid.

INDEX recommends and fills all machines with:

– **Renolin MR10 ISO VG 32 (from Fuchs)**

Properties of hydraulic fluids

- Lubricant class **L**
  according to ISO 19378
- Viscosity class **ISO VG 32**
  according to DIN ISO 3448
- Classification **HLPD**
  according to ISO 6743/4, DIN 51502, and DIN 51524-2
- Purity grade **15/13/10**
  according to ISO 4406

Lubricants

In general:

- Lubricants must not be decomposed, hardened or washed off by the cooling lubricant.
- They must be resistant to aging, oxidation and emulsification, and they must not corrode the coating and the sealing materials commonly used in mechanical engineering.

The following specifications apply unless the machine documentation indicates other values:

Central lubrication and other places of use

Properties of lubricating oils

- Lubricant class **L**
  according to ISO 19378

Viscosity class ISO VG 68 or ISO VG 220
according to ISO 19378

Be sure to follow the information at the lubricating oil tank.

- Classification **CGLP**
  according to ISO 6743/4, DIN 51502, and DIN 51524-2

Properties of lubricating or fluidized greases

- Consistency class **NLGI 000**
  according to DIN 51818

- **GP 000 N-30**
  according to DIN 51502

- **ISO-L-XCHB 000**
  according to ISO/DIS 6743-9

For the oils and greases used for clamping devices (chuck or collet), follow the specifications of each clamping device manufacturer.

Properties of spindle oils

Generally similar properties are required as those of lubricating oils:

Only spindle oils must be used that are very resistant to aging and have good low-temperature properties.

- Lubricant class **CL** (gear oil)
- Viscosity class *DIN 51519*
- Requirements according to *DIN 51517-2*

Cleaning material

The machine must be cleaned only with a normal cleaning cloth and kerosene or cleaning oil.

Do not use cotton waste and highly volatile solvents such as benzene, trichloroethylene or the like.

The machine must not be cleaned with compressed air.

Cleaning the machine with steam, high-pressure or dry ice cleaners is not permitted.

Pneumatic system

Pneumatically controlled machine functions

- Sealing air
- Control of cooling lubricant valves
- Workpiece removal unit with gripper (option)
- Opening and closing of doors and flaps
- Customized facilities such as workpiece measuring device, contact checking units, fixture, aligning unit, etc.

Required properties

To ensure troublefree operation of the machine, the operator must provide compressed air in appropriate quality.

The quality of compressed air is divided into classes according to ISO 8573-1 that specify the allowed level and type of contamination.

Type of contamination	Quality class	Explanation
Solid contamination	4	Max. particle size 15 µm Max. particle density 8 mg/m^3
Pressure dew point	4	+3°C
Total oil content	4	≤ 5 mg/m^3

The required compressed air is conditioned in a compressed-air maintenance unit. The compressed-air maintenance unit requires no settings.

The factory default of the system pressure (pneumatics) is 6 bar.

Indicators are available to check normal functionality.

Air consumption

The air consumption is influenced both by the machine type and the specific machine equipment, as well as by the cycle time.

For the precise determination of the corresponding air consumption of the specific machine, be sure to consult the user documentation or contact the machine manufacturer.

Corrosion protection

The following anti-corrosion agents are used at the factory:

– RIVOLTA K.S.P. 204 simple oily corrosion protection with residual lubricating properties
– RIVOLTA K.S.P. 317 resistant waxy long-term corrosion protection for longer transports such as by sea, or for long storage.

Simple oily corrosion protection

Before delivery, all machines are provided with corrosion protection. Removing the corrosion protection before initial start-up is not necessary because it is flushed away by the cooling lubricant.

Waxy long-term corrosion protection

In some cases, the machine is sprayed with long-term corrosion protection in certain locations against corrosion. This is the case, for example, during long storage or transportation by sea. High-quality parts or items on the machine, such as ball screws or swivel grippers, must be sprayed with the simple oily version of corrosion protection only.

These machines are specially marked.

A warning sign indicating this type of corrosion protection is affixed to the viewing glass of the work area door.

Machines that are marked in this way must be cleaned, otherwise wipers and seals may be damaged.

Note that a thin mineral oil should be used as cleaning agent.

Prior to another transport, the machines must be again sprayed with an appropriate anti-corrosion agent (matching the conditions of transport).

If corrosion inhibitors from other manufacturers are used, their equivalence must be guaranteed by the supplier or manufacturer in writing.

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