

Safety Precautions and Technical Details

CNC Lathes

Note on applicability

Illustrations in this publication may deviate from the product supplied. Errors and omissions due to technical progress expected.

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1 Explanation of symbols

1.1 Symbols used in the user documentation

This chapter explains the symbols that are used in the user documentation to call attention to dangers and important notes.



This symbol warns against a direct imminent danger to the life and health of individuals.

Failure to observe this danger warning may result in severe health impairment such as perilous injury and even death.



These symbols indicate important notes for the proper operation of the machine.

Failure to observe this information may result in damage to or malfunction of the machine or its components.



This symbol warns against a direct imminent danger from electricity.

Failure to observe this danger warning may result in severe health impairment such as perilous injury and even death.

1.2 Information and safety instructions on the machine

All information and safety instructions directly on the machine must be observed and must be kept in a fully legible condition.

Various symbols and warnings may be found on the machine, depending on the design of the machine and its intended use.

2 General instructions for safe operation

2.1 Obligations of the operator/owner

The operator/owner must ensure that all the specified limits, ambient conditions, and clearances in the vicinity of the machine are observed at the place of installation.

Prior to commencing operation of the machine:

- The machine operator must understand the dialog language of the control system user interface.
- The personnel responsible must be sufficiently qualified to perform the work assigned to them. This applies particularly to commissioning, maintenance and servicing, as well as any working on electrical equipment and components.
- All safety equipment must be properly attached and functional; it must not be tampered with or disabled.
- Devices and measures to override the restricted access to the controller (e.g., keys for switches, passwords) must be accessible only by authorized personnel.
- The machine must be in proper functional condition. Any damaged or defective parts must be replaced immediately. This applies particularly to all safety equipment.

2.2 Personnel obligations

The personnel responsible must read and understand the user documentation including the caution labels. This applies particularly to the safety labels and warnings.

Before starting work, all those operating the machine or who are assigned work on the machine must commit to do the following:

- Follow the basic regulations on occupational safety and accident prevention.
- Comply with the safety chapter and the warnings in the user documentation. This requires them either to read the relevant sections or to receive instruction about their content.

All those carrying out work on the machine must use the required personal protective equipment.

2.3 Requirements for personnel selection and qualifications

2.3.1 Definition of “qualified employee”/“qualified personnel”

A qualified employee is capable, on the basis of their relevant professional education, training and/or experience, to recognize risks and to avoid possible hazards that arise when using the product.

Depending on the activities to be carried out, these qualified employees may be from various fields, e.g. qualified transport personnel for machine transport or qualified electricians for work on the electrical equipment of a machine.

2.3.2 Personal selection and qualifications

The personnel responsible must be sufficiently qualified to perform the work assigned to them. Individuals undergoing training must not work on the machine without constant supervision by a person having the required qualifications.

Qualified personnel must meet the following requirements:

Transport personnel

- Qualified employees/trained individuals with knowledge of the relevant load securing and approval for the means of transport of the relevant type.

Installation/commissioning personnel

- Qualified employees/technically trained individuals with experience of installing and commissioning machines of this type.

Setup personnel

- Trained and qualified employees
- Specialized training by the machine manufacturer

Programming personnel

- Trained and qualified employees
- Specialized training for the machine or programming system by the machine manufacturer

Operating personnel

- Trained skilled employees or semi-skilled employees
- Comprehensive instruction on the machine
- Operator training by machine manufacturer

Maintenance personnel

- Trained skilled employees or semi-skilled employees
- Specialized training by the machine manufacturer

Service and repair personnel

- Trained and qualified employees
- Specialized training by the machine manufacturer

Decommissioning/storage personnel

- Trained and qualified employees

Disposal personnel

- Trained and qualified employees

Expert

- A person who has sufficient knowledge of the machine based on professional training and experience and who is familiar with all regulations, thereby enabling evaluation of the inspected machine with regard to occupational safety.

The following also applies:

- Work on the machine may only be carried out by reliable persons who are able to cope with the physical demands involved.
- Key switches may only be operated by instructed and authorized persons. The key must be removed after use and stored in such a way that unauthorized persons do not have access.
- Work on the electrical equipment of the machine may only be carried out by qualified electricians or by instructed persons under the direction and supervision of a qualified electrician in accordance with the electrical/electronic regulations.
- Work on the hydraulic system may only be carried out by trained and authorized persons.

2.4 Intended use of the machine

The machine has been designed mainly for cold working of common metallic materials without requiring access to the work area during machining.

The machine is intended exclusively for use in an industrial environment.

The machine has been designed and constructed in accordance with current best practices and generally recognized safety rules. All the required safety equipment and protective apparatus are present.

The operational safety of the machine is only ensured if it is used as intended. If it is not used as intended, risks may arise.

Residual risks exist even when the machine is used as intended.

For this reason, the safety notices and warnings in the operating instructions and on the machine must be observed.

All the safety notices and warnings on the machine must be kept in a legible condition and must be replaced if necessary.

The limits specified in the technical data (e.g., maximum rotational speed or maximum turning length) must be observed.

The machine must not be operated in an explosive atmosphere.

Only one person at a time may work on the machine.

If more than one person is required in exceptional cases, the operator/owner must appoint one person as the person responsible for coordinating the work and complying with the occupational safety regulations.

Do not walk on the machine or its auxiliary units.

If in exceptional cases it is necessary to be on the machine, this is expressly permitted only when the machine is switched off.

2.5 Reasonably foreseeable misuse of the machine

Reasonably foreseeable misuse includes:

- Bypassing protective apparatus during operation
- Operating the machine in ambient conditions other than the approved ambient conditions

Machining of the following materials is not permitted:

- Explosives
- Materials releasing hazardous substances during the machining process (e.g., toxic or radioactive substances)
- Materials that produce explosive dust during machining
- Combustible materials
This does not apply to titanium alloys if appropriate fire-safety measures are met when dealing with the collection of chips.
- Materials without sufficient inherent stability

2.6 Modifications to the machine

Modifications to the machine may result in a safety risk. This applies particularly to all safety equipment, electrical circuits, and the machine control system software and parameters.

Significant modifications to the machine may lead to non-conformance with the applicable directives for product safety.

Therefore, the operator/owner must not make any modifications or additions to the hardware or software of the machine without the written approval of INDEX-Werke GmbH & Co. KG.

Modifications approved by the manufacturer must be documented in a retraceable manner.

2.7 Spare parts and accessories

The use of unapproved products may change the structural characteristics of the machine and negatively affect its active or passive safety.

The use of original spare parts and accessories is recommended. For damages caused by the use of parts from third-party providers, liability and warranty are excluded.

If you have any questions or doubts, contact INDEX-Werke GmbH & Co. KG. Doing so could prevent major damage.

2.8 Repairs

The operator/owner's employees may only carry out maintenance and repair work to the extent described in the user documentation. The instructions for it must be followed in all particulars.

INDEX-Werke GmbH & Co. KG assumes no liability or warranty for damage and operational malfunctions as a result of non-compliance with these instructions or improper repairs by the operator/owner's personnel.

Please consult INDEX-Werke GmbH & Co. KG if any uncertainties or complications arise. Doing so could prevent major damage.

The information and instructions in this document and in the accompanying technical documents must be observed.

2.9 Workspace of the operator

It is recommended that a working area of at least 1 m is kept free around the machine (including attached units) for operator activities.

Workspaces can vary depending on the activity.

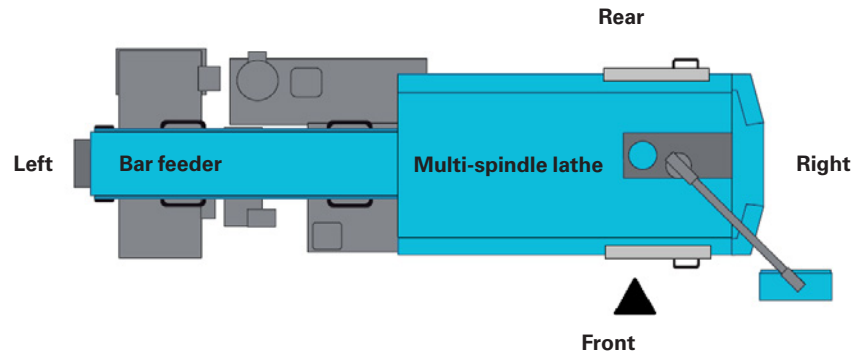
The following activities, among others, can occur during production:

- Operating the machine from the operating panel
- Loading and unloading workpieces
- Refilling bar stock in the loading magazine, if one is present
- Removing chips in the work area and on the chip conveyor, as needed
- Emptying the chip container
- Observing and maintaining the process at the operating panel and in the work area
- Removing and measuring workpieces
- Checking operating fluids (such as hydraulic fluid, lubricant, cooling lubricant) and refilling if necessary
- Changing tools on the tool magazine or in the work area
- If needed: making adjustments for tool wear in the machine control system

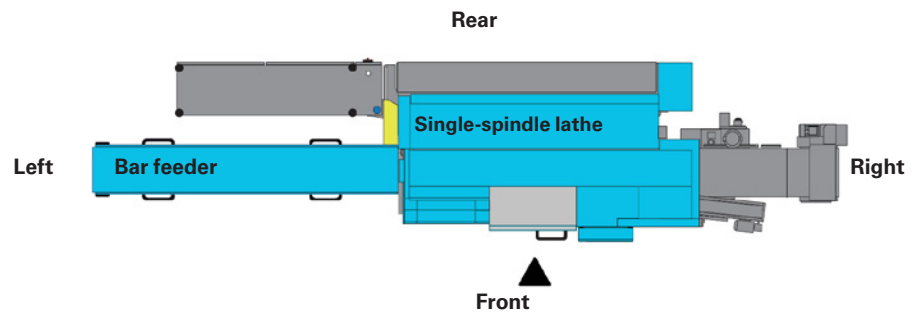
A different workspace may apply during the following activities:

- Setup
- Inspection and testing
- Cleaning work
- Maintenance work

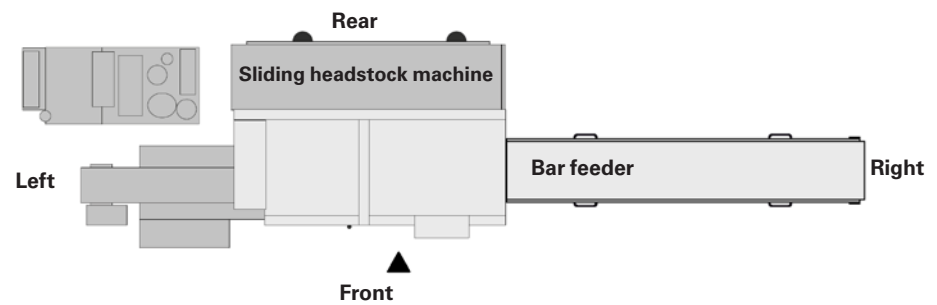
2.9.1 Spatial allocation in the workspace



Spatial allocation of a multi-spindle lathe, example



Spatial allocation of a single-spindle lathe, example



Spatial allocation of a sliding headstock automatic lathe, example

2.10 Personal protective equipment

The machine operator/owner must provide personal protective equipment.

The operator/owner's safety representative should be consulted regarding the use of personal protective equipment.

Personal protective equipment required depending on the specific activity:

- close-fitting workwear
- safety shoes
- safety glasses (suitable eye protection)
- hairnet
- safety helmet
- safety gloves
- hearing protection
- skin barrier cream

Additional personal protective equipment required if combustible cooling lubricants are used:

- flame-retardant work clothes



Work clothes contaminated with oil must be removed immediately.

2.11 Climbing aids

If climbing aids (ladders or steps) are used to carry out certain activities, be sure to observe the safety regulations and instructions for the intended use published by the respective manufacturer.

2.12 IT and data security

Direct access to the production network should be protected by a firewall and hence according to the current IT security standards. Nevertheless, it is the operator's responsibility to verify that the measures taken in the existing network are sufficient.

External data storage media as well as maintenance and service devices represent basic security risks. These devices should be scanned for viruses before they are used.

Only software that is required for production is installed on the controller. Installation of additional software is not permitted.

Only network connections that are necessary, secure, and have been selected for the production process (e.g., for remote maintenance) may be set up on the controller. Unrestricted internet access to the controller must be prevented.

Additional protection can be achieved by network segmentation (e.g., by separating the production network from the office network) to prevent mutual interference.

Modifications to the operating system are not permitted.

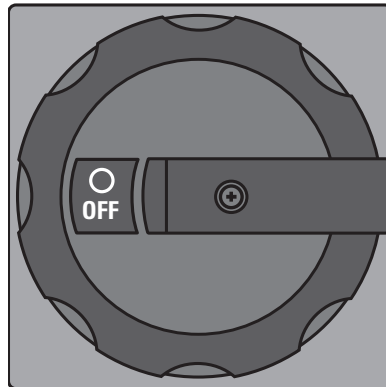
3 Safety functions and safety equipment

Some machine components, aside from their technical functions, also fulfill a safety function that is designed to protect personnel from dangers at the machine.

For this reason, safety functions must not be tampered with, disabled or removed. In case of damage to or failure of safety functions or equipment, the machine must be shut down immediately.

Removal of safety functions is only allowed during repair work on the machine. Once the repairs are finished, all safety equipment must be reinstalled and checked for proper functioning.

3.1 Main switch



Main switch, example

Turning the main switch to the “O” position (OFF) switches off the power supply to the machine.



Danger!

Exception: lines that are specially marked. These can be live even when the main switch is switched off and can be potentially lethal if not handled properly.

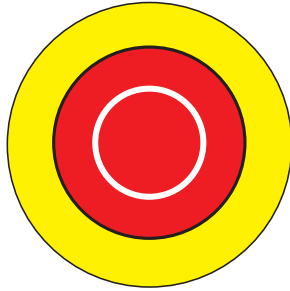
Before all installation and repair work, if applicable:

- **Switch off the relevant area switch and lock it out**
- **Remove the relevant fuses**

For more details, see the electrical documentation of the machine.

The main switch can be secured with a safety lock to prevent it being switched back on without authorization.

3.2 EMERGENCY STOP



EMERGENCY STOP device, example

EMERGENCY STOP devices are located at every operator position and should be actuated when human life is in danger.

When actuated, all hazardous movements are switched off as quickly as possible and a safe state is established.

However, the machine is not disconnected from the power supply.

A fault message is displayed on the screen.

Unlocking the EMERGENCY STOP does not cause the machine to restart automatically.



Ensure the EMERGENCY STOP devices are accessible and visible at all times.

3.3 Work area enclosure and work area door

The work area enclosure and work area door are safety partitions.

During setup and production of workpieces, it is possible for machine parts or workpieces to accidentally come loose and be thrown around.

If this happens, the safety partition protects the personnel at the machine against dangers resulting from this situation. For this reason, no modifications may be made to the safety partition.

The specified impact resistance of the safety partition must be observed. Detailed specifications for the resistance classes can be found in the applicable standards. The impact resistance is rated based on the forces expected, but it may be exceeded due to special process parameters.

This applies, in particular, when specially adapted clamping devices are used. For the selection and adaptation of clamping devices not provided as standard, the technical limits and impact resistance of the machine and the instructions for the clamping devices must be observed.

The protective measures were implemented according to the applicable type C standard for the machine, although a residual risk always remains.



During production, always maintain a distance of at least 20 cm from the work area door, which must always be closed.

In setup mode, the possible movements are severely restricted (e.g., by reduced axis speeds) when the work area door is open.

Automatic work area doors do not have handles, in order to prevent people from getting caught during movements of the door.

The interlock on the work area door must not be tampered with or disabled.

3.4 Window pane(s)

The work area door is fitted with window panes. These window panes have the required resistance class and provide:

- A view of the machining process
- Protection from objects that may be thrown out, e.g., chips, tools, or broken-off parts of workpieces
- Protection from splashed coolant

The window panes must be inspected for damage, such as cracks, in accordance with the maintenance instructions.

The window panes must be replaced every time they are damaged (e.g. if they become cloudy or cracked) because their protective effect is no longer guaranteed.

The year of manufacture is indicated on the window panes.

When the interval specified in the maintenance instructions expires, the window panes must be replaced even if they are not damaged.

3.5 Splinter protection film on the design pane

For additional safety, one¹⁾ special highly transparent splinter protection film is affixed to the outside of the design pane.



Danger from flying splinters!

The splinter protection film affixed to the design pane to protect against splinters must never be removed!

1) On some machine types, two safety films are used.

3.6 Clamping conditions

A description of clamp stroke monitoring is included in the respective user documentation.

The monitoring measures designed to ensure the clamping conditions (e.g. clamping stroke monitoring, clamping pressure monitoring) must not be bypassed.

3.7 Pneumatic safety valve (optional)

If compressed air is used in the machine, the machine will feature a compressed air maintenance unit with pressure regulating valve, including a pressure gauge to display the system pressure (for setting the operating pressure), an electric switch-on and shut-off valve, and a manual switch-on and shut-off valve to separate the machine from the compressed air supply (customer's air network).

A system pressure sensor to monitor the customer's network is also installed.

3.8 Warning signals/indicators

Various indications, alerts, and fault/error messages are displayed on the screen. They are usually self-explanatory.

The machine status is signaled by an LED multi-indicator lamp.

3.9 Keys and password protection

Access to the various operating modes and settings is protected using keys and passwords.

Do not allow keys or passwords to come into the hands of unauthorized persons.

Setup mode is safeguarded by a key.

The key must be pulled out again once setup mode is finished.

Machine programs and other safety-critical settings can only be accessed after entering the corresponding passwords.

The passwords are linked to a number of protection levels.

The protection levels available are determined by the customer's requirements and the configuration used by the manufacturer.

3.10 Confirmation mode

In setup mode with the work area door open, hazardous movements can only be started when both the confirm key and the action key are pressed.

If one of the keys is released, the movement is stopped.

3.11 Pressure tanks

According to the Pressure Equipment Directive 2014/68/EU, the pressure accumulators built into the machine are of category I / module A.

They are CE marked by the manufacturer, and a declaration of conformity has been issued.

Due to this categorization, the pressure accumulators must be put into operation and inspected in accordance with national laws and standards.



The machine's operator/owner is obliged to check the pressure accumulator according to applicable rules and directives.

The directives and regulations applicable in the country of use must be followed.

According to applicable regulations, defective pressure accumulators must be depressurized and disposed of by an authorized and qualified employee.

The pressure accumulator must be replaced as specified in the user manual of the manufacturer.



When carrying out maintenance work on fluid systems (hydraulic, pneumatic, and lubrication systems), make sure the respective system has been depressurized before starting the work (using accumulator drain valve / manual slide valve).

4 Instructions for safety-conscious work



All specifications in the user documentation as well as the applicable directives and regulations must always be observed. For integrated components made by third parties, the user documentation of the respective manufacturers must be observed as well.

4.1 Handling of workpieces

4.1.1 Clamping the workpiece

The clamping system forms the interface between the machine and the workpiece and serves to absorb the forces occurring during the machining process. For this reason, the clamping system is of particular importance.

The shape and mass of the machined workpiece before, during and after machining are vitally important. Therefore, workpieces must have a balanced mass. For unbalanced workpieces, the clamping device must be adapted appropriately.

In general:

- Only clamping devices that have been approved by the machine manufacturer may be used.
When in doubt, the machine or clamping device manufacturer should be consulted.
- The clamping device must be dimensioned and used according to the specifications in the (third party manufacturer's) user documentation and applicable directives.
- All components of the clamping system must be maintained in proper and functional condition.
- The maximum permitted rotational speed must be limited. In this regard, the lowest permissible rotational speed of all components involved (clamping device or workpiece) determines the maximum permitted rotational speed. The rotational speed limitation must be stored in the controller and written into the machining program.
- When using chucks (jaw chucks), the maximum permissible speed must be calculated (taking into account the resistance class of the respective machine).



It is recommended that the maximum permissible speed always be calculated using the software (calculation aid for speed limitation) stored in the controller. The respective resistance class of the machine is stored in the software.

The specifications in the applicable user documentation must be observed.

- The prescribed rotational speeds must be adhered to.
- Components of the clamping system may only be modified after consultation with the machine manufacturer.
- Remove chips only with suitable auxiliary equipment.

4.1.2 Clamping pressure and clamping force

The required clamping force must be determined based on applicable directives and regulations. The actuation forces of the clamping system and the centrifugal forces acting on the clamping device must be taken into consideration in determining the clamping force required.

The required clamping force is set via the pressure/spring preload on the clamping cylinder. However, the set clamping pressure does not give a direct indication of the actual clamping force. Therefore, the clamping force must be measured when the workpiece is set up. The measurement must be performed as specified by the manufacturer of the clamping device.

The clamping force decreases due to wear and contamination of the clamping device. The clamping force must therefore be checked at regular intervals. If the clamping force is found to be reduced, the clamping device must be lubricated and serviced according to the manufacturer's specifications.

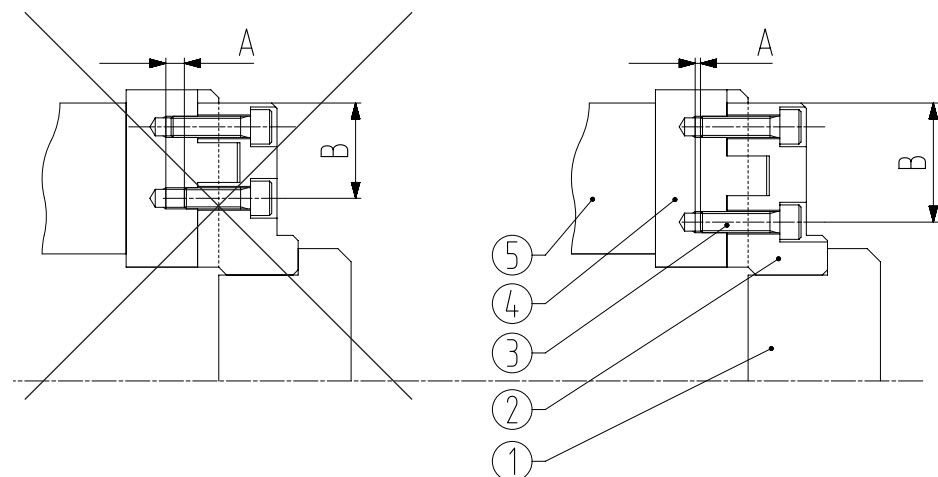
Anomalous operating conditions can occur depending on the workpiece (e.g., for highly unbalanced parts or special jaws). This may change the permitted rotational speed, chuck actuating forces and other characteristics required for safely clamping the workpiece.

4.1.3 Chuck and jaws

When a part is being placed in a chuck, there is a risk that fingers will be crushed between the jaws and the part.

In general:

- The original mounting means of the clamping device manufacturer must be used to mount the jaws.
- Mounting screws of the maximum possible length must be used.
- The mounting screws must be tightened with a torque spanner. The torque must be selected according to the strength class of the screws or in conformity with the specifications of the clamping device manufacturer.
- Distance A (refer to drawing) between the end of the screw and the end of the thread must not exceed 2 mm.
- Distance B (refer to drawing) must be as large as possible.
- Jaws with a maximum permissible rotational speed that is less than that of the clamping device or the spindle must be marked in a clearly visible manner (e.g., with the maximum permissible rotational speed).
- The jaw stroke of each jaw must not exceed 4 mm. It must be ensured that the jaws are shaped accordingly.
- For single-spindle lathes:
If a clamping travel of < 4 mm (0.163 in.) cannot be achieved, a suitable foot-operated switch must be used.
- For multi-spindle lathes:
Manual loading and unloading in automatic mode is not allowed. For manual loading and unloading in setup mode with clamping strokes > 4 mm, appropriate safety measures must be taken.



Incorrect

Correct

- 1 Workpiece
- 2 Top jaw
- 3 Mounting screw
- 4 Base jaw
- 5 Chuck body

4.1.4 Machining of bar stock

The following always applies to the machining of bar stock:

- The spindle passage must be adjusted to the diameter and profile of the bar stock (e.g., with reduction sleeves).
- Bar stock must not protrude beyond the end of the spindle.

The following must be observed when machining bar stock:

Bar stock may only be machined in combination with a bar guide or bar feeder. If no bar feeder is used, the opening in the machine covering provided for this purpose must be closed.

Manual loading of short bars is only permitted if this is carried out through a secured feed opening on the machine side. INDEX offers suitable solutions for this.

The machine-specific max. dimensions of the bar stock must be observed.

Manual loading of bar stock is not permitted on the C100 and C200 automatic lathes and on all sliding headstock automatic lathes.

4.2 Handling of tools

4.2.1 Changing tools

When tools are changed, there is a risk of injury from protruding and sharp-edged tools.

In general:

- Suitable personal safety equipment must be used.
- Tool carriers must be moved to an ergonomically convenient position.
- Suitable protective measures must be taken (e.g., cloth or protective sleeves) for protruding tools (e.g., boring bars).
- Suitable tools (e.g., torque spanner with extension) must be used.
- The required torque must be observed. The relevant specifications can be found in the data sheets of the tool holders.
- When using laser systems for tool breakage monitoring, avoid looking directly into the laser source.
- For live tools and tool holders, the maximum permitted rotational speed and corresponding balance quality must be maintained.



4.2.2 Mechanical interface

Use only tools and tool holders that are designed for the corresponding mechanical interface and match the technical data of the tool mounting. The operator/owner is responsible for the correct installation of the tools or tool holders.

4.3 Chip conveyor

The chips resulting from the machining are transported by a chip conveyor from the work area to a collection bin. The chip conveyor has a conveyor belt that transports the chips sideways and upward, so they can be dropped into the collection bin. The chip conveyor does not transport the chips continuously out of the work area, but at (adjustable) intervals.

The staff at the machine is not able to see when the chip conveyor starts the transport operation. This results in conjunction with a variety of possible crushing or shearing points in the work area of the machine and at the discharge point of chips to an increased risk of injury.

Walking on the chip conveyor is always forbidden.

To avoid injury of the staff at the machine, the following measures have been taken:

- The movement of the chip conveyor is disabled when the work area door is open. Backward movement in jog mode is possible in combination with the confirm key.
- At the beginning of each conveying interval, the conveyor belt moves only a small distance. This so-called start-up motion is to warn the staff at the machine of the imminent start of the conveyor belt in order to allow them to leave the danger zone.
- A discharge chute is attached to the discharge point of the chip conveyor, which prevents direct access to the conveyor belt. The discharge chute may only be removed if access to the conveyor belt is prevented in another way (e.g., by a cover with a hole exactly matched to the discharge opening).
- The chip conveyor has a button at the discharge chute, by which the running direction of the conveyor belt can be reversed. This allows the operator to remove accumulated chips clogging the transport channel without dismantling the discharge chute or other covers.

4.3.1 Machine without chip conveyor

Before commissioning a machine without a chip conveyor (e.g., with centralized chip removal), the operator/owner must provide a safe and environmentally friendly option for chip removal.

When operating a machine without a chip conveyor, hazards arise at the mechanical interface.

Possible hazards due to the opening:

- In the event of a fault, parts may be thrown out through the chip conveyor opening (clamping jaws, workpieces, bar remnants, etc.)
- Breathing difficulties or asphyxiation due to escaping extinguishing gas
- Hot and sharp-edged chips
- Cooling lubricant coming out (possibly under high pressure)
- Slipping/falling on leaked cooling lubricant
- Flames coming out

In the case of centralized chip disposal and machining with oil:

- Flames coming out through the gap or into the centralized delivery.
Remedy: apply a seal so that there is no gap

4.4 Work on electrical components

Improper practices when working on the electrical equipment of the machine may result in death or serious injury.

All work on the electrical equipment must be carried out exclusively by properly trained and instructed qualified personnel.

All specifications in the wiring diagrams must be observed; this applies particularly to the connection of the machine.

Prior to commencing any work on the electrical equipment, the main switch must be switched off and locked out. To avoid damages to the machine, the prescribed power on/off sequence of the machine must be observed.

Electrical components may carry electric energy even after the machine has been switched off. These components are labeled and must not be touched before the specified discharging time has elapsed.

Some electrical components of the machine generate high voltages (e.g., power modules of the drives in the control cabinet). Any work on these components must be carried out with utmost care, as any mistakes in this respect may result directly in death.

Electrical components may only be replaced with components having identical ratings.

After finishing work on electrical assemblies, the electrical equipment must be inspected by qualified personnel. In particular, it must be ensured that all the required protective covers have been attached correctly.

Prior to switching on the machine, all doors to electrical installation spaces must be closed and secured against unauthorized access.

In case of a power failure, the main switch must be switched off and locked out. The machine may only be switched back on after the power system has been restored.

4.5 Prevention of burns and scalds

Before starting work on the machine, disconnect it safely from the power supply, depressurize it, and allow it to cool down, as operating fluids may heat up and parts located under covers may be hot.

If necessary, use suitable protective gloves for heated parts.

4.6 Conduct around noise

Noise emitted from the machine is measured according to the applicable directives and regulations. For details of noise emission values, see the "Technical details" section.

The actual noise emission at the machine depends on the production process and the environmental conditions at the installation location.

Noise can cause hearing loss. Wear hearing protection if needed.

4.7 Conduct around laser radiation

Laser-based systems may be used on the machine. The lasers used, at maximum intensity, conform to Class 2 (according to DIN EN 60825).

Caution signs are posted around the usage site of the lasers, warning against directly looking into the laser beam to avoid burns (particularly of the retina) due to laser radiation.

4.8 Handling of operating fluids and auxiliary materials

For all work in connection with operating fluids and similar materials, the information in the data sheets of the respective manufacturers and the information in the document "Notes on Operating Materials" must be observed.

The required amount of the operating fluids to be filled can be obtained from the relevant fluid diagrams.

The following always applies to handling of operating fluids and additives:

- Leaked or spilled liquids must be removed immediately to prevent people from slipping, stumbling, or falling.
- Filling aids (e.g., funnels) must be used for adding fluids.
- Skin contact with lubricants and cooling lubricants must be avoided.
- The manufacturers' material safety data sheets and instructions for use must be observed.
- Personal safety equipment must be used.
- Operating fluids and additives must be disposed of in a safe and environmentally friendly way.
- The specifications in the user documentation for operating fluids and auxiliary materials must be observed.

Machining may cause emissions (dust gases, or cooling lubricant vapors) that require an exhaust system.

An exhaust system is optionally available and can be obtained—together with the machine—from INDEX. The defined interface to the exhaust system is to be used.

Follow the supplier documentation and the drawing provided.

5 Fire protection

5.1 Fire risks

The operator/owner is generally responsible for preventing fires/explosions.

The operator should establish the required measures in consultation with the appropriate bodies (e.g., occupational health and safety organizations, fire safety engineer, fire brigade).

High heat generation, open fire or other ignition sources (e.g. cigarettes) in the vicinity of the machine are prohibited.

An elevated risk of fire may arise in the following cases.

5.1.1 Combustible working materials and by-products

To combat fires caused by combustible materials or their dust (e.g. titanium), appropriate fire and explosion protection measures must be taken.

5.1.2 Minimal quantity lubrication system or dry machining

Using a minimal quantity lubrication system or dry machining poses a potential fire risk.

Therefore, such a system may only be used after consulting the manufacturer. In this case, it must be checked what other equipment (e.g., an exhaust unit) is required for the safe operation of the machine.

5.1.3 Combustible cooling lubricants

The use of some cooling lubricants in combination with certain manufacturing parameters and the material to be machined poses an increased risk of deflagration and fire.

As this puts the personnel at the machine at an elevated risk, suitable precautions must be taken to prevent deflagration and fires.

Sufficient cooling must be ensured during the entire machining process in order to prevent sparking. The cooling lubricant must be checked at regular intervals and its correct fill level must be maintained.

The machine must be operated under supervision when using combustible cooling lubricants. A machine is adequately supervised if a person can perceive the audible and visual signals of the machine's fire extinguishing system and can react accordingly.

The use of a fire extinguishing system is recommended when using water-based cooling lubricant with an oil content greater than 15% or cutting oil based on mineral oil.

5.2 General fire safety measures

The operator/owner is responsible for following the applicable regulations and directives for fire safety and to train the personnel for an emergency.

A fire extinguishing system does not relieve the operator/owner from the usual preventive or defensive measures in case of fires. This applies particularly to the area around the machine.

Despite all technical protection measures, the possibility of flames coming out cannot be entirely ruled out. Therefore, there is a residual risk for the personnel at the machine.

No permanent workstation may be in the vicinity of potential flame exit points on the machine (e.g., table for cleaning workpieces).

Personnel should avoid being in the vicinity of potential flame exit points as much as possible.

The following always applies in event of a fire:

- If a warning signal (e.g. signal horn) sounds, leave the danger area immediately; the personnel must be instructed accordingly for this purpose.
- Access to the area where the fire event took place may only be granted after this has been approved by an authorized person (e.g. fire safety engineer, fire insurance company, fire department).

5.2.1 Use of CO₂ as an extinguishing agent

The extinguishing effect of CO₂ is based on reducing the air oxygen below the concentration required for combustion.

There must be a safety area of 10 m³ of space volume per kg of CO₂ around the machine, in which the extinguishing gas can disperse after flowing out of the machine. This corresponds to 60 m³ room volume for a 6 kg CO₂ small extinguishing system and 300 m³ room volume for a 30 kg CO₂ extinguishing system.



Ambient CO₂ concentrations greater than 5% constitute a health hazard. This must be observed especially if the extinguishing gas is able to flow into spaces at a lower level.

5.3 Fire extinguishing system for cooling lubricant fires

After consultation with the customer, INDEX-Werke GmbH & Co. KG will equip machines with a fire extinguishing system to extinguish cooling lubricant fires if this is required for the machine's expected use.

5.3.1 Intended use of the fire extinguishing system

The fire extinguishing system is intended only for detecting and extinguishing cooling lubricant fires within the machine's work area.

The fire extinguishing system is enabled only when the work area door is closed.



If a fire extinguishing system is used, the ambient conditions for transport and storage of the machine are reduced to -10 °C to +50 °C.

The fire extinguishing system allows the use of a water-based cooling lubricant with an oil content greater than 15 % and cutting oil based on mineral oil.

The amount of cooling lubricant at the cutting edge must always be high enough to prevent the development of ignitable mists.

The cooling lubricant must have the following properties:

- Viscosity ≥ 10
- Flash point $> 145^{\circ}\text{C}$
- Evaporation loss $< 60\%$

Servicing should be carried out at regular intervals by qualified personnel according to the specifications of the manufacturer of the fire extinguishing system.

Push in the extinguishing opening (if there is one) only in case of fire. During operation, the opening must be closed.

After the extinguishing process, the cover must be refitted.

5.3.2 Foreseeable misuse of the fire extinguishing system

The fire extinguishing system is designed to combat fires of combustible materials or their dust.

When combustible materials are used, other suitable measures must be taken to protect against fires and explosions.

5.4 Central extraction system

If the machine is connected to a central extraction system, the interaction with substances that are processed or used in other connected machines must be checked.

For assembly and tolerance reasons, a flexible pipe section is often installed between the central extraction system and the machine.

The flexible pipe section between the extraction system and the machine must be kept as short as possible and consist of fire-retardant or non-combustible material, due to the risk of fire.

6 Safety instructions for different life phases

The phases of the machine's lifecycle are:

- Transport and packing
- Setup, installation, and commissioning
- Setup mode
- Operation (production mode)
- Maintenance, service, and repair
- Storage and decommissioning
- Disposal

6.1 Transport and packing

All covers and doors must be closed and secured.

The hydraulic system must be depressurized before transport. The vent hole in the fluid reservoir must be closed during transport (e.g., by a screw plug).

Before transporting, the secure fastening of the batteries must be checked in the control cabinet.

Transporting the machine with the work area door open and tools mounted poses an increased risk of injury from protruding, sharp-edged tools. If necessary, the tools must be wrapped with a cloth or covered with protective sleeves.

The prescribed transport locks must be used. Only suitable, trouble-free transport means having sufficient load-carrying capacity may be used. Damaged transport means must not be used. The transport means must be attached to the fastening points provided for this purpose. The cargo must be secured for transport with suitable lashing straps.

The machine must not be lifted at the control cabinet.

People must be kept away from under hanging or suspended loads. Danger areas must be avoided and the required safety distances must be observed when the machine is maneuvered/moved. The transport route must be kept free of obstacles and checked for levelness, floor damages, ascending or descending slopes, etc.

The applicable rules and directives for air and sea transport must be observed.

6.2 Setup, installation, and commissioning

The load-carrying capacity of the floor must be observed. It must be chosen such that, when the machine is installed, the machine legs do not rest on openings in the floor (e.g., manhole covers) and there are no crushing or shearing points around the machine. The latter applies particularly to all movable parts of the machine (e.g., covers and doors). The required specifications can be found in the user documentation.

To avoid unintentional movements, the machine must be switched off before removing the transport locks.

Any hydraulic, pneumatic, or electric lines or hoses damaged during transport must be replaced immediately. The hydraulic and cooling lubricant equipment must be checked (for leak tightness) before being switched on.

6.3 Setup mode

Setup mode allows movements at reduced speeds with the work area door open, which may pose a certain risk. To reduce the risk, the following measures are required:

- The work area door should be kept closed as much as possible, especially during workpiece and tool movements.
- Avoid reaching into the work area when the spindle is rotating (max. rotational speed during setup mode is 50 rpm).
- The required personal safety equipment must be used, especially safety goggles.
- After setup is complete, the machine must be left in a state that allows it to start (or resume) production mode.

When the tailstock quill is actuated, there is a risk of injury from the travel of the quill tip. The use of an insertion aid and wearing of protective gloves are recommended for manual tooling and when using a tailstock.

In case of a power supply failure, do not reach into the work area until all spindles, drives and tool carriers have come to a halt.

If persons are accidentally trapped or detained, observe the following:

- Locking in persons accidentally is impossible, due to the design of the machine.
- Freeing trapped persons must be carried out by qualified personnel only, by traversing the corresponding NC axis, depending on the particular situation.
- Freeing trapped persons must take place by manual movement (using auxiliary equipment).

Moreover, the instructions in section 4.2.1 "Changing tools" also apply.

6.4 Operation (production mode)

Operation of the machine requires a detailed analysis and assessment of the planned production process in terms of the risks and hazards that may be caused by it, such as the risks arising from the cooling lubricant or the material.

- If non-combustible cooling lubricants are used in combination with non-combustible working materials, supervision of the machine is not required.
- The machine must be operated under supervision when using combustible cooling lubricants. A machine is adequately supervised if a person can perceive the audible and visual signals of the fire extinguishing system and can react accordingly.

The machining sequence must be checked before starting the production (using a test run).

The cooling lubricant spray gun may only be used for cleaning workpieces and clamping devices. Always use appropriate protective equipment, especially goggles, during use. Use is only allowed with the work area door open.

Sufficient cooling of the entire machining process must be ensured.

Work in the work area must be carried out with the work area light switched on.

The work area light must be maintained in clean condition to ensure safe working.

When the tailstock quill is actuated, there is an increased safety hazard from the travel of the quill tip. The use of an insertion aid is recommended for manual tooling and when using a tailstock.

Do not reach between the pallets or workpieces during operation when using a workpiece feeder and discharge unit.

Chips may only be removed with suitable auxiliary equipment.

After every collision, the machine must be checked according to the instructions in the user documentation. When in doubt, the manufacturer should be consulted.

For machines with tool and workpiece magazines that can be entered, the machine must be switched off and locked out before troubleshooting any problems with the tool or workpiece logistics.

6.5 Maintenance, service, and repair

Maintenance and repair work is to be performed only by authorized and trained personnel.

This applies particularly to work on motors (spindle motors) or other electrical assemblies. The instructions in the respective manufacturer documentation must be followed for such work.

We recommend the use of original spare parts and accessories. For damages caused by the use of parts from third-party providers, liability and warranty are excluded. The use of such products may change the structural characteristics of the machine and negatively affect the active or passive safety.

Prior to working on the machine, it must be allowed to cool down, as hot parts may be located under covers.

In general, maintenance and repair is to be carried out with the machine turned off. The main switch must be locked out.

Electrical components may carry electric energy even after the machine has been switched off. These components are identified with an information label and must not be touched before the specified discharging time has elapsed.

In a few cases, maintenance and repair need to be performed with the machine turned on (e.g., replacement of backup batteries). These activities may only be carried out by qualified personnel, and particular care must be taken. The control system manufacturer's instructions must be observed.

Attach a warning sign on the operating panel to prevent any actuation of switches or keys. Set up barriers to prevent access or interference by unauthorized persons.

Care must be taken when performing any maintenance and repair activities on the machine. Fasteners must be loosened carefully and parts must be secured against falling down. When elastic items (springs) are removed/replaced, appropriate devices must be used. Any non-horizontal axes that pose a risk of falling down must be moved to their end positions or secured against falling down.

Pedal switches must be put aside to avoid inadvertent actuation.

For removing machine parts, suitable lifting gears must be used. Removed machine parts must be placed in a safe position and secured against falling over.

It may be necessary to remove or disable safety devices in order to carry out repairs. Any removed safety devices must be reinstalled immediately after finishing the repair.

When the control cabinet is open or the machine covers are open or removed, no cellular or cordless phones may be used within a 2 m radius.

For work on the hydraulic system, it must be depressurized by opening the accumulator drain valve(s).

Damaged hydraulic hose lines must be replaced immediately. Typical types of damage include chafing, kinks, cracks, deformations, or visible leaks.

The machine operator/owner is responsible for compliance with the laws and regulations of the country of use with regard to the use of hydraulic hoses.

We recommend inspection and documentation of the hydraulic hose lines installed inside the machine and not directly visible every 12 months. For hydraulic hose lines which are visible in the work area or which are mounted outside the machine and which connect components to the machine, we recommend inspection and documentation every 6 months.

Flexible, pressurized hydraulic hose lines of INDEX/TRAUB equipment are generally thermoplastic or metal hydraulic hose lines.

For the flexible, pressurized hydraulic hose lines used by INDEX/TRAUB, empirical values are available for very different periods of use, some of which exceed 10 years.

If the machine was disconnected from the power supply, the main switch must be switched off and locked out (e.g., using a padlock) before the power supply is reconnected.

After all maintenance and repair activities and work on electrical assemblies are finished, a test run or functional check must be performed.

6.6 Storage and decommissioning

The following must be observed if the machine will not be used for an extended period of time:

- Move tool carriers to their bottom end position.
- Switch off the machine and lock it out.
- Close and secure all covers and doors.

6.7 Disposal

For the disposal of the machine as well as machine parts, consumables, coolants, and operating fluids, the applicable regulations and directives must be observed. The disposal of the machine may only be carried out by personnel trained for this purpose. If necessary, a specialist company must carry out the disposal.

7 Product monitoring

We are committed to monitoring our products during their entire service life.

Therefore, we request that you notify us of any concerns related to the safety of the machine. This applies also to necessary specifications that are not included in the documentation.

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8 Certificate of conformity

The certificate of conformity is issued for each machine in accordance with the requirements of Directive 2006/42/EC Annex II and is provided to the customer as a separate document.

9 Technical details

9.1 Approved ambient conditions

The following ambient conditions apply:

- electromagnetic conditions according to IEC 61000-6-2 and DIN EN 55011 (limit class A)
- relative humidity (at 40 °C) max. 50%
- max. altitude 1,000 m a.s.l.
- ambient temperature at the location of use 10 °C to 40°C
- ambient temperature during transport and storage -15°C to 55°C (for 24 h also up to 70°C)
- If a fire extinguishing system is used: ambient temperature for transport and storage of the machine is reduced to -10 °C to +50 °C.
- brightness conditions at the machine according to DIN EN 12464
- contamination of environment within the scope of the contamination caused by the machine itself
- no ionizing or non-ionizing radiation
- no explosion hazard in the environment
- strong and vibration-free foundation
- conductive grounding transitions less than 1 megaohm for optimum operation of the capacitive touch panel

In the case of all optional components, the details in the purchased-part documentation for the components must be observed.

9.2 Noise emission

Valid: 03/2020.

Measured emission sound pressure level LpA at the workplace (the operator's position):

Operating state of the machine	Ready	Idling	Machining
Machine	Emission sound pressure level LpA [dB(A)]		
ABC	64	72	73
B400	66	67	71
C100	61	66	65
C200	63	67	69
G200	62	66	68
G220	71	69	70
G420	64	66	67
R200	65	71	73
R300	65	71	71
MS16-6	73	74	75
MS22-6	71	75	75
MS22-8	75	75	75
MS32-6	67	73	76
MS40-6	70	75	75
MS40-8	71	76	78
TNA400.2	66	68	72
TNL18	65	68	70
TNL20	68	68	68
TNL32	64	69	70
Measurement uncertainty KpA in [dB]			
All above-mentioned machines	4	4	4

The values when idling and machining were determined using the Index acceptance testing workpiece (with a special work cycle with machining according to ISO 8525). The specified noise emission characteristics were determined according to ISO 230-5, incorporating ambient and room correction values.

According to DIN EN ISO 23125, we are required to issue the following statement:

"The values mentioned are emission levels and not necessarily safe working levels. Although there is a correlation between the degree of noise emission and the degree of noise pollution, it cannot be used reliably to determine whether additional protective measures are required or not. Among the factors that affect the actual noise level to which workers are exposed, are the properties of the work area and other sources of noise, which is to say, the number of machines and other processes in the vicinity and the duration during which an operator is exposed to noise. In addition, the permissible exposure level may vary from country to country. However, this information should allow the user of the machine a better assessment of the hazards and risks."



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