Operation Manual
Twin-screw extruder
ZSE 18HPe-PH-40D

CE

This operating manual contains important advice for you and your staff on the operation and maintenance of the machine.

If not agreed upon otherwise you will be delivered 2 copies of this manual.

Not all of the pictures and sketches contained in this manual correspond with every detail of your machine.
We are, however, trying hard to deliver a manual that is as close to the machine as possible.
We reserve the right for technical alterations and improvements!

In case our manual cannot help you, please contact our service-department. The service-department can either give advice so that you can solve the problem yourself, or immediately send a technician.

All of the original-parts and spare-parts are especially made for this extruder. We would like to point out that all parts or/and spare-parts which have not been delivered by us are not checked and released by us. Using those parts can possibly negatively affect the constructively intended functions of the extruder and also decrease the active and/or passive safety. We do not take responsibility for damages arising from the usage of non-original parts.

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1. Security

This operating manual contains basic pieces of advice which have to be considered for installment, operation and maintenance of the machine. Therefore this operating manual has to be read by the engineer in charge of erection of the machine, as well as by the technical staff / operator before erection and commissioning of the machine. It must be stored with the machine line to be available at any time.

I.Advice contained in the operating manual

The pieces of security-advice have to be followed as otherwise endangerment of persons cannot be ruled out.
There is advice directly on the machine like e.g.:

- Direction of rotation
- Mark for liquid-connection which have to be kept in a fully legible condition.

II.Staff-qualification/training

The personnel in charge of operation maintenance, inspection and erection has to have the necessary qualification for this work. The personnel's field of responsibility, competence and surveillance have to be clearly determined by the operator. In case the personnel is lacking the necessary knowledge, it has to be trained and instructed. This can be done if need be by the manufacturer or supplier of the machine on order of the operator. Furthermore the operator has to make sure that the operating manual has been fully understood by the staff.

III.Dangers in case of disregard of the security-advice

The disregard of pieces of security-advice can result in negative effects not only for men, but also for environment and machine. The disregard of pieces of advice can lead to the loss of any compensations. In particular disregard can lead to the following endangerments, for example:

- Breakdown of important functions of the machine line
- Failure of laid down methods for maintenance and upkeeping
- Endangerment of persons by electrical, mechanical or chemical effects
- Endangerment of the environment due to leakage of dangerous substances

IV.Security-conscious working

The pieces of security-advice stipulated in this operation-manual as well as the ruling national regulations for the prevention of accidents and possibly internal work-, factory- and security regulations of the operator have to be complied with.

V.Security-advice for operator

- In case hot or cold parts of the machine mean danger, those parts have to be covered up against contact.
- Covers against rotating/moving parts (e.g. coupling) may not be removed as long as the machine is running
- Leakages (e.g. shaft sealing) of dangerous materials to be conveyed (e.g. explosive, toxic, hot) must be drained, so that there will not be any endangerments of men and environment. Legal regulations have to be adhered to.
- Endangerment by electrical energy have to be ruled out (specifications, see regulations of the VDE [Association of German energy suppliers]) and the local energy suppliers.

VI.Security advice for maintenance, inspection erection works

The operator has to make sure that any maintenance-, inspection- or assemblingwork will be implemented by qualified staff who have carefully studied the operating manual. Principally any repairs etc. on the machine may only be done when the machine stands still. Stick to the description of how to turn off the machine. Decontaminate pumps and aggregates which convey material dangerous to your health. Immediately after all works on the machine have been done, reassemble and restart all functions which are meant for security and protection.

VII.Conversion and spare-parts' manufacturing on operator's own authority

The conversion or the alteration of the machine are only allowed in compliance with the manufacturer's consent. Original spare-parts and authorized equipment serve your security. Usage of other parts can lead to non-liability for possible consequences.

VIII.Improper operation

The operational security of the supplied machine is granted when the machine is utilized for the purpose it is destined to. The stated limit-figures may never be exceeded.

1.1. Advice on additional risk

In spite of abiding by all instructions for the prevention of accidents and all operation and security instructions listed in the operation manual, still the following additional dangers might occur:

- Danger of burning in the range of the die
- Danger of burning at the extruded product
- Still there is danger of burning after the machine has been switched off due to hot surfaces, leaking steams/gases, oozing melt at the die, heated up lubricants, heated up cooling fluids
- Leaking of water in the range of cooling fluid circuit
- Leaking of oil in the range of the gearbox's oil-supply
- Discharge off gases and steams
- Dusty air in the extrusion-line's surrounding area

All processing products or processed products may escape from the extruder's feed zone, vent zone, degassing zone or die zone as melt and/or gas and/or dust. The company operating the line is responsible that all adequate safety-means according to the safety data sheets of the processing materials or the processed materials will be taken in order to protect man, environment and machine.

1.2. Purpose of use and qualified use

Operation of the extrusion line never without supervision!

The extrusion-line is used for conveying, compression/redensification and homogenizing of thermically treatable materials. Additional conveying of solid or liquid additives is possible.
The qualified use of the extrusion-line is exclusively limited to the applications stipulated by the buyer and agreed to by *Leistritz AG.*
The application is stipulated in the order confirmation and is only valid for this extrusion-line.

Improper change of operation conditions and/or application purpose may result in danger for men, environment and machine.

1.3. Incorporation of fillers

The extruder is designed for continuous operation for the task specified in the order. For incorporating fillers (chalk, glass fibres etc.) into the material which has to be extruded, a sufficient amount of carrier materials has to be (e.g. polymer) fed. With an increasing filler content in the melt the friction forces between screws and barrel increase. In case of insufficient lubrication by the carrier material, the screw, screw shafts and gear box can be damaged due to the increased stress.

1.4. Material-shapes and properties

Barrel and screw of the extruder, as well as all the equipment in the scope of supply are designed for the processing task specified in the order. If the processing task of the extrusion line will be supplemented, extended or altered, then the particularity of the basic processing material and the additives have to be taken into consideration in order to prevent damages at the extruder.

The basic materials and the additives of the product to be manufactured have to meet certain requirements:

- The size of the pellets or the ground stock must be adequate for that they can be caught and conveyed by the feed-screws in the first heating/cooling zone.
- The basic materials and the additives have to be free of impurities which could lead to damages on screws and barrels (e.g. metal pieces, stones, etc.).
- Pellets, ground material and powders must be pourable or the affiliated dosing units must have the adequate auxiliary equipment to prevent bridge-building in the feed-hopper.
- In case of use at normal temperature and mixing conditions the basic material (carrying material) has to be meltable. The melt film which develops in the processing-unit of the extruder is absolutely necessary in order to reduce friction.
- When fluids are added they have to be free of solid body impurities and sediments which could lead to clogging of the inlets and dies.

The melt film that builds up in the extruder shall at no time cure during the extrusion process.
The cured material that remains in the extruder after switching off the machine has to be plasticised completely before switching on the extruder drive again.
If this is not the case there is a big risk of durable damage of the extruder screws and drive shafts.

1.5. Protection of an Extrusion Line

The extrusion line may never be operated without using a protection device against the melt pressure rising above the maximum level.
The maximum permissible melt pressure can be found in the technical data section of the manual.
In any case the maximum value is exceeded, the extrusion line has to be stopped.
In case an according protection device was not installed by the supplier (Leistritz Extrusionstechnik GmbH) – due to the customer's specification – the customer has to ensure that a function protection turn-off exists before the first time the line is put into operation.
If not already done by the machine supplier and according to the machine type the following machine parameters should be protected from exceeding the maximum values:
Max. melt temperature
Max. screw speed
Max. torque
Max. oil temperature of gear box
Max. / min. oil pressure
Interlocking the feeders which contain fillers with the extruder
protection against the current consumption dropping below < 15%)
limitation of screw speed at repeated start-up

1.6. Disposal

At disposal of machines or parts of machines or discharge of liquids and materials into canalization or waters please observe the national and international regulations and laws!

Machines or parts of machines and/or eventually resulting products have to be disposed separately from the usual domestic waste via especially designated places.

Please dispose parts of the machine and/or eventually resulting products according to their nature:

- electric- and electronic component parts
- steel
- aluminium
- copper
- plastics
- oils
- contaminated liquids
- other liquids
- production wastes

Appropriate disposal and separated collection of used machines, parts of machines and resulting production- and cleaning wastes is a condition for possible recycling and serves to prevent potential environmental- and health damages.

☞ **Detailed information about disposal will be provided by your environmental health officer, your community/authority or your waste disposal services.**

2. Explanation of the symbols

This operation manual contains symbols and pictograms which point out danger and peculiarities while handling the machine.

Their meanings are:

Attention! While not paying attention to this warning the health of the operating staff may be endangered, in addition to that damages on the machine may occur.

Attention, electrical current! While not paying attention to this warning the health of the operating staff may be endangered, by influence of electrical current in addition to that damages on the electrical components of the machine may occur.

Protection of your hands during all assembly works! If you do not heed this warning you will run a higher risk of hurting the hands by sharp edged machine components or burning.

Attention, danger of squashing! While not paying attention to this warning there will be increased danger of injury. All of the rotating parts have to be permanently covered.

☞ **Hint to special observance of the regulations and/or for better understanding of the above descriptions.**

3. Data of Delivery

Twin-screw extruder	
Co-rotating	
Machine-No.:	3851
Year of production:	2009
Date of delivery:	01/2009
Delivered to:	Stiefel

4. Technical Data ZSE 18HPe-PH-40D

4.1. Machine data

Model	co-rotating
Axle base of screws	15 mm
Screw diameter	17,8 mm
Diameter of kneading discs and -blocks	17,6 mm
Material of screw	see material certificates
Barrel diameter	18 H8
Material of barrel	see material certificates
Screw functionary length	40 D
Screw torque max.	2 x 35,5 Nm
Drive	AC-Motors
Drive power	9,4 kW
Max. motor speed	1200 rpm
Total speed increasing ratio	i = 1
Max. screw rotation	1200 rpm
No. of heating zones	8
Heating power	7,5 kW
No. of cooling zones	7
Kind of cooling	ZIK (Zylinder Intensiv Kühlung = Barrel intensive cooling) (*)
Cooling medium	Water
Working pressure of cooling mediom	3,5 bar
Kind of cooling of feeding zone	Water
Max. flow of feeding zone	20 l/h
Max. melt pressure	150 bar
Operating height	1050 mm
Approx. weight	350 kg

(*) In order to avoid fissures in the barrel the cooling water temperature for barrel cooling must be only max. 60°C below the set processing temperature.

4.2. Electrical connection data

☞ **Tolerance of voltage of all electrical heating elements according to DIN IEC 38 (+6/-10%)**

Extruder	**Power [kW]**	**Voltage [V]**	**Frequenzy [Hz]**
Drive	9,4	460	60
Barrel heating power	7,0	230	60
Additional aggregates	**Power [kW]**	**Voltage [V]**	**Frequenzy [Hz]**
Die heating	0,5	230	60

The electrical main connection of the electrical circuit from customer side to our control must be installed according to the local regulations of Power Supply Company and is not part of the scope of supply of LEISTRITZ AG.

The voltage and frequency have to be taken from the wiring diagram or from the identification-plate

Attention: The electrical main connection, as well as any works on electrical parts may only be done by qualified staff. Non-professional work lead to non-liability of the manufacturer. Comply with your country's ruling regulations for the prevention of accidents.

4.3. Measuring sheet ZSE 18 HPe -PH 40D

5. Enclosed tools ZSE 18

Description	Size
Screw tip wrench	3026852
Screw assembling device	3044746
Double ended spanner	SW 8 – 9 10 – 11 12 – 13 14 – 17 19 – 22 24 – 27
Hexagonal socket screw spanner	SW 4 / 5 / 6 / 8 / 10
Screw driver flat	Gr. 3,5 / 5,5 / 7
Torque wrench	0057639
Plug–in for BIT's	0057640
Hexagonal BIT's	5 / 6 / 8 / 10
Double key–bit wrench	SW 7
Flat scraper	3001868
Round brush	0040800

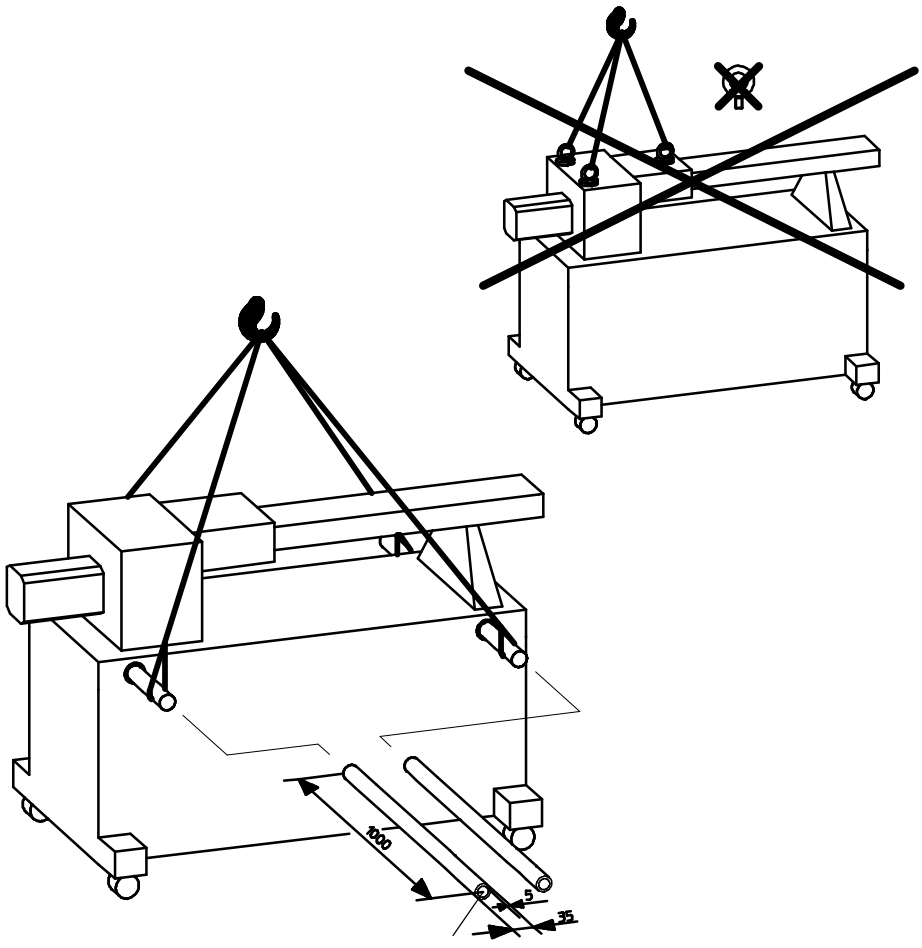
6. Transport

These instructions are based on the safety rules being valid in Germany and have to be adhered to.

Never attempt to lift the entire extruder by a single eye bolt at the gearing, motor etc.

The extruder is located on conveying rolls. Due to this fact it can be moved in any direction.

Transportation by crane or by block and tackle.



Steel

By crane resp. winding tackle. There are 2 pairs of ropes with a different length (to have the possibility to lift the machine in center). Steel bars of round section rod having a diameter of min. 35X5 mm and a length of 1000mm are pushed into the rectangled opening of the machine frame. Each pair of rope must have the ***minimum carrying capacity of 1200 kg*** . The angle between ropes on either side of the extruder must not exceed ***60 degrees***.

6.1. Erection of the Extruder

The machine has to be erected on plane ground. In order to grant save erection at the place desired you will find spindles aside the running wheels which take some load off the wheel and which will bring the extruder exactly into balance.

☞ **Caution: Lifting spindles are situated beside the four double guide rolls.**
For operation of the extruder the spindles have to be unscrewed to completely relieve the double guide rolls. The extruder will be aligned horizontally by means of these lifting spindles..
This alignment is absolutely necessary in order to guarantee a precise adaptation of downstream equipment (e.g. micro pelletizer).
The reference surface for the horizontal line is the extruder barrel, and not the machine frame.

6.2. Connection of the extruder

All connections to the extruder are to be taken from the inscriptions on the machine and the P&I-diagram.

7. Description of segments and handling

ATTENTION: As most of the maintenance works and assembly-works have to be implemented when the extruder is heated up we should point out that the corresponding measurements have to be taken for the prevention of accidents and injuries caused by scalds.

When the extruder is heated up, all of the inlets and outlets of the heating/cooling system are under pressure. When powderized materials are processed, dust intensive works (swivelling aside or cleaning of the feeder, blowing dust off the extruder, transferring contains or refilling of containers or hoppers..) the machine must be turned off. (DANGER OF DUST-CAUSED EXPLOSIONS)

7.1. Drive unit

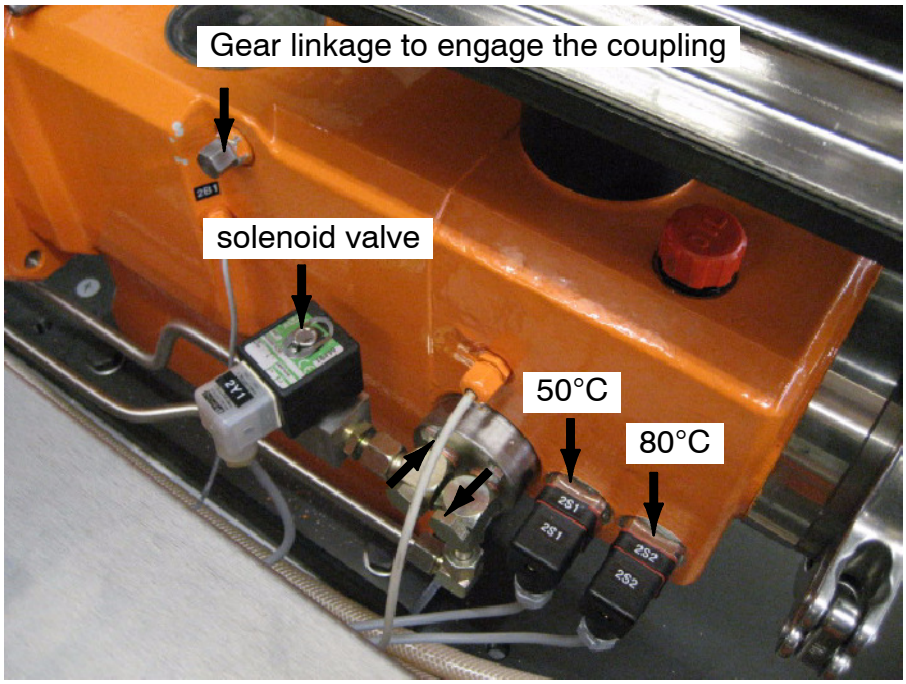
The drive unit comprises of an AC-drive and a reduction gear with axial bearing.

When the motor reaches the pre-set torque it will be throttled down to 0 rpm. In case the predominating torque does not decrease after 10 seconds the standstill supervision turns off the drive.

The torque is transmitted to the motor by safety coupling to the drive input shaft.

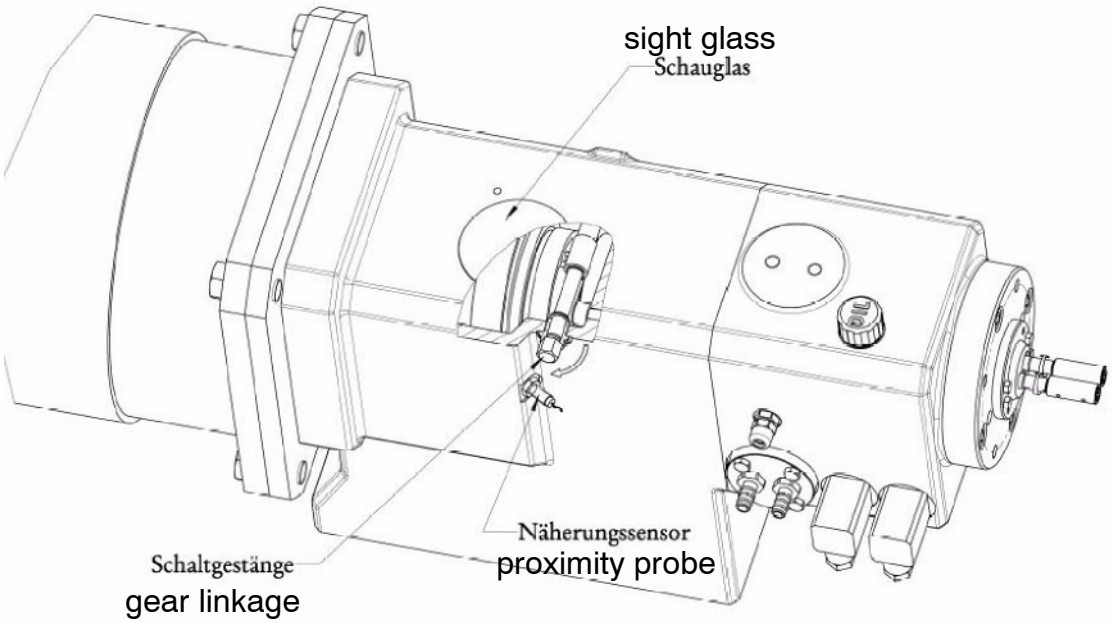
The number of revolutions in the drive is reduced in the gear box and transmitted to two drive-output shafts. The gear is equipped with a splash lubrication and temperature controlled oil-cooling.

Two temperature probes within the oilpan indicate the real temperature to a temperature-controller. At an oil-temperature of approx. 50°C the controller opens a a solenoid valve for the water-inlet of oil-cooler. At an oil-temperature of approx. 80°C the drive will be switched off automatically.



☞ **The optimum operating temperature of the extruder is between 15°C and 20°C.**

Exceeding of the adjusted maximum torque leads to release of the safety clutch.
This process is supervised by means of a proximity probe. The coupling disconnects the motor permanently from the gearbox and has to be reengaged after elimination of the faults. This happens by turning the gear linkage with a wrench (SW13).
It has to be considered that first the gear cuttings of the coupling have to be put into engagement position.


sight glass
Schauglas
Näherungssensor
proximity probe
Schaltgestänge
gear linkage

7.1.1. Oil content, oil cooling, oil change

- Only use **new** name brand oils (FDA approved)
- Only use the recommended name brand oil. Mixing oil with different viscosity, from various suppliers and mixing mineral and synthetic oil is not permitted.
- The markings on the sight glass are the only valid measurements concerning the amount of oil needed for filling. Indicated quantities are only guidelines and therefore estimated figures.
- By no means, the oil level may fall beneath the mark and therefore has to be controlled periodically at standstill of gearbox.
- The operating oil or less viscous oil from the same supplier has to be used for cleaning during oil change.
- Permanent magnets at the oil outlet and dirty sight glasses have to be cleaned during oil change.
- Please note that by no means dirt should be able to enter the gearbox.
- Should external particles have entered the gearbox the complete unite needs intense cleaning and an oil change.
- Used oil has to be disposed due to according hazard and environment regulations.

7.1.2. First Operation

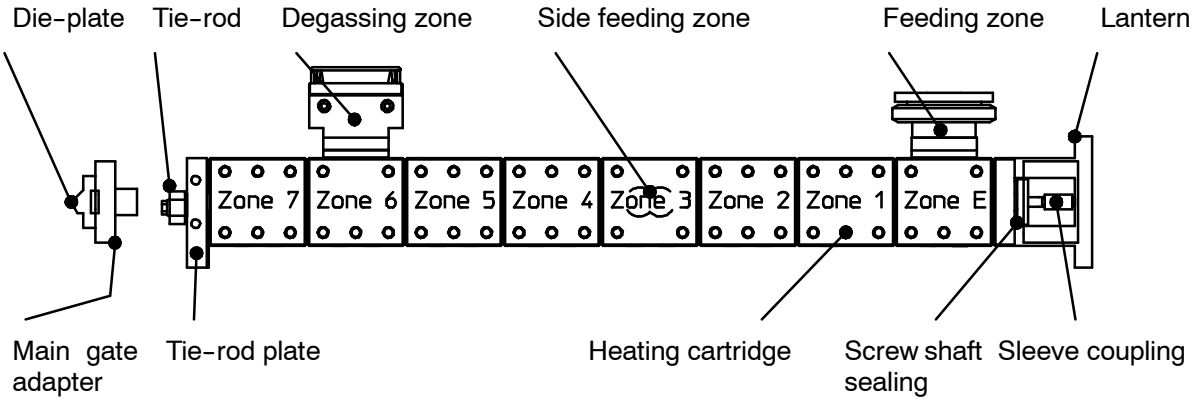
- The gearbox should run without load for several hours.
- If the gearbox operates without troubles, it has to be operated with gradually increasing load in reasonable periods of time.
- In case of longer standstill periods, the gearbox has to be operated for a short time every 4 weeks in neutral setting and at rated speed. Should such proceedings be impossible, it has to be protected with suitable preservation materials.

7.2. Barrel

The extruder barrel is designed according to the special process technology in 5D – lengths up to a complete length of 40D.
The barrels are made of special steel (see list of product touching parts). The barrels 8-bore is honed. The barrel water cooling system type ZIK is connected onto the vertical and horizontal bore.
The individual barrels are entered to each other by two socket head studs and are spanned by two interior tie rods between lantern and tie rod plate.

In the barrel heater cartridges are screwed in*(see chapter 7.4.1. Page 46)*. Barrel is covered by a water cooled hood.

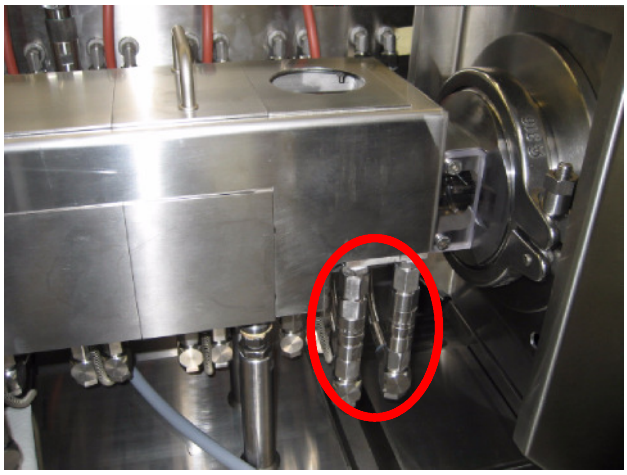
7.2.1. Description of parts of barrel



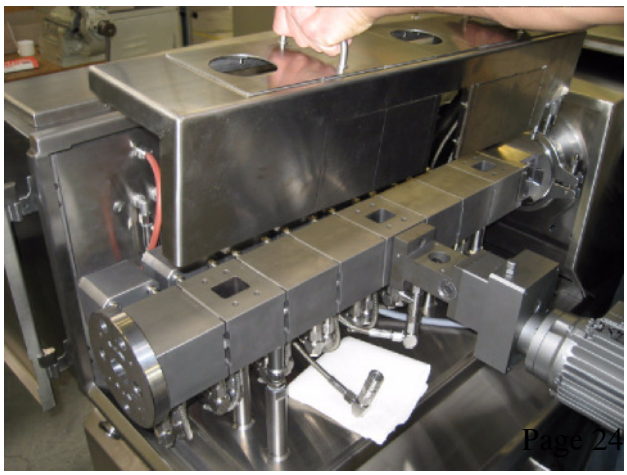
7.2.2. Removal of the cover hoods

- Turn off extruder
- Cut off connection from metering shaft to feed shaft
- Remove feeder from extruder
- Dismantle degassing together with vacuum hose (if included in scope of delivery)
- Cut off connection to injection nozzle (if included in scope of delivery)

- Cut off water inlet of the cooled cover hood



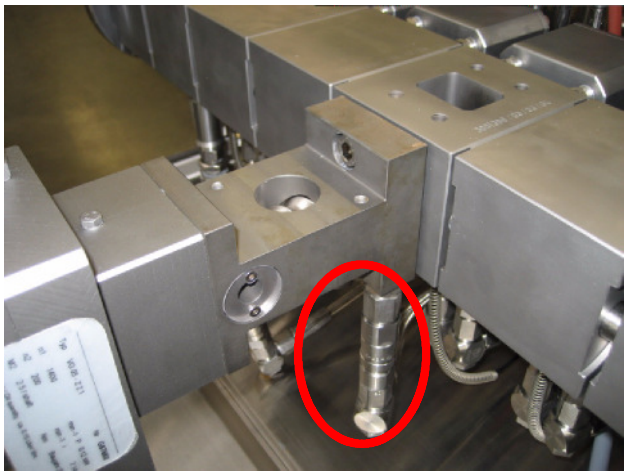
- Lift off hood



7.2.3. Dismantling of the barrel

Caution! Always take care of a safe connection between barrel and barrel lifting device.

- Switch off extrusion line
- Lift off hoods as described in chapter 7.2.2. Page 24
- Dismantle discharge part together with pressure- and temperature transducer, thermocouple and heaters see chapter 7.2.6. Page 34 (the barrel must have working temperature)
- Pull extruder screws (barrel must have working temperature) see chapter 7.3.6. Page 42
- Loosen quick disconnect to side feeder (option) .



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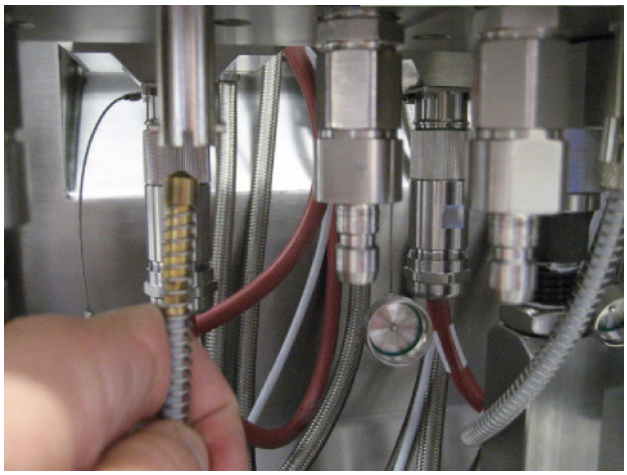
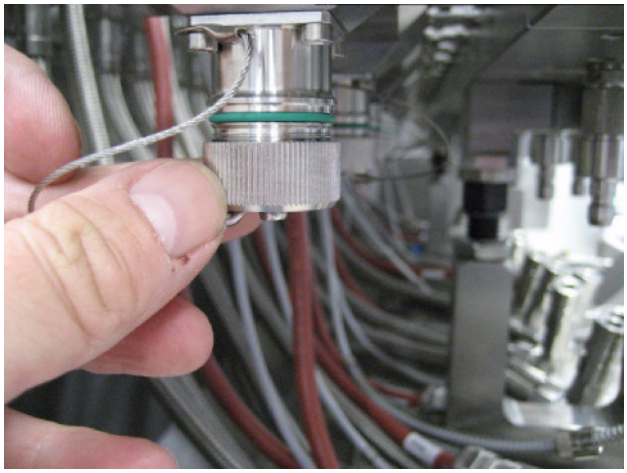
- Unscrew thermocouple, loosen quick action clamps of the cooling unit



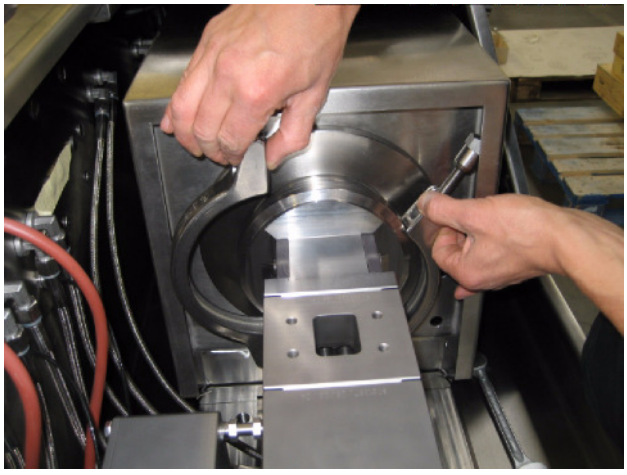
- loosen plugs

- close bushings

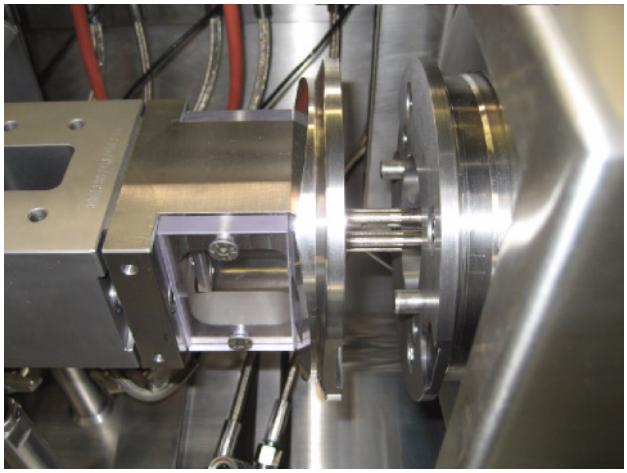


- make sure that all connections are loosened

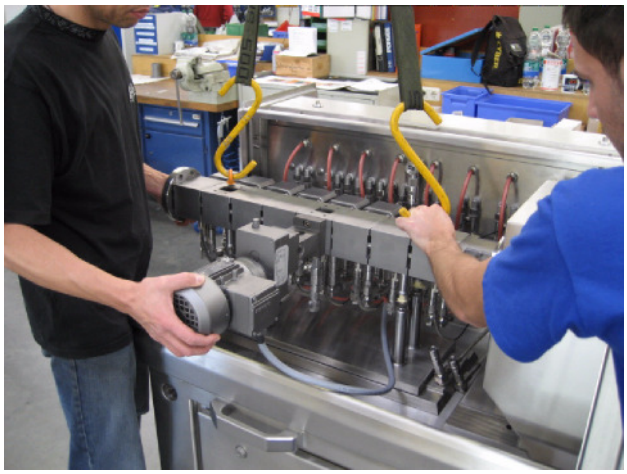
- Loosen clamp connection barrel – lantern



- Push complete barrel assembly on the dovetail guide into extrusion direction until the screw shaft sealing is free from the lantern

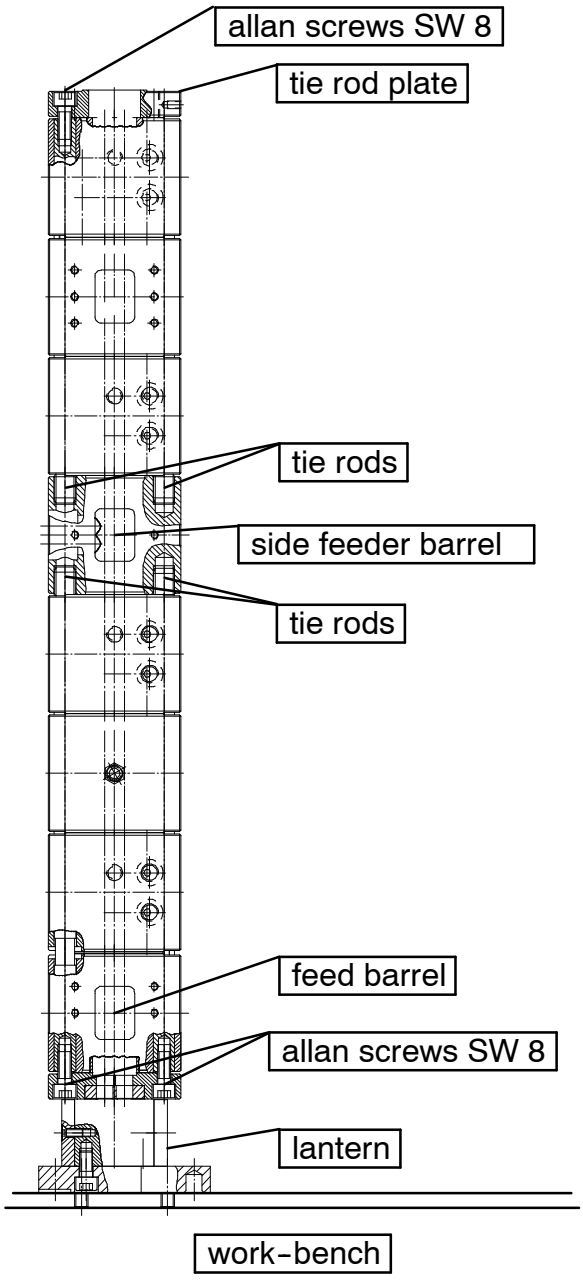


- Tighten barrel with ropes aon a crane and lift carefully. Take care that the barrel does not wedge.



7.2.4. Assembly of barrel (with barrel for side feeder)

- span vertically lantern on a work-bench
- Screw in the 4 tie rods into the side feed barrel
- plug in feeding barrel
- assemble all other barrels compl. with superstructures and heaters
- According to the barrel configuration assemble the side feed barrel with the screwed in tie rods
- assemble all other barrels compl. with superstructures and heaters
- insert tie rod plate onto last barrel
- pre-stress barrel by allan screws SW 8
- flange barrel onto distribution gear



7.2.5. Initial stressing force of tie rods

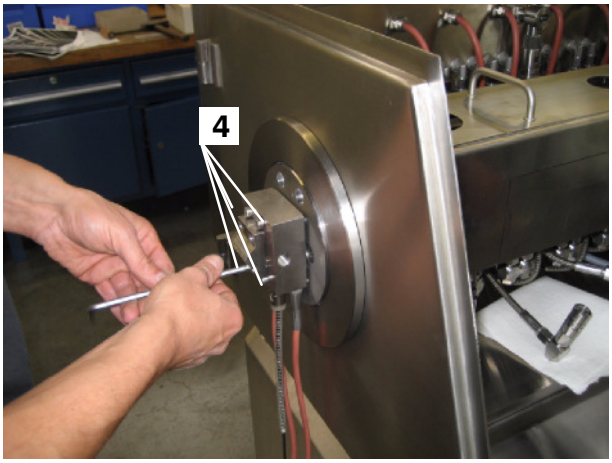
The pre-stressing of the tie-rods is effected during the heating up period of the barrel. We recommend to tighten tie-rods step by step.

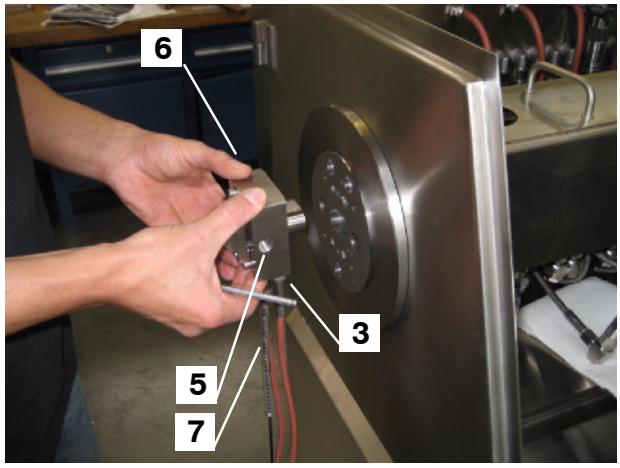
- Fasten the screws of the barrel's tie-rod manually while the barrel is not heated up.
- Slowly heat up the barrel which is connected to the heating-cooling device unit and at the same time increase step by step the torque of the screws by 10 Nm.
- When the operating temperature is reached the torque should be 30 Nm.

☞ **Attention: When the operating temperature is changed then the torque must be checked and if necessary be re-adjusted.**

7.2.6. Disassembly of the die head

Condition: Barrel and screw in working temperature





- Purging extruder
- loosen plug connections from temperature transducer (5) pressure transducer (6) and heater cartridges (3)
- Turn out temperature probe (7)
- loosen screws (4) and remove the die
- clean sealing faces
- extruder screws are now accessible
- assembly in reverse order
- tighten screws (4) crosswise

☞ **Screw torque: 30 Nm**

7.2.7. Disassembly and assembly of atmospheric vent, vent port and vent port closure

Precondition: barrel and screw in heated-up state for opertating

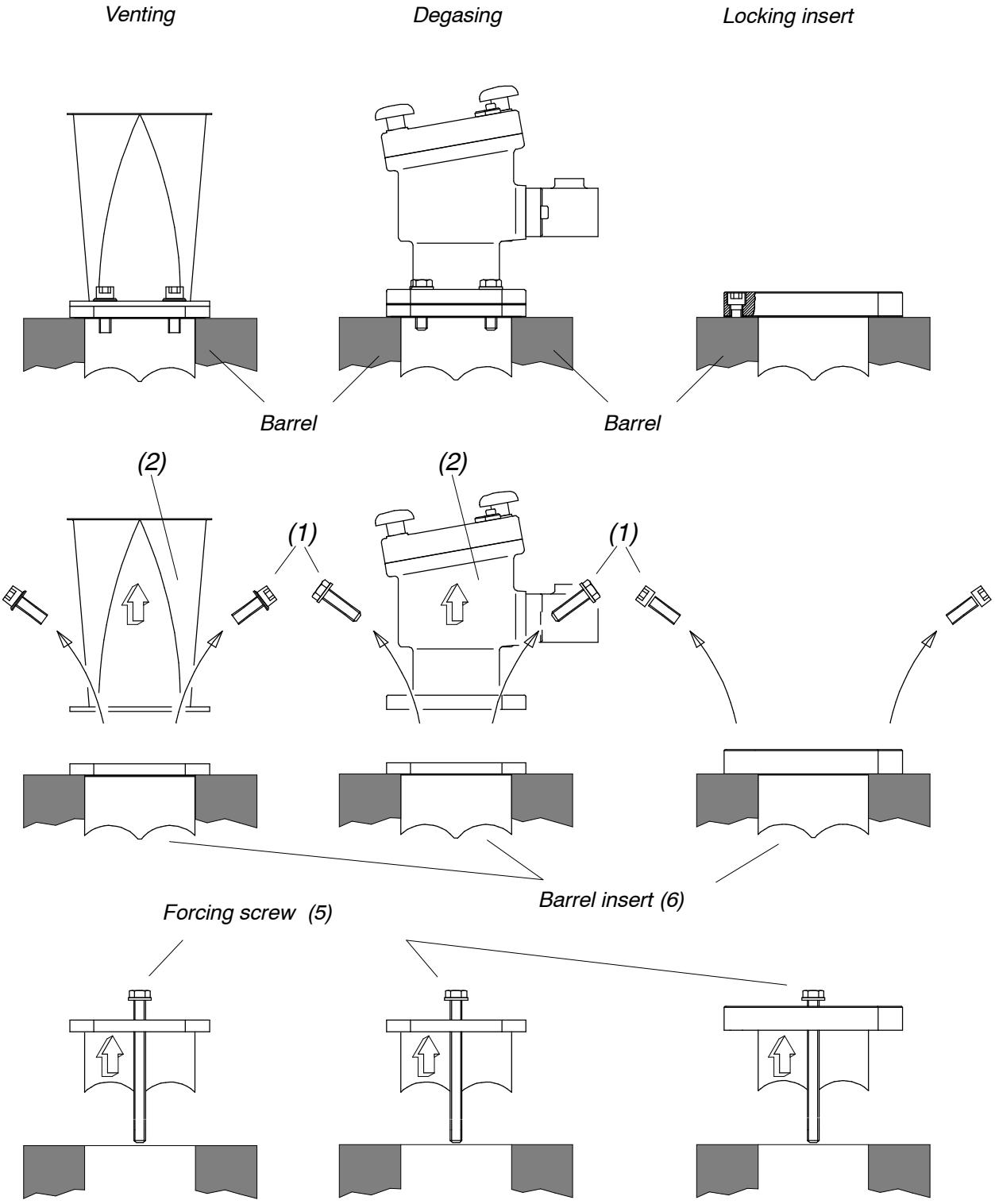
see picture 7.2.7.

- Run the extruder until it is empty
- Remove the vacuum hose (if scope of supply)
- Remove barrel cover
- Loosen screws (Pos.1)
- Take off the degasing / venting dome (Pos.2)
- Clean the sealing surface
- Screw in the forcing screws (Pos.5) in the provided threaded bores and tighten them equally until the insert (Pos.6) gets off the barrels
- Take off the insert from the Barrel
- Clean the sealing surface with a suitable tool
- Put on the cleaned insert (Pos.6)
- Put on the degasing / venting dome (Pos.2)
- Equally tighten the Allan screws crosswise

☞ **The starting torque for vent port closure is 40 Nm**

☞ **The starting torque for degasing dome / venting dome is 40 Nm**

Sketch 7.2.7.


Venting
Degasing
Locking insert
Barrel
Barrel
(2)
(2)
(1)
(1)
Barrel insert (6)
Forcing screw (5)

7.2.8. Exchange of screw shaft sealing

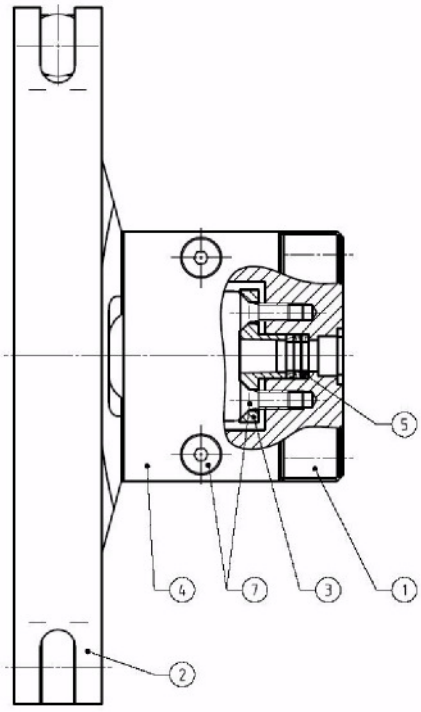
☞ **Precondition: Screw set disassembled resp. screw shaft withdrawn from sealing section**

- screw of pxiglass cover (Pos.4)
- Loosen screws (Pos.7)
- Dismount gland (Pos.3)
- Exchange worn out sealings against new ones (Pos.5), clean surfaces
- Insert the seal glands in the housing (Pos.3)
- Fasten the nuts (7) until the seal glands slightly lie on the sealing
- Carefully assemble the set of screws
- Cautiously tighten the muts (Pos.6) so that the sealing (Pos.3) evenly lies at the circumference of the screw shafts

☞ **Attention: Never fasten the gland too tightly**

- Fasten the nuts (7) until the seal glands slightly lie on the screw shaft
- When decreasing sealing effect is ascertained, please equally tighten nuts (Pos.7)

☞ **Fix plexiglass cover again**



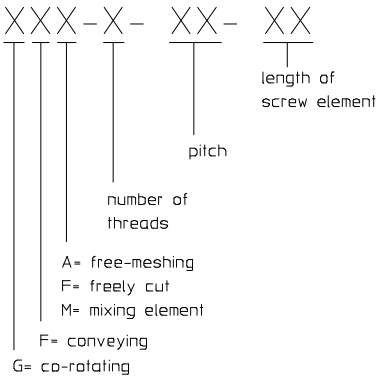
7.3. Set of screws

The screws are segmented and can be adapted according to the processing length, the barrel configuration and the specific characters of the product. The elements are ground and polished. The screw shaft and the screw elements have a spline profile.

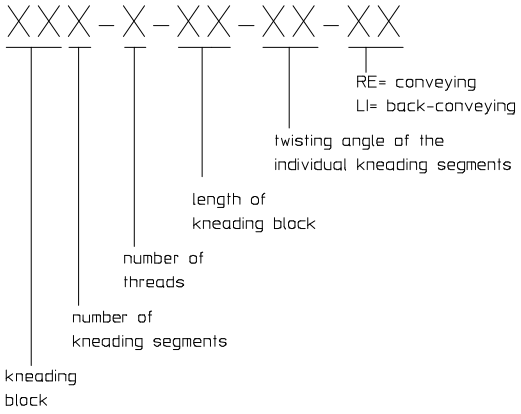
When storing, transporting and cleaning the screw elements make sure that the fore-parts will not be damaged.

7.3.1. Description of screws

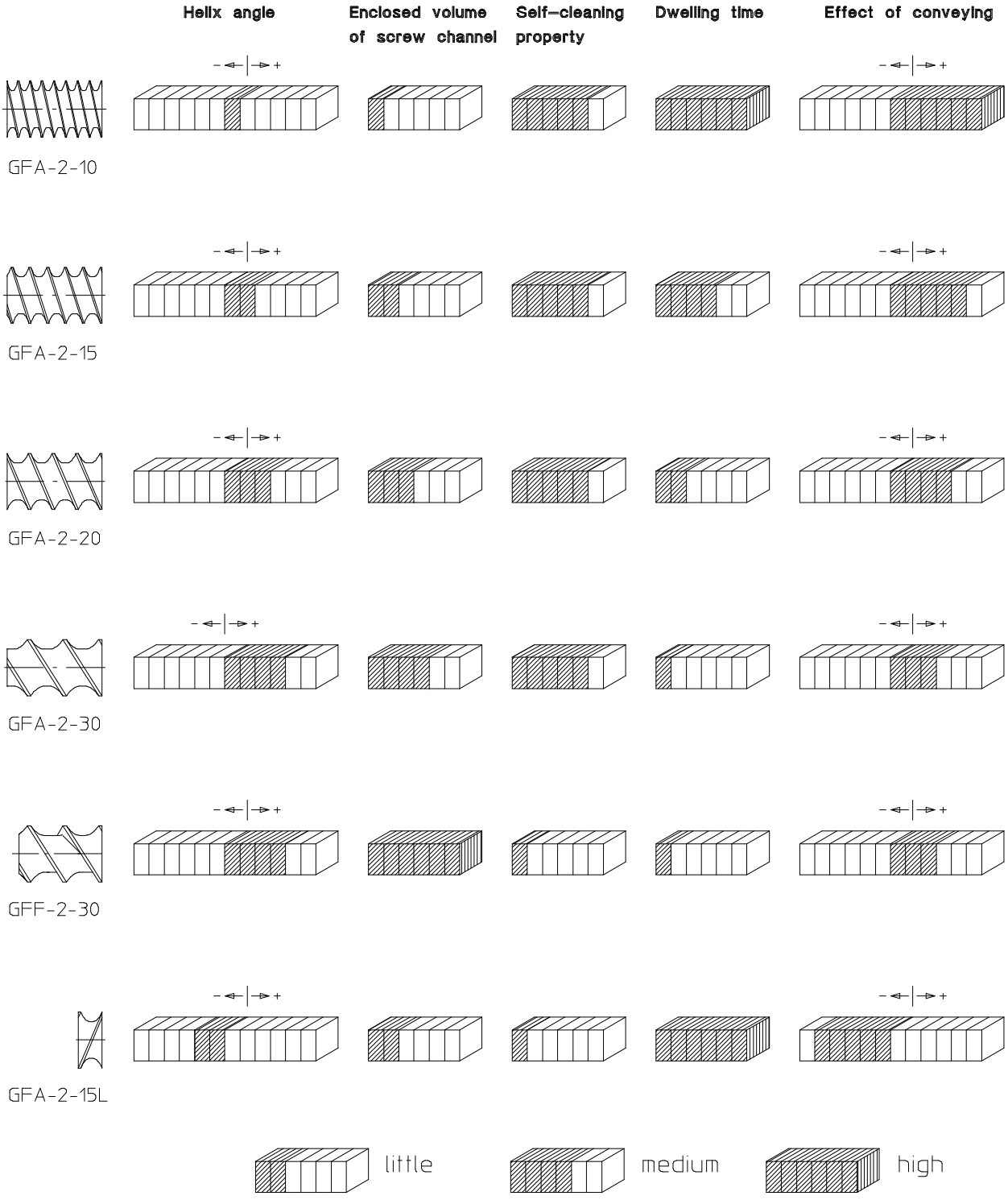
GFA_2_10_60
GFA_2_15_15
GFA_2_15_15_LI
GFA_2_15_30
GFA_2_15_60
GFA_2_20_30
GFA_2_20_60
GFA_2_30_15
GFA_2_30_30
GFA_2_30_60
GFF_2_30_90
GFM_2_15_30
GFM_2_15_60



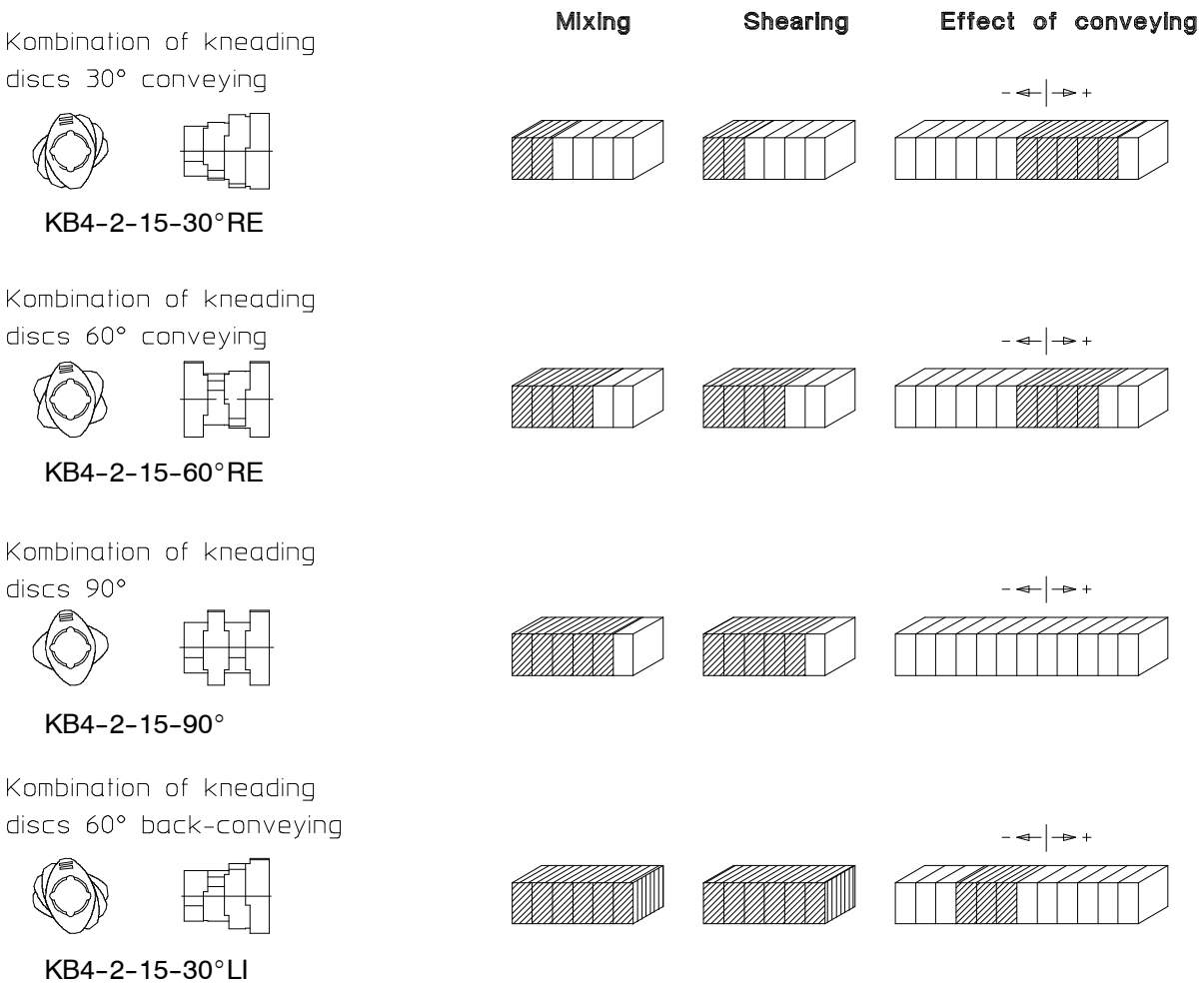
KB4_2_15_30GRD_RE
KB4_2_15_60GRD_RE
KB4_2_15_90GRD
KB4_2_15_30GRD_LI
KB4_2_15_60GRD_LI
KB5_2_30_30GRD_RE
KB5_2_30_60GRD_RE
KB5_2_30_90GRD

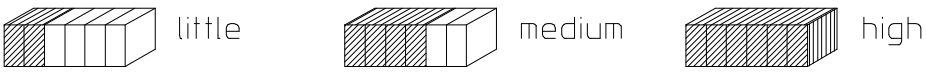


7.3.2. Function of screw elements with different helix angles



7.3.3. Function of screw elements and combinations of kneading disks with different twisting angles



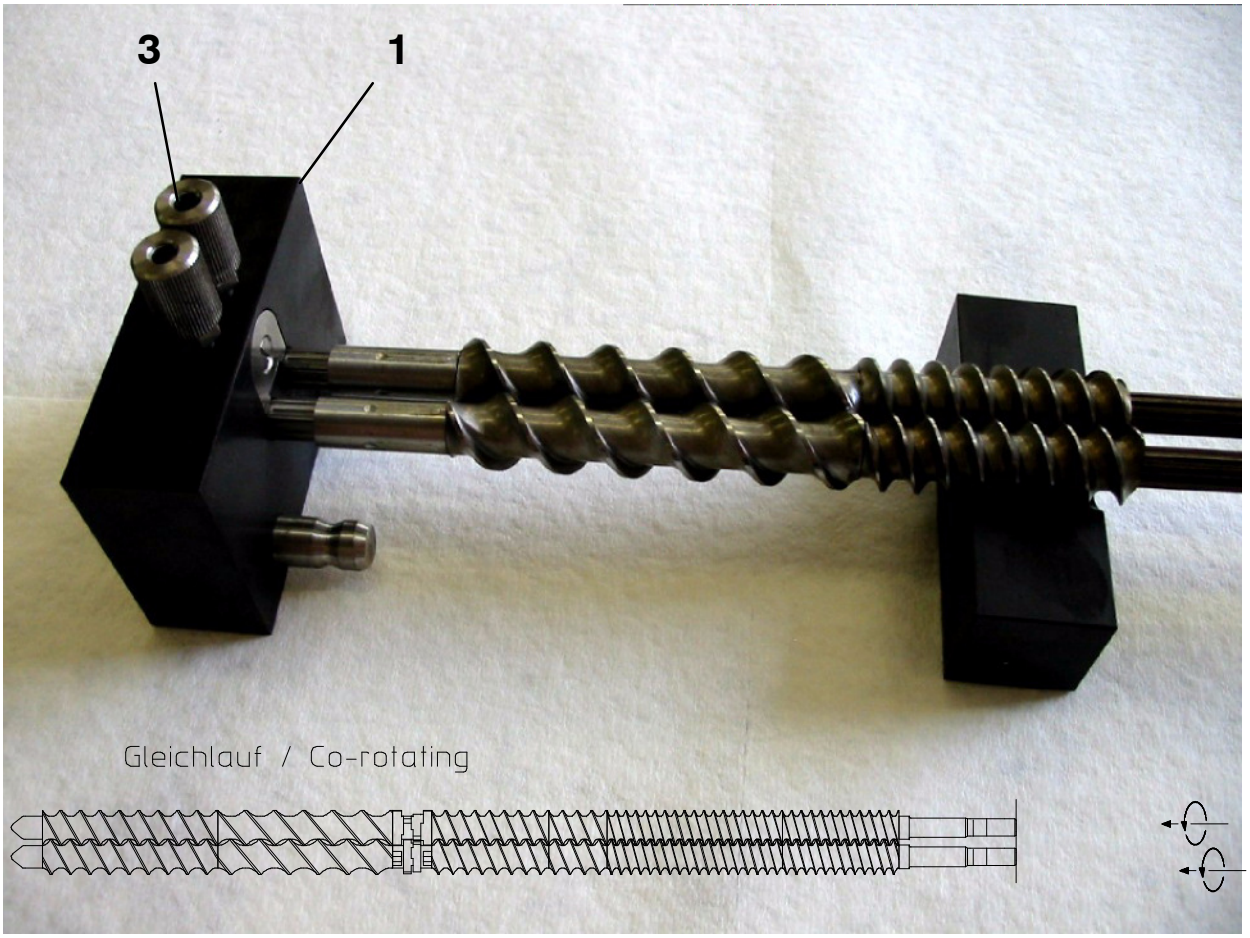


7.3.4. Assembly of set of screws

☞ **When assembling the screw sets on the screw shaft take care of rotation sense of screws (co-rotating)**

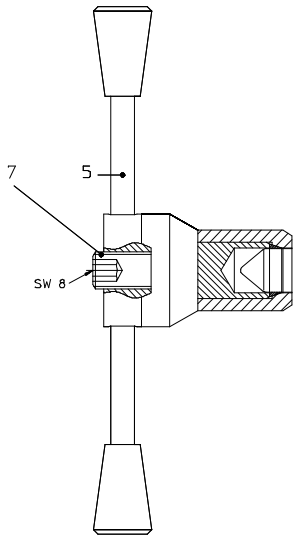
- Clean the shafts, so that all residues and impurities are removed.
- Inspect the groove bores of the elements for melt residues. Clean every bore.
- Check the front faces of all elements (sealing joints). They should not show any notches, burrs and melt residues.

Both shaft-ends are pushed into the assembling device (1) with the grooved toothprofile diameter, the bolts (3) are to be tightened. Pull the screw onto the shafts in pairs. *(the elements should slide easily enough so that they can be pushed on and pulled from the shaft manually.)*



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

- Insert screw tip wrench onto the screw tip
- Secure lever (pos.5) and span working (pos.2) by turning the screw (pos,7) in right sense with the screw tips.
- Tighten screw tips with lever (pos.5).



☞ **Co - rotation: both screw tips - left-handed-thread**

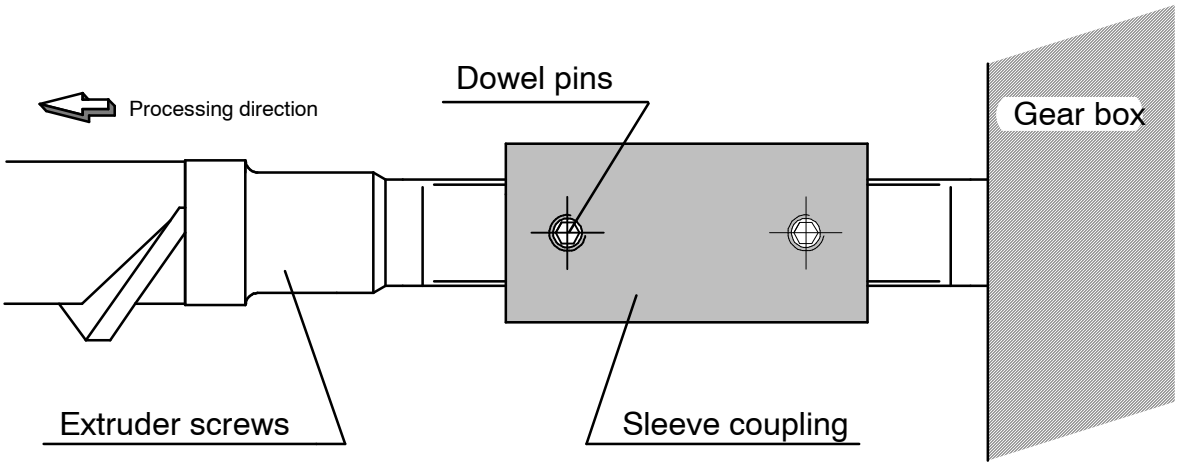
- Remove the screws from the screw assembly device and roll them together on a plane support. It should be possible to turn round the screws completely.

☞ **If this is not the case, the screw hangs or rubs, the elements are not correctly pushed on. Checking is absolutely necessary.**

- Then heat screw set up to operation temperature and heat up completely. **Now tighten the screw tips again.**

☞ **Do not fix additional levers or prolongations on the wrench**

7.3.5. Axial screw safety device



Before each screw-assembly or disassembly loosen the fastened dowel pin that is located in the sleeve coupling and provides the axial screw safety.

☞ **Only loosen the dowel pin at the front (processing direction) which strains the screw shaft. The dowel pin at the rear remains fastened so that the sleeve coupling remains on the output shaft of the gear box when pulling the screws.**

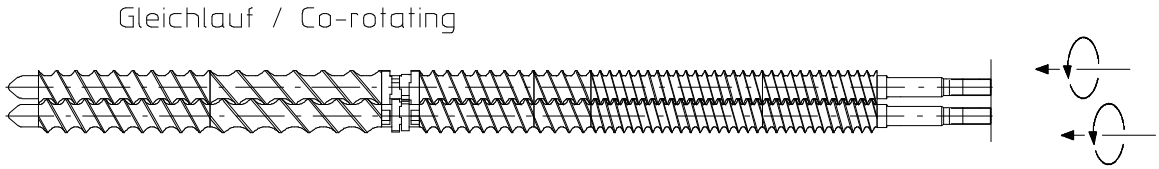
Attention! As long as the dowel pins are loosened do not switch on the drive as the dowel pins could be sheared off by the rotating sleeve couplings!

7.3.6. Screw disassembly and assembly

Assembly:

Precondition: barrel and screw in heated-up state for opertating

- Put screws together in the right order



- Align the screw shafts so that the wedge surfaces of the screw shafts are in the same position like the closed gear cutting of the sleeve coupling.
- Support the pair of screws, so that it doesn't sag when inserting into the bore.
- Push screw pair in the 8-bore of the barrel

☞ **Attention: Be careful that the screw shaft sealing is not damaged.**

- Insert the screw into the sleeve coupling, while both screws are turned in rotation direction (see drawing) until the shafts snap into the sleeve coupling
- Push in the screw-shafts to the limit stop

☞ **Attention: The screws should be pushed smoothly into the bores. They may not be pressed in by force! Afterwards the dowel pin that provides the axial screw safety must by any means be refastened in the sleeve coupling (see also chapter 7.3.5. Page 41).**

- Check assembly: Screw tips should not show any axial shifting
- Attach main gate adapter

Disassembly:

Precondition: barrel and screw in heated-up state for operating

Although the screws are segmented, they are pulled in one piece.
As both screws are intermeshing, both screws have to be drawn together.

Normally screw pulling is no problem.

- After ending the production process clean the screws by extruding cleaning pellets. The cleaning pellets purge the screws so that only small impurities are left.
- Purge extruder completely.
- Switch off the drive.
- Make enough place behind the barrel , so that the screw can be drawn completely and put down on a support.
- Screw off the discharge part or the die head, to uncover the screw tips.

☞ **Attention: Before pulling the screws it is absolute necessary to loosen the dowel pins that provide axial screw safety, in the sleeve couplings (see also chapter 7.3.5. Page 41).**

- Insert screw tip wrench onto the screw tip and fasten it
- Pull out the screws by menas of the screw tip wrench
- Start with cleaning the screws, as soon as the first elements rise from the barrel.

7.3.7. Detach screw elements from the shafts

To detach the screw elements from the shafts is the most difficult mounting work and demands corresponding sense for the used materials.
The reason is, that melt can penetrate between the elements which leads to bonding between screw shaft and screw element.
However that happens in different degrees and depends on many factors.
It is a fact that the longer a machine is operated with worn and/or damaged screws , the more it is difficult to detach the elements.
It can as well lead to problems, as during the last screw assembly you haven't tightened the screw tips.

The basic method when detaching the screw elements is as follows:

☞ **Screw must have operation temperature**

- Unscrew the tip, if not already done. **Caution: Both tips of co-rotating screws have left-hand thread!**
- Detach the elements directly after cleaning the outer surfaces. During dismantling the screw must have operating temperature. Should they already be cooled down, push the screw set back into the extruder barrel, heat it up and warm the screws up.
- Jam a screw horizontally in a vice with brass- or aluminium jaws. Support the longer tail of the screw to avoid that it sags.
- Try to pull each element from the shaft.

If this is not possible please contact Leistritz service department. They have an hydraulic dismantling device with which the screw element can be pulled from the shaft without damages.
Or proceed as follow:

☞ **Never stroke directly with a hammer against a screw element**

- Always try to detach only one element.
- Clean the screw shaft, which makes detaching of the next element easier.
- Take care, that the screw shaft does not cool down too much.

If a screw set is not dismantled since a very long period, it will be very difficult to remove the elements.
Therefore it is advisable to dismantle the screws regularly and to clean them.

7.3.8. Checking of screw elements and barrels

- If the elements are clean, check them for micro cracks, notches or grooves.
  Smaller notches or grooves can be polished out The faces can be sanded with emery paper (grain 320) in order to clean them.
- Measure the diameters of the screw elements and check them for wear.
  Record the measuring values and compare them with the previous measurements.
  So you can determine individual wear behaviour of your screw
  Profit from the experience of the r Leistritz Service-department with special tools to measure screw and barrel
- It an element is evidently damaged it must be replaced.
  Always replace a pair of screws i.e.. the damaged one and the one on the second shaft that is on the same situation
  If a damaged element is not replaced, it could destruct barrel and even the gearbox.
-

7.4. Heating/cooling

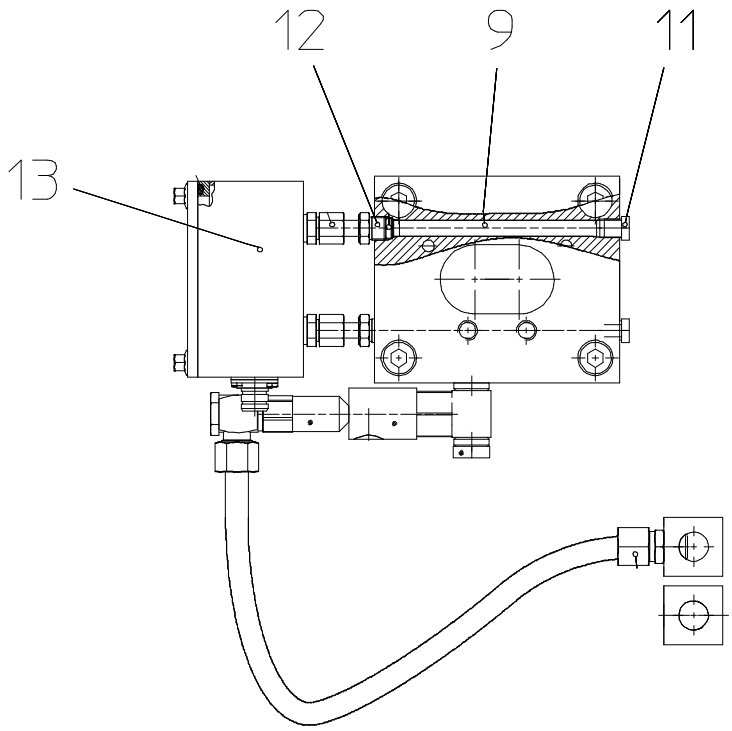
All barrels are designed as ZIK barrels (barrel–intensive–cooling) and equipped with supply fittings for cooling water. Each barrel of zone 1 – 7 is equipped with 4 heating cartridges. At barrel intensive cooling (ZIK) the cooling medium is led through the channels in the barrel via solenoid valve if needed

The cooling medium is taken forward or back respectively by stainless steel hoses to the individual barrels. The heating/cooling zones are subsequently numbered controls are effected by a microprocessor temperature control systems respectively.

Attention: When the extruder is heated up all inlets and outlets of the heating / cooling system are under pressure

7.4.1. Exchange of heating cartridges

☞ **Precondition: Barrel has cooled down to room temperature; plug has been pulled main switch ”OFF”**



- Loosen all bland nuts (12) of the heating cartridges
- Move terminal box (13) together with heating cartridges (9) from barrel
- Open cover of terminal box
- disconnect cable of the defect heating cartridge and replace it
- Before inserting a new heating cartridge check if the bore hole is damaged or dirty (if so clean it with emery cloth)
- Insert the new heating cartridges right down into the bore hole. (inserting of the cartridge must be possible manually, not with force!)

Do not re-commission the machine before the heating zone in which you have exchanged a heating cartridge has reached the necessary processing temperature

8. Control before commissioning

- All lubricant-levels have been checked
- All water in- and outlets connected
- Possibly necessary pressure air connected
- All electrical connections installed
- Thermo couple assigned to the correct heating zones
- Sense of rotation of screw verified
- Feed unit supplied with material
- Product container made ready

8.1. Commissioning

Operation of the extrusion line never without supervision!

- Turn on main switch
- Turn on the temperature controllers
- Check temperature set at the controllers, if need be set average value.

orientation figures:	*PE-PP*	*approx. 180-220 °C*
	ABS-Polystyrol	*approx. 220-240 °C*
	PA-PET-PBT	*approx. 260-300 °C*

- Open the cooling circulation for the feed barrel and the heating/cooling device and turn on the heating/cooling device.
  Wait until the extruder is heated up[1]. Meanwhile check, if the heating zones are heating up. *(if the heating up period is too short it might be possible that the melt soars up in the degassing port and jams it)*
- Open water circulation of the vacuum pump and the gear oil cooling.
- When the machine is heated up, turn on the drive
- In case a side feeder is connected, turn it on and let it run at low speed. *(While the side feeder is running, it will be prevented that melt intrudes into the side feed barrel when turning on the extruder.)*
- The drawing of current has to be controlled steadily after the extruder has been turned on. *(Too high drawing of current is a sign for too low melt temperature.)*
- Set low rotation speed (10-15 rpm)

1. The heating up period depends on the size of the production line; when the controllers indicate that the set control point is reached, it is advisable to heat up the machine a bit longer until the machine will be completely heated up.

- Turn on the feed aggregates (dosing unit, injection pump, etc.) one after the other.
- Equally increase rotation speed of extruder and dosing units. *(check drawing of current)*
- Turn on vacuum pump and open the ball-valve at the degassing port after the melt comes out of the die head. *(In case the vacuum pump is turned on before the melt comes out of the die head there might bee the risk that the melt soars up the degassing port and jams it.)*
- Increase the extruder's rotation speed.
- Feed the side feeder with material and let it convey.

8.2. Shut down of machine

- Stop feed devices (feeder, crammer feeder etc.)
- Run the side feeder until it is empty, but do not turn it off.
- Stop vacuum pump
- Run extruder empty
- Switch off side feeder
- Reduce extruder speed to "0"
- Switch off extruder
- Switch off down stream equipment (for example pelletizer)
- Switch off heating, stop heating / cooling device
- Close cooling circuits
- Main switch "OFF"
- Clean machine from melt remnants

8.3. Break up process of manufacture

It has to be ensured that all energy systems are turned off (especially all heaters, water and pressured air supplies, venting systems, cooling fans, pumps, additional drives).
The line has to be put at zero potential. No materials which could cause a chemical reaction (self-ignition, evaporation of gasses, crosslinking) should be in or around the extrusion line.

9. Maintenance and storage instructions

The service life and operation security of the extruder strongly depends on regular maintenance and care. Therefore steady control of lubricants and adherence with the maintenance intervals is most important.

9.1. Maintenance instructions for the gearing ZSE 18HPe-PH-40D

9.1.1. First filling and commissioning

Only use **new** name brand oils

Only use the recommended name brand oil. Mixing oil with different viscosity, from various suppliers and mixing mineral and synthetic oil is not permitted.

Before switching on the main power supply, check oil levels of the extruder.

☞ The oil level must reach mid-oil-eye level when the drive is turned off.

The lubricants are filled in at vent screw on the top of the gear box. To reach a filling-level of "middle of sight glass" you will need approx. 2l. Only FDA approved oils with a viscosity of 320 cST / 40°C can be used.

The markings on the sight glass are the only valid measurements concerning the amount of oil needed for filling. Indicated quantities are only guidelines and therefore estimated figures.

If the gearbox operates without troubles, it has to be operated with gradually increasing load in reasonable periods of time.

☞ First filling: **Factory made the gear box is without initial oil filling. The customer has to care for the right oil level.**

9.1.2. Operation

- By no means, the oil level may fall beneath the mark and therefore has to be controlled periodically at standstill of gearbox and operating oil pump.
- Warm-up due to operation at full load is generally below 70°C at room temperature.

9.1.3. Oil Change

- Oil change is to be effected only if extrusion line is turned off and in operating temperature.
- The operating oil or less viscous oil from the same supplier has to be used for cleaning during oil change.
- Oil pipes and oil pump have to be rinsed and cleaned with pressured air according to the extent of pollution.
- Permanent magnets at the oil outlet and dirty sight glasses have to be cleaned during oil change.
- Please note that by no means dirt should be able to enter the gearbox.
- Should external particles have entered the gearbox (e.g. if pump is damaged) the complete unite needs intense cleaning and an oil change.
- Used oil has to be disposed due to according hazard and environment regulations.
- In case of longer standstill periods, the gearbox has to be operated for a short time every 4 weeks in neutral setting and at rated speed. Should such proceedings be impossible, it has to be protected with suitable preservation materials.

9.2. Maintenance plan

The extruder is almost maintenance free, the operatability, however, strongly depends on the care of the machine. Therefore the extruder should be regularly checked for leakages at the gear box and the heating/cooling system. Worn out parts have to be replaced timely.

Besides extruder screws and barrel elements have to be checked to wear at certain intervals.
As wear behaviour of screws and barrels depends on multiple different parameters (wear protection of screws and barrels, processed materials, operation conditions …) the intervals can strongly vary and exact operation hours cannot be determined.
Therefore it is necessary to do the first checks at shorter intervals (e.g. after 3000 and 6000 operation hours) in order to determine the specific wear behaviour of a plant.
Check-up should be carried out by a service technician of LEISTRITZ Extrusionstechnik GmbH who will prepare a test protocol. By means of this protocol further service intervals can be determined. In order to guarantee a constant output capacity at constant product quality we recommend to replace worn parts always in time.

after determination of wear behaviour	check screws and barrels to wear (*)
after 600 operation hrs.	1st oil change
every 4000 operation hrs.	2nd and following oil changes (3-shift operation)
every 2 years at the latest	oil change at the low rate of utilization

The bearings of the gear box have a service live of approx. 16.000 hrs.. Please find the maintenance intervals of the auxiliary equipment in the supplementary.

(*) rule of thumb for max. permissible wear of screws and barrels:
Screws and barrels made of nitrided steel 1.8550: nitrided layer 0,5 – 0,6 mm
Screws and barrels made of through hardened steel: max. 4 % of diameter
Or if total throughput of the plant resp. product quality deteriorate significantly before reaching the a.m. wear limits (e.g. 10 % less output compared to the new plant).
Under normal conditions wear in the processing part affects at 2/3 the screws and at 1/3 the barrel. Accordingly it is recommendable to check the barrel and to replace it if needed after the second screw replacement.

9.3. Storage instruction for barrels and screws

- clean from melt remnants
- paint / spray with corrosion preventative
- store separately
- store screw elements on appropriate prisms
- store in dry rooms
- protect against damages

9.4. Directions for cleaning of the unit

Aggressive and toxic cleaning agents damage the plant and constitute a high risk of accident. To avoid damages and accidents the following points have to be considered:

☞ For cleaning of the component parts of the unit isopropyl alcohol should be used

Universally valid:

- Following components parts are suitable for ultrasonic bath and industrial dishwasher: single screw elements (without shaft), barrel housing, barrel inserts, barrel tops, die and material discharge part, metering tools, vertical tube, horizontal stirrer as well as funnel and cover
- The existing national prescriptions for accident prevention as well as eventual internal working-, operation- and safety prescriptions of the operator have to be considered.
- Cleaning of the plant only in disconnected condition
- Systems under pressure to make pressure-less before cleaning
- Do not clean the plant with caustic cleaning agents
- Cleaning of the plant only with untoxic cleaning agents and desinfectants
- Take care that no rests of cleaning agents stick on the parts in touch with the product to be processed, e.g. hopper, screw elements, barrels with inserts, dosing punps pipes and injection dies, conveyor belt, die plates, knife head, cutting-casing, pellet slot:
- In the motor area only clean with a light air stream.
- External contaminations to clean with a humid cloth and the usual cleaning agents.
- If necessary take the individual components apart according to the directions of the operation instructions and clean
- Metal parts which are soiled by melt residues have to be cleand under hot running condition with a brass brush
- For cleaning of the extruder barrel please use the also delivered steam tube brush.
- Never use sharp-edged tools
- Directly after conclusion of the cleaning works all safety devices have to be put up resp. set into function again.
- For cleaning the screw please take care that all screw elements are pulled off from the screw shaft and that the screw shaft has to be cleaned separately from the screw elements.

10. Disturbance Cause Remedying

Disturbance	Cause	Remedying
Extruder stops	Emergency off was activated	Unlock emergency off
	Main switch off	Main switch on
	Minimum drawing of current has fallen below 15%	Extruder must be re-started.
	Oil temperature to high	See disturbance oil temperature
	Overheating of the switch-cabinet	Clean the filter tissues, clean the fan, check if the cables are broken and exchange them if need be
	Overheating of the motor	Care for sufficient fresh water, repair the bearings
	Extruder is overfed	Turn off the feeding aggregates and run the extruder until it is empty, feed the extruder with less material, i.e. decrease input. If screws are blocked don't switch on the extruder again before screws are extracted and cleaned
	Melt-pressure is too high Melt-temperature is too low	Check the thermo couple for cable breakage and contacts, replace defect thermo couple, replace defect heaters, check the function of the heating/cooling device check the parameter-tuning at the controller, check the solenoid valves of the heating/cooling device and replace them if necessary, increase the heating-up period
	Electrical malfunction	Check the fuses and replace them if necessary, any other checks and repairs may only be implemented by a qualified electrician
	Down-stream aggregate has stopped	See manual of the aggregate for remedying
Oil temperature is too high	Button temperature probe in the oil circulation	Check the contact, replace the defect probe
	Water supply in the heat exchanger is interrupted	Check the water inlet or care for water inlet; respectively check the solenoid valve

Disturbance	Cause	Remedying
	Too little water flow rate in the heat exchanger	Check the heat–exchanger for possible lime scum and clean it if necessary
Vacuum pump stops	Switch on the operation panel off	Check the position of the switch
	Standstill of the pump	Check the water inlet; Check the connections (plug/cable breakage) clean the pump replace it, if necessary
Quality and output decreases	Error at one or several heating–zones	Check the fitting of the heaters, check the fitting of the thermo couple, check the el. contact, check the function of the controller, check the solenoid valves of the heating/cooling system and replace them, if necessary
	Jamming in the feed section	Establish or increase cooling water inlet to the feed barrel, decrease conveying quantity of the feed aggregate
	Heating/cooling device defect	Establish water inlet
	Vacuum pump defect	Establish water inlet
	Degassing too low	Check the vacuum hose for tight fit or jamming, open/close ball–valve clean the degassing zone from soared up melt
	Wear of screw and/or barrel	Replace the screw segment and/or barrel