

Leistritz
EXTRUSION TECHNOLOGY

OPERATING

Twin screw extruder ZSE 12

extruders.leistritz.com

These operating instructions contain important advice for you and your staff on the operation and maintenance of the machine.

Not all pictures and drawings contained in this manual correspond with every detail of your machine. We do however endeavour to keep our manual up to date with the current status. Subject to technical alterations and improvements!

In case our manual cannot help you, please contact our Service department. The service department will either help you to solve the problem yourself or send a technician as soon as possible.

The declaration of conformity and installation is issued for the whole extrusion line and is enclosed in original condition with the line documentation.

Service hotline:
Tel.: **+49 911 4306-444**
E-mail: extrusion-service@leistritz.com

Spare Parts:
Tel.: **+49 911 4306-444**
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In order to process your case as quickly as possible, we need to identify your extrusion line, the machine type and machine and job number. These are indicated on the nameplate.



Please have this information on every call!

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1 Safety

1.1 General safety notes

This manual contains basic instructions to be heeded during installation, operation and maintenance. The manual therefore must be read by the engineer in charge and by the responsible technician prior to installation and commissioning and must be kept constantly available at the site of the machine/line.

Notes in the operating instructions

Special attention must be paid to the safety instructions contained in these operating instructions which pose a risk to persons if not heeded. Instructions affixed directly on the machine, such as

Direction of rotation arrow

Mark for fluid connections

Warning notices

must be always heeded and kept in a completely legible condition.

Staff qualification and training

The staff entrusted with operation, maintenance, inspection and installation tasks must have the necessary qualifications for this work. The owner must clearly stipulate the areas of responsibility and monitoring for the various members of staff. If the staff do not have the necessary know-how, they must be trained and given corresponding instruction. If necessary, training and instruction can be provided by the manufacturer/supplier on behalf of the owner. Furthermore, the owner must ensure that the contents of the manual have been fully understood by the staff.

Hazards on failure to comply with the safety instructions

Failure to comply with the safety instructions can pose a hazard to persons, the environment and the machine. Failure to comply with the safety instructions can lead to the loss of any kind of compensation.

In particular, failure to comply with the safety instructions can result in the following hazards:

- Failure of major functions of the machine/line
- Failure of prescribed methods for maintenance and upkeep
- Hazard to persons from electrical, mechanical and chemical effects
- Hazard to the environment from leakage of hazardous substances

Safety-minded approach to work

The safety instructions featured in this manual must be heeded, together with the existing national accident prevention regulations as well as any internal standard operating procedures and safety regulations issued by the owner.

Safety instructions for the owner/operator

- Any hot or cold parts of the machine that pose a hazard must be covered up to prevent any contact.
- Covers provided as protection for moving parts (e.g. coupling) must not be removed when the machine is operating.
- Leaks (e.g. shaft seal) of hazardous materials being conveyed (e.g. explosive, toxic, hot) must be drained in such a way as to prevent any hazard for persons and the environment. Statutory regulations must be heeded.
- Hazards from electrical energy must be ruled out (for details, please see the regulations issued by the VDE [German Association of Electrical, Electronic & Information Technologies] and the local energy suppliers).

Safety instructions for maintenance, inspection and installation work

The owner must ensure that all maintenance, inspection and installation work is carried out by authorised, qualified staff after carefully studying the operating instructions. As a basic rule, all work on the machine must always only be carried out when the machine is at a standstill. Always comply with the procedure stated in the operating instructions for bringing the machine to a standstill. Decontaminate pumps and units conveying materials that pose a health hazard. Ensure that all safety and protection devices have been refitted and restarted as soon as the work is finished.

Unauthorised modification and parts production

Modifications or changes to the machine are only permitted after obtaining the manufacturer's consent. In the interests of safety, always use original parts and accessories authorised by the manufacturer. The use of other parts can render liability for any resulting damage null and void.

Incorrect operation

Operational safety of the supplied machine is only warranted when the machine is used for its intended purpose. The stated limit values must never be exceeded.

Information concerning the plant documentation

The plant consists of different machine components. Operating instructions of the respective component manufacturers are included in the plant documentation. Specifications in the extruder's instructions manual concerning components of other manufacturers are universal and not referring to the respective manufacturer. All binding information has to be taken from the operating instructions of the manufacturer.

For safe operation the plant documentation has to be read thoroughly, comprehended and accessible to each operator during the whole life cycle of the plant.

1.2 Warning notes in the operating instructions

These operating instructions use warning notes to draw attention to hazards and special aspects to be observed when handling the machine.

The meanings of the **signal words** are:

⚠ DANGER!	**DANGER indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.**
⚠ WARNING!	**WARNING indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.**
⚠ CAUTION!	**CAUTION indicates a potentially hazardous situation which, if not avoided, could result in minor or moderate injury.**
NOTE!	**NOTE indicates a possibly dangerous situation, which can lead to material damage if not avoided.**

The meanings of the **symbols** are:



General danger sign



Transport with forklift truck/lift truck



Information that needs to be heeded specially and/or for a better understanding of the preceding descriptions



Wear safety shoes!



Wear gloves / heatproof gloves!



Wear protective goggles!



Wear respirator mask!



Reference to another manual enclosed with the documentation

1.3 Safety symbols

1.3.1 Safety symbols on the line

All the safety symbols that are affixed to the overall line are explained below.



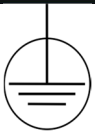
Identification of a general hazard. Only trained specialist personnel are allowed to work in this area of the line.



Identification of an electrical hazard. Only qualified electricians are allowed to work in these areas of the line.



Marking: Attention: Hot surfaces.



Indication that an earthing or protective conductor connection is installed or necessary.

1.4 List of safety instructions for operating the extruder

Below is a summary of the safety instructions listed in the document to give an overview of the possible hazards that may affect people or the machine.

General safety notes:

⚠ DANGER!

Risk of electric shock!

Electrical shocks can cause serious injury or death.

- Switch off the extruder before working on the electrical system and secure it against being switched on again!
- All work on the electric system is only allowed to be carried out by a qualified electrician.

⚠ WARNING!

Warning: Danger of crushing!

Rotating parts can crush or pull in body parts and cause serious injuries.

- Switch off the extruder before carrying out any maintenance, conversion, servicing or cleaning work and secure it against being switched on again!
- Do not reach into rotating parts by hand!

⚠ WARNING!

Warning: Danger of burns!

Cooling water and/or steam spraying out can cause serious injuries.

- Keep the ball valve closed during operation.
- Open the slide valve for filling or venting only at temperatures below 50 °C.

⚠ WARNING!

Warning: Danger of injury!

Improperly installed safety devices can lead to serious injuries.

- Operate extruder only with safety devices installed.
- Replace damaged or missing safety devices.
- Safety devices must not be tampered with.

⚠ CAUTION!

Caution: Hot surfaces!

The machine can reach over 60 °C during operation. The heaters are not switched off during an emergency stop.

- Always wear heatproof gloves when carrying out assembly/disassembly work on the process section!
- The functions of the heater can be changed on the control panel. See the manufacturer's operating instructions.

⚠ CAUTION!

Caution: Risk of injury!

Inlet and outlet lines are pressurised when heated and can lead to injuries during maintenance work.

- Parts of the line exposed to pressure are only allowed to be dismantled after the pump has been switched off and the pressure gauge no longer indicates pressure!

⚠ CAUTION!

Caution: Risk of burns!

Due to temperatures above 60 °C at the process section!

- Always wear heatproof gloves when carrying out assembly/disassembly work on the process section!

⚠ CAUTION!

Caution: Risk of burns!

During assembly/disassembly work, cooling water or steam spraying out can cause burns.

- Assembly/disassembly work on the heating/cooling unit is not allowed to be carried out until the measured temperature values of all heating zones are less than 50 °C!

⚠ CAUTION!

Caution: Risk of injury!

Sharp edges on the screw elements can cause cuts!

- Wear gloves when touching the screws (and the screw elements).

NOTE!

Attention: Risk of damage!

The screws can be damaged by incorrect installation.

- Pay attention to the direction of rotation of the screws (synchronous running) when tightening screw pairs on the screw shaft.
- Never turn the assembled screw sets backwards (back-conveying).
- Pay attention to the installation direction!
- The end faces of the adjacent elements are never allowed to be offset!

Safety instructions relating to transport and unpacking:

DANGER!

Danger: Falling items during transport!

- The extruder is only allowed to be lifted with a suitable lift truck at the prescribed anchor points.
- Transport is only allowed to be carried out by authorised personnel!

NOTE!

Attention: Risk of damage!

Due to improper transport.

- The extruder is only allowed to be lifted with a suitable lift truck.
- Transport is only allowed to be carried out by authorised personnel!

NOTE!

Attention: Risk of damage!

Damage due to careless unpacking!

- Carefully unpack the machine by hand.

Safety instructions for normal operation:

DANGER!

Danger: Potentially explosive atmosphere!

Changing the operating conditions and/or the intended use can lead to hazards for people, the environment and the machine.

- Do not use the extruder in a potentially explosive environment!

DANGER!

Danger: Risk of injury!

Operating the machine with excess pressure can cause parts of the machine to be ejected, resulting in serious injury.

- Notes on max. general conditions such as pressure and temperature taken into account.
- Specify and describe service and maintenance intervals in coordination with component suppliers (inspection plan).

DANGER!

Danger: Risk of burns!

Due to temperatures above 60 °C! The heaters are not switched off during an emergency stop!

- Always wear heatproof gloves when carrying out assembly/disassembly work on the process section!
- The functions of the heater can be changed on the control panel.
- See the manufacturer's operating instructions.

WARNING!

Warning: Danger of burns!

Escaping melt can cause severe burns.

- Always close openings or connect them to the supply line!

⚠ WARNING!

Warning: Danger of scalding!

In heated state, all inlets and outlets of the heating/cooling unit are under pressure. When opening, spraying out liquids can lead to scalding.

- Always wear personal protective equipment (PPE)!

⚠ CAUTION!

Caution: Risk of injury!

- The extruder must never be operated without supervision!

NOTE!

Attention: Risk of damage!

The extruder could be damaged!

- The extruder must not be run without material!

1.5 Residual risks

In spite of compliance with the accident prevention regulations and all operation and safety instructions contained in this manual, the following residual risks still apply to the extruder:

- **Risk of burning in the vicinity of the nozzle**
- **Risk of burning on the entire barrel**
- **Risk of burning on the extruded product**
- **Risk of burning even after the line has been switched off, from hot surfaces, leaking vapors/gases, leaking melt at the nozzle, heated lubricants, heated cooling fluids**
- **Water leaking from the cooling circuit**
- **Oil leaking from the oil supply to the gearbox**
- **Leaking gas and vapors**
- **Dust-enriched ambient air**

All products available for processing or products created during the processing process can occur on the extruder in the form of molten material and/or gas and/or dust in the areas of the filling, venting, degassing openings and the nozzle area. The owner shall comply with the safety data sheets issued for these processing or processed products to ensure that the corresponding safety measures are taken to protect man, the environment and the machine.

1.6 Safety devices

1.6.1 Safety devices on the extruder

⚠ WARNING!

Warning: Danger of injury!

Improperly installed safety devices can lead to serious injuries.

- Operate extruder only with safety devices installed.
- Replace damaged or missing safety devices.
- Safety devices must not be tampered with.

The following safety devices are defined on the extruder:

- Use of TC clamps without wing nut (cylinder head screws) for inserts and attachments
- Corresponding closing pieces for open barrels or sensor connections on the nozzle
- Mass pressure sensor (level C)
- Reach-in protection on the feed barrel
- Cover on the cylinder block
- Cover on the nozzle – drum cooler (if included in delivery)

1.6.2 Emergency stop of the overall line

⚠ CAUTION!

Caution: Hot surfaces!

The machine can reach over 60 °C during operation. The heaters are not switched off during an emergency stop!

- Always wear heatproof gloves when carrying out assembly/disassembly work on the process section!
- The functions of the heater can be changed on the control panel.
- See the manufacturer's operating instructions.

The overall line has an emergency stop under the operating unit. All drives (rotating parts) are switched off in this case! The heaters remain switched on to prevent the extruder from cooling down. The functions of the heater can be changed on the control panel.



For further information on the control panel and the control system, see the manufacturer's operating instructions.



Figure 1 Emergency stop switch

1.6.3 Signal tower

The overall line is equipped with a signal tower. This is located above the operating unit. In the event of a fault, the signal tower flashes red for an alarm or yellow for a warning. A green light indicates that there are no pending alarms or warnings. The machine is ready for use.
In production mode, an alarm signal sounds when an alarm is triggered.



Figure 2 Signal tower

2 Machine overview

2.1 Proper use and intended purpose

The extruder is used for conveying, compressing and homogenizing of thermally processible materials, which do not exhibit chemical reactions. The conveying of additives in solid or liquid form is possible. The extrusion line is to be operated in a **non-explosive** environment. The minimum ignition energy of the processed material must be at least 3 mJ. The max. permissible temperature of the heating zones must not be higher than:

- the glow temperature – 75 K of the dust layer
- or 2/3 of the ignition temperature of the dust cloud of the dusts to be processed

In any case, the set target temperature of the heating zones must not exceed 250 °C. Materials, which can develop a dangerous explosive atmosphere inside the apparatus, must not be processed. The extruder is not suitable for unattended operation.

2.1.1 Reasonably foreseeable misuse

The barrel and screw of the extruder are designed for the task specified in the order; the same also applies to the feed devices in the scope of the supply. Any amendment, addition or alteration to the process tasks to be performed by the extrusion line must take account of the properties of the basic processing material and the additives in order to avoid damage to the extruder.

2.1.2 Requirements on basic processing material and additives

The basic processing material and the additives must meet certain requirements:

- The size of the pellets or ground stock must be suitable for being caught up by the feed elements in the extruder screws and conveyed to the first heating/cooling zone.
- The basic processing material and the additives must not contain any impurities that could damage the screw and barrel (e.g. metal parts, stones, etc.).
- Pellets, ground stock and powders must be pourable, or the respective dosing units must be provided with the corresponding auxiliary equipment to prevent bridging in the feed funnel.
- The basic material (carrier material) must be plasticisable for applications under normal temperature and mixing conditions. The melt film produced in the processing part of the extruder is absolutely necessary in order to reduce friction.
- Any added fluids must be free of solid impurities and sediments that could clog the inlets and nozzles.

The melt film that builds up in the extruder must not be allowed to harden at any time during the processing process. The hardened material left in the process section after the extrusion line has been switched off must be plasticised completely before the extruder drive is switched on again. If this is not heeded when the machine is switched on again, there is a great risk of permanent damage to the extruder screws and drive shafts.

2.1.3 Incorporation of fillers

The extruder is designed for continuous operation for the task specified in the order. When incorporating fillers into the material being extruded, ensure that sufficient carrier material (e.g. polymer) is added. The greater the share of filler in the melt, the larger the friction forces between screws, shafts, gearbox and barrel. Inadequate lubrication by the carrier material can result in increased loads that cause damage to the screws, screw shafts and gearbox.

2.1.4 Safeguarding the extrusion line

The extrusion line must never be operated without using a protection device to prevent the melt pressure from exceeding the maximum level. The maximum permitted melt pressure is stated in the technical data of the operating instructions. The extrusion line must always be switched off whenever this maximum level is exceeded. The following machine data must be protected to ensure that the limit values are not exceeded in accordance with the specific machine type, if this has not already been done by the manufacturer:

- *max. melt pressure*
- *max. melt temperature and zone temperature*
- *max. screw speed*
- *max. screw torque*
- *max. gear oil temperature*
- *motor cooling*
- *interlocking of the filler dosing device*
- *low power safeguard*

2.2 Function and structure

The extruder is used for the incorporation and extrusion of two (active) materials.
The machine is supplied with media via appropriate connections in the room. The connection is made by the customer.

The extruder consists of a barrel structure with a screw pair and a drive unit. The extruder screw is installed in the barrel block. The screw and the drive unit are connected via a sleeve coupling, i.e. the cylinder block is connected to the gearbox via the lantern. The extruder consists as standard of a compact cylinder comprising an upper and lower section with 8 zones, held in a C-profile, two screws, an outlet zone (consisting of a material discharge section and nozzle, zone 9), a drive unit and two heating/cooling circuits. The motor/gearbox cooling circuit, zone 1, is cooled via a house cooling water connection or a cooling unit. The cooling circuit for the cylinders is connected to a heating/cooling unit.
The barrel zones 1 – 8 can be heated and cooled, zone 9 can only be heated.

The zones are heated electrically. Cooling is provided by means of a heating/cooling unit. All zones are equipped with temperature sensors. The temperature of the zones is controlled by a software controller. Temperature setpoints are adjustable for each zone. The melt pressure and melt temperature are recorded in the material outfeed part of zone 9. A cover above the process section serves as protection against accidental contact.

The product to be processed is manually fed into the dosing tank of the dosing unit by the operator. Dosing is usually volumetric, gravimetric is also possible. Zone 1 of the extruder is fed via the dosing system. Zone 1 is continuously cooled by means of the cooling circuit and represents the coldest zone in order to avoid melting in the feed zone. However, it is basically possible for the zone to be heated.

The product mixture is extruded through the temperature zones of the process section. In this process, a defined energy is supplied to the product mixture from outside by heating and cooling.
In zones 2 – 8, the product mixture is conveyed, compacted and homogenised by the arrangement of screw elements in combination with kneading blocks. The arrangement of the kneading and screw elements significantly influences the process.

Two different extrusion line configurations are possible:

- Extruder with cooling belt and granulator, if required
- Extruder with cooling roller

2.2.1 Structure of the line



Figure 3 Structure of the line (image shows the heating/cooling unit mounted on profile supports on the machine frame, special design)

No.	Designation
1	Melt pressure sensor (Gefran) / Melt temperature sensor (Gräf)
2	Compact cylinder with cover
3	Cooling water distribution
4	Dosing unit
5	Signal tower
6	Control panel

No.	Designation
7	Heating/cooling unit
8	Electrical area +K1 (rear)
9	Electrical area +K2 (front)
10	Motor / Gear in technical area +K3
11	Plug plate +E2
12	Material discharge incl. nozzle

2.3 Assemblies

2.3.1 Machine frame

The machine frame consists of a stiffened underframe, which is placed on the floor with 4 machine casters. The drive unit is in a technical area and is mounted on the frame.
The heating/cooling unit can be mounted on profile supports attached to the machine frame. In the standard configuration, the heating/cooling unit is located next to the machine.

All necessary plug connections such as for additional units are located on the side of the frame (Plug plate +E2, +E). The functions of plugs and connections are labelled accordingly. The extruder does not have a separate electrical cabinet as standard. The entire electrics are accommodated in a frame.

2.3.2 Drive

The drive consists of an electric motor and a reduction gear with axial bearing. The torque of the motor is transmitted to the gearbox input shaft via a coupling. The gearbox distributes the rotation speed to two gearbox output shafts. The gearbox has splash lubrication with temperature-monitored gear oil cooling. If the permissible temperature of 80 °C is exceeded, the drive switches off.

The extruder screws are connected to the gearbox via a sleeve coupling; the gearbox in turn is connected to the drive unit.

2.3.3 Process section

The process section of the extruder consists as standard of 8 barrels (zone 1 – 8), two screws and an outlet zone (consisting of material discharge section and nozzle, zone 9).
The barrel zones 1 – 8 can be heated and cooled, zone 9 can only be heated.

Zones 1 – 8 are equipped with two heating cartridges 265 W. Zone 9 is equipped with one heating cartridge (100 W).

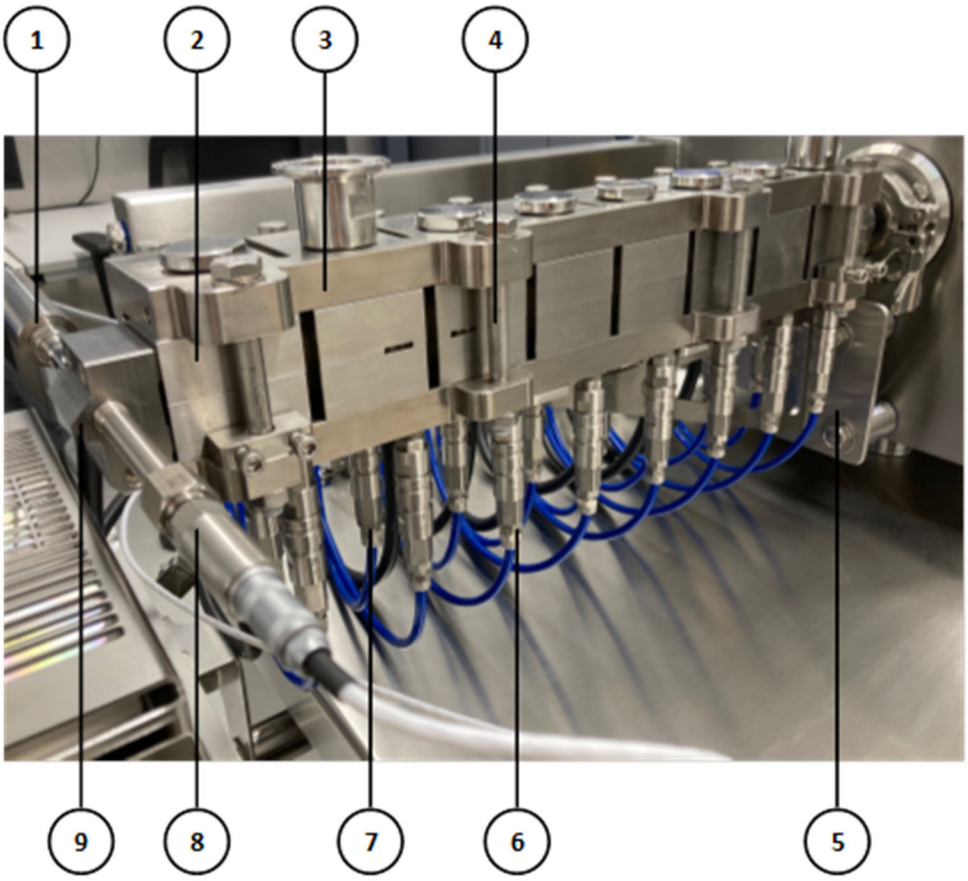


Figure 4 Process section

No.	Designation	No.	Designation
1	Melt pressure sensor	**6**	Cooling water supply
2	Cylinder upper/lower section	**7**	Cooling water return
3	C-profile	**8**	Melt temperature sensor
4	C-profile screws	**9**	Material discharge section with integrated nozzle
5	Cylinder support		

The heating/cooling zones are numbered consecutively. A temperature sensor (PT100 class B) measures the temperature in each zone. A control regulator switches the solenoid valves to regulate the heating and cooling. The water flow is stopped during the heating phase.
The solenoid valves are located in the technical area +E3.

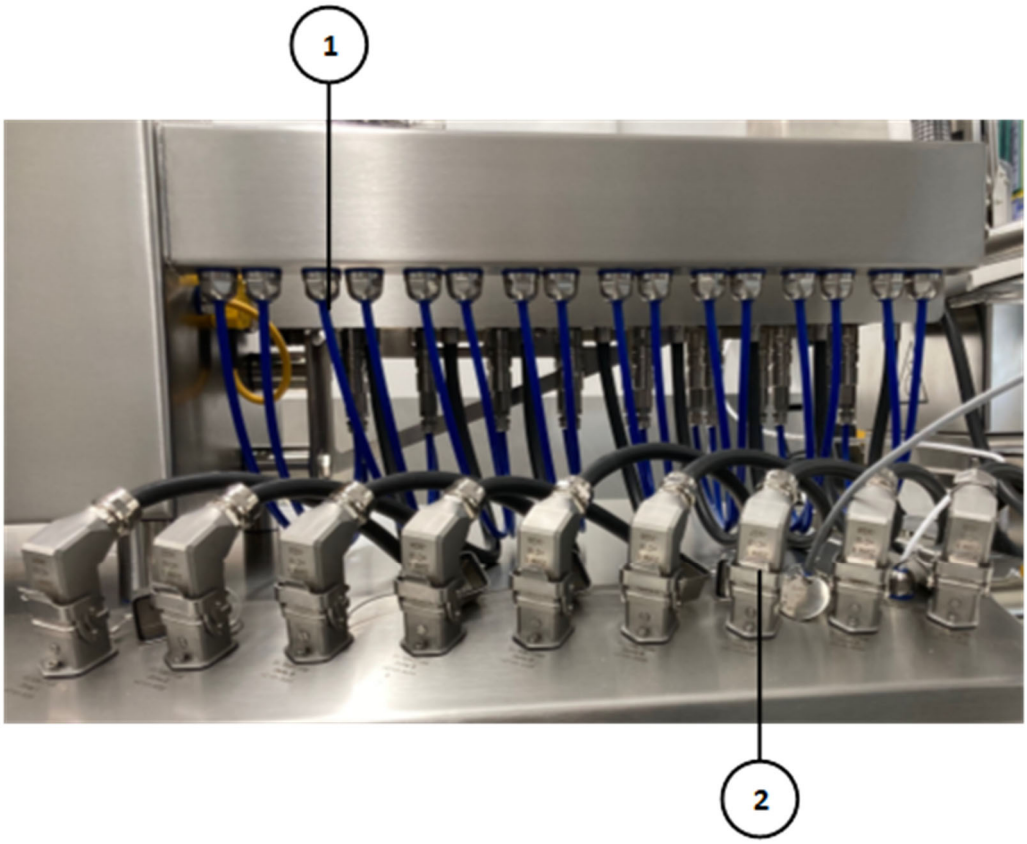


Figure 5 Process section viewed from behind. Cooling water distribution and heating cartridges

No.	Designation	No.	Designation
1	Cooling hose	**2**	Plug heating catridge/ temperature sensor combination

2.3.4 Cylinder

The cylinder has a compact design and consists of an upper and lower section. Both sections are held in a C-profile.

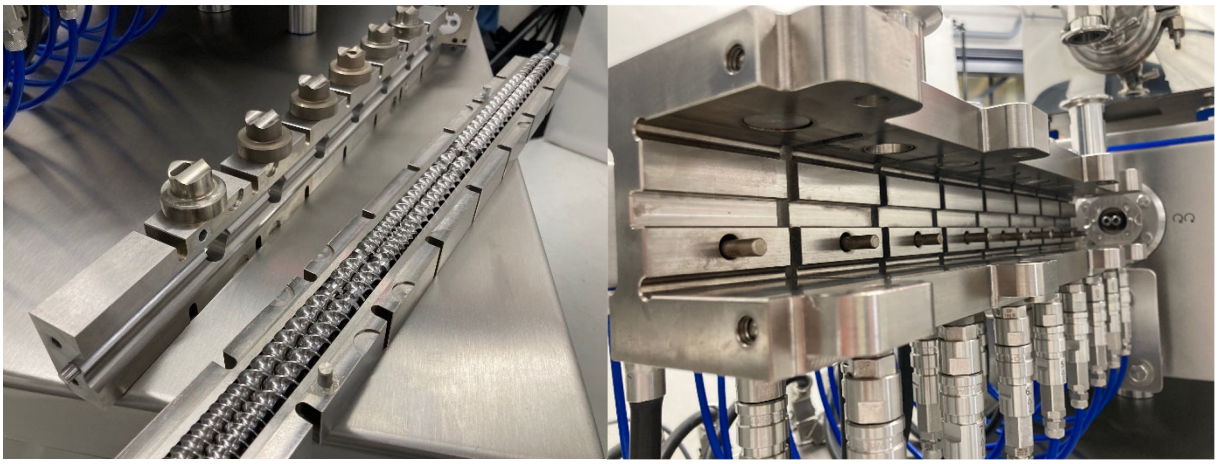


Figure 6 Cylinder opened, upper and lower section including closing inserts and inserts

The cylinder is constructed as follows as standard:
Zone 1: open, feed
Zone 2: open
Zone 3: open
Zone 4: open
Zone 5: open
Zone 6: open
Zone 7: open
Zone 8: closed

Zones are closed off by installing the closure inserts. A zone can be ventilated or a liquid injected by installing an insert.
The melt temperature sensor and melt pressure sensor connection are closed off with a closure piece.

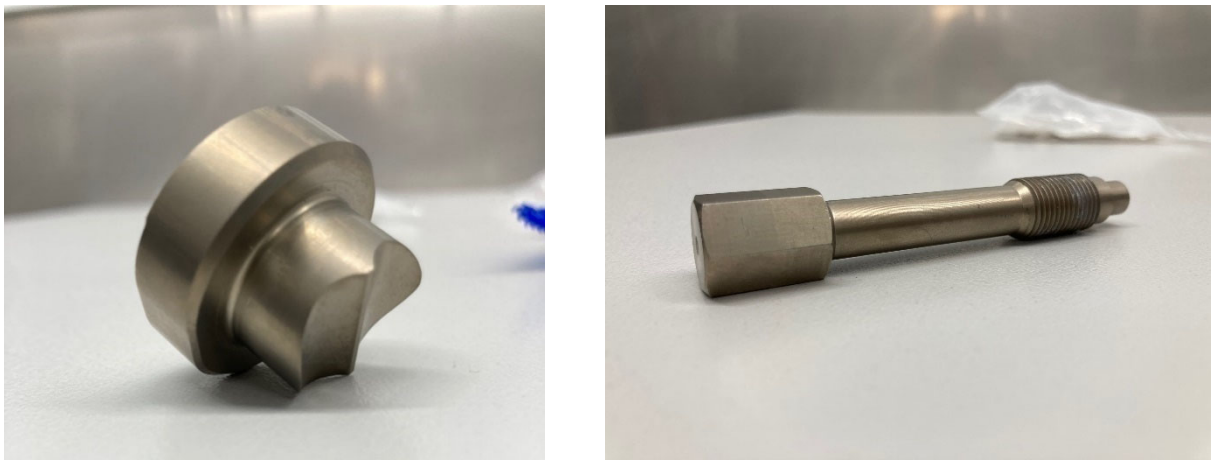


Figure 7 Closing insert zone (left). Closure piece injection zone and melt pressure sensor as well as melt pressure sensor connection (right)

2.3.5 Cover / contact protection

The cover must be installed on the compact cylinder as protection against contact.



Figure 8 Cover / contact protection

⚠WARNING!

Warning: Danger of burns!

- The cover is not cooled.
- Only touch the cover with suitable personal protection equipment (PPE)!

2.3.6 Latern

The screw and the drive unit are connected via a sleeve coupling i.e. the cylinder block is connected to the gearbox via the lantern.



Figure 9 Latern

2.3.7 Screw set

The screw set is designed as a segment screw set and is supplied fully assembled. It can be adapted depending on the barrel configuration and specific material conditions of the product (further details from the Service department at Leistritz). The individual elements are ground and polished. The screw shaft and screw elements have a spline shaft profile. The elements are fixed in place via this splined shaft profile. The elements are held together on the shaft via the screw tips.
The screw shaft ends are mounted on the gearbox via a sleeve coupling using toothed coupling sleeves.

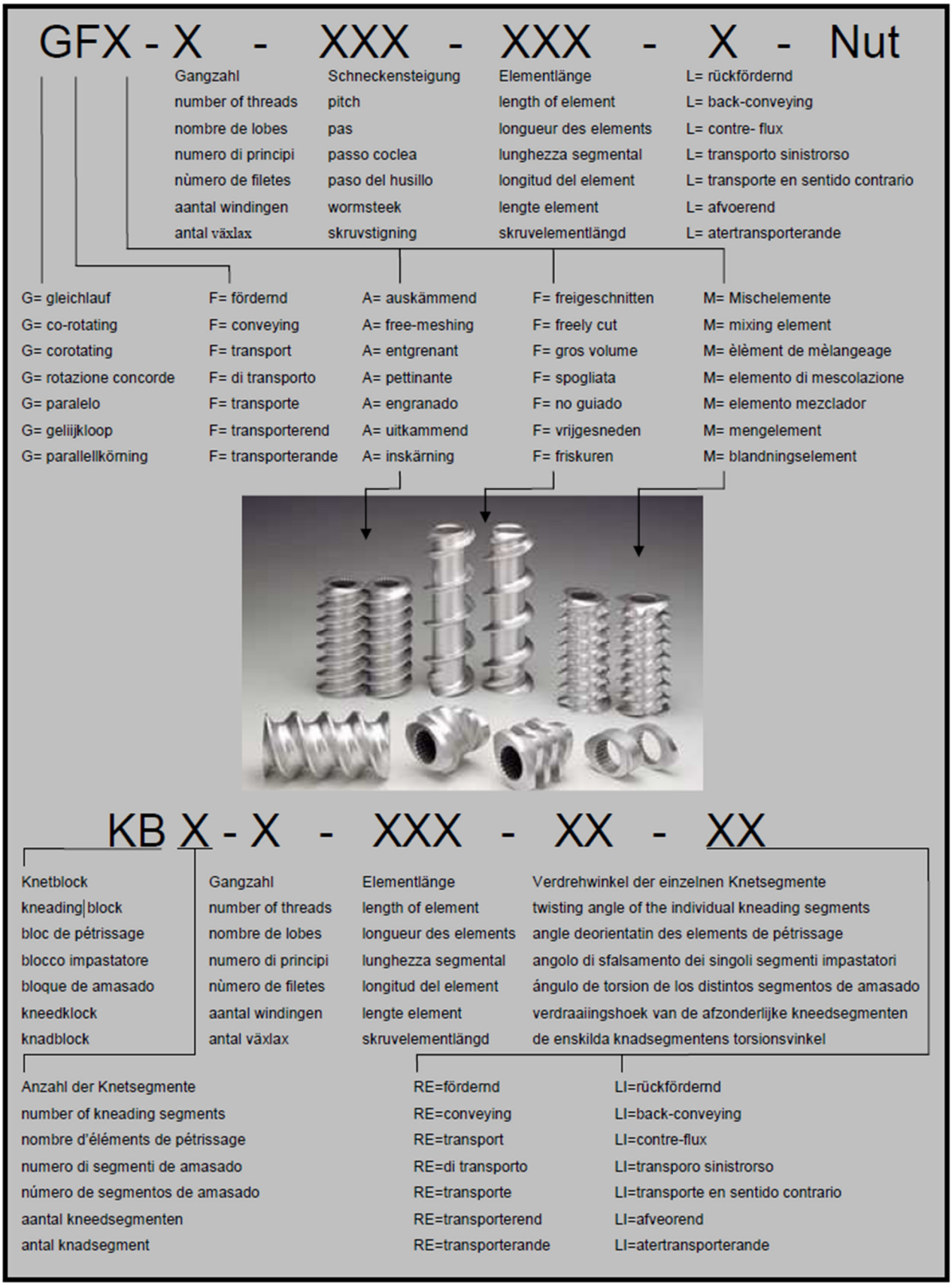
Take care during storage, transport and cleaning of the elements to ensure that the head ends of the screw elements are not damaged.

NOTE!

Attention: Damage to the screw!

- The mounted screw sets must never be turned backwards (back-conveying) because of the special spline shaft profile.

There are various screw elements:



2.3.8 Temperature sensors

The heating zones of the extruder each include a non-product-contacting temperature sensor (PT100 class B.
A melt temperature sensor is installed in the material discharge for measuring the melt temperature.
The temperature sensors are integrated into a component with the heating cartridges.



Figure 10 Heating catridges temperature sensor combination and installation in the zone

2.3.9 Melt pressure sensor

The melt pressure sensor (PIRZA) is a pressure sensor mounted flush in the material discharge section to measure the pressure of the melt.

The extruder switches off at a discharge pressure of 140 bar. This process is safety-relevant and the line must therefore not be in operation.



Figure 11 Melt pressure sensor (left in the picture

2.3.10 Melt temperature sensor

The melt temperature sensor (T201) is a temperature sensor that is mounted flush in the material discharge to measure the temperature of the melt.



Figure 12 Melt temperature sensor

2.3.11 Injection nozzle

An injection nozzle is installed by screwing it in to inject liquids into a zone.



Figure 13 Injection nozzle

2.3.12 Control panel

The machine is monitored and the process parameters are set on the control panel.



Figure 14 Control panel



- For further information on the control panel and the control system, see the manufacturer's operating instructions.

2.3.13 Main switch

The main switch is used to switch the system on and off. The main switch can be locked with a lock.



Figure 15 Main switch

2.4 Auxiliaries and tools

2.4.1 Screw tip wrench

The screw tip wrench can be used to tighten or loosen the screw tips.

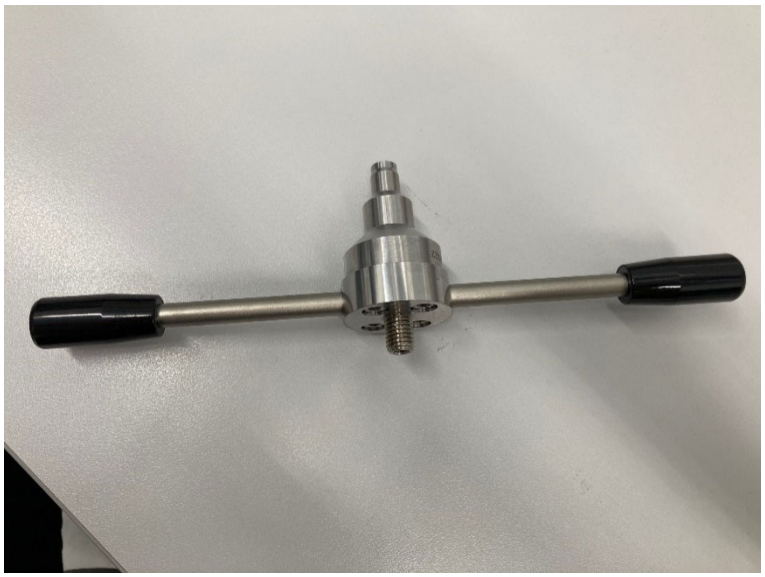


Figure 16 Screw tip wrench

2.4.2 Screw assembly device

The screw mounting device clamps the screw shafts in place, allowing the screw elements to be pushed onto the shaft or removed from it.



Figure 17 Screw assembly device

2.5 Additional components

2.5.1 Heating/cooling unit

⚠ WARNING!

Warning: Danger of burns!

By hot liquids spraying out when working on the heating/cooling unit!

- Assembly/disassembly work on the heating/cooling unit is not allowed to be carried out until the temperatures of all heating zones are less than 50 °C!



Wear personal protective equipment (PPE)!

The heating/cooling unit is connected to the extruder's power supply and can be operated via the display or the extruder's control system.
It has a water circuit and is used to provide temperature-controlled cooling water for zones 2-8.



Figure 18 View from the front of the heating/cooling unit and from the back

The device is connected to the fresh water/supply hose.
During the heating-up phase, the pressure of the heating/cooling unit should never drop unless the unit is switched off. The actual pressure can be read on the pressure gauge of the heating/cooling unit.

A temperature sensor measures the temperature in each zone. A controller switches the solenoid valves and stops the water flow during the heating phase. The cooling medium is supplied to and removed from the individual cylinder zones via PTFE hoses. A bypass between the flow and return prevents steam formation in the system's return flow.

⚠ CAUTION!

Caution: Risk of injury!

In heated state, all inlets and outlets of the heating/cooling unit are under pressure.

- Parts of the line exposed to pressure are only allowed to be dismantled after the pump has been switched off and the pressure gauge no longer indicates pressure!

To prevent corrosion and deposits in the heating/cooling circuit, certain requirements for the cooling water must be met:
The heating/cooling unit must only be operated with fully demineralized water.



- For further information on the heating/cooling unit, see the manufacturer's operating instructions.

2.5.2 Dosing of solids



Figure 19 Volumetric doser

The solids dosing unit (RX3000/RX3100) is an additional component for the extruder. The bulk material is transported manually to the funnel.
A motor in the doser drives the screw conveyors and the horizontal agitator (screw filler). The bulk material is transported in a constant stream via the screw conveyors. The speed of the screw conveyors is set via the control system. The feed screws can be replaced.



- For further information on the doser, see the manufacturer's operating instructions.

2.5.3 Dosing of liquids

The liquid dosing unit (RX4000) is an additional component for extrusion line.
The system consists of a dosing pump, a controller and a motor controller. The product is conveyed from the feed vessel via a pump hose, connected to an injection nozzle, into the corresponding zone (with hole).
The dosing performance is set via the operator interface using the speed of the dosing pump.



- For further information on the liquid dosing unit, see the manufacturer's operating instructions.



Figure 20 Peristaltic pump

2.5.4 Cooling conveyor belt



Figure 21 Extrusion line with cooling conveyor belt and granulator

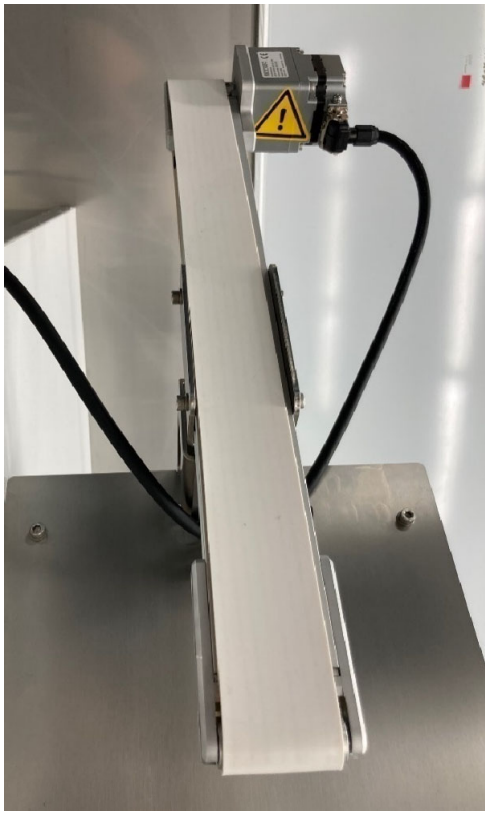


Figure 22 Cooling conveyor belt

The cooling belt is driven by a motor. The motor is controlled by a frequency converter installed in the technical area. The belt is made of FDA/EU-compliant material and is resistant to temperatures of up to 180 °C.
The target speed can be adjusted variably via the extruder control system.

The cooling conveyor belt (RX6000) is mounted on a metal plate, which is attached to the extruder frame. For this variant, the support plate must be mounted in the lower row of holes.

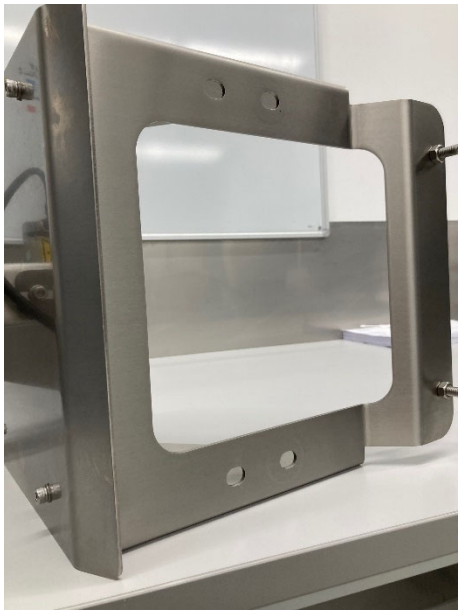


Figure 23 Support plate for installing cooling conveyor belt or drum cooler

It is height-adjustable by loosening or tightening the screws.
The cooling belt has 4 mm compressed air hose connections for connecting compressed air for cooling if required.



Figure 24 Compressed air connection cooling conveyor belt



- For further information on the cooling conveyor belt, see the manufacturer's operating instructions.

2.5.5 Pelletizer



Figure 25 Extrusion line with cooling conveyor belt and granulator

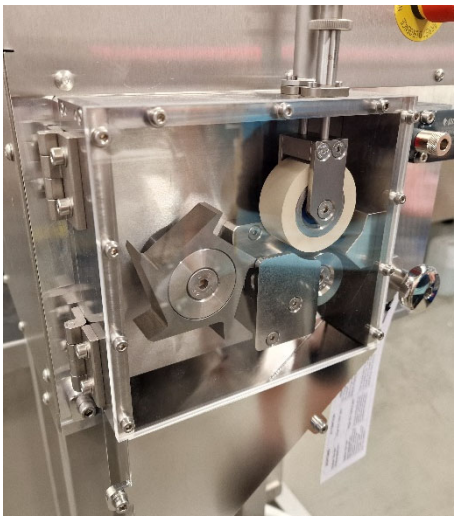


Figure 26 Pelletizer

The extrudate is transported to the pelletizer (RX7000) via the cooling conveyor belt (RX6000). The strand is manually fed into the pelletizer, rolled inside it and pelletized in the further step. The crushed product drops to the bottom. The target speed is variably adjustable via the operator interface.



- For further information on the pelletizer, see the manufacturer's operating instructions.

2.5.6 Drum cooler

The cooling roller can be installed on the trolley or on the sheet metal attached to the extruder frame.



Figure 27 Drum cooler connected to the extruder on the trolley



Figure 28 Drum cooler

The product exits the nozzle and falls/runs into the opening of the drum cooler's safety grid, hitting the centre between both drums (= drum gap). The drums are cooled.
The product is cooled and rolled by being pressed between the drums and exits at the material outlet. The drum cooler is driven by a motor/planetary gear, which in turn drives the drums. The motor is controlled by a frequency converter installed in the technical area.
The target speed can be variably adjusted via the extruder control system.

The cooling roller can be installed on a trolley (see illustration) or on a support plate.

Variant 1 trolley: The trolley must be screwed to the extruder frame.



Figure 29 Extruder frame attachment trolley or support plate

Variant 2 Support plate: The support plate is mounted on the extruder frame (same position as trolley). For this variant, the support plate must be mounted in the upper row of holes.

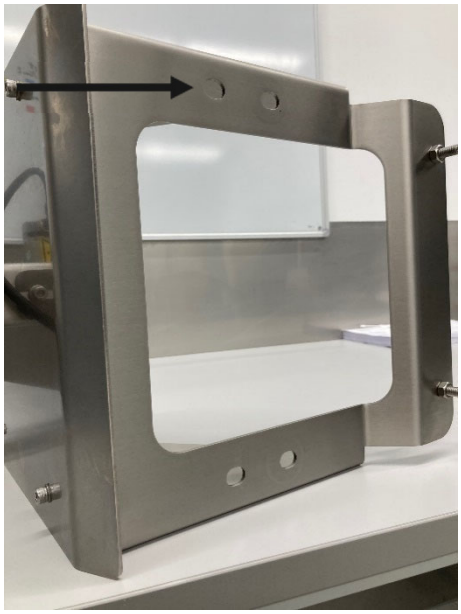


Figure 30 Support plate for installing cooling conveyor belt or drum cooler



- For further information on the doser, see the manufacturer's operating instructions.

3 Transport

3.1 Transport in packed condition

NOTE!

Damage due to improper transport!

- The extruder is only allowed to be lifted with a suitable lift truck.
- Transport is only allowed to be carried out by authorised personnel!



Wear personal protective equipment (PPE)!

The extruder is delivered on a wooden pallet. The extruder must only be transported in its packed state using a suitable lift truck.



Figure 31 ZSE 12

3.2 Transport in non-packed condition



Wear personal protective equipment (PPE)!

- The extruder is located on conveying rolls. Due to this fact it can be pushed in any direction.
- The extruder can also be transported with a suitable lift truck.

4 Assembly

⚠ WARNING!

Warning: Danger of injury!

Assembly and operation without personal protective equipment (PPE) can lead to injuries.

- Assembly and operation are only allowed by qualified personnel and with the use of personal protective equipment (PPE)!

4.1 Unpacking

NOTE!

Damage due to careless unpacking!

- Carefully unpack the machine by hand.

1. Carefully unpack the extruder.
2. Check the delivery for completeness and transport damage.
3. Immediately report any damage to Leistritz Extrusionstechnik and, if necessary, to the transport company.

4.2 Disposal instructions

HINWEIS!

The packaging material must be disposed of properly.

The following materials are used for packaging the extrusion line:

- Wood
- Paper/cardboard
- Plastic foils

The components must be separated and sorted by raw material for correct disposal in the appropriate container.

4.3 Requirements on the installation room

- The machine is only allowed to be installed in a closed room with a room temperature of min. 5 °C to max. 40 °C and on a flat, level floor with a compressive strength of the foundation of min. 200 kN/m².
- The concrete quality should be B25 (C30/35) or better, and the thickness of the reinforced - baseplate min. 20 cm.
- This reinforced concrete work must be carried out according to DIN 1045, EC2 or BS8110 (with CEP).
- The relative atmospheric humidity at the installation site is not allowed to exceed 80%.

4.4 Setting up and aligning the extruder

The extruder is only allowed to be aligned using the machine casters! The barrel support on which the process section is supported is not allowed to be adjusted!

The extruder is supplied fully aligned. The drive unit with the motor as well as the process section are mounted in precise alignment with the gearbox.



Figure 32 Casters of the ZSE 12

1. To align the extruder, move the unit to the desired position.
2. Finally, tighten the brakes on the casters.

4.5 Establishing the electrical connection

The electrical connection of the extruder is only allowed to be carried out by qualified personnel.



For more information, see the extruder wiring diagram.

4.6 Connecting heating/cooling unit

⚠ WARNING!

Warning: Danger of scalding!

Cooling water and/or steam spraying out can cause serious injuries.

- Keep the slide valve closed during operation.
- Open the slide valve for filling or venting only at temperatures below 70 °C



- For further information on the heating/cooling unit, see the manufacturer's operating instructions.



Figure 33 Heating/cooling unit connections

All connections of the heating/cooling unit are labelled and marked with symbols.

1. Connect the heating/cooling unit to the machine.

4.7 Assembling the segment screw

Push the two shaft ends into the assembling device with the groove in the tooth profile on the outside (**1**) and tighten the bolts (**2**).

1. Pull the screw elements in pairs onto the shafts.

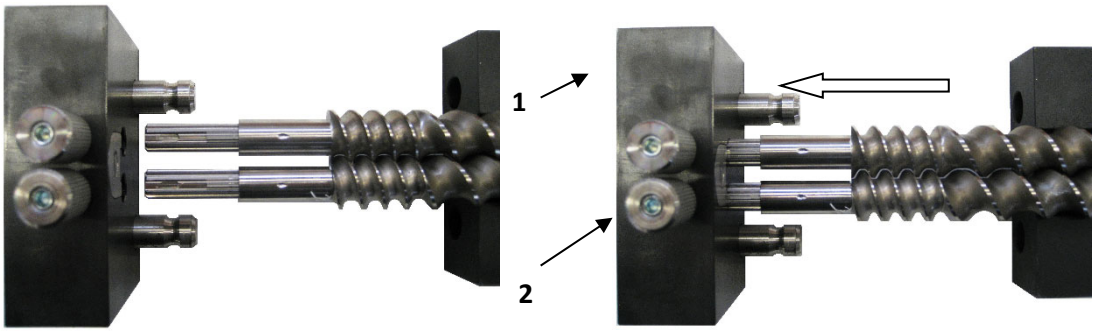


Figure 34 Installation of segment screw

- In the case of co-rotating screw elements, the marking must point in the direction of the extruder gearbox.
- The initial elements of the screws must be pushed on with an offset of 90° to one another.
- All elements of the screws must be pushed on so that the flat surface is in contact with the following screw element.
- Mount the first/end kneading discs so that the ground stage points towards the centre kneading disc or the flat surface is in contact with the following screw element (see Figure 18).
- The kneading discs must always be installed in the order of the first, center and end kneading discs, in which case the number and angle of the center kneading discs can be freely varied.

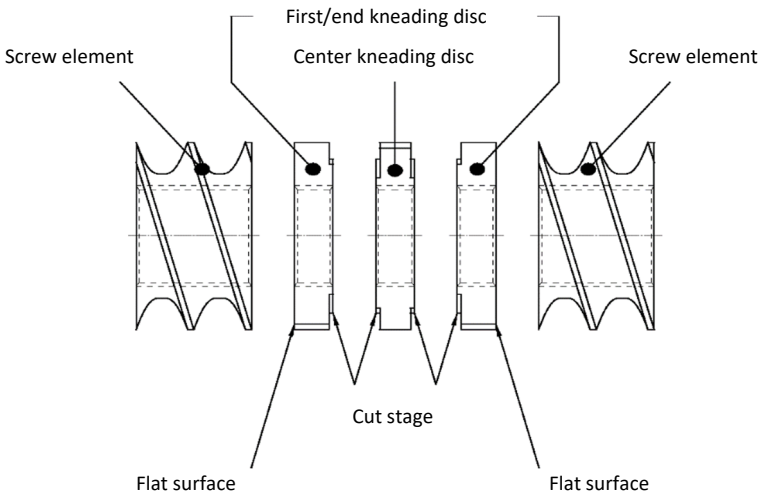


Figure 35 Installation of screw elements

4.8 Tightening the screw tip

After having mounted the last screw element's pair, the screw tip is to be tightened with the screw tip wrench as follows:

1. Place the screw tip wrench on the screw tip.
2. Hold lever (**5**) firmly and clamp the clamping part onto the screw tip by turning the screw (**7**) clockwise.
3. Tighten the screw tip with the lever (**5**).
4. After that, heat up the screw set to operating temperature and allow it to heat through completely.
5. Tighten the screw tips again until hand-tight.

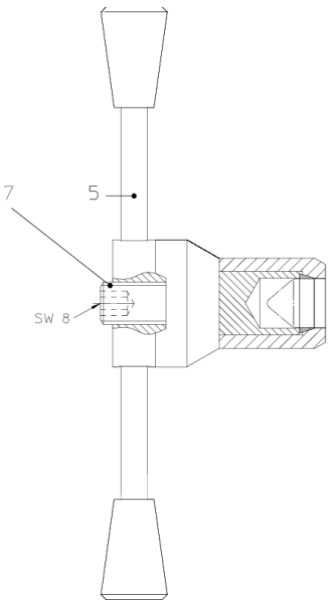


Figure 36 Screw tip wrench

Both screw tips with left-hand thread!

4.9 Installing screw in the barrel

1. Place the Tri-Clamp between the barrel block and the gearbox and tighten it.
2. Insert the barrel block into the C-profile.
3. Tighten the screws of the barrel block.
4. Insert the screw pair into the extruder.
5. Insert the grub screws.
6. Insert the cotter pin between the screw pair.

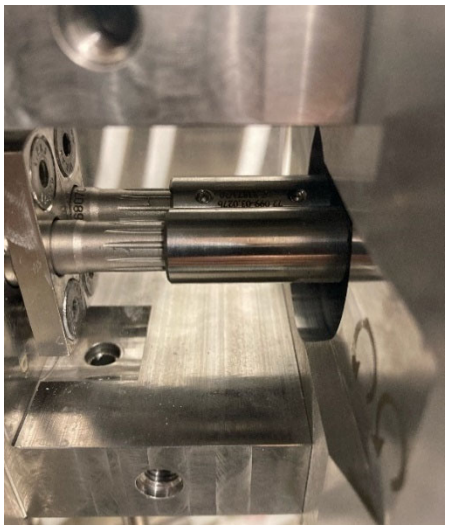


Figure 37 Grub screws

4.10 Installing barrel

Insert the closure and filling attachments into the corresponding position in the cylinder block.



Figure 38 Cylinder with closure inserts

4.11 Installing the injection nozzle

Grease the screws with high-temperature assembly paste beforehand!

1. Remove the closure insert
2. Install and screw in the injection nozzle
3. Install and screw in the Luer-Lock adapter and hose adapter



Figure 39 Injection nozzle with Luer-Lock and hose adapter installed

4.12 Connecting supply/return of the heating zones and temperature sensor



Figure 40 Heating hose connections

All connections for the supply/return are labelled and marked with symbols. The connections are self-sealing. They are quick-release couplings.

1. Establish supply and return of the heating zones.

NOTE!

Attention risk of confusion!

Incorrect installation will affect the cooling capacity or the temperature in the zone.

When installing, ensure that the symbols are correct – install the supply arrow on the supply arrow / install the return arrow on the return arrow.
When installing, ensure that the zones are assigned correctly!

4.13 Connecting the heating cartridge/temperature sensor combination



Figure 41 Heating cartridge/temperature sensor combination

All heating cartridge/temperature sensor combinations have a labelled plug.

1. Install the heating cartridge/temperature sensor combination in the cylinder.
2. Connect the heating cartridge/temperature sensor combination plug.



Figure 42 Plug for the heating cartridge-temperature sensor combination

NOTE!

Attention risk of confusion!

Incorrect installation will affect the temperature in the zone.

- Ensure correct zone assignment during installation!

4.14 Installing segment screw

Make sure that both screws are installed with the identical structure.

- To check correct installation, make sure there is a clean transition of the elements and that the space between both screws remains even.
- For checking, both screws are taken out of the mounting fixture and rolled along a clean, level table closely together.
- Given correct mounting, no resistance should be felt during rolling

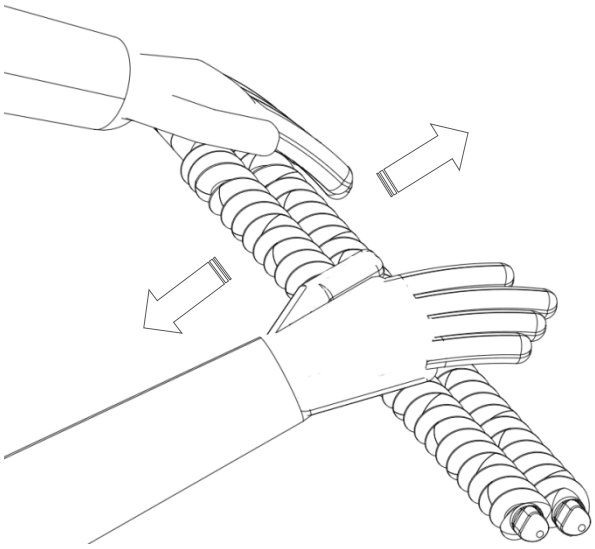


Figure 43 Placing a screw pair together

1. Place screw pair together correctly.



2. Push screw pair in the 8-bore of the barrel.

Make sure that the screw shaft sealing is not damaged.

3. Insert the screw shafts into the sleeve coupling using the screw tip wrench. Turning both screws in the direction of rotation, until the shafts engage in the sleeve coupling.

4. Insert the split pin for axial securing of the screws.

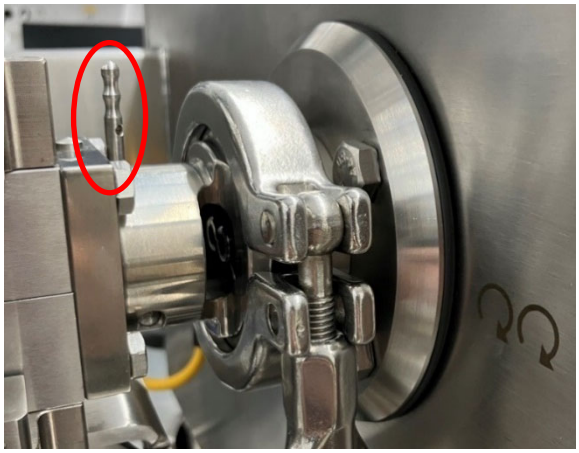


Figure 44 Splint pin for axial securing of the screws

The screws must be able to be pushed easily into the holes and coupling. They are not allowed to be forced in.

5. Check installation: Screw tips must not be axially offset.

4.15 Material discharge / Mounting the die

1. The cylinder and screw pair are correctly installed.
2. Install the material discharge part with integrated die.
3. Connect the melt pressure sensor to the die.
4. Connect the melt temperature sensor to the die.

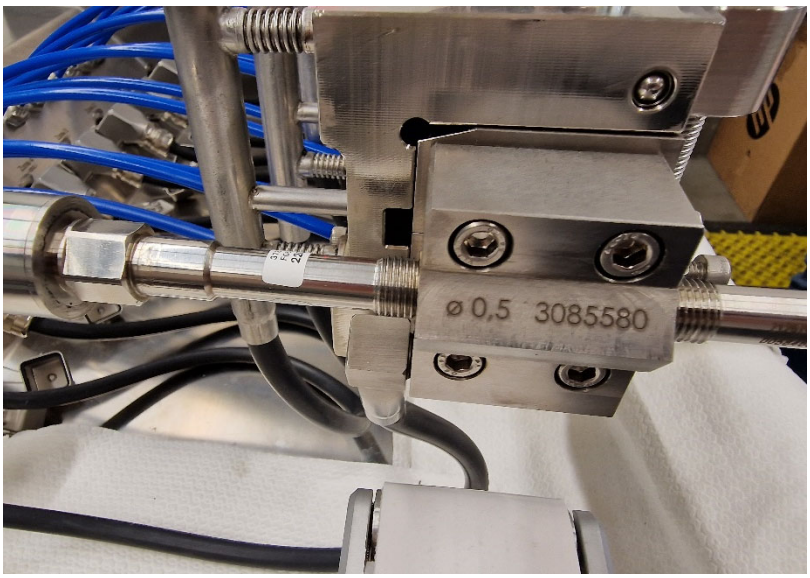


Figure 45 Die with connected melt pressure and melt temperature sensor

4.16 Further assembly work



Wear personal protective equipment (PPE)!



- For further information, see the manufacturer's operating instructions.

1. Put on the cover.
2. Check the supply and return connections of the heating/cooling unit.
3. If necessary, install closure inserts (close off zones, ventilation, injection nozzle, feed adapter).

4.17 Mounting additional components

4.17.1 Establishing electrical connections to peripherals

The connector panel +E2 is located on the side of the extruder. The RX13000 drum cooler (2 connectors!), RX4000 liquid dosing unit, RX6000 cooling belt and RX7000 granulator are connected here.

Furthermore, the technical area for connecting the heating/cooling unit is located at the front of the extruder on the side (see Chapter 4.6).



Figure 46 Technical area for connecting heating and cooling unit

Behind the +E3 technical area is the slot for connecting the RX3000 dosing unit.



Figure 47 Connection dosing unit

4.17.2 Installing the dosing unit

1. Place the dosing unit on the gear section or just above zone 1.
2. Establish electrical connection
3. Align horizontally
4. Install dosing screws
5. Install outlet, connect filter to extruder material feed



Figure 48 Assembly of the dosing unit

4.17.3 Installing the cooling conveyor belt

NOTE!

Attention!

- The conveyor belt must not touch the extruder nozzle.
- The cooling conveyor belt could be damaged!

Assembly process:

1. Mount the guide rail of the cooling conveyor belt on the support plate.
2. Attach the support plate to the extruder frame.

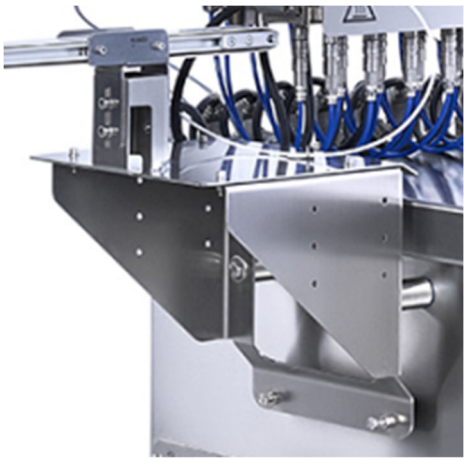


Figure 49 Assembly of the cooling conveyor belt

3. Place the conveyor belt in the rail.
4. Set the desired height.
5. Tighten both nuts with a wrench.
6. Establish the electrical connection.



Figure 50 The screws of the guide rail

4.17.4 Installing the pelletizer

1. Position the pelletizer on a process line with the cooling conveyor belt.
2. Establish electrical connection.

4.17.5 Installing the drum cooler

The drum cooler can be installed on the trolley or on the support plate attached to the extruder frame.

1. Install the support plate or attach the trolley to the extruder frame
2. Attach the drum cooler
3. Install the protective cover/tamper protection on the cover
4. Establish the electrical connection



Figure 51 Tamper protection drum cooler

NOTE!

Attention! Safety contact

- The tamper protection is equipped with a safety contact!
- The drum cooler must not be operated without the tamper protection fitted.

5 Commissioning

⚠ WARNING!

Warning: Danger of injury!

Due to incorrectly installed safety devices.

- Operate extruder only with safety devices installed.
- Replace damaged or missing safety devices.
- Safety devices must not be tampered with.



Wear personal protective equipment (PPE)!

5.1 Check before commissioning / Operational readiness

- ✓ Have all lubricant levels been checked?
- ✓ Are all water inlets and outlets connected?
- ✓ Have all electrical connections been established?
- ✓ Have heating catridges/temperature sensors been assigned to the correct heating zones?
- ✓ Have cylinders been installed correctly and in accordance with the application?
- ✓ Are the screws assembled correctly and the screw tips tightened?
- ✓ Screws installed – Is the direction of rotation of the screws correct?
- ✓ Material discharge installed with melt pressure and melt temperature sensors connected?
- ✓ Is the dosing unit ready for operation?
- ✓ Is the heating/cooling unit ready for operation?
- ✓ Have the product collection container or downstream systems been provided?
- ✓ Have all safety devices been installed?



The extruder must be kept clean and external deposits must be removed.

6 Operation

⚠ WARNING!

Warning: Overheating!

Improper operation can lead to overheating and thus to injuries.

- The extruder is only allowed to be operated when fully assembled.
- All components are checked for completeness by the owner-user in accordance with the process instructions.

The extruder must be kept clean and external deposits must be removed.

6.1 Starting the extrusion process

NOTE!

Attention: The extruder could be damaged!

- The extruder must not be run without material!

For further information on the operation of the control panel, see the manufacturer's operating instructions.

For further information on the dosing unit, see the manufacturer's operating instructions.

1. Extruder is ready for operation.
2. Switch on main switch.
3. Switch on the control voltage at the control panel.
4. When the computer has started up, enter logon data and log on.
5. Define process parameters (see manufacturer's operating instructions).
6. Set/test/calibrate dosing unit (see manufacturer's operating instructions).

The extraction system must be switched on at this time. (If available)

NOTE!

Attention: The dosing unit could be damaged!

- Do not empty the dosing unit during operation.

⚠ WARNING!

Warning: Danger of injury!

Improper filling of the dosing unit can lead to injuries.

- Only fill the dosing unit when standing on a suitable climbing aid.

Make sure that the material is not spilled. If necessary, clean the workplace immediately

7. Fill the dosing unit using the funnel.
8. Make sure that no alarm messages are displayed, if necessary, reset all or acknowledge alarm.
9. Switch on the heating/cooling unit.
10. Allow the extruder to heat up (observe the heating-through time).
11. Start the extruder.
12. Start dosing units.

⚠ WARNING!

Warning: Danger of burns!

Melt spraying out at the nozzle head can cause burns and serious injuries.

- Do not stand behind the extruder or directly next to the nozzle head during the extrusion process.

NOTE!

Attention: The extruder could be damaged!

During the extrusion process, melt can spray from open barrels.

- Stop the extrusion process and determine the cause of the melt spraying out.
- Pay attention to unusual noises and the process parameters in the control panel.

NOTE!

Attention: The extruder could be damaged!

- Do not rest on the weigher during the extrusion process (if gravimetric dosing is included in the scope of delivery).

6.2 Ending the extrusion process



If automatic operation is active, the extruder is automatically emptied and switches off automatically. However, all heaters remain switched on!

1. Empty the extruder and dosing unit.
2. Empty the dosing unit if necessary.
3. Pour approved cleaning agent into the main feed opening and clean the extruder. For this purpose, please contact the Service department at Leistritz if necessary.
4. Switch off all units.
5. Switch off the heating/cooling unit.
6. Turn off cooling water.
7. Clean the line and remove melt residues.
8. Remove the segment screws when they are at operating temperature.
9. Remove barrel.
10. Switch off peripheral devices.
11. Switch off the main switch and the visualization system, the controller automatically shuts down.

6.3 Overload



If the drive is blocked and the current consumption of 100% is reached, the extruder switches off (e.g. with blocked screws). Prior to switching back on, the cause of the blockage/overload must be eliminated otherwise the drive, gearbox and screws could be damaged.

Possible measures for rectifying blocked screws:

1. Extend heating time.
2. Select higher temperature.
3. Run the extruder until it is empty.
4. Remove nozzle.
5. In case of overfilling of the feed barrel: Remove material.

7 Error cause and elimination

DANGER!

Danger: Risk of accident!

Correcting malfunctions on a device in operation can lead to serious accidents.

- Only carry out activities on the unit when it is switched off and secure the main switch against being switched on again.

Fault	Cause	Remedy
Extruder shuts down	Emergency stop has been pressed	Unlock emergency stop
	Main switch set to “0”	Main switch set to “ON”
	Low power safeguard (set value) undershot	Extrusion line must be re-started
	Oil temperature too high	See oil temperature fault
	Overheating of the motor	Water-cooled motors: check the cooling lines, repair bearing damage Air-cooled motors: Clean motor (only at standstill), repair bearing damage
	Extruder overdosed	Turn feed unit off and run extruder until it is empty, feed less material into the extruder, i.e. turn feed units down. If the screws are blocked: 1. Pull screws 2. Clean screws 3. Install screws 4. Switch on extruder
	Melt pressure too high, melt temperature too low	Check thermal sensors for faulty cables/contact, replace defective thermal sensors, replace defective heating elements, check functioning of heating/cooling unit (see annex), check parameter settings, check functioning of heating/cooling unit solenoid valves and replace, if necessary, increase heating up time
	Electrical fault	Check fuses, replace if necessary. All other work to the electric system may only be carried out by qualified electricians
	Downstream unit has shut down	For troubleshooting, see the unit manual

Fault	Cause	Remedy
Decrease in quality and output	Fault in one or several heating zones	Check heating elements, check thermal sensor fitting, check electric contact, check functioning of the solenoid valves in the heating/cooling unit and replace if necessary
	Clogging in the feed section	Establish or increase cooling water supply to feed barrel, reduce quantity being conveyed by feed unit
	Heating/cooling unit defective	For further information on the heating/cooling unit, see the manufacturer's operating instructions
	Permanently high cooling water temperature	Establish water supply
	Screw and/or barrel worn out	Replace screw segment and/or barrel
Conveyed material emerges at the gearbox side	Screw shaft seal is worn out	Replace the screw shaft seal
Conveying quantity decreases	Barrel and/or screws are worn out	Measure the barrel and screws and replace them if necessary
Error (emergency stop) cannot be acknowledged	Emergency stop active	- Check all emergency stop switches in the entire system to see if they have been triggered -Check the plugs of additional units and plug them in if necessary - Press “Reset all” in the alarm window

8 Cleaning

Cleaning means the manual cleaning of components and surfaces by prior disassembly.

DANGER!

Danger: Risk of accident!

Performing cleaning work when the unit is switched on can lead to serious accidents.

- Only perform cleaning work on the unit when it is switched off, and secure the main switch against being switched on again.

NOTE!

Attention: Damage to property if the extruder is not cleaned!

- Never take the extruder out of operation without cleaning it. The product hardens. The extruder must be reheated for cleaning. This can cause product residues to burn in.

Aggressive cleaning agents damage the line and pose an elevated accident risk. Always comply with the following points to avoid any damage and accidents.



Only use suitable cleaning agents to clean the individual parts of the extrusion line. For this purpose, please contact the Service department at Leistritz if necessary.



The extruder must be kept clean and external deposits must be removed.



Wear personal protective equipment (PPE)!

Generally:

- The following parts can be cleaned in an ultrasonic bath: Individual screw elements (without shaft), barrel halves, barrel fittings, nozzle and material outfeed part, dosing tools, vertical pipe, agitator as well as funnel and cover.
- The existing national accident prevention regulations must be heeded as well as any internal standard operating procedures and safety regulations issued by the owner.
- Only clean the line after it has been turned off.
- If necessary, clean the line with compressed air.
- Relieve the pressure in all pressurised systems before carrying out any cleaning work.
- Only clean the line with a suitable cleaning agent. For this purpose, please contact the Service department at Leistritz if necessary.
- Make sure that no cleaning agent residues remain adhering on the parts that come into contact with the product to be processed.
- Only clean with a low-pressure air jet in the area of the motors.
- Use a damp cloth and customary cleaning agents to remove any external soiling.
- Moisture must not be allowed to reach electrical components.
- Never use sharp tools.
- Ensure that all safety and protection devices have been refitted and restarted as soon as the cleaning work is finished.

8.1 Procedure for cleaning

1. Run the extruder empty (when warm, immediately after the process).
2. Switch off the main drive.
3. Remove melt residues.
4. Remove the screws when they are at operating temperature.
5. Clean metal parts soiled with melt residues at operational temperature.

8.1.1 Removing segment screw

NOTE!

Attention: Risk of damage!

- The segment screw is only allowed to be removed at operating temperature.
- Cooled and/or hardened melt could cause damage to the nozzle head and screw tip.



Wear personal protective equipment (PPE)!

1. Make the feed barrel accessible from the top (swivel aside the dosing unit).
2. Empty out extruder and switch off the main switch if this has not already been done.

Dismantle the melt pressure sensor at operating temperature and disconnect it from the connector. This prevents the screw from restarting.

3. Remove the cover hood.
4. Pull out the splint pin (see Figure 54).

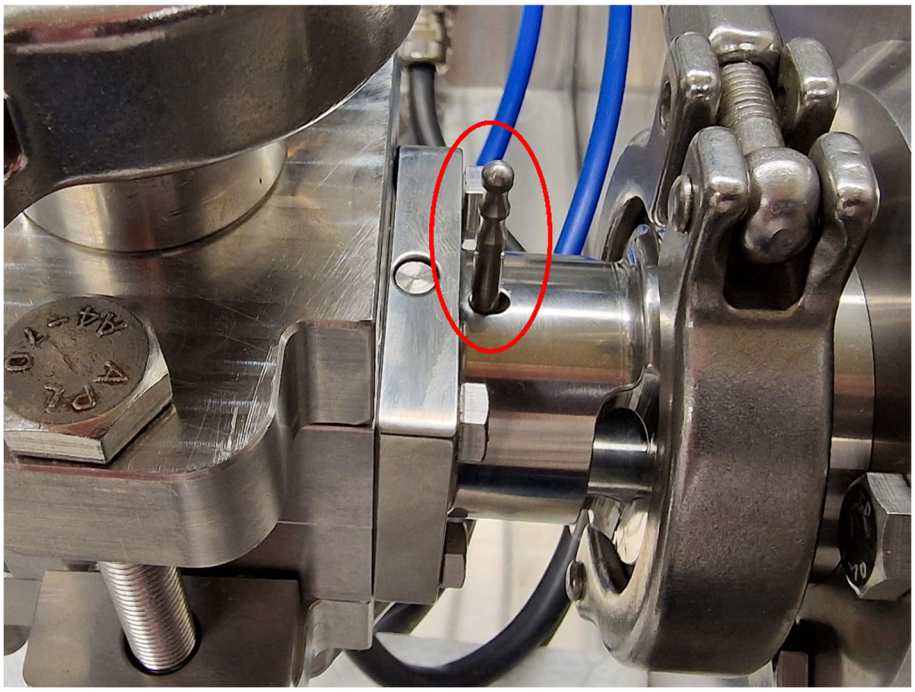


Figure 52 Splint pin

5. Remove material discharge part or die head. Both components should be at operating temperature.

Release the axial screw lock each time before installing or removing the screw.

If no screw extraction device is available:

1. Use a lever with aluminium, copper or brass tip to press the screws through the filler hole in conveying direction.
2. Clean the screw pair continuously with a brass brush to remove melt residues.
3. Slowly pull the screw pair out of the barrel with the screw tip wrench and mount in the screw mounting device.
4. Clean the barrel and screw set with a round brass brush (distilling tube brush).

When cleaning the screw, ensure that all screw elements are removed from the screw shaft and that the screw shaft is cleaned separately from the screw elements.

8.1.2 Loosening screw elements from shafts

Loosening the screw elements from the shafts demands a corresponding feel for the respective materials. This is because melt can penetrate between the individual elements and cause adhesion between the screw shaft and screw element. But this happens to differing extents and depends on many factors. As a general rule, the longer a machine operates with worn and/or damaged screws, the harder it is to loosen the elements. Problems can also occur if the screw tips were not tightened last time the screws were fitted.



Wear personal protective equipment (PPE)!

⚠ CAUTION!

Caution: Risk of burns!

Due to temperatures above 60 °C at the process section.

- Wear personal protective equipment (PPE)!

Prerequisite: The screw must be at operating temperature.

The basic method for loosening the screw elements is as follows:

1. Unscrew the screw tip. Attention: both tips have a left-hand thread!
2. Loosen elements immediately after cleaning the outer surfaces.

If melt has penetrated between individual elements, the screw must be at operating temperature during disassembly. If the screw set has already cooled down, it must be pushed back into the extruder barrel and heated through.

3. Fix the screw horizontally and pull the individual elements from the shaft.
4. Only ever loosen screw elements individually.
5. Clean the screw shaft, this makes it easier to loosen the next element.

If this is not possible, contact the Leistritz Service department for assistance.

Never strike directly with a hammer against a screw element.

If a screw set has not been dismantled for a very long period of time, it will be very difficult to remove the elements. It is therefore advisable to dismantle and clean the screws at regular intervals.
Once the screw elements have been cleaned, inspect them for hairline cracks, notches or grooves. Smaller notches or grooves can be polished out.

Measure the diameters of the screw elements and check them for wear. Record the measured values and compare them with the previous measurement. In this way you can determine the individual wear behavior of your screw. Take advantage of the experience of the Service department at Leistritz with special tools for measuring screws and barrels.

If an element is visibly damaged, it must be replaced. Always replace screws in pairs, i.e. the damaged one and the element on the second shaft in the same position. If a damaged element is not replaced, it could destroy shafts, barrels and even the gearbox.

8.1.3 Removing and disassembling barrel



Wear personal protective equipment (PPE)!

NOTE!

Attention!

The barrel is removed up to step 7 at operating temperature.

1. The extruder has been run empty, the main drive has been switched off and the segment screws have been removed.
2. The heating and cooling connections have been removed.
3. Loosen and remove the connecting clamp between the gearbox and the cylinder.

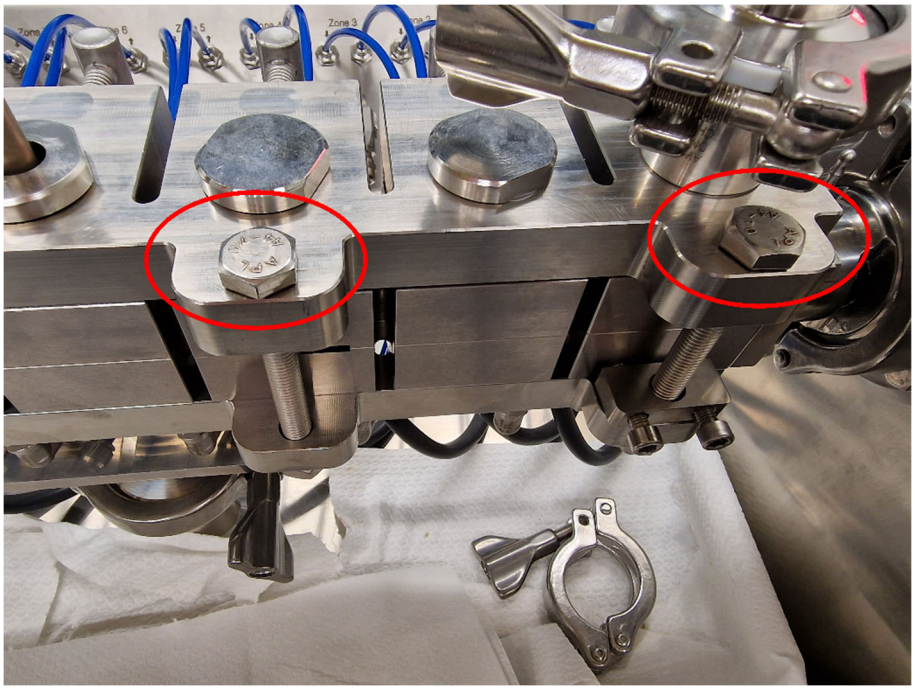


Figure 53 Clamping screws of the C-profile

4. Loosen the clamping screws of the C-profile
5. Remove the barrel block.

9 Maintenance

DANGER!

Risk of electric shock!

Electrical shocks can cause serious injury or death.

- Switch off the extruder before working on the electrical system and secure it against being switched on again!
- All work on the electric system is only allowed to be carried out by a qualified electrician.

WARNING!

Warning: Danger of crushing!

Rotating parts can crush or pull in body parts and cause serious injuries.

- Switch off the extruder before carrying out any maintenance, conversion, servicing or cleaning work and secure it against being switched on again!
- Do not reach into rotating parts by hand!



The extruder must be kept clean and external deposits must be removed.



Wear personal protective equipment (PPE)!



For maintenance and servicing measures of the components (peripheral devices), see the manufacturers' operating instructions.

The service life and operational safety of the extruder depends to a great extent on regular maintenance and care. This includes in particular on-going lube checks and compliance with the maintenance intervals.

9.1 Maintenance plan

The functionality of the line strongly depends on the maintenance and care of the machine. Perform visual inspections of the extruder at regular intervals. Particular attention must be given to leaks on the gearbox and the heating/cooling unit. Replace worn out parts in due time.

Also check the extruder screws and barrels for signs of wear and tear at certain intervals. The wear-and-tear behaviour of screws and barrels depends on a great many different parameters (wear protection of screws and barrels, materials being used, operating conditions, ...) so that the inspection intervals can vary greatly; it is therefore not possible to state an exact number of operating hours here. The first inspections must therefore be carried out at shorter intervals (e.g. after 3,000 and 6,000 operating hours) to ascertain the specific wear-and-tear behaviour of a line. The inspection should be carried out by a service technician from Leistritz Extrusionstechnik GmbH. The technician produces an inspection report that can be used to define the subsequent servicing intervals. We advise always replacing worn out parts in good time to warrant a constantly high output rate with unchanged product quality.

All of the following actions are mandatory. The intervals are defined for continuous operation. If the maintenance intervals are changed, consult with Leistritz.

Component	Action	Interval
Screws and barrels (Mechanical qualified staff)	Measurement, wear test	12 months (The wear-and-tear behaviour of screws and barrels depends on a great many different parameters (wear protection of screws and barrels, materials being used, operating conditions, ...) so that the inspection intervals can vary greatly; it is therefore not possible to state an exact number of operating hours here. The first inspections must therefore be carried out at shorter intervals to ascertain the specific wear-and-tear behaviour of a line.)
	Visual inspection for damage	For each installation and removal
Bushing (Mechanical qualified staff)	Visual inspection, check sealing	Every week
	Retightening	If leakage was observed
	Replace	If required (if retightening is no longer possible) or after 5 years
Barrel heating/cooling unit (Mechanical qualified staff)	Visual inspection for tightness	Every working day
Cables and connectors (Mechanical qualified staff)	Visual inspection for damage	Every week
Zone temperature sensor (Mechanical qualified staff)	Functional test incl. calibration	At least every year Calibration according to customer definition
	Visual inspection for damage	Every week

Component	Action	Interval
Melt pressure sensor (Mechanical qualified staff)	Functional test incl. calibration	At least every year Calibration according to customer definition Testing safety device 140 bar
	Visual inspection for damage	Every week
Melt temperature sensor (Mechanical qualified staff)	Functional test incl. calibration	At least every year Calibration according to customer definition
	Visual inspection for damage	Every week
Extruder gearbox (Mechanical qualified staff)	Check oil level, top up if necessary	Every working day
	Visual inspection for tightness	Every working day
	Oil change	First oil change after 600 operating hours Further oil changes depending on operating hours: 5000 h or 12 months Visual assessment and/or oil analysis if necessary
	Acoustic check for unusual running noises	Every working day
	Visual inspection for damage	Every week
Extruder surface, frame (Mechanical qualified staff)	Visual inspection for damage	Every week
	Cleaning	According to the customer's hygiene plan
Electrical cabinet integrated into the machine frame (Electrical qualified staff)	Clean frequency inverter/ IPC fan	Every year
	Visual inspection for damage	Every year
Tri-Clamp seals (Mechanical qualified staff)	Visual inspection for damage	Every working day
	Replace	At least every year
Panel PC incl. software (Electrical qualified staff)	Visual inspection for damage	Every week
	Software maintenance	Backup, disaster recovery, ... corresponding definitions of the customer

The bearings of the gearbox are designed for a service life span of approx. 20,000 hours. Please see the manufacturers' operating instructions for the maintenance intervals of the additional units.

It can be assumed as an approximation that after the second screw replacement, the barrel will also have to be checked and possibly replaced if the overall throughput of the line or the product quality have significantly deteriorated (e.g. 10% less output compared to the new line) even before the aforementioned wear limits are reached. Under normal conditions, wear in the processing part affects the screws 2/3 and the barrel 1/3.

9.2 Gear oil change



For further information on the gearbox, see the manufacturer's operating instructions.



Wear personal protective equipment (PPE)!

Generally:

- Only use unused and brand-name oils according to the specifications.
- Synthetic oil is also recommended for its aging resistance. However, in this case please contact the Service Department at Leistritz.
- Never mix oils of differing viscosity or from different manufacturers; never mix mineral and synthetic oil.
- The oil should be changed at operating temperature.
- Only use the oil level markings on the sight glass as an indication of how much oil should be filled in. Indicated quantities are only guideline values. The correct filling quantity corresponds to an oil level in ¼ of the oil sight glass when the gearbox is at a standstill and in the installed position.
- Never allow the oil level to fall below the indicated marking; check the oil level from time to time when the gearbox is at a standstill.
- Clean the gearbox with the grade of oil used for operation or with oil with lower viscosity of the same make.
- Clean permanent magnets at the oil outlet and soiled oil sight glasses when changing the oil.
- Always ensure that the gearbox is kept free of impurities.
- If there are any impurities in the line, clean the overall line and change the oil.
- Dispose of used oil correctly according to the corresponding hazard and environment regulations.
- In case of frost and longer standstill periods, drain the cooling water and use compressed air to blow the system free of water residues.
- A visual inspection of leaks must be carried out during filling.
- Leaked liquids must be removed immediately with suitable measures and means.



The oil should be filled up to ¼ of the oil sight glass when the machine is in a horizontal position.
(~ 150 ml)
Use Optileb GT220

9.2.1 Draining oil

The lubricant is drained via the oil drain plug.

1. Unscrew the hexagon socket screw and screw in a hose nozzle instead.
2. Push on a sufficiently long hose and run it to a collecting container.
3. Open the ball valve and drain the oil.

9.2.2 Filling with oil

Option A: motor – gear block is disassembled.

1. The lubricant is filled in via the **vent** screw on top of the gearbox. Only use the oil level markings on the sight glass as an indication of how much oil should be filled in. Indicated quantities are only guideline values. The correct filling quantity corresponds to an oil level in ¼ of the oil sight glass when the gearbox is at a standstill and in the installed position.
2. During initial commissioning, initially the oil level falls as the oil is being distributed in the pipes of the overall line. This is why gear oil has to be replenished as quickly as possible.
3. During filling, a visual inspection of leaks must be carried out. Leaked liquids must be removed immediately with suitable measures and means.

Option B: Motor – gear is assembled.

1. The lubricant is filled in via the **drain** screw at the site of the gearbox. Unscrew the hexagon socket screw and screw in a hose nozzle instead. Push on a sufficiently long hose. Put the oil container on top of a frame and fill in the oil (use gradient).
2. Only use the oil level markings on the sight glass as an indication of how much oil should be filled in. Indicated quantities are only guideline values. The correct filling quantity corresponds to an oil level in ¼ of the oil sight glass when the gearbox is at a standstill and in the installed position.
3. During initial commissioning, initially the oil level falls as the oil is being distributed in the pipes of the overall line. This is why gear oil must be replenished as quickly as possible.
4. During filling, a visual inspection of leaks must be carried out. Leaked liquids must be removed immediately with suitable measures and means.

9.3 Adjusting cylinder support

The cylinder must be installed when adjusting the cylinder support. It may be necessary to adjust the cylinder support if the cylinder is no longer at the correct extrusion height.

1. Open the lock nut and adjust the cylinder supports. The cylinder must then be horizontal again at the extrusion height.



Figure 54 Cylinder support

9.4 Replacing the screw shaft seal



Wear personal protective equipment (PPE)!

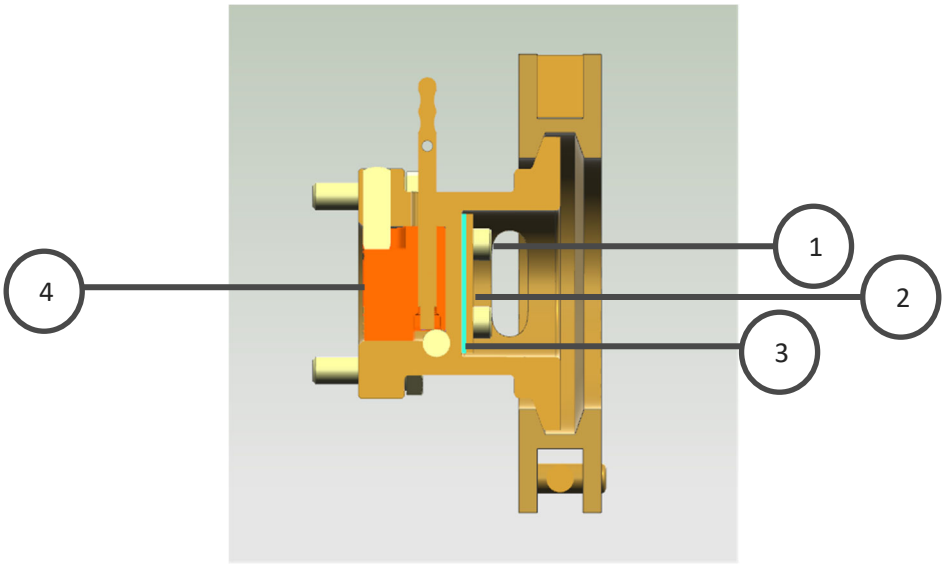


Figure 55 Cross section latern

No.	Designation	No.	Designation
1	Screws	**2**	Pressure plate
3	Gasket	**4**	Bushing

1. Loosen screws (1).
2. Remove pressure plate (2).
3. Remove worn gasket (3) and replace with a new one.
4. Place pressure plate (2) on the gasket and screw in place with screws (1).
5. Tighten the screws (1) until the pressure plate (2) rests lightly on the gasket (3).
6. Carefully install the screw set (hand-tight).
7. Tighten the screws (1) carefully so that the sealing material fits evenly around the circumference of the screw shafts.



Caution: Never tighten the screw shaft gasket too tightly to avoid leaving marks on the screw shaft.

8. If the seal weakens, tighten the screws (1) evenly.



The screw shaft seal must be checked regularly and tightened if necessary!

9.5 Exchanging heating cartridges

Barrel must be cooled down to room temperature.

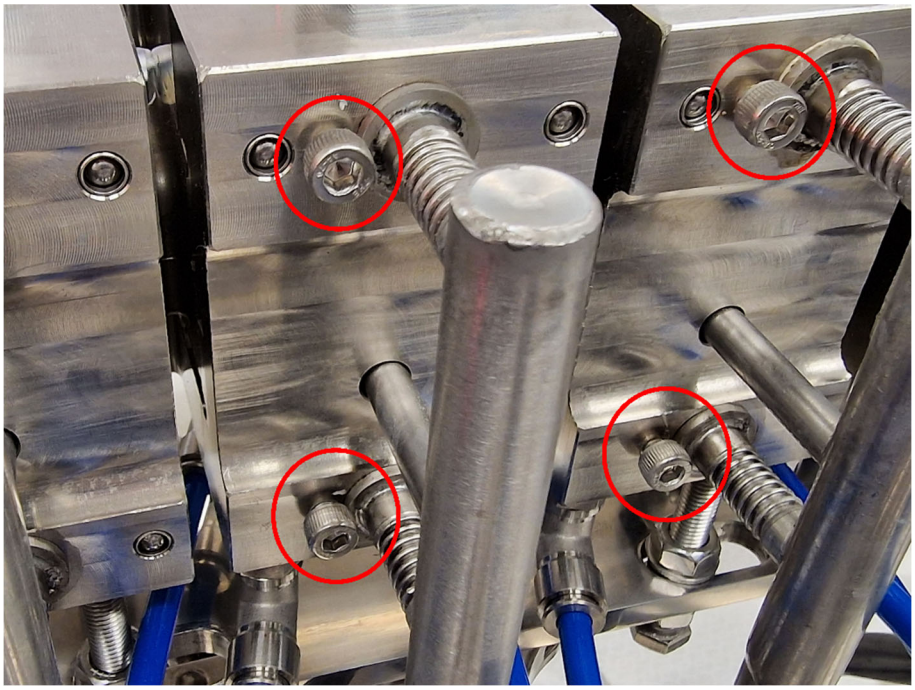


Figure 56 Heating cartridge screws

1. Loosen the screws with a hexagon socket screw.
2. Pull out the heating cartridges.
3. Assembly in reverse order.

Prerequisite: Do not take the machine back into operation until the heating/cooling zones in which the heating cartridges have been replaced has reached the required working temperature.

The heating cartridges have an integrated temperature sensor. When the heating cartridge is replaced, the new temperature sensor should be calibrated.

10 Decommissioning and storage

10.1 Taking the overall line out of operation

The following steps must be performed before the overall line is decommissioned:

1. Cleaning of all components
2. Drain water and blow free with compressed air.
3. Main switch off.
4. Cover if necessary

10.2 Storage instructions for barrel and screw

1. Clean to remove melt residues (see Cleaning, page 64).
2. Store screw elements on suitable prismatic blocks.
3. Store in dry rooms.
4. Protect from damage.

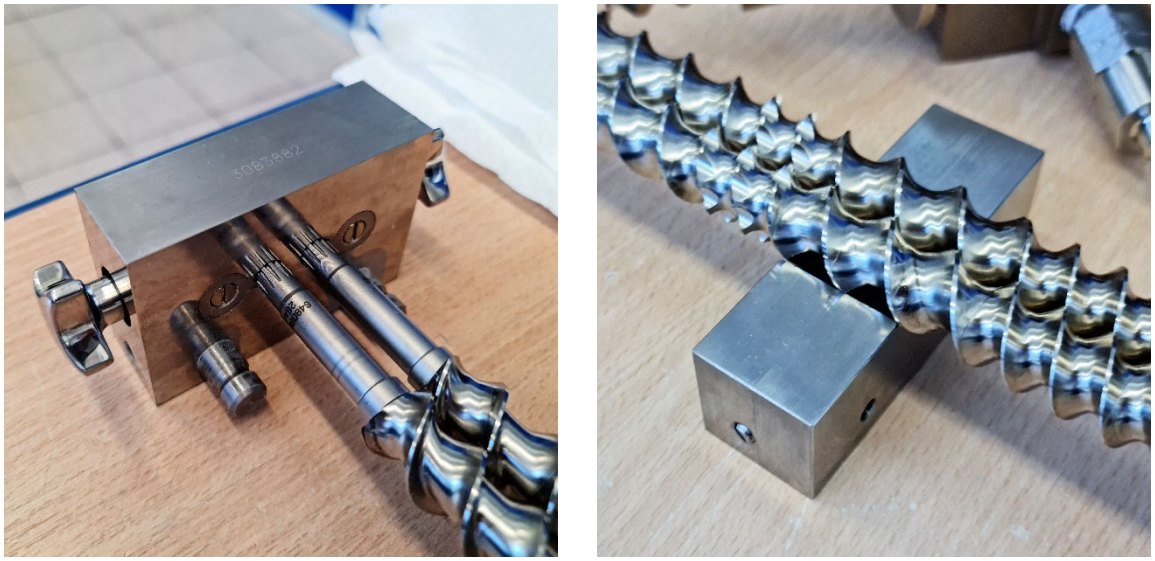


Figure 57 Screw elements

It is important to wipe off any residual water/cleaning fluid and dry the surfaces. The components must be stored in a dry place.

11 Disassembly and disposal



Always comply with the national and international regulations and laws when disposing of machines or parts of machines, or when discharging fluids and materials into the sewage system or bodies of water!

Machines or parts of machines and/or possibly resulting products must be disposed of separately from usual domestic waste, in specially designated places.

Dispose of the parts of the machine and/or possibly resulting products according to their characteristics:

- **electrical and electronic parts**
- **steel**
- **aluminium**
- **copper**
- **plastic**
- **oils**
- **contaminated fluids**
- **other fluids**
- **production waste**

Correct disposal and separate collection of used machines, parts of machines and waste generated by production and cleaning is prerequisite for possible reuse and recycling and serves to prevent potential environmental damage and health hazards.



Detailed information about disposal is available from your company environment officer, your local authority or your waste disposal companies.

12 Technical data



For further information on the technical data, see the project documents in the design specification (DS)

12.1 Limits of the machine

Melt pressure	max. 200 bar
Melt temperature	max. 200 °C
Sound power level	< 85 dB(A)
Screw torque	Max. 20 Nm

12.2 Greases

Component	Filling quantity	Grease type (Long-term/lifetime free-flowing grease)
Extruder	Approx. 2.00 l	Klübersynth UH1 6-220, NSF H1 (Registration no. 124438)
Apply grease to thread	N/A	Interflon Mounting Paste HT1200 (NSF H1, registration no. 122320)

12.3 Barrel tightening torques

Tightening torques for screw connection of **barrels ZSE 12 HP-PH in Nm**	**Tie rod screw fitting**
	M10
	40

The specified tightening torques apply to barrels with flat-ground flange faces.
See below in case of different flange face versions.

NOTE!

Also use half the tightening torque at the screw connection between the feed barrel and the gear unit housing.

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