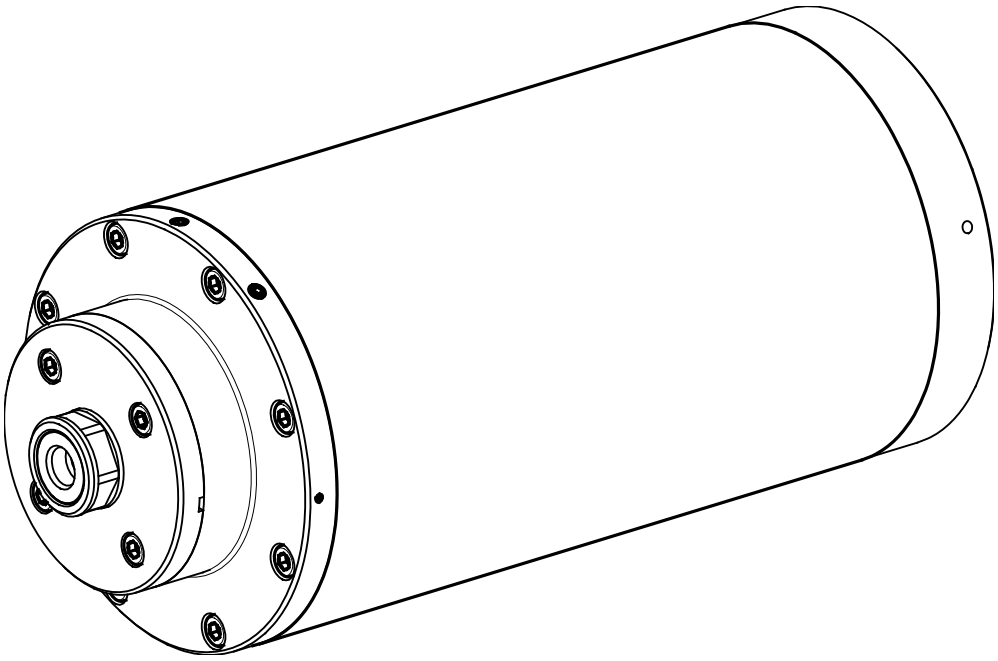
Assembly Instruction

for high Frequency Spindles

Type MF with Oil-Air Lubrication



Translation of Original Assembly Instruction No 94050-058

Index I

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1. Introduction

These instructions describe the operation of the "MF" series of spindles. These state-of-the-art spindles are constructed according to approved safety standards and regulations. Nevertheless during operation there is still an inherent danger to the user or third persons and at the same time damage to the machine or other property is possible. For this reason these instructions must be read and understood by all persons who work with the machine.

1.1 Identification

Identification of the spindle

Your MF series spindle has the following specifications:

Serial number:	_____
Designation:	_____
Diameter:	_____
Direction of rotation:	_____
Lubrication:	oil-air
Cooling:	water with additive
Year of manufacture:	_____

In most cases the engraved number and type designation are no longer visible after the spindle has been installed. However, to ensure that the spindle can be identified later without any difficulty, an additional nameplate containing the most important data is supplied. Secure this nameplate alongside the nameplate of the machine in which it is installed.

To be entered by the customer:

Inventory number:	_____
Inspection number:	_____
Mounting location:	_____

1.2 Targeted readers and purpose of these operating instructions

Targeted readers

These operating instruction are designed for:

- the **installation personnel** (mechanic, electrician, electronics technician) at the manufacturers of the machine in which the spindle is to be incorporated
- the **machine operator** and **service technician** at the end customer

The following **skills** have been assumed:

- Installation personnel
  - Mechanical work: training as mechanic (or equivalent training)
  - Electrical work: training as electrician or electronics technician (or equivalent training)
- Operator and service technician: training as mechanic (or equivalent training).

In addition it is assumed that these persons have the necessary basic knowledge on how to handle spindles.

Purpose of these operating instructions

These operating instructions should enable the various target groups to carry out all working procedures safely and correctly. Therefore these operating instructions must be read and understood by all persons who work on or with the spindle.

1.3 Information on using these instructions

Structure and use

In these instructions you will find all the necessary information on the MF series of spindles, for their installation, operation, maintenance and for trouble shooting. This information is supplemented by relevant information on safety and hazards.

Information on the installation of periphery devices is not included in these instructions. This information can be found in separate documents provided with the relevant devices.

All persons assigned to work on the spindle must read and understand the relevant chapters, and in particular the references to safety and hazards, before carrying out any work on or with the spindle.

In addition observe:

- the information and instructions in the documents for periphery devices
- all local safety regulations

Conventions employed

This pictogram indicates important information for the correct and economical application/operation of the product.

This pictogram with an additional **"WARNING!"** at the beginning of the text indicates instructions on safety or hazards, which If ignored, **will result in danger to the user or third persons.**

This pictogram with an additional **"CAUTION!"** at the beginning of the text indicate instructions on safety and hazards, which If ignored, **could result in damage to the spindle or other property.**

- Procedures requiring **several steps** are numbered.
- **Lists** are indicated by a **dash** "-".

Safekeeping of documents

Always keep these operating instructions (including documents for periphery devices) near to the associated machine so that they are always available.

Should you lose these instructions, contact the company Fischer AG and for a nominal charge you will receive a replacement. Please send a fax containing the number of the spindle plus the language you require (German, English, French)

Suggestions and proposals for modifications

We would welcome any comments and suggestions which could help to improve these instructions. Should you have any suggestions and proposals for modifications, proceed as follows:

1. Copy the relevant page(s) and note your remarks or modifications.
2. Send the page(s) with your name and address (incl. telephone and fax number)

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2. Safety precautions

2.1 Approved applications

The state-of-the-art MF spindles are built for safe operation. However, if not used according to instructions the spindles can cause hazards.

The spindles are to be used **exclusively** for:

- **conventional grinding**

Other applications are not approved. The company Fischer AG accepts no responsibility for damage caused by non-approved usage. The user carries the full responsibility for any risks.

The following points also have to be observed:

- The full observation and implementation of the procedures, guidelines and information contained in these operating instructions for MF spindles
- The prescribed inspection and maintenance intervals
- Correct maintenance of the spindles
- Operation within the specified environmental and operating conditions

WARNING! In particular the spindles **are not permitted to be used:**

- as centrifuges or for ventilator operation
- in general as a drive
- under water

If used in the above-mentioned applications, you must expect the spindle to be damaged or, due to the centrifugal force caused by the high rotation speed, parts of the object being driven could fly out.

2.2 Organizational measures

- Only persons sufficiently qualified for the work involved and who have the necessary knowledge of the product are permitted to install, operate, service and if necessary repair the spindles.
  It is the responsibility of the customer to ensure that the operating instructions are supplemented by company-internal instructions with respect to supervision, reporting, work organization, staff qualification etc.
- The responsibility for the various tasks involved in the installation and operation of the spindle must be clearly determined and followed in order to prevent any doubt on accountability.
  This applies in particular to work carried out on electrical, pneumatic and hydraulic equipment which demands specially trained personnel.
- All personnel engaged in working with the spindle **must have read and understood these operating instructions.**
- Please observe the additions to the operating instructions:
  - all warnings for safety and hazards contained in the separate documents for periphery devices.
  - all local and general instructions and regulations regarding work safety, prevention of accidents and protection of the environment.
- **Without written permission** obtained from Fischer AG, it is **not** permitted to carry out **modifications or extensions** to the spindles or periphery devices.
- For replacements to the spindles use **exclusively original accessories and spare parts** provided by the company Fischer AG.

2.3 Inherent product hazards

WARNING! Even when used strictly according to instructions, when working on or with the spindle an inherent danger to life and limb of the user or third persons still exists and damage can be caused to the spindle or other property. **Therefore the following safety and hazard warnings must be strictly observed:**

- It is only permitted to operate MF spindles in the rotational direction specifed in chapter 1.1 (clockwise or anticlockwise). In order to determine the direction of rotation observe the spindle from the connection side to the collet side.

  WARNING! If this warning is ignored, persons could be injured or killed by flying parts of the grinding mandrel.

  The MF spindles have a very high rotational speed (0-150`000 1/min). Therefore in operation, grinding wheel splinters or, should a the grinding wheel break, pieces of it can fly out at very high speed. The following measures must be carried out on the machine in which the spindle is installed:

  - It must be possible to enclose the working space in a cabin.
  - The door of the cabin must be monitored by a technical safety arrangement so that the spindle can only be operated when the door is closed.
  - The cabin must be constructed so that splinters and pieces of tool cannot penetrate the walls or windows of the cabin.

WARNING! If this warning is ignored, persons could be injured or killed by flying splinters or fragments.

- All grinding wheels and grinding mandrels must meet the standard DIN 8085 (centrifugal force test) and be dynamically balanced according to the quality level G2.5 set out in the standards VDI 2060 or ISO 1940. The maximum permitted rotation speed of the grinding wheels/ mandrelsused is not to be exeeded under any circustances.

WARNING! If this is ignored, persons could injured or killed by flying parts of the grinding tool.

2.4 Additional hazards

Electrical system

- Only skilled and fully trained personnel who are familiar with the inherent dangers are permitted to work on the electrical system. In cases where the machine has to be worked on under power, an additional skilled person should be called in who can take the necessary steps in emergency situations.
- Before carrying out any work on the electrical system:
  - disconnect the machine and periphery devices from the mains and ensure that the power cannot be reconnected.
  - wait until the discharge time of the frequency converter has elapsed (see the operating instruction for the frequency converter).

Pneumatic system

- Work on the pneumatic system is only to be carried out by skilled personnel.
- Before carrying out any work on the pneumatic system, switch off the machine and the pneumatic set, if separately powered (close valve) and ensure that it cannot be switched back on inadvertently. Afterwards ensure that the pneumatic system is no longer under pressure (see the operating instructions for the pneumatic periphery devices).

Cooling system

- Work on the cooling system is only to be carried out by skilled personnel.
- Before carrying out any work on the cooling system, switch off the machine and the cooling system, if powered separately, and ensure that they cannot be switched back on inadvertently (see operating instructions for the cooling system).

Fuels

- Fuels (oil and cooling fluid) can be hazardous to persons in several ways (allergic reaction, danger of slipping if the material leaks on the floor, etc.). Therefore take great care when handling such materials and always observe the relevant factory safety regulations.

2.5 Protection of the environment

When not correctly used, oil and cooling agent additives can pollute the environment. Therefore handle such materials with care and strictly observe local regulations and laws.

Collect the used materials in suitable containers (e.g. original canisters) and ensure that the correct disposal procedures are carried out.

3. Operating description

3.1 Function

Layout drawing of connections

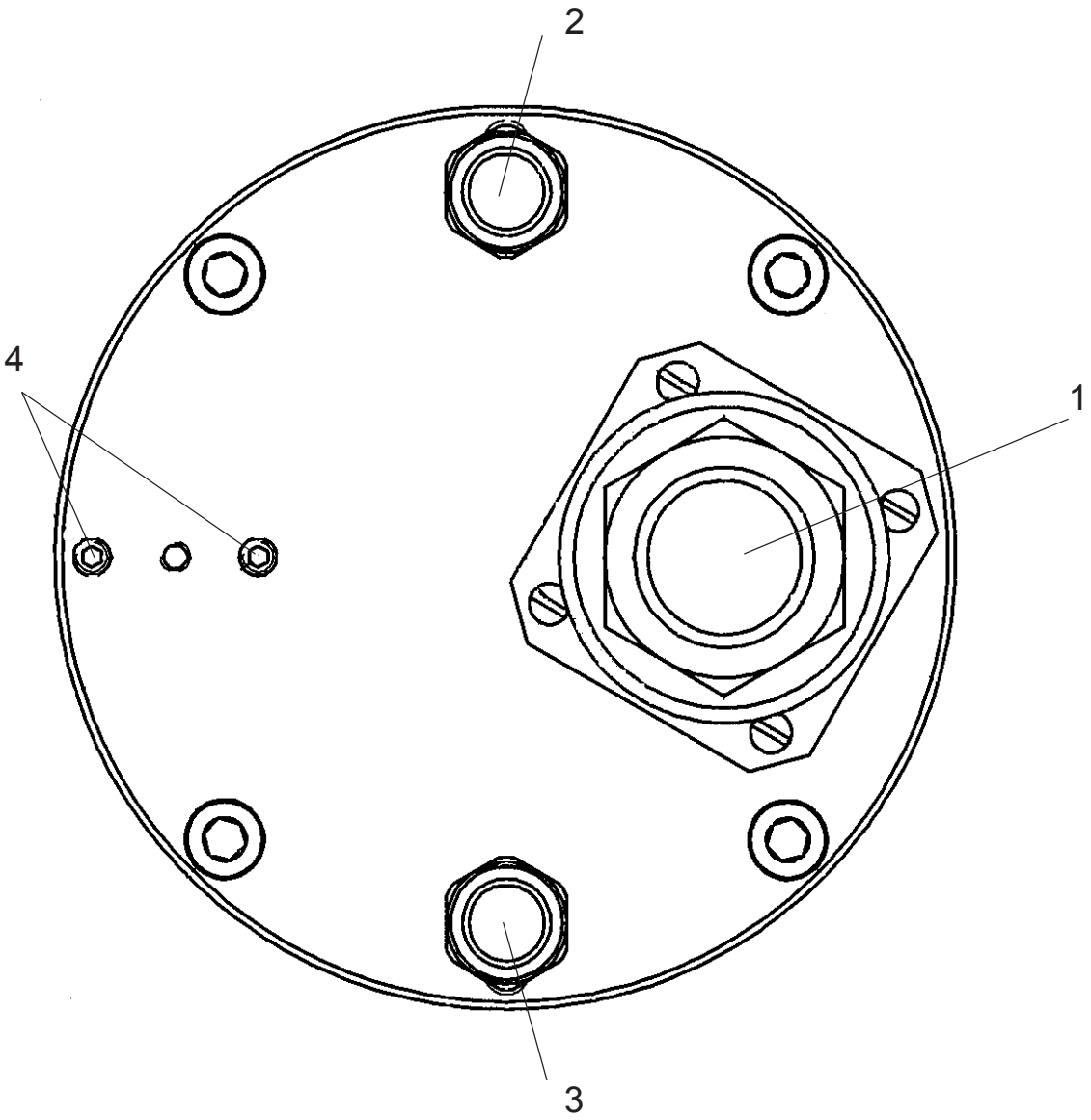


Fig. 3-1: Overview of connections

Legende

1 Connector for power + PTC
2 Cooling in
3 Cooling out
4 Connection for oil+air lubrication system

3.2 Operating description

The function of the spindles is as follows:

The MF spindles are driven by the asynchronous motor, built into the spindle sleeve. The rotation speed of the motor is continuously variable via the static frequency converter.

The lubrication of the bearing is carried out by an oil-air-system. Special labyrinth seals prevent foreign bodies entering the bearing.

In order to keep thermal expansion of the spindle and heat losses to minimum, the spindle must be cooled. For this purpose, the MF spindles are fitted cooling channels to which a cooling system with return cooling is connected.

An air treatment unit cleans unit cleans the compressed air. The air is then fed vie the oil-air lubrication system.

3.3 Use of the spindel

The MF spindles are used for:

- **conventional grinders**

3.4 Standard material supplied

The standard material supplied contains:

- spindle
- operating instructions manual
- nameplate (with the most important data)
- wooden box

MF spindles are equipped as standard with the following automatic switches:

- **PTC (positive temperature coefficient) sensors** (low temperature sensors)
- The PTC sensores monitor the temperatur in the windings of the spindle motor.

3.5 Periphery devices

Various periphery devices are required for operating MF spindles
Below you will find a short description of the periphery devices with minimum specifications that have to be met.

Information: Periphery devices are not included in the standard delivery package. They can, however, be obtained from the company Fischer AG, matched to the required spindle model. Each device is supplied with its own operating instructions.

Air treatment unit

The air treatment unit is required in order to clean and dehydrate the air fed from compressor.The air is then fed to the oil-air lubrication system.

The air treatment unit must be fitted with a prefilter and a fine filter and also meet the following **minimum specifications:**

-	Max. size of pores, prefilter	**5 µm**
-	Size of pores, fine filter	**0.5 µm**
-	Min. permitted air flow	**300 l/min**
-	Pessure drop at oil saturated fine filter with input pressure of 5 bar	**0.3 bar**

Oil-air lubrication unit

The oil-air lubrication unit is designed for lubricating the roller bearing.
For the lubrication of the MF series spindles we **recommend exclusively the oil-air lubrication units obtainable from the company Fischer AG.** Other oil-air lubrication units do not meet the specifications demanded for the bearings used with these spindles.

Should, however, another oil-air lubrication unit other than the prescribed system be required, please consult the company Fischer AG beforehand.

Cooling unit

The cooling unit dissipate the heat generated by the operation of the spindle.
The cooling unit must meet the following minimum specifications:

- Cooling power (according to the following table):

Spindle type	Cooling power (Kw)	Spindle type	Cooling power (Kw)
MFN-860	0.48	MFV-1224	1.7
MFN-875	0.38	MFV-1230	1.3
MFN-890	0.3	MFV-1245	1.1
MFN-8120	0.23	MFV-1260	0.8
MFN-8150	0.12	MFV-1275	0.75
MFN-1045	0.68	MFV-1424	3.0
MFN-1060	0.6	MFV-1430	2.3
MFN-1075	0.45	MFV-1445	1.2
MFN-1090	0.4	MFV-1712	5.3
MFN-10120	0.3	MFV-1718	4.8

- Pumping power (according to the following table):

Spindle type	Rate of flow (l/min)	
	minimum	max. (6 bar dyn. pressure)
MFN-860	1.4	
MFN-875	1.1	
MFN-890	1	6.0
MFN-8120	0.7	5.4
MFN-8150	0.4	7.8
MFN-1045	2	7.6
MFN-1060	1.8	7.4
MFN-1075	1.3	
MFN-1090	1.2	10
MFN-10120	0.9	10
MFV-1224	4.9	6.7
MFV-1230	3.8	6.5
MFV-1245	3.2	6.9
MFV-1260	2.4	7.5
MFV-1275	2.2	7.0
MFV-1424	4.3	6.0
MFV-1430	6.7	
MFV-1445	3.5	5.0
MFV-1712	15.2	
MFV-1718	13.8	6.2

- Max. dynamic pressure at the spindle: 6bar
- Equipment:
  - **Closed circuit cooling**
  - **Connection for pre and post cooling**
  - **Thermostat**
  - **Flow detector (Range 2-10 l/min)**
  - **Temperature detector**
  - **Cooling water heater incl. thermostat (for room temperatures below 20°C)**

Frequency converter

The frequency converter permits continuously variable rotation speed control of the asynchronous motor built into spindle.

The frequency converter must meet the following **minimum specifications:**

- Power in kVA:= 1.6 * spindle power S1 in kW (see section 9.1)
- Max. perm. intermed. circuit V Uzk: $Uzk = U_{network} * 2^{1/2} * 1.15$

  Using the factor 1.15, a network over voltage of 5% and the operating swing of the brake chopper are allowed for.

- For maximum switching frequency, max. rise tme and max. pulse voltage, see the following table:

max. switching frequency at max. frequency	max. rise time	max. peak pulse voltage between two phases
		Typical for 380V mains voltage
< 2 kHz	100 V/ µsec	990 V z.B. 1.6 * Uzk
	250 V/ µsec	900 V z.B. 1.45 * Uzk
	400 V/ µsec	800 V z.B. 1.3 * Uzk
2 kHz bis 10 kHz	100 V/ µsec	870 V z.B. 1.4 * Uzk
	250 V/ µsec	800 V z.B. 1.3 * Uzk
	400 V/ µsec	740 V z.B. 1.2 * Uzk
> 10 kHz	100 V/ µsec	740 V z.B. 1.2 * Uzk
	250 V/ µsec	710 V z.B. 1.15 * Uzk
	400 V/ µsec	680 V z.B. 1.1 * Uzk

Caution! A frequency converter employing pulse width modulation and an input voltage of more than 240 V may only be used for the spindle if an LC filter is integrated which generates a sine-wave output current and a sine-wave output voltage not exeeding 220 V.

3.6 Danger points and safety equipment

Overview of danger points

The spindle has the following **danger** points:

- Rotating parts of the spindle and **grinding wheel**
- Electrical connections
- Pneumatic connections
- Cooling water connections

Overview of safety equipment

In order to guarantee safe operation, MF spindles and their periphery devices are equipped with several monitoring devices:

- Sensors integrated in the spindles
  - 1 sensor for monitoring the temperature of the spindle motor
- The following monitoring systems must be integrated into the periphery devices:
  - In the cooling system
    - Temperature sensor
    - Flow detector
  - In the oil/air lubrication system
    - Pressure sensor
    - Level sensor
    - Pump control
  - In the frequency converter
    - Current limiter
    - PTC triggering

3.7 Grinding mandrels and grinding wheels

Grinding mandrels

The following point must be observed in connection with grinding mandrels used with MF spindles:

- The tool holder should be as **short and light** as possible and **symmetrical** whenever possible.
- The grinding mandrel must be dynamically balanced according to **quality rating G2.5** listed in the **standards VDI 2060 or ISO 1940**.

Grinding wheels

- **Maximum eccentricity: 0.01 mm**
- The grinding wheel must be dynamically balanced to **quality rating G2.5** listed in the standards **VDI 2060 or ISO 1940**.
- The maximum rotation speed must be engraved on the grinding wheel.

WARNING!

Grinding mandrels and grinding wheels which do not meet the above -listed specifications are not to be used.

Grinding mandrels and grinding wheels must each be subjected individually to a centrifugal force test according to DIN 8085.

The maximum permitted rotation speed is not to be exceeded on any account.

Information! When you are uncertain regarding critical rotation speeds, the grinding wheels together with the spindles can be calculated by Fischer AG.

4. Installation & Commissioning

4.1 Installation & Commissioning Safety

WARNING! The following guidelines on safety and hazards are to be strictly observed and implemented. If ignored, it could result in danger to persons and/or damage to the spindle or other property.

- Only persons sufficiently qualified for the particular work and who have the necessary knowledge of the product are permitted to install and commission the spindles.
- The customer is responsible for assigning personnel for the various tasks associated with the installation and commissioning of the spindles and for ensuring that they are **qualified** and have the **necessary competence**.
- All persons assigned the task of carrying out installation and commissioning work must have read and understood these operating instructions.
- Without the written permission of Fischer AG, it is **not permitted to carry out any extensions and modifications** to the spindle or to any periphery devices supplied by Fischer AG.
- All safety equipment are to be connected to machine control according to the relevant function. The safety equipment is **not to be bridged or removed**.

4.2 Checks Before Installation

Before carrying out the installation procedures make the following checks:

- **Equipment supplied**
  - Check that the equipment supplied conforms to that listed on the delivery note.
  - Check for any transport damage (any damage should be reported within 10 days of receipt to the transport company and to the supplier).

- **Spindle mounting in the machine**

  The spindle mount must meet the following minimum specifications:

  - Minimum clamping length: **1.3 x diameter of spindle**
  - Diameter tolerance: **ISO H6**
  - Cylindrical error: **max. 0.01 mm**
  - Concentricity of hole **max. 0.01 mm**

- **Periphery devices**

  Various periphery devices are required for the operation of the spindle. Check whether all the periphery devices listed below are available and whether they meet minimum specifications:

  - Air treatment unit (see paragraph 3.5)
  - Oil-air lubrication unit (see paragraph 3.5)
  - Cooling unit (see paragraph 3.5)
  - Frequency converter (see paragraph 3.4)

Note! The installation of the periphery devices is not dealt with in these operating instructions. For the necessary information consult the relevant documentation supplied with each periphery device.

4.3 Mounting the Spindle

Safety precautions

- **WARNING!** Use only hoisting equipment with sufficient bearing capacity and always observe the basic safety regulations regarding transport.

  Information: The weight of your spindle can be found in paragraph 9.1 "Technical specifications".

- **WARNING!** The spindle may only be secured on its sleeve using a hemp rope or a clamping system. It is assumed that persons assigned the task of transporting the spindle have adequate knowledge on how to secure loads correctly.

- **CAUTION!** When installing (and removing) or shifting the spindle in its holder, it is only permitted to strike the spindle sleeve. When doing this only use a plastic hammer.
  Striking the spindle shaft can cause damage to the spindle.

Mounting position

MF spindles can be mounted either **horizontally or vertically** (mount facing downwards).

Preparation for mounting

1. Lift the spindle out of its wooden box by hand or with the aid of a crane (weight >25 kg) and place it on a soft surface (wood, cloth, cardboard etc.).
2. Remove the anti-corrosion paper and clean the spindle sleeve.
3. Smear a little oil or grease on the spindle sleeve in order to protect the contact surface in the clamping area (spindle sleeve/spindle holder) from corrosion.
4. Clean the spindle holder attachment hole in the machine.

Vertical mounting

1. Place the two ground steel support plates with the same thickness on the machine bnch (see fig. 4-1). Lift the spindle onto the bench and place it on the support plates so that the non-moving part is on the plate. This prevents damage to the clamping system.

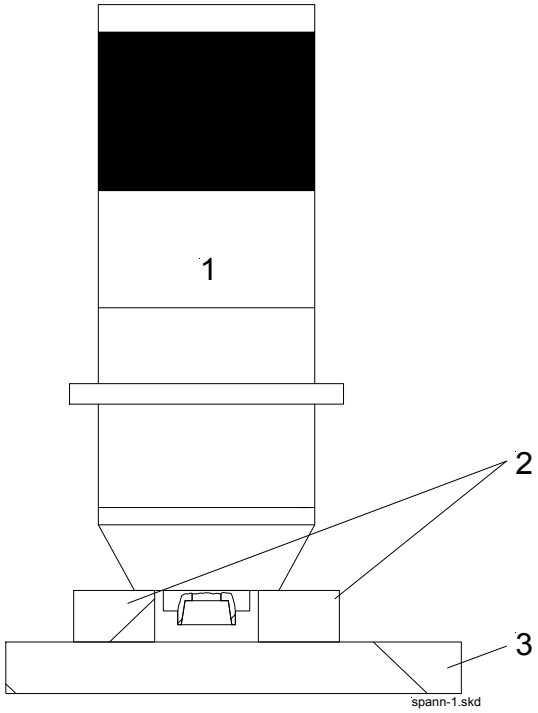


Fig. 4-1: "Positioning the spindle on the machine bench"

Legende

1	Spindle	3	Machine bench
2	Support plates		

2. Centre the spindle approximately with respect to the attachment hole in the machine.
3. Lift the machine bench slowly (or lower the spindle holder) until the black section of the spindle almost touches the attachment hole of the holder.
4. Then centre the spindle precisely to the attachment hole of the holder. Use a spirite level to check that the spindle is vertical to attachment hole to ensure that it does not cant when inserting.
5. Raise the machine bench carefully (slowly) until the spindle is in the required position.
6. Fix the spindle by tightening the clamping bolts which should have been treated beforehand with "Loctite" (or an equivalent product).

CAUTION! The clamping moment of the spindle holder should be 3 times greater than the torque of the spindle. Take note of this figure when calculating the tightening torque of the bolts in your construction.

CAUTION! The two rectangular openings in the spindle`s sleeve must remain uncovered.

7. Fix the nameplate supplied with the spindle next to the nameplate on the machine in which it is mounted.

Horizontal mounting

1. Place two aluminium prisms with the same height on the machine bench and set the spindle on them.

CAUTION! When mounting the spindle in the horizontal position, ensure that the connections designated with **"Oil return"** are **at the bottom.**

2. Position the machine bench so that the rear black section of the spindle (its diameter is 0.1 mm smaller than the spindle sleeve) can be slid easily into the attachment hole of the holder.
3. Slide the spindle carefully by hand into the attached hole of the holder until it is in the required position.

CAUTION! If it is not possible to slide the spindle into the correct position by hand, use a **plastic hammer** but be sure to strike **exclusively** on the spindle sleeve.

4. Fix the spindle by tightening the clamping bolts which should have been treated beforehand with "Loctite".

CAUTION! The clamping moment of the spindle holder should be 3 times greater than the torque of the spindle. Take note of this figure when calculating the tightening torque of the bolts in your construction.

5. Fix the nameplate supplied with the spindle next to the nameplate on the machine in which the spindle is mounted.

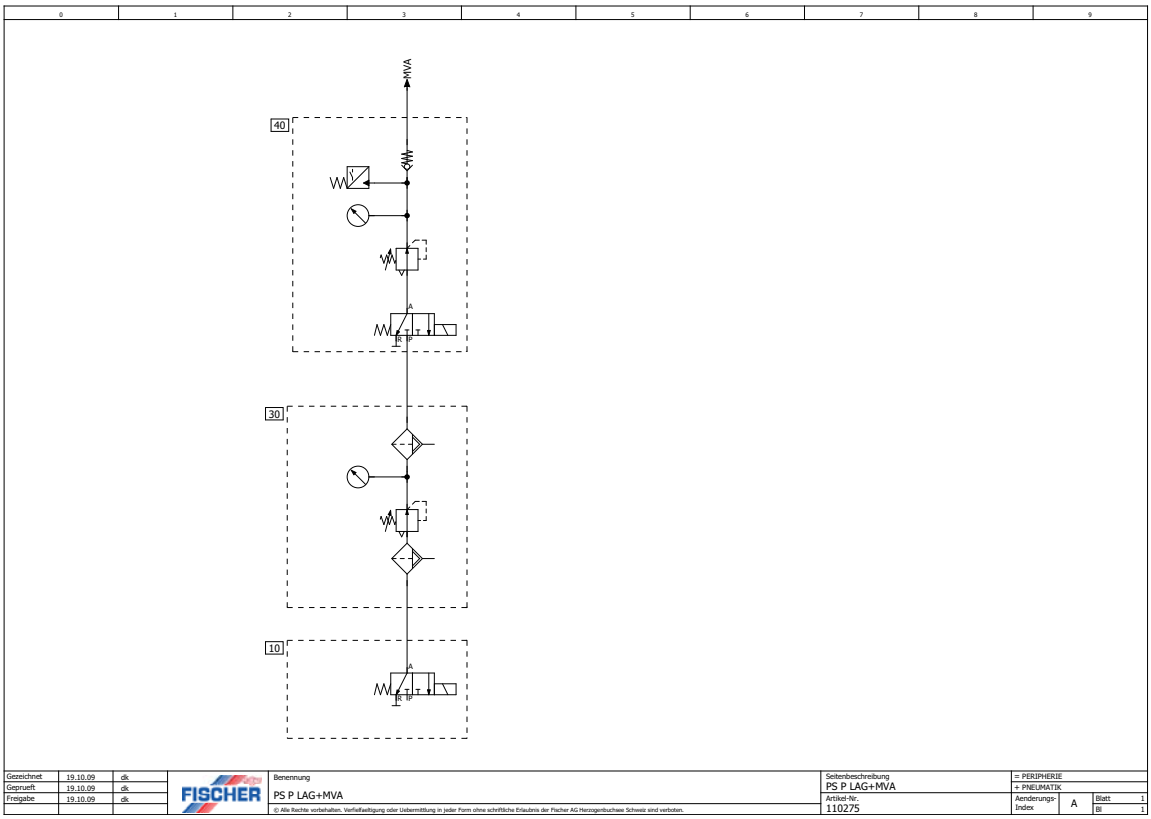
4.4 Connection Procedures

Information: You will find a connection diagram of the complete installation for MF spindles in chapter 10" Appendix".

4.4.1 Connecting Pneumatic System

Pneumatics Installation: Schematic 110275.

Compressed air, according to ISO Standard 8573.1 (Class 4.4.4) must be fed to the air treatment unit, before it is supplied to the individual systems of the spindle.



Legend:

10 Main check valve

30 Air treatment unit

40 Air lubricant

MVA oil-air lubrication

Air supply

For operating the MF spindles an air supply system is required which must meet the following minimum specifications:

Min. pressure 5 bar with an air stream of 300 l/min

CAUTION! If an air treatment unit is used which does not meet the minimum specifications set out in paragraph 3.5, the spindle could be damaged.

CAUTION! The spindle has to be supplied with compressed air according to the ISO-Standard 8573.1, Class 4.4.4. Class 4.4.4 means: Maximal size of dirt particles 15 µm, maximal dirt level 8 mg/m3, dew point +3°C and maximal oil content 5 mg/m3.

Information: For more information on connection data for the periphery devices (air treatment unit/ oil-air lubrication unit) consult the relevant operation instructions.

4.4.2 Connecting Spindle Motor Cooling System

Installation overview

The following drawing shows the installation of the cooling system.

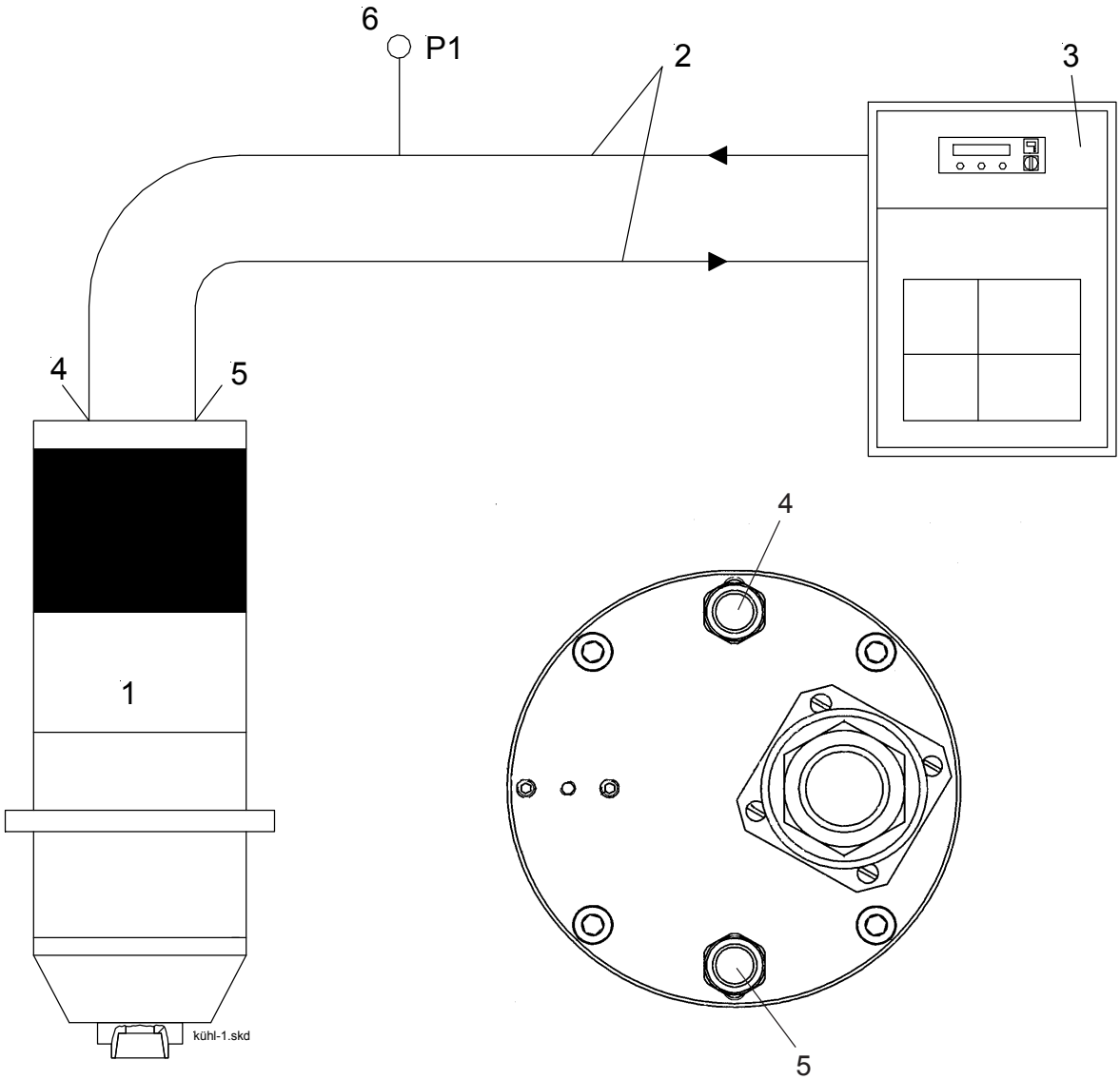


Fig. 4 - 3: Installation overview "Cooling system"

Legend

1	Spindle	4	Connection "Colling in"
2	PEUR tubes	5	Connection "Cooling out"
3	Cooling unit	6	max. 6 bar

Connection Data

Please observe the following data when connecting the cooling system to the espindle:

- Spindle connections: **Legris Ø 8mm (Spindel-diam. 80mm)**
  Legris Ø 10mm (Spindel-diam. > 80mm)
  - Designation: **Water in**
    Water out
- Coolant quality: min. 5% anti-corrosion emulsion (e.g. the exclusively recommended and ready-for-use COOL-X coolant
- Tube specifications:
  - Material: **PEUR (Polyether - Polyurethan)**

Information! If the tubes used are not made of 100% PEUR, there is a danger of holes forming in the tubes at a later data.

Legris Ø 8mm

- Colour: **black**
- Min. intern diameter: **6 mm**
- Ext. diameter **8 +/-0.15 mm**
- Tube length: **no limit**
- Rated pressure: **8 bar**

Legris Ø 10mm

- Colour: **black**
- Min. intern diameter: **7 mm**
- Ext. diameter **10 +/-0.15 mm**
- Tube length: **no limit**
- Rated pressure: **8 bar**

Connection Procedure

Connect the spindle to the motor cooling system according to the drawing in Fig. 4 - 3 and observe the following remarks:

- Observe the installation and service instructions in the documentation of your cooling unit.
- Respect the absolute cleanliness during the installation procedure.
- Keep all the connectors of the spindle closed, by means of blind caps, until you finally connect all the lines.
- Install all the periphery units in consideration of the length of lines and prepare the lines accordingly.
- The lines must not be under tension.
- Place the tube connections in a cable duct or secure them to suitable points at the machine.
- The lines must not be bent, respect minimal bend radius during installation of the lines.
- The lines must stand the required pressure and must have the necessary quality.
- Unless the exclusively recommended and ready-for-use COOL-X coolant is used a water-miscible corrosion inhibitor must be added to the cooling water to protect the spindle from corrosion and to keep the coolant biostable.
- Unless the exclusively recommended and ready-for-use COOL-X coolant is used add from the beginning the appropriate additive according to Chapter 9: Technical Specifications in order to prevent organic residues (fungus).

Note: Unless the installed lines are made of 100% PEUR, the life time of the lines can be reduced because of holes.

4.4.3 Connecting Lubrication System

Installation overview

The following drawing shows the installation of the oil-air lubrication system.

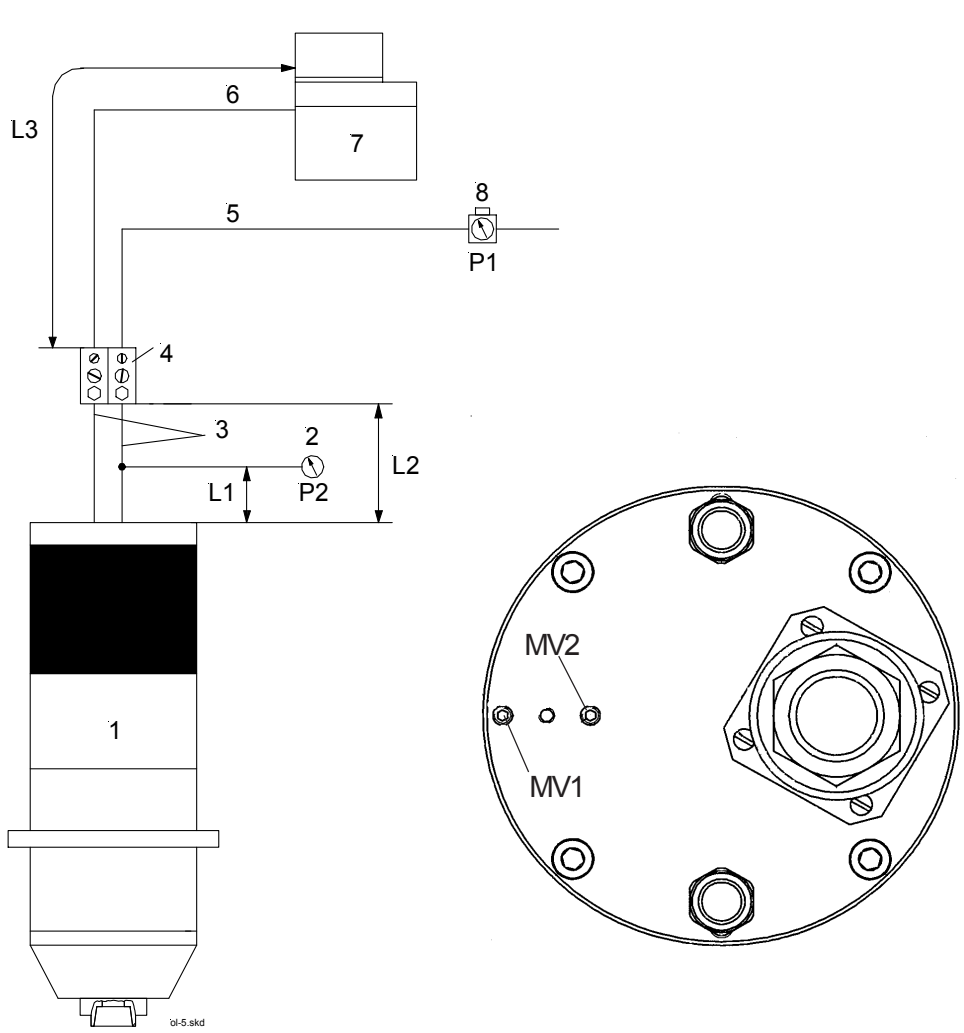


Fig. 4 - 4a: Installation overview "Oil-air lubrication system"

Legend

1	Spindle	L1	100-150 mm
2	Manometer (only for installation)	L2*	Length min / max = 1 m / 5 m
3	Oil-air lubrication feed lines	L3	as short as posible; if longer than 15 m, please contact Fischer AG
4	Dosage unit	P1	4 bar
5	Air feed lines	P2	2.3 ± 0.2 bar
6	Oil feed lines	*	for L2 oil tubing to be arranged in several loops, Fig. 4-5b.
7	Oil-air lubrication unit		
8	Pressure reduction valve with manometer		

Connection data

Please observe the following points when connecting the oil-air lubrication system to the spindle:

Connections lubrication unit - dosage unit

- Lubrication unit connection. **G 1/4"**
- Dosage unit connection: **M10x1**

Information: A **6 mm diameter Legris connection** is available on lubrication and dosage units supplied by Fischer AG.

- Tube specifications
  - Colour: **transparent**
  - Min. int. diameter: **3.7 mm**
  - Ext. diameter: **6 +0.05/ -0.1 mm**
  - Tube length: **max. 15 m using above-mentioned tube**

Information: For tube lengths between 15 m and 40 m please contact the company Fischer AG.

- Rated pressure **70 bar**

Connection air treatment unit - dosage unit

- Air treatment unit connection: **Study the information in the documentation with your air treatment unit**
- Dosing unit connection: **M10x1**

Information: A **6 mm diameter Legris** connection is available on dosage units supplied by Fischer AG.

- Tube specifications
  - Colour: **transparent**
  - Min. int. diameter: **4 mm**
  - Ext. diameter: **6 +/-0.1 mm**
  - Tube length: **max. 15 m**
  - Rated pressure: **9 bar**

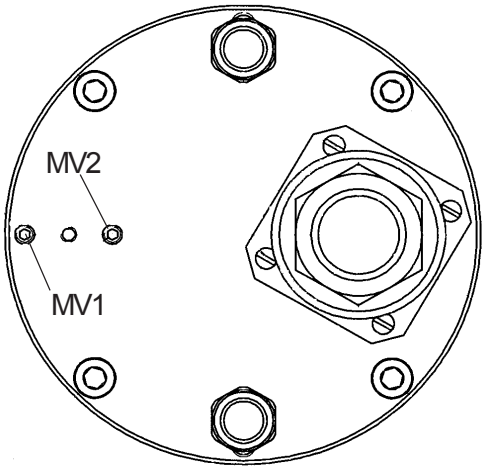
Connections dosage unit - spindle

- Spindle connections: **Legris diameter 4 mm**
- Dosage unit connections: **M8x1**

Information: A **4 mm diameter Legris connection** is available on dosage units supplied Fischer AG.

- Designation: **connections designated with MV fol lowed by a figure.**

Spindle type	No. of connections
MFV, MFN	2



- Tube specifications
  - Material: **PUR (Polyester - Polyurethan)**
  - Colour: **transparent**
  - Min. int. diameter: **2.5 mm**
  - Ext. diameter **4.0 +0.05/ -0.08 mm**
  - Tube length: **min. 1 m, max. 5 m**
  - Rated pressure: **20 bar**

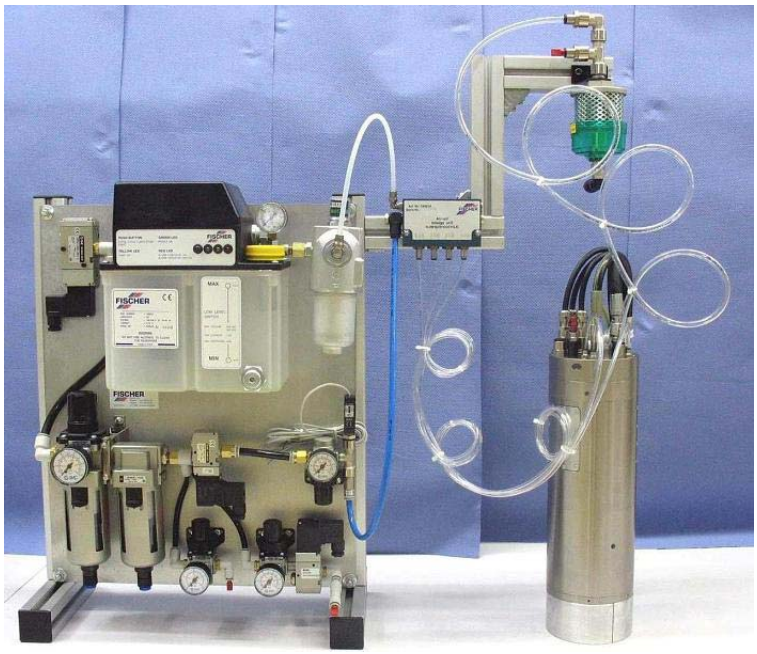


Fig. 4 - 5b: Tubing arrangement for oil feed & return

This arrangement of tubing (see above) shortens the pre-lubrication time for oil feed. For oil return it prevents oil from flowing back into the spindle.

Connection Procedures

- Make all connections between **spindle, dosage unit, oil-air lubrication unit and air treatment unit** according to fig. 4 - 4a.

CAUTION! Do not connect the lubrication oil tubes to the spindle yet because the lubrication system must first of all be thoroughly "flushed" (cleaned) (see paragraph 4.6.1).

CAUTION! The function of the hybrid bearings used in the spindles demands very high conditions with regards to cleanliness. Therefore during the installation procedures ensure that working area is absolutely clean. The operational life of the spindle`s bearing will be considerably reduced if this is not strictly observed.

Take note of the following additional points:

- Be sure to observe the installation procedure in the operating instructions for the oil-air lubrication unit.
- Do not remove the locking caps on the spindle connections
  - Use clean air to blow through the tubes before connecting them to the dosage unit(Legris connections). Close the free end of the tubes with a suitable plugs.
  - Ensure that the tube connections are not under stress. If possible, place the tube connections in a cable duct or secure them to suitable points on the machine.

4.4.4 Electrical Connection

Electrical schematics appear in the next pages.

CAUTION! Before starting any work on the electrical installation (connection of the spindle to the frequency converter, connection of the proximity switches) ensure that the machine and the frequency converter are disconnected from the mains supply and the intermediate circuit capacitors (see the operating instructions for the voltage converter) are discharged. **If this is not observed, there is a risk of a dangerous electric shock.**

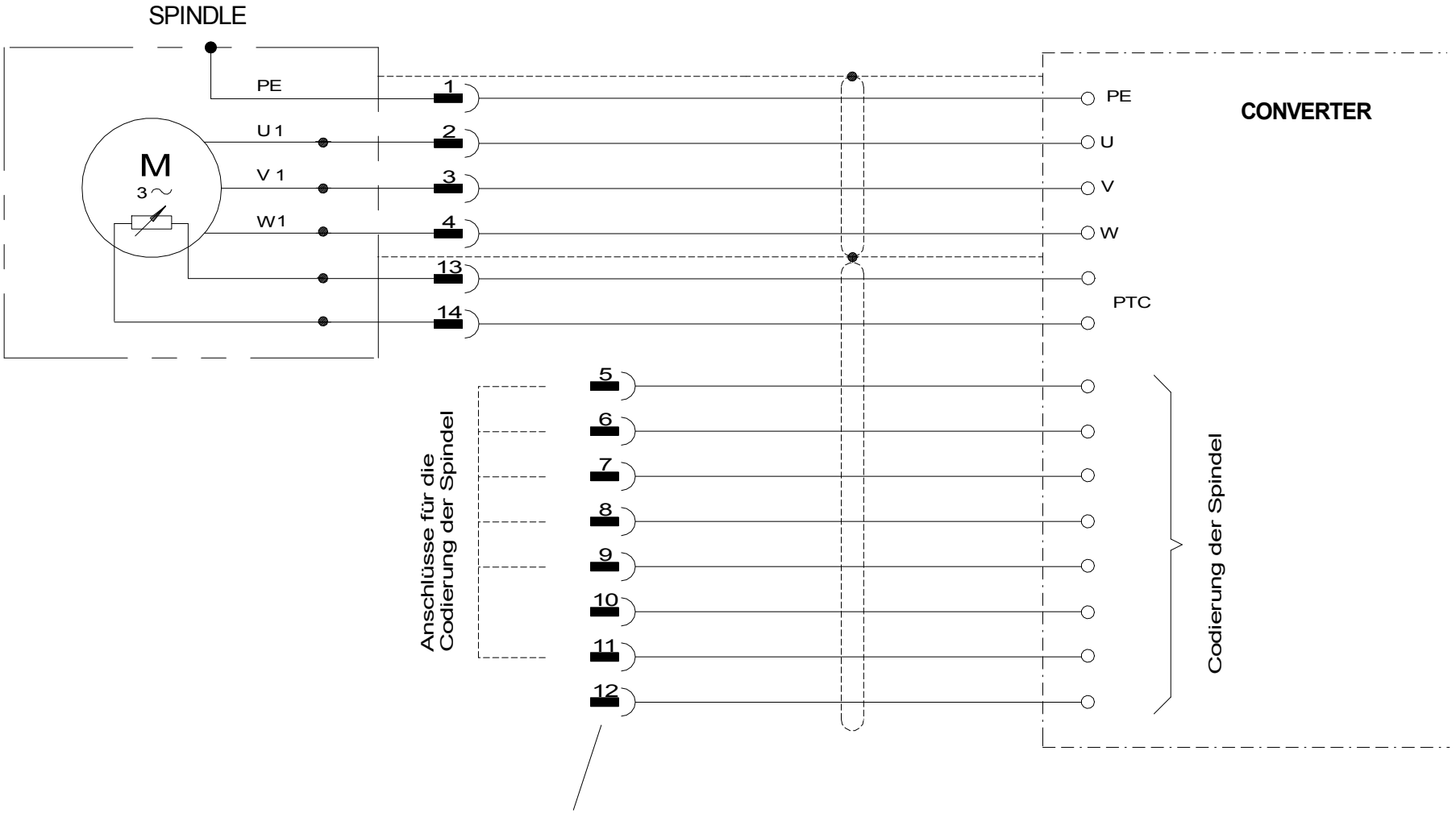
Making the electrical connection from the spindle to the frequency converter and to the machine control equipment, observing the following points:

- Be sure to observe the installation procedures in the operating instructions for the frequency converter and the machine control equipment.
- Ensure that the connection cables are not under stress.
- If possible, place the connection cables in a cable duct or secure them to suitable points on the machine.

4.4.5 Electrical Schematic for Spindles: MFV, MFN, MFZ, MFI, MFC

91170-050

The following schematic indicates all electrical connections of the spindle to the frequency converter over a plug connector.



Steckdose
GA 14290102822
Stecker
GA 14290102797

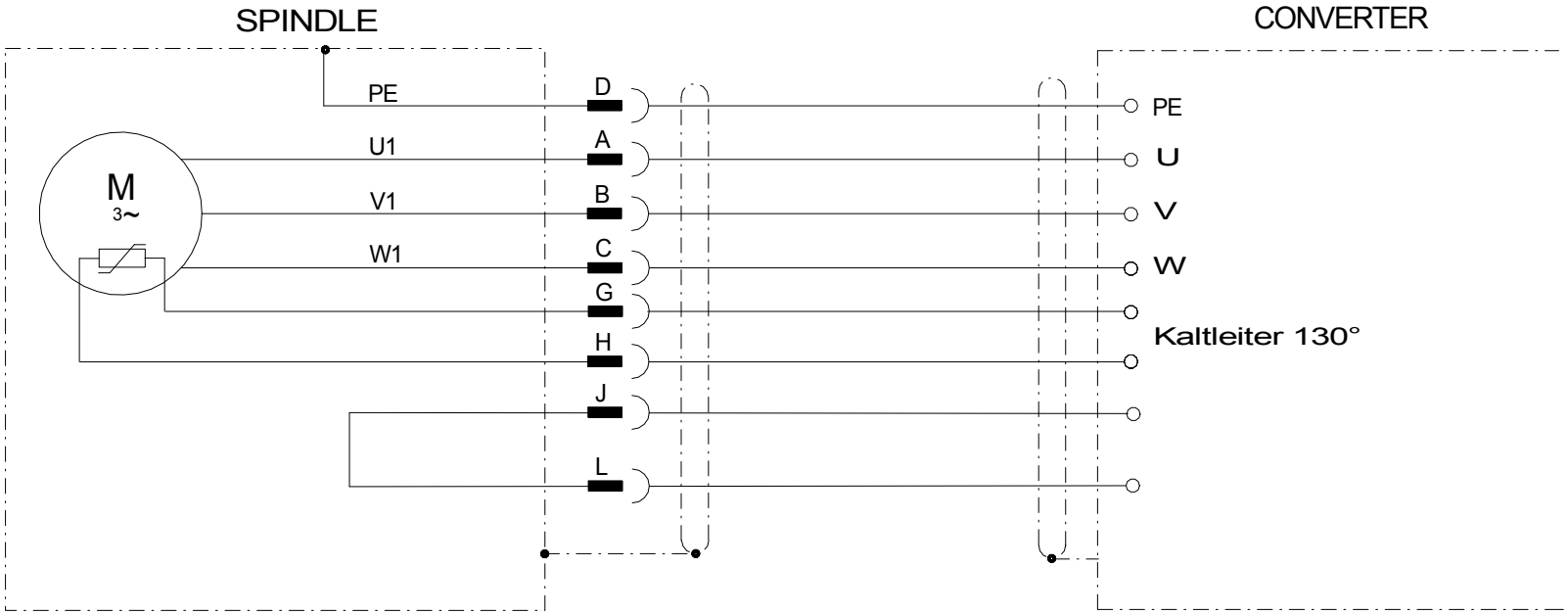
oder

Steckdose
Socapex SLSEM 315 S
Stecker
Socapex SLSFFD 315 S

Designed	16.08.1996	GP	FISCHER	Project description: MFV, MFN, MFZ, MFI, MFC	Page description		
Checked	17.02.2000	rj					
Released	17.02.2000	rj			Remarks	Drawing number: 91170-050	Index B
Draft							Total 1 / Page 1

4.4.6 Electrical Schematic of Combitec

103467



Designed	24.03.2004	pbu	FISCHER	Project description: 14-p Combitec 2312-674	Page description		
Checked	24.03.2004	IS					
Released	24.03.2004	pbu			Remarks	Drawing number: 103467	Index: A
Draft							Total 1 / Page 1

4.4.7 Electrical Schematic of Motor + PTC

100752

Designed	25.06.2001	rj	FISCHER	Project description: Motor + PTC	Page description		
Checked	25.06.2001	rj					
Released	25.06.2001	rj			Remarks	Drawing number: 100752	Index: A
Draft							Total 1 / Page 1

4.4.8 Cable Specifications

The dimensions for the cable for power and PTC can be found in the following tables:

Spindle type	Cable for power and PTC (mm^2)
MFN-860	6x1
MFN-875	6x1
MFN-890	6x1
MFN-8120	6x1
MFN-8150	6x1
MFN-1045	6x1
MFN-1060	6x1
MFN-1075	6x1
MFN-1090	6x1
MFN-10120	6x1
MFV-1224	4x4+2x1
MFV-1230	4x2.5+2x1
MFV-1245	6x1.5
MFV-1260	6x1
MFV-1275	6x1
MFV-1424	4x6+2x1
MFV-1430	4x4+2x1
MFV-1445	4x2.5+2x1
MFV-1712	4x16+2x1
MFV-1718	4x16+2x1

- Spindle motor power supply (connector pins 1,2,3 and 4)

- PTC temperature sensor (connector pins 13 and 14)

  The PTC temperature sensors monitor the temperature in the spindle. They are built into the stator windings of the asynchronous motor according to DIN 4480. They provide A resistance signal which is dependent on the temperature. They must be connected to the relevant inputs of the frequency converter.

Information: Details of the inputs to the frequency converter can be found in the separate operation instructions for the frequency converter.

4.4.9 Installing & Connecting Monitoring Devices

For monitoring the operation of the spindle, in addition to the proximity switches and the encoder installed in the spindle, the following devices are required.

- **Pressure switch for the oil-air lubrication system**

  The pressure in the pneumatic system must be continuously monitored. This is achieved by installing a pressure switch before the dosage unit. This switch applies an electrical signal to machine control as soon as the pressure falls below the minimum specified value of 3.5 bar.

Information: Please consult the separate instructions included with your pressure switch for details on its connection.

- **Water-flow detector for the cooling system**

  The flow of water in the cooling system must be continuously monitored. This is achieved by installing a flow detector in the return flow of the cooling system. This detector applies an electrical signal to machine control as soon as the water flow falls by 1 l/minute.

Information: For details on connecting the flow detector, please consult the separate operating instructions included with your cooling system.

- **Temperature control for the cooling system**

  The temperature in the cooling system must be continuously monitored. This is achieved by installing a temperature sensor at the pump outlet in the cooling system. This sensor applies an electrical signal to machine control as soon as the temperature of the water exceeds the specified value of 35 °C.

Information: For details on connecting the temperature sensor, please consult the separate operating instructions included with your cooling unit.

- **Current limiter for the spindle motor in the frequency converter**

  The current in the spindle motor must be limited according to the values listed in the following table in order to prevent damage to the motor.

Spindle type	Current S1 (A)	Current S6 (A)
MFN-860	5.5	7.0
MFN-875	4.2	5.8
MFN-890	3.6	4.6
MFN-8120	2.8	3.0
MFN-8150	2.0	2.0
MFN-1045	7.3	10.0
MFN-1060	6.4	9.0
MFN-1075	6.6	7.0
MFN-1090	4.5	6.0
MFN-10120	4.3	5.0
MFV-1224	26.0	28.0
MFV-1230	18.5	21.0
MFV-1245	13.1	16.0
MFV-1260	8.4	11.0
MFV-1275	8.7	11.2
MFV-1424	41.0	46.0
MFV-1430	31.0	35.0
MFV-1445	18.0	20.0
MFV-1712	68.0	75.0
MFV-1718	64.0	69.0

Information: For details on the current limiter, please consult the separate operating instructions included with your frequency converter.

4.5 PLC/CNC Programming

In order to achieve correct and safe operation of the spindle, the following points must be observed for the design of the control system:

- Cooling system
- Switch-on sequence and switch-off when trouble occurs

Cooling system

The cooling system must be switched together with the main switch of the machine and it must remain on during operation of the machine. When the machine is witched off it should remain on for a further 10 minutes.

Switch-on sequence and switch-off when trouble occurs

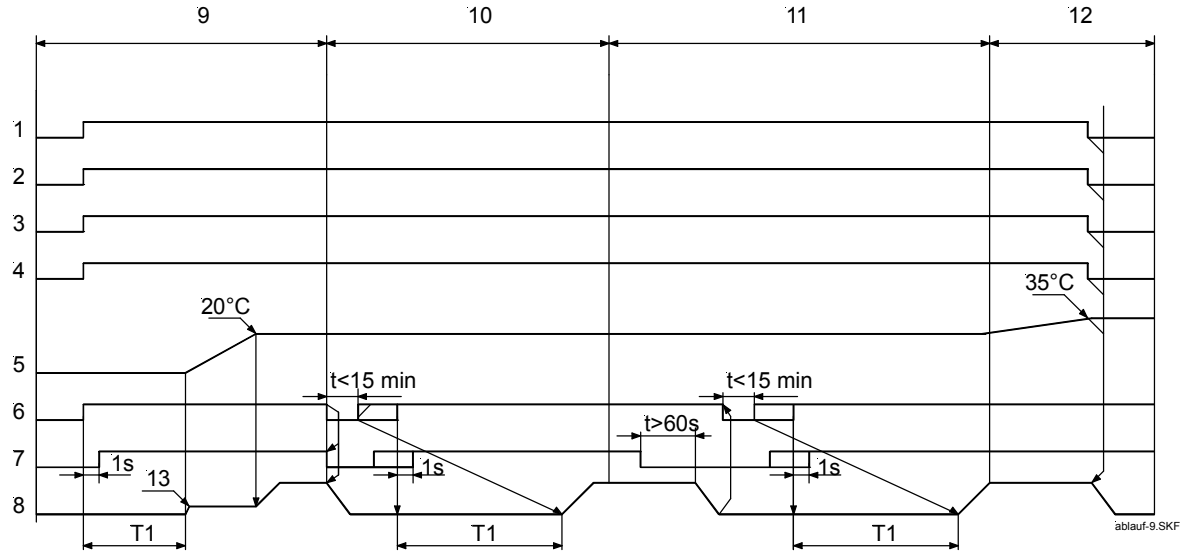


Fig. 4-6: Switch-on sequence and switch-off when trouble occurs

Legend

1 Power supply
2 Frequency converter
3 Cooling unit
4 PTC
5 Temperature control cooling water
6 Pressure switch (air) oil-air lubrication system
7 Oil-air lubrication unit ok
8 Spindle rotation speed
9 switch-on sequence
10 Air pressure oil-air lubrication system is too low
11 Oil-air lubrication unit defective
12 General fault condition
13 Rotation speed - 10% of maximum speed

T1 Prelubrication time of 3 minutes per meter required between dosage unit and spindle.

4.6 Adjusting & Checking Procedures

4.6.1 Adjustment Procedures

To carry out the adjustment procedures, it is assumed that the installation work on the spindle and periphery devices has been completed and that the machine control equipment is functioning correctly.

Pneumatic system

1. Open by hand the valve for the compressed air feed to the air treatment unit..
2. Adjust the **input pressure** to the air treatment unit to **5 bar** (see the operating instructions for the air treatment unit)
3. Open the valve of the **compressed air feed to the dosage unit** and adjust the pressure to **4 bar.**
4. Adjust the pressure switch of the dosage unit to 3.5 bar falling.

Cooling system

1. Unless the exclusively recommended and ready-for-use COOL-X coolant is used, fill the tank of the cooling system with an **anti-corrosion cooling emulsion** (see chapter 10 „Annex“).
2. Check the rate of flow of the cooling system according to the data in the following table:

Spindle type	Rate of flow (l/min)	
	minimum	max. (6 bar dynam. Press.)
MFN-860	1.4	
MFN-875	1.1	
MFN-890	1	6.0
MFN-8120	0.7	5.4
MFN-8150	0.4	7.8
MFN-1045	2	7.6
MFN-1060	1.8	7.4
MFN-1075	1.3	
MFN-1090	1.2	10
MFN-10120	0.9	10
MFV-1224	4.9	6.7
MFV-1230	3.8	6.5
MFV-1245	3.2	6.9
MFV-1260	2.4	7.5
MFV-1275	2.2	7.0
MFV-1424	4.3	6.0
MFV-1430	6.7	
MFV-1445	3.5	5.0
MFV-1712	15.2	
MFV-1718	13.8	6.2

3. Adjust the **thermostat for the recooling** to a temperature between **20° and 25 °C**. (see the operating instructions for the cooling system).
4. Adjust the **flow detector** to a value **1 l/min below the actual flow** (see the operating instructions for the cooling system).
5. Adjust the **temperature sensor** at the outlet of the cooling system to **35 °C** (see the operating instructions for the cooling system).
6. If your cooling system is also equipped with a heater, set the **heating thermostat** to **20 °C**. (see the operating instructions for the cooling system).

Oil-air lubrication system

WARNING! Ensure absolute cleanliness when working on the oil-air lubrications system.

1. Fill the tank of the oil-air lubrication unit with the **specified lubrication oil** (see chapter 10 „Annex“).
2. Remove the plug from the free end of the lubrication oil tube (connection between dosage unit and spindle) and place the open tube into a collecting vessel.
3. Switch on the oil-air lubrication unit.
4. On the oil-air lubrication control unit adjust the interval times according to the following table (see also the operating instructions for the oil-air lubrication unit):

Spindle type	Interval time (Min.)	Spindle type	Interval time (Min.)
MFN-860	2	MFV-1224	1
MFN-875	2	MFV-1230	1
MFN-890	4	MFV-1245	1
MFN-8120	4	MFV-1260	2
MFN-8150	4	MFV-1275	2
MFN-1045	1	MFV-1424	1
MFN-1060	2	MFV-1430	1
MFN-1075	2	MFV-1445	1
MFN-1090	4	MFV-1712	1
MFN-10120	4	MFV-1718	1

WARNING! When several spindles are being operated simultaneously the interval time has to be adjusted to the smallest value of the involved spindle.

5. De-aerate the dosage unit. This is done by opening the vent screw until bubble-free oil is discharged and then close the vent screw again (see the operating instructions for the oil-air lubrication unit).

   Then let the oil-air lubrication unit run for **one hour**. This will ensure that any impuriti es/ slush oil in the dosage unit are washed out of the lines.
6. Remove the locking plugs from the lubrication oil connections on the spindle and connect the lubrication oil lines (Legris connections).
7. Adjust the **dynamic pressure** on each individual lubrication connection to: 2.3 ±0.2 bar at a maximum distance of 15 cm.

Information! After the dynamic pressure on the lubrication connections has been set the manometer used for the measurement must be removed.

Frequency converter

Adjust the operating parameters as listed in the operating instructions for the frequency converter, while still observing the spindle motor data.

Designation	Spindle type					
	MFN-860		MFN-875		MFN-890	
Number of poles	2		2		2	
Rotation speed (1000 min-1)	45	60	60	75	75	90
Frequency (Hz)	750	1000	1000	1250	1250	1500
Voltage (V)	263	350	280	350	292	350
Current S1 (A)	5	5.5	4.2	4.2	3.6	3.6
Current S6 60% ED ts 2 min (A)	6.2	7	5.8	5.8	4.6	4.6

Designation	Spindle type					
	MFN-8120		MFN-8150		MFN-1045	
Number of poles	2		2		2	
Rotation speed (1000 min-1)	90	120	120	150	30	45
Frequency (Hz)	1500	2000	2000	2500	500	750
Voltage (V)	263	350	280	350	234	350
Current S1 (A)	2.8	2.8	2	2	7.2	7.3
Current S6 60% ED ts 2 min (A)	2.9	3	2	2	9.8	10

Designation	Spindle type					
	MFN-1060		MFN-1075		MFN-1090	
Number of poles	2		2		2	
Rotation speed (1000 min-1)	45	60	60	75	75	90
Frequency (Hz)	750	1000	1000	1250	1250	1500
Voltage (V)	263	350	280	350	292	350
Current S1 (A)	6.2	6.4	6.6	6.5	4.2	4.5
Current S6 60% ED ts 2 min (A)	8.6	9	7	7	6	6

Designation	Spindle type						
	MFN-10120		MFV-1224			MFV-1230	
Number of poles	2		4			4	
Rotation speed (1000 min-1)	90	120	15	21	24	24	30
Frequency (Hz)	1500	2000	500	700	800	800	1000
Voltage (V)	263	350	220	306	350	312	350
Current S1 (A)	4.3	4.3	26	25	24	18.5	18.5
Current S6 60% ED ts 2 min (A)	5	5	28	28	28	21	21

Designation	Spindle type					
	MFV-1245		MFV-1260		MFV-1275	
Number of poles	2		2		2	
Rotation speed (1000 min-1)	30	45	45	60	60	75
Frequency (Hz)	500	750	750	1000	1000	1250
Voltage (V)	234	350	263	350	280	350
Current S1 (A)	12.6	13.1	8.3	8.4	8.7	8.5
Current S6 60% ED ts 2 min (A)	15	16	10.8	11	11.2	11

Designation	Spindle type					
	MFV-1424		MFV-1430		MFV-1445	
Number of poles	4		4		2	
Rotation speed (1000 min-1)	18	24	24	30	30	45
Frequency (Hz)	600	800	800	1000	500	750
Voltage (V)	263	350	350	350	234	350
Current S1 (A)	41	41	31	25	17	18
Current S6 60% ED ts 2 min (A)	46	46	35	28	19	20

Designation	Spindle type					
	MFV-1712		MFV-1718			
Number of poles	4		4			
Rotation speed (1000 min-1)	9	12	12	18		
Frequency (Hz)	300	400	400	600		
Voltage (V)	263	350	237	350		
Current S1 (A)	68	68	62	64		
Current S6 60% ED ts 2 min (A)	75	75	69	69		

Information! In addition to the frequency converter, the run-up time is dependent mainly on the grinding wheels used. This time can be determined by carrying out tests. A time of 4 seconds can be quoted as a guideline.

Information! The run-down time is also dependent on the tool used. As guideline approx. 2.5 seconds can be set. When the tool change/ time unit is often carried out, a braking resistance should be planned. Information for this can be found in the separate documentation supplied with the frequency converter.

4.6.2 Checking Procedures

Before the first time operation of the spindle check:

- that all securing screws on the spindle are properly tightened.
- that all tubes are correctly connected, suitably labelled, securely fixed, not crimped and properly sealed.
- that all cables, especially those of the PTC temperature sensors, are correctly connected.
- that the pressure of the oil-air lubrication unit and the cooling system have been correctly set.
- that all pressure sensors, flow meters and thermostats (pneumatic and cooling systems) function correctly.
- that the parameters set on the frequency converter match the parameters of the motor.
- that the interval time set on the oil-air lubrication unit is permitted for your spindle. (see paragraph 4.6.1).
- that the tanks of the oil-air lubrication unit and the cooling system have been filled with the correct material. (see paragraph 4.6.1)
- that the levels in the tanks of the oil-air lubrication unit and the cooling system are correct (see the operating instructions for the relevant periphery device).

4.7 First-Time Operation

WARNING! Before putting the spindle into operation for the first time, all installation and adjustment procedures must have been completed and the system (spindle and periphery devices) checked.

For the first-time operation of the spindle carry out the following procedure:

1. Turn the main switch of the machine on.
2. Switch all periphery devices on.
3. Using a torch to **check** whether **oil is flowing** in the lubrication tubes.
4. Place a test taper mount or a dynamically balanced tool holder in the spindle and clamp it.

CAUTION! Never run the spindle unless it has a tool or a test taper fitted and clamped. If this is ignored, the interface will be damaged.

5. **Wait approx. 10 to 15 minutes** after the periphery devices have been switched on until oil discharge is visible at the oil return point (check using a torch).
6. Switch the spindle and keep it running for **approx. 10 minutes at 10 % of the maximum speed**.

WARNING! It is only permitted to operate MF spindles in the rotational direction specified under chapter 1.1 (clockwise or anticlockwise). In order to determine the direction of rotation the spindle is observed from the connection side to the collet side.

7. Increase the speed to maximum gradually over a period of an hour.
8. Keep the spindle running at maximum speed for approx. half an hour.
9. During this period check the spindle temperature and vibration according to the test protocol. The spindle temperature must be between 25° and 30 °C. If the temperature is higher, the spindle must be switched off and the cooling system checked.
10. Insert all tool holders one after the other and let the spindle run at the maximum speed for each tool (without exceeding the maximum speed of the spindle) and check how the spindle operates.

CAUTION! Ensure that only toolholders/tools are inserted which meet the specifications described in chapter 3.6.

CAUTION! The vibrations should not be significantly greater than those produced when a test taper or a well balanced tool holder was fitted. If stronger vibrations are produced, check the tool or tool holder.

5. Operation

5.1 Safety measures during operation

WARNING! The following guidelines on safety and hazards are to be strictly observed. If these points are ignored, it could result in danger to persons and/or damage to the spindle or other property.

- The spindles are to be operated by skilled personnel (e.g. machine operator).The **customer is responsible** for assigning the personnel and ensuring that they are qualified and competent to operate the spindle.
- When safe operation can no longer be taken for granted, switch the spindle off and ensure that it cannot be switched back on inadvertently. Safe operation of the spindle can no longer be taken for granted:
  - when the spindle has visible damage,
  - when the spindle does not operate normally (strong vibrations, loud knocking sound, etc.)
  - when one or more periphery devices fails (cooling unit, oil-air lubrication unit, etc.)
- Generally applicable instructions and guidelines for safe working condition must be strictly observed.
- It is **only permitted to use fully tested grinding wheels** (centrifugal force test according to DIN 8085, dynamically balanced to quality rating G2.5 according to VDI 2060 or ISO 1940) which have the **maximum rotation speed engraved** on them. The **maximum speed is not to be exceeded**.
- **Safety equipment** fitted is **not be removed or bridged**. Operation of the spindle with open protection cabin is not permitted.
- Without the written permission of Fischer AG, it is **not permitted to make any modifications or extensions** to the spindle or its periphery devices.
- It is only permitted to operate MF spindles in the rotational direction specified in chapter 1.1 (clockwise or anticlockwise). In order to determine the direction of rotation observe the spindle from the connection side to the collet side.

5.2 Starting up and running down the spindle

Daily switch-on procedure

To start up the spindle carry out the following procedure:

1. Turn on the main switch of the machine.
2. After switching on, make the following checks on the machine:
   - Check that all periphery devices to the spindle are operating and that their operating parameters are within the specified tolerances.
   - Check visually the flow of oil inside the lubrication tubes by using a light source. A fine regular flow of oil towards the spindle must be visible in all the tubes.

CAUTION! If any of these checks prove negative, do not operate the spindle. Report the situation to the person responsible for maintenance.

3. Clean the tool clamp and the grinding mandrel.
4. Insert the grinding mandrel and clamp it securely.

CAUTION! Never operate the spindle unless a grinding mandrel is fitted and securely clamped

5. Start-up the spindle as soon as the preliminary run-in time of the lubrication system has elapsed (approx. 10-15 minutes, depending on machine control). Run up the spindle slowly to 50 % of the maximum speed and let it run approx. 15 minutes.

CAUTION! From cold, never accelerate the spindle to maximum speed during the start-up time (approx. 4 seconds), otherwise due to different thermal expansion characteristics in the bearings, stress conditions are produced which can cause damage to the spindle.

As soon as the spindle has been run-up (after approx. 4 seconds) it can be accelerated and braked.

CAUTION! If the temperature of the spindle housing is **below 15°C** (e.g. after a longer period out of operation), the spindle must, in any case, be run in as described in point 5.

CAUTION! If the spindle has been idle for **more than a week,** run the spindle up according to the procedure for first-time operation (see paragraph 4.7) starting at point 6.

Daily running down procedures

To put the spindle out of operation carry out the following procedure:

1. Set the spindle to zero speed.
2. Remove the grinding mandrel out of its mount.
3. Turn the main switch of the machine off.

5.3 Operation of the spindle

Work on the spindle during operation is limited to observing the correct functioning of the spindle and grinding wheel change.

Observing the operation of the spindle

The operation of the spindle should be continuously monitored. If any changes are detected which could impair safe operation, put the spindle out of operation immediately and ensure that it cannot be inadvertently switch back on. Safe operation can no longer be expected if any of the following conditions occur:

- when the spindle has visible damage,
- when strong vibrations are detected,
- when unusual noises are audible,
- when one or more of the periphery devices fails (cooling unit, oil-air lubrication unit, etc.), etc.

Grinding mandrel change

Whenever a grinding mandrel is changed, take note of the following points:

- Change of grinding mandrel is only permitted when the spindle has come to a complete stop.
- The taper in the spindle and on the grinding mandrel must be **clean and without damage**.
- Before use, all grinding wheels must be inspected. Only grinding wheels which meet the specifications set out in paragraph 3.7 are to be used.

6. Maintenance

6.1 Safety precautions during maintenance work

WARNING! The following guidelines on safety and hazards are to be strictly observed. If this warning is ignored, it could result in danger to persons and/or damage to the spindle or other property.

- All maintenance work is to be carried out by fully trained skilled personnel. The customer is responsible for ensuring that personnel is qualified to carry out the various tasks.
- Personnel who will have the task of carrying out maintenance work on periphery devices must have read and understood the relevant documentation before starting this work.
- Individual maintenance tasks have to be carried out when the machine or periphery devices are switched on. For this reason the instructions for the maintenance work must be strictly observed and implemented.
- Before starting any maintenance work on pneumatic systems, these units must be made completely safe (isolate the units from the mains, no pressure in the systems, etc.)

6.2 Maintenance schedule

We assume, that the average of the machine operators are producing in a two shift interval with their High-Speed-Cutting Centers, i.e. the operating hours are based on 15 hours per day, 5 days per week or 48 weeks per year.

ATTENTION: If the machine operators work on a one, three or four shift basis, the maintenance schedule must be extended or shortened accordingly.

Daily maintenance

What	Who
Check the oil flow in the lubrication lines (dosage unit - spindle).	machine operator

Weekly maintenance

What	Who
Check oil level in oil-air lubrication unit and refill if necessary	machine operator
Empty oil separator	machine operator

Half-yearly maintenance or maintenance after 1800 h

What	Who
Replace fine filter element in air treatment unit	skilled worker

Annually maintenance or maintenance after 3600 h

What	Who
Replace filter element in oil separator	skilled worker
Check and replace cooling water (if necessary)	skilled worker

6.3 Maintenance procedures

CAUTION! The oil-air lubrication system and protecting air must be switched on when maintenance work is carried out on the spindle.

What	When	Who
Check oil flow in lubrication lines near the spindle connector .	every day	machine operator

Proceed as follows:

1. Switch on the oil-air lubrication system.
2. Inspect visually each lubrication tube between dosage unit and spindle. A fine regular oil flow must be visible in all lines. Use a light source to illuminate the tubes. If this not the case, do not run the spindle or switch it off immediately if it is already running. Report the situation to the person responsible for maintenance.

What	When	Who
Check oil level in oil-air lubrication unit and refill if necessary.	every week	machine operator

Proceed as follows:

1. Check the oil level in the oil-air lubrication unit.
2. Refill with oil if the level is within 1 cm of the minimum mark. Top up to approx. 1 cm below the maximum mark.

CAUTION! The oil used for refilling must meet the quality standards specified in chapter 9 "Technical Specifications" or chapter 10 "Annex". If this is not observed, the life time of the bearings will be considerably reduced.

CAUTION! Observe and implement the directions indicated in the operating instructions for your oil-air lubrication unit.

What	When	Who
Empty oil separator	every week	machine operator

Proceed as follows:

1. Switch the spindle off (main switch of the machine set to OFF and secured in this position).
2. Disassemble the oil separator as described in the instructions.
3. Dispose of the oil.

CAUTION! Never use oil a second time. Oil can pollute the environment. Ensure that the oil is correctly disposed of. Observe any local regulations and laws regarding the disposal of oil.

What	When	Who
Replace fine filter element in air-treatment unit	every 6 months	skilled worker

Proceed as follows:

CAUTION! When working on the pneumatic system, ensure absolute cleanliness. Dirt in the pneumatic system can create problems when operating the spindle.

1. Switch the spindle off (main switch of machine to OFF and secured in this position).
2. Separate the spindle from the compressed air network.
3. Wait until the pressure indicated on the manometer has fallen to 0 bar.
4. Replace the filter according to the procedure in the instructions for the air treatment unit.

What	When	Who
Replace filter element in oil separator	every year	skilled worker

Proceed as follows:

1. Switch the spindle off (main switch of the machine set to OFF and secured in this position).
2. Replace the filter according to the procedure set out in the instructions for the oil separator.

What	When	Who
Replace motor cooling liquid	every year	skilled worker

Proceed as follows:

1. Switch the spindle off (main switch of the machine set to OFF and secured in this position).
2. Replace the liquid according to the procedure set out in the operating instructions for the cooling unit.

CAUTION! Unless the exclusively recommended and ready-for-use COOL-X coolant is used, the liquid used for cooling the motor must meet the quality standards, i.e. the mixture of water and aditifs must be according to specified information in chapter 9 "Technical Specifications" or chapter 10 "Annex".

6.4 Protection of the environment

WARNING! Fuels (oils, coolants, etc.) can cause environmental pollution. Therefore handle such materials with care and ensure that used oils, coolants, etc. are correctly disposed of or recycled.
In addition all local regulations and laws on handling fuels and on protecting the environment are to be observed.

7. Trouble shooting / repair

7.1 Safety precautions when trouble shooting and carrying out repair work

WARNING! The following guidelines for safety and hazards are to be strictly observed and implemented. If this warning is ignored, it could result in danger to persons and/or damage to the spindle or other property.

- All work associated with trouble shooting and repair is only to be carried out by fully trained skilled personnel. The customer is responsible for ensuring that personnel is qualified to carry out the work.
- Before starting any worked associated with trouble shooting and repair, carry out the switching off procedure described in paragraph 5.2 and ensure that the machine and periphery devices cannot be inadvertently switched back on again.
- Should, for any reason, work need to be carried out when the machine is running, this work is to be assigned to a skilled person who is full aware of the danger involved. In addition a suitably instructed assistant should be present who can switch the machine off in an emergency.
- When spindle components need to be replaced, use exclusively original spare parts supplied by the company Fischer AG.

7.2 Trouble and elimination

Trouble	Cause	Check/action
Spindle vibrates	Grinding wheel or grinding mandrel not correctly balanced	Set dynamic balance of tool and tool holder to quality rate G2.5 (see standards VDI 2060 or ISO 1940).
	Concentricity of Grinding wheel out of tolerance	Maximum concentricity tolerance of grinding wheel 0.01 mm.
Spindle does not rotate	Electrical connection interrupted	Check electrical connections and replace if necessary
	Defective frequency converter	Check the voltage at the output of the frequency converter. If no voltage appears, consult service instructions of frequecy converter
	Shorted turns	Measure the difference in resistance of the windings. The difference in resistance of the individual motor phases must not exceed 0.1 Ohm. If the difference exceeds this figure, the spindle will have to be returned for repair to Fischer AG
	Short circuit to earth	Check all electrical connection for short circuit to earth. If a short circuit is still present when the mains plug is pulled out, the spindle will have to be returned for repair to Fischer AG.

Trouble	Cause	Check/action
Temperature sensor in stator windings indicates error	Cooling system not switched on	Switch cooling system on
	Faulty electrical connection to PTC	Measure resistance between frequency converter and spindle and if necessary replace electrical connection
	Spindle overloaded	Reduce load
	Temperature sensor defective	Measure resistance of sensor. If resistance is above 3000 Ohm at room temperature, the spindle will have to be returned for repair to Fischer AG.

7.3 Repair

Note: In this manual is no particular description of any repair works, which can be done by the user. Repair works must be carried out only by the spindle manufacturer Fischer AG.

7.4 Customer services

For repair work which cannot be carried out by the customer, proceed as follows:

- Disassemble the spindle described in paragraph 8 and pack it according to instructions (wrapped in anti-corrosive paper) in its original wooden case.
- Make a copy of the repair formula in chapter 10 "Annex" and fill in the following information:
  - Full address (including the name of the person to contact if any questions arise)
  - Spindle number
  - A precise description of the defect.
  - Date and signature
- Put the repair form in the wooden box with the spindle and send it to the company Fischer AG (the precise address can be found on the repair form).

By carrying out this procedure you will make your contribution to a quick repair.

8. Decommissioning

8.1 Safety when decommissioning the spindle

WARNING! The following guidelines for safety and hazards are to be strictly observed and implemented. If this warning is ignored, it could result in danger to persons and/or damage to the spindle or other property.

- All work associated with decommissioning the spindle is only to be carried out by fully trained skilled personnel. The customer is responsible for ensuring that personnel is qualified for the various tasks.
- When starting the decommissioning work, the machine and individual systems will still be connected to the mains voltage supply and some systems will still be under pressure. Therefore be sure to observe the instruction for running down the spindle.
- Be sure to observe local instructions and regulations on the handling of fuels and oils (oil, cooling water, etc.).

8.2 Decommissioning and disassembly

Decommissioning procedures

To decommission the spindle carry out the following procedure:

1. Switch the spindle off and ensure it is not rotating.
2. Remove the tool from the spindle.
3. Interrupt the compressed air supply and wait until the pressure in the system has fallen.
4. Disconnect the machine from the mains power supply and ensure that it cannot be switched back on inadvertently (**main switch to OFF** and secured in this position).

WARNING! Before continuing with this work wait until the intermediate circuit capacitors in the frequency converter have completely discharged (see the operating instructions for the frequency converter).

5. Ensure that the power supply to the periphery devices (hydraulic power unit, oil-air lubrication unit, etc.) has been switched off (check with a voltmeter).

Disassembly

1. Remove the tube connections from the spindle to the periphery devices and mark them if this has not been done already.

WARNING! Ensure absolute cleanliness. Immediately after removing the tubes seal them and the connections on the spindle with suitable plugs.

2. Disconnect the electrical cable.
3. Ensure that there is no water remaining in the cooling system of the spindle by emptying the system (blowing the water out).
4. Disassemble the spindle. Carry out the procedure described in paragraph 4.3 but in the reverse order.
5. Place the spindle in its original wooden box.

8.3 Storage

Preparing a used spindle for storage

If a used spindle has to be kept in storage, proceed as follows:

1. Smear some oil on the spindle sleeve and then pack the spindle in anti-corrosion paper.
2. Place the spindle in its original wooden box which provides the best possible protection against damage and corrosion.
3. Fix a label to the wooden box indicating the **spindle type** and the **date it was put into storage**.

Preparing a new spindle for storage

If a new spindle has to be kept in storage, proceed as follows:

1. Place the spindle in its original wooden box which provides the best possible protection against damage and corrosion.
2. Fix a label to the wooden box indicating the **spindle type** and the **date it was put into storage**.

Information for storing oil-air and a grease lubricated spindles

Observe the following points for storing the spindles:

- During the storage no aggressive media may influence e.g. gases, nebulas or aerosols of acids, caustic solutions or salts.
- Direct sunlight is to be avoided, since it can lead to large variations in temperature in the packing.
- In order to prevent the condensation in the interior of the spindle the temperature changes day/night must be < 8°C.
- The permissible storage temperature must be between +4 °C and +40 °C.
- The storage location must be dry and well ventilated.
- The relative humidity of the storage location must be max. 55%.
- Storage in the open air is not permitted.

Note: The bearings of oil-air lubricated spindles must be checked after a storage of 3 years.

Warning: If these informations are not obeyed, the operation readiness is no longer garanteed and the maximum life time of the bearings will be reduced strongly.

8.4 Disposal

Should it be necessary to dispose of the spindle, return it to Fischer AG in its original packing.

The company Fischer AG will ensure that the spindle is disposed of correctly with no danger to the environment.

Fischer AG accepts no responsibility for any results of unsuitable disposal by the customer.

9. Product Specifications

9.1 Technical Data

Designation	Spindle type		
	MFN-860	MFN-875	MFN-890
Diameter (mm)	80	80	80
Length (mm)	230	210	190
Weight (kg)	7.2	6.6	5.7
Direction of rotation	R/L	R/L	R/L
Operational position	any	any	any
n max. (1/ min)	60'000	75'000	90'000
Number of poles	2	2	2
P max. S1 (kW)	2.5	2	1.5
P max. S6 60% ts 2 min (kW)	3.2	2.5	2.0
Power dissipation (kW)	0.48	0.38	0.3
Max. torque (Nm) at n (1000/min)	0.5 60	0.31 75	0.21 90
Connection load (kVA)	3.1	2.6	1.9
Nominal voltage (V)	3x350	3x350	3x350

Designation	Spindle type		
	MFN-8120	MFN-8150	MFN-1045
Diameter (mm)	80	80	100
Length (mm)	180	170	260
Weight (kg)	5.6	5.4	13.2
Direction of rotation	R/L	R/L	R/L
Operational position	any	any	any
n max. (1/ min)	120'000	150'000	45'000
Number of poles	2	2	2
P max. S1 (kW)	1.2	0.75	3.5
P max. S6 60% ts 2 min (kW)	1.5	0.8	4.5
Power dissipation (kW)	0.23	0.12	0.68
Max. torque (Nm) at n (1000/min)	0.1 120	0.05 150	0.95 45
Connection load (kVA)	1.7	1.0	4.0
Nominal voltage (V)	3x350	3x350	3x350

Designation	Spindle type		
	MFN-1060	MFN-1075	MFN-1090
Diameter (mm)	100	100	100
Length (mm)	240	220	200
Weight (kg)	12.3	11.1	10.1
Direction of rotation	R/L	R/L	R/L
Operational position	any	any	any
n max. (1/ min)	60'000	75'000	90'000
Number of poles	2	2	2
P max. S1 (kW)	3	2.8	2
P max. S6 60% ts 2 min (kW)	4.0	3.0	2.5
Dissipation (kW)	0.6	0.45	0.4
Max. torque (Nm) at n (1000/min)	0.63 60	0.38 75	0.25 90
Connection load (kVA)	3.6	3.5	2.4
Nominal voltage (V)	3x350	3x350	3x350

Designation	Spindle type		
	MFN-10120	MFV-1224	MFV-1230
Diameter (mm)	100	120	120
Length (mm)	190	285	265
Weight (kg)	10	20.8	21.5
Direction of rotation	R/L	R/L	R/L
Operational position	any	any	any
n max. (1/ min)	120'000	24'000	30'000
Number of poles	2	4	4
P max. S1 (kW)	1.8	9.7	7.5
P max. S6 60% ts 2 min (kW)	2.0	11.0	8.5
Power dissipation (kW)	0.3	1.7	1.3
Max. torque (Nm) at n (1000/min)	0.15 120	4.4 15	2.7 30
Connection load (kVA)	2.3	17.1	11.3
Nominal voltage (V)	3x350	3x350	3x350

Designation	Spindle type		
	MFV-1245	MFV-1260	MFV-1275
Diameter (mm)	120	120	120
Length (mm)	250	235	230
Weight (kg)	19.1	19.9	18.7
Direction of rotation	R/L	R/L	R/L
Operational position	any	any	any
n max. (1/ min)	45'000	60'00	75'000
Number of poles	2	2	2
P max. S1 (kW)	6	4	4
P max. S6 60% ts 2 min (kW)	7.5	5.2	5.0
Power dissipation (kW)	1.1	0.8	0.75
Max. torque (Nm) at n (1000/min)	0.59 45	0.82 60	0.63 75
Connection load (kVA)	7.8	6.7	4.6
Nominal voltage (V)	3x350	3x350	3x350

Designation	Spindle type		
	MFV-1424	MFV-1430	MFV-1445
Diameter (mm)	140	140	140
Length (mm)	325	305	290
Weight (kg)	31	27.4	24.8
Direction of rotation	R/L	R/L	R/L
Operational position	any	any	any
n max. (1/ min)	24'000	30'000	45'000
Number of poles	4	4	2
P max. S1 (kW)	18	13.5	7
P max. S6 60% ts 2 min (kW)	20	15	8
Power dissipation (kW)	3.0	2.3	1.2
Max. torque (Nm) at n (1000/min)	7.9 24	5.9 24	1.7 45
Connection load (kVA)	24.5	15	22
Nominal voltage (V)	3x350	3x350	3x350

Designation	Spindle type		
	MFV-1712	MFV-1718	
Diameter (mm)	170	170	
Length (mm)	380	360	
Weight (kg)	55	55	
Direction of rotation	R/L	R/L	
Operational position	any	any	
n max. (1/ min)	12'000	18'000	
Number of poles	4	4	
P max. S1 (kW)	32	30	
P max. S6 60% ts 2 min (kW)	35	32	
Power dissipation (kW)	5.3	4.8	
Max. torque (Nm) at n (1000/min)	27.8 12	16.9 18	
Connection load (kVA)	41	33	
Nominal voltage (V)	3x350	3x350	

9.2 Environmental Conditions

Permissible operating conditions

- Ambient operating temperature range: **0 – 45 °C**
- Ambient air conditions: **corrosives substances are not permitted**

9.3 Environmental Impact

Spindle type	Nois emitted at max. speed with grinding mandrel (dBA)	max. vibrations permitted with test taper (mm/s)
MFN-860	80	2
MFN-875	80	2
MFN-890	80	2
MFN-8120	80	2
MFN-8150	80	2
MFN-1045	80	2
MFN-1060	80	2
MFN-1075	80	2
MFN-1090	80	2
MFN-10120	80	2

Spindle type	Nois emitted at max. speed with grinding mandrel (dBA)	max. vibrations permitted with test taper (mm/s)
MFV-1224	80	2
MFV-1230	80	2
MFV-1245	80	2
MFV-1260	80	2
MFV-1275	80	2
MFV-1424	80	2
MFV-1430	80	2
MFV-1445	80	2
MFV-1712	80	2
MFV-1718	80	2

9.4 Conformity

All MF series spindles meet the EU guidelines 89/392/EWG

10. Annex

10.1 Operating Supplies

Lubricant for Bearings

Quality	DIN 51524, Part 2/ISO VG68 (68mm2/s by 40°C)
Purity	for prefiltered oil 15/13/10 or higher, acc. to ISO 4406:99
Filtration	ß 3µm, min. 100
Recommended	MOTOREX SPINDLE LUBE Hyperclean ISO VG 68
Available at:	www.motorex.com or at Fischer AG (Art. No 879-010-0684)

Unless the lubricants used meet these standards, the lifetime of the precision ball bearings will be shorter or the spindle will fail rapidly.

Lubricant for Clamping Unit

Characteristic	Temperature range -80° C - +1200° C
	Pressure resistant 3600 kg/cm2
Recommended	Metaflux 70-81 Metal Anti-Seize Spray
	High performance lubrificant, metallic enriched with titan, without copper and nickel
Available at:	www.metaflux.com or at Fischer AG
	(Art. No 879-500-000)

Coolants for Motor and Bearing

Water-based coolant

Characteristic	free of nitride, corrosion resistant can decompose biologically, manintenance-free
Recommended	MOTOREX COOL-X ready-for-use coolant
Available at:	www.motorex.com or at Fischer AG (Art.No 106717)

Oil-based coolant

Characteristic	corrosion protection low manintenance
Recommended	MOTOREX COOL-OIL ready-for-use coolant
Available at:	www.motorex.com oder bei Fischer AG (Art.No 118179)

Unless coolants are used corresponding to these standards, the life time of some components of the cooling system will be shorter or the spindle will fail. Coolants on glycolbasis can also affect the PEUR tubes and components of zinc.

Additif against fungus

Characteristic	preservative agent
Recommendation	Motorex Antisept
available at:	www.motorex.com or at Fischer AG (Art.No 879-900-0100)

Cleaning additif after fungus attack

Characteristic	cleaning agent
Recommendation	CS-Cleaner
available at:	www.motorex.com or at Fischer AG (Art.No 120891)

10.3 Peripherals Connection Diagram

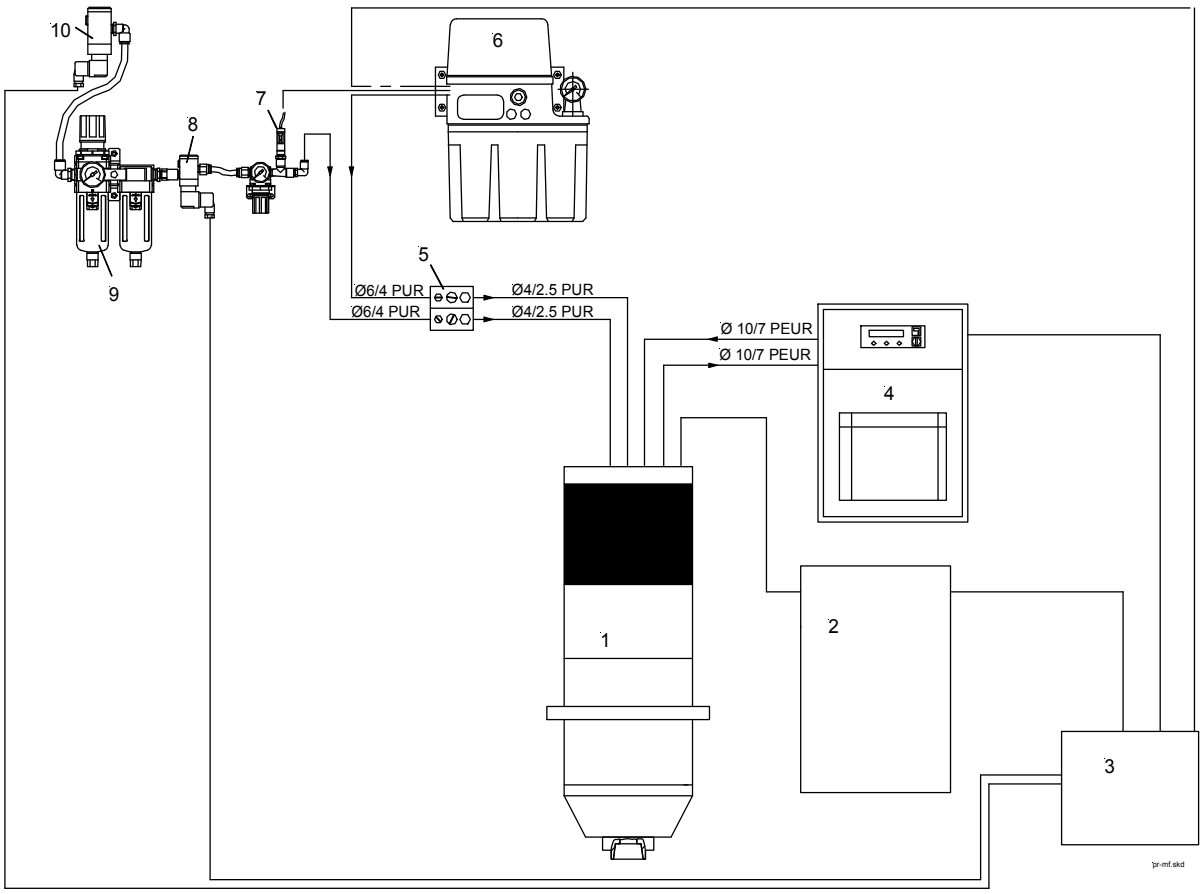


Fig. 10 - 1: Connection diagram for MF spindles

Legend

1	Spindle	6	Oil-air lubrication unit
2	Frequency converter	7	Pressure switch for oil-air lubrication
3	PLC/CNC	8	3/2 way valve for air in oil-air lubrication system
4	Cooling unit	9	Air treatment unit
5	Dosage unit	10	3/2 way valve (main valve)

10.4 Repair Receiving Form

The form is on the following page.

Fischer AG Präzisionsspindeln
P.O. Box 31
CH-3360 Herzogenbuchsee

T +41 62 956 22 22
F +41 62 956 22 00
fch@fischerprecise.ch

www.fischerprecise.ch

Repair Receiving Form

Date: _____

Contact-Information:

Company Name: _____ Contact Name: _____

Street: _____ Apt./Suite: _____

City: _____ State/Province: _____ Zip Code: _____

Phone: _____ Fax: _____ E-Mail: _____

Spindle-Information:

Make & Model: _____ Serial Number: _____

Description of Spindle Symtoms:	
Application Description:	

Desired Date: ***Express:*** ☐ ***YES*** ☐ ***NO***

Addional Comments:	

Shipping information:

Shipping Address:	**Customs Information:**
Fischer AG Präzisionsspindeln Birkenweg 2 CH-3363 Oberönz	VAT-No.: 102.213.056 Centralized settlement procedure „CSP“ 8821-1 Customs Tariff No. 8466.1000 EORI-No. DE1766228

Please enclose to the delivery a proforma invoice with a declaration of origin.

NOTE: When shipping spindles to FISCHER AG, if possible, use original spindle container.