Operation Manual
Twin-screw extruder
ZSE 50HP-PH

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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Index

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.:	4439
Year of production:	2014
Date of delivery:	07/2014
Delivered to:	Novartis

4. Technical Data ZSE 50HP

4.1. Machine data

Model	Co-rotating
Axle base of screws	41,5 mm
Screw diameter	49,7 mm
Diameter of kneading discs and -blocks	49,5 mm
Material of screw	see list: list of parts in contact with material
Barrel diameter	50 H8
Material of barrel	see list: list of parts in contact with material
Screw functionary length	40D
Screw torque max.	2 x 750 Nm
Drive	water cooled AC-motor
Drive power	65 kW
Max. motor speed	1340 rpm
Total speed increasing ratio	i = 2,68
Max. screw rotation	500 rpm
Power transmission	Safety coupling (switch off torque 573 Nm)
No. of heating zones	10
Heating power	49,14 kW
No. of cooling zones	10
Cooling of feed zone 1	ZIK (Zylinder Intensiv Kühlung) heating/cooling unit RX9200
Cooling Zone 2 to 10	ZIK (Zylinder Intensiv Kühlung) heating/cooling unit RX9100
Max./continous melt pressure	200 bar
Max. melt temperature	250°C
Airborne noise emitted	$\leq$ 85 dB (A)
Operating height	1050 mm
Approx. weight	3000 kg

4.2. Fastening torques

Bolt diameter	Position at extruder	Fastening torque [Nm] max.
M16	Barrel flange	190
M10	Feedport	hand-tight
M10	product discharge part	30

The values apply to a supposed coefficient of friction of 0.14 between screwand supporting surface and a yield point utilization of 90 %. The screw quality is A4-80.

4.3. Electrical connection data

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

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

The power supply lead from the terminal strip of the switch cabinet to the terminal strip of the extruder (designation of terminal strips are identical) should be laid in the ground into a cable channel provided for these causes.

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.

4.4. Measuring sheet ZSE 50HP-PH

see separate dimension drawing in chapture “Aufstellungsplan“

5. Enclosed tools

Suggestion of needed tools

Leistritz Part-No.:	Description	Ammount
3063486	Screw tip wrench	1
3063485	Pin for Screw tip wrench	1
3062488	Screw assembling device	1
3062605	Screw extraction device	1
0071522	Double ended spanner SW10/13	1
0072125	Double ended spanner SW12/14	1
0071523	Double ended spanner SW17/19	1
0071700	Double ended spanner SW22/24	1
0071681	Double ended spanner SW24/27	1
0071682	Double ended spanner SW30/32	1
0071524	Double ended spanner SW32/36	1
0071531	Double ended spanner SW 17/19	1
0072061	Double ended spanner SW 22/24	1
0071526	Hexagonal socket screw spanner SW05	1
0071527	Hexagonal socket screw spanner SW06	1
0071528	Hexagonal socket screw spanner SW08	1
0071529	Hexagonal socket screw spanner SW10	1
0071684	Hexagonal socket screw spanner SW12	1
0071530	Hexagonal socket screw spanner SW14	1
0071685	Hexagonal socket screw spanner SW17	1
0071533	Screw driver flat (flach) Gr. 3,5	1
0071534	Screw driver flat (flach) Gr. 7,0	1
0074053	Screw driver flat (flach) Gr. 9,0	1
0071535	Screw driver flat (kreuzschlitz) Gr. 1,0	1
0074619	Torque wrench TX20	1
0073277	Siederohrbürste	1
3001868	Flat scraper	1
0060675	Hydraulic aggregate for screw assembling	1
	Bolt for bore nut ø 2,5 mm	1
3063491	Bore nut	2
HY11400/1.1	Support sleeve	1

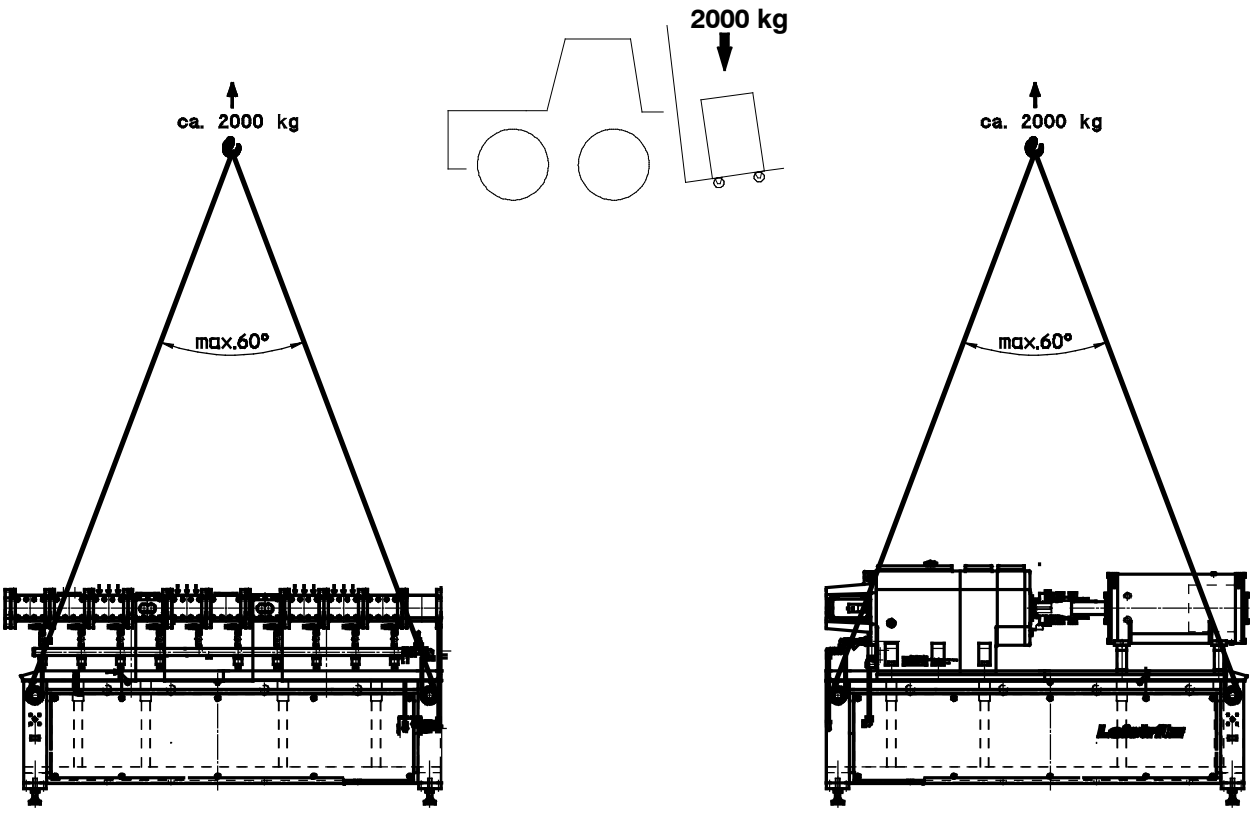
6. Transport

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. All transport locking devices have to remain on the machine as long as the machine parts are installed at site.

☞ Transport has to be carried out without machine covers

With crane resp. lift truck



The machine parts can be loaded with a fork lift. Because of the slippery surfaces the parts must be secured on the forks against slipping.

In order to hang up the machine parts on a crane 2 pairs each of ropes with different length and the two transport bars (special equipment) are used (to hang up in the centre of the machine). The tubes must be put through the lower openings (dia. 44 mm) in the frame of the extruder and the ropes be fixed on them. Each pair of ropes has to have a minimum limit load of 2000 kg. The stretching angle of the ropes may not exceed 60°.

6.1. Assembling of the extruder

☞ **Assembly of both machine frames as well as connection of all media connectors to be done by Leistritz service technician.**

The machine has to be erected on plane ground. In order to grant save erection at the place desired you will find spindles which will bring the extruder exactly into balance.

☞ **Caution: Lifting spindles are situated in the main frame.**
For operation of the extruder all spindles have to be unscrewed untill they fit to the ground. 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 the two machine frames and 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.

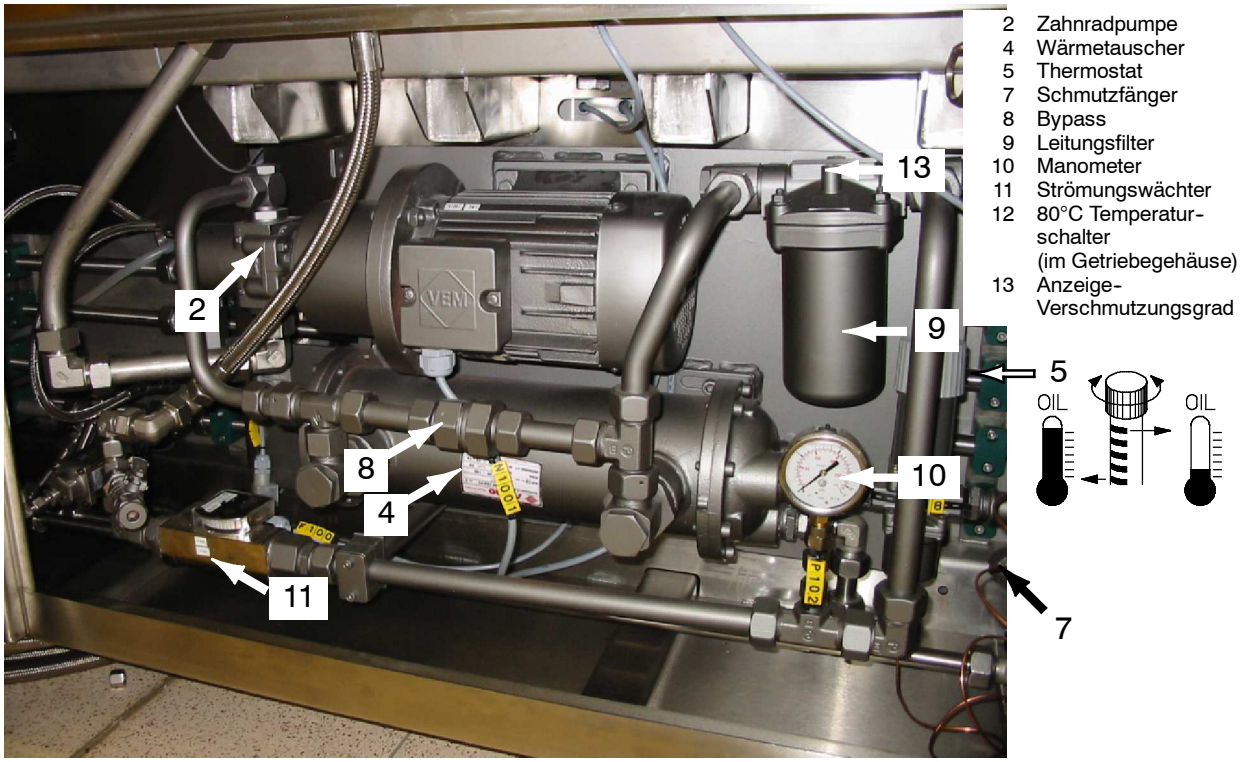
When the extruder is heated up, all of the inlets and outlets of the heating/cooling system are under pressure. When powderized materials are processed, dust intensive works (swivelling aside or cleaning of the feeder, blowing dust off the extruder, transferring contains or refilling of containers or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

7.1. Drive unit pressure circulatory lubrication

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

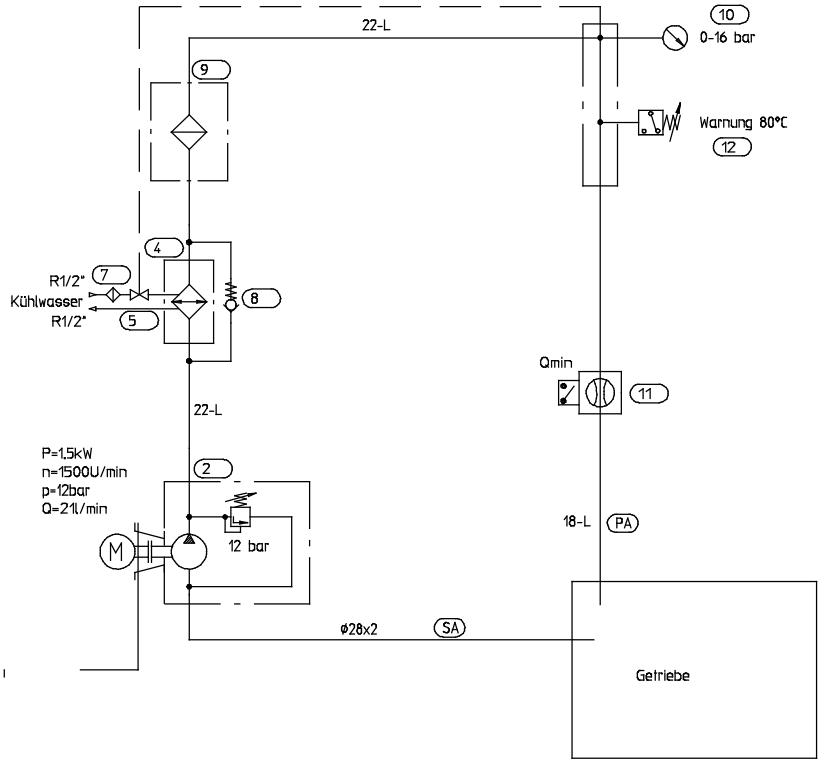
The torque is transmitted to the motor by a safety coupling to the drive input shaft.

The number of revs is reduced in the gearbox and transmitted to two output shafts. A built in pressure circulation lubrification incl. oil-cooling supplies all gears, wheels and bearings. The gear pump (2) pumps gear oil into the heat-exchanger (4). The gear oil is cooled down to operation temperature by means of cooling water of cooling circuit 2 in the heat-exchanger. The operations temperature is set on thermostat (5). When the set temperature is exceeded the cooling-water circulation switches on. If the oil-temperature exceeds 80°C the extrusion line will be switched of by means off the heat-valve (12). In case the necessary quantity of oil will fall short then the extrusion-line will also be switched off by the flow switch (11).



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

7.1.1. Hydraulic diagram
Oil circulating lubrication



2 Gear pump
4 Heat exchanger
5 Thermostat
7 Dirt separator
8 Bypass
9 Filter
10 Manometer
11 Flow switch
12 Temperature switch

Prinzipskizze

7.2. Gear box

7.2.1. Oil content, oil pump, 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 guide-lines 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 and operating oil pump.
- In operating temperature, the normal oil pressure should amount to 0.5 to 3.0 bar according to the posting of the pressure gauge.
- 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.
- The degree of soiling of the oil-filter can be seen at the optical soiling indicator. we recommend to replace the oil-filter element by a new one once it has been soiled. It is, however, also possible to clean the soiled filters.
- If the lubricant-flow falls under the set value at the flow switch the extruder-drive will be switched off by an impulse.
- Used oil has to be disposed due to according hazard and environment regulations.
- The water in the oil-cooler may not exceed a pressure of 8 bar.
- In case of frost and longer standstill periods of the gearbox the cooling water has to be drained off and the water residues have to be blown off with pressured air.
- The flow-through direction of the water in the oil-cooler is designed for reverse flow cooling.

7.2.2. First Operation

- At the first operation the oil content will decrease due to the fact that the oil is distributed throughout the piping of the line. Therefore gear oil has to be added immediately.
- After the first operation the oil pressure in the piping has to be checked and compared with the obligatory value.
- 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.

7.2.3. Assembly-works on the gear

- All journals of shafts do have a thread-bore at the face. Couplings must be pulled upon by means of pressure plates and bolts over the face thread-bore or by means of other auxiliary devices. Forcing the couplings on by means of heavy blows and pushing has to be avoided by any means as this may lead to damages of gear box parts.
- Make sure that gear box-oil inlet and outlet at the oil outlet bore is unpreventedly possible. On extrusion-lines with restricted space circumstances the oil-inlet and outlet should possibly equipped with appropriately arranged tubes.
- Couplings and flanges have to be adequately aligned closely paying attention to the advice given by the coupling-manufacturer.
- Disassembly and assembly of the gear pump:
  - Open the terminal of the permanent current motor
  - Disconnect the connection-cable
  - Loosen the gear-pump's conduit and take it off
  - Loosen the foot-bolts and lift away the motor-pump combination
  - Mark the permanent current motor and lantern before disassembling
  - Loosen the fasting bolts between permanent current motor and lantern
  - Lift away the gear-pump and the lantern
  - Ascertain the position of the coupling's hub of the gear-pump and mark it
  - Pull off the coupling's hub from the gear-pump by means of an extractor
  - Check the conditions of both of the coupling-hubs as well as the coupling-box
  - Loosen the fastening-bolts between lantern and gear-pump
  - Heat up the coupling's hub to a maximum of 80°C and push it on to the replacement gear-pump up to the mark
  - Wait until the pump-shaft has cooled down to ambient temperature in order not to damage the shaft-seal ring
  - Mount the gear-pump to the lantern
  - Mount the permanent current motor to the lantern

- Assembly of motor-pump combination in reverse order

- Disassembling and assembling of the permanent current motor:
  - Open the terminal of the permanent current motor
  - Disconnect the connection-cable
  - Loosen the gear-pump's conduit and take it off
  - Loosen the foot-bolts and lift away the motor-pump combination
  - Mark the permanent current motor and lantern before disassembling
  - Loosen the fasting bolts between permanent current motor and lantern
  - Lift away the gear-pump and the lantern
  - Ascertain the position of the coupling's hub of the gear-pump and mark it
  - Pull off the coupling's hub from the gear-pump by means of an extractor
  - Check the conditions of both of the coupling-hubs as well as the coupling-box
  - Loosen the fastening-bolts between lantern and gear-pump
  - Heat up the coupling's hub to a maximum of 80°C and push it on to the replacement motor hub up to the mark
  - Wait until the motor-shaft has cooled down to ambient temperature in order not to damage the shaft-seal ring
  - Mount the gear-pump to the lantern
  - Mount the permanent current motor to the lantern
  - Assembly of motor-pump combination in reverse order

- Disassembly and assembly of heat-exchanger
  - Disassembly the cooling-water tube and the lubrification tube
  - Loosen the fastening bolts and lift away the heat-exchanger
  - Mount the replacement cooler
  - Re-connect tubes

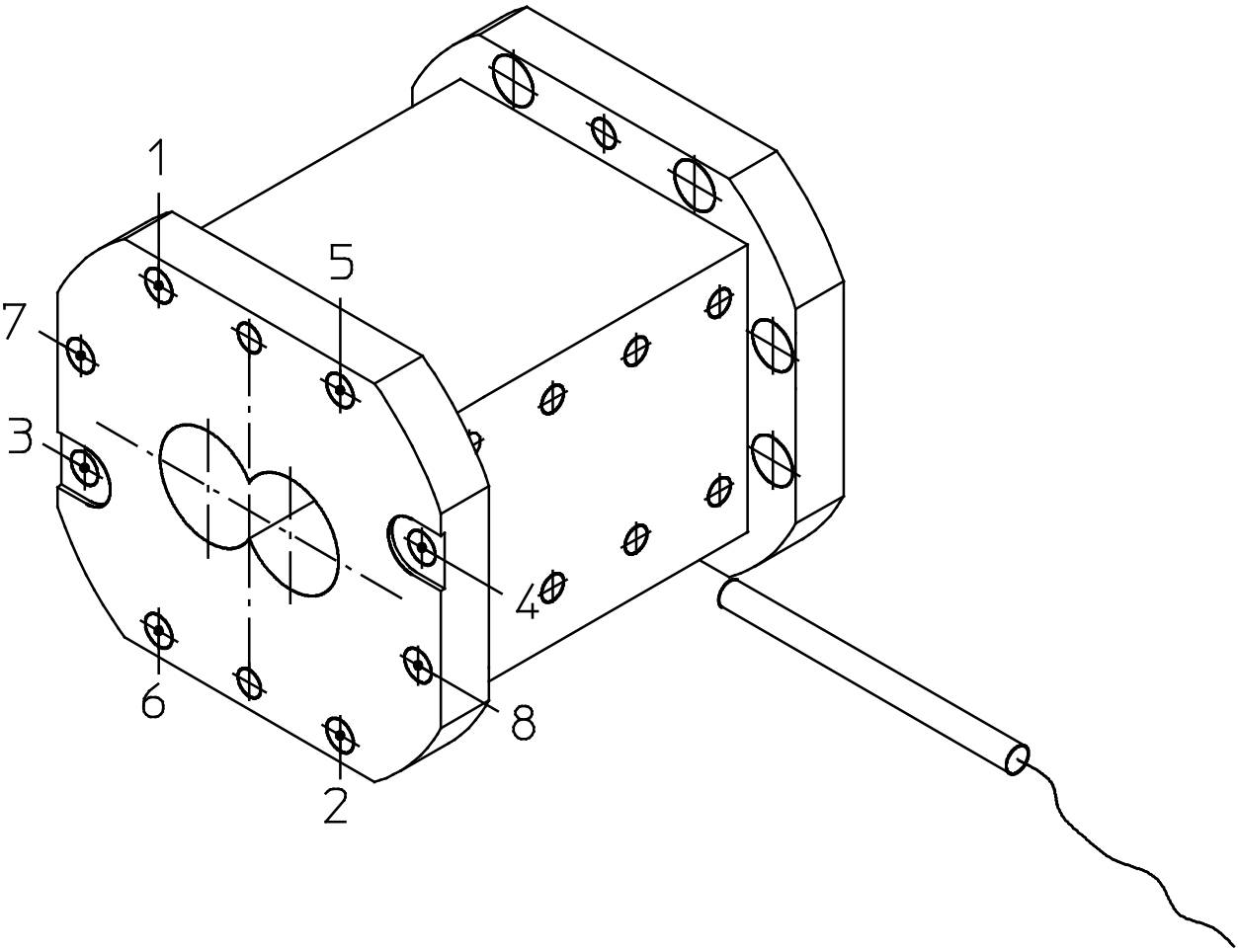
- Disassembly and assembly of the heat valve
  - Open the safety-cap of the heat valve
  - Disconnect the connection-cables
  - Loosen the thermo-couple and completely pull out the heat-valve
  - Assembly of replacement heat-valve in reverse order
  - Adjustment of heat-valve via adjustment-screw with °C scale.

- Clean filter
  - Open filter-housing
  - Pull out the filter-element while slightly moving it to and fro in the housing
  - Clean ring-solenoid and assemble the replacement-filter

- Push the replacement-filter-element to the shaft in the housing and assemble it
- If necessary replace seal

7.3. Barrel

The extruder barrel is designed according to the special process technology. It consists of a feed barrel zone and the different 4D[1] barrels.
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 different barrels are pinned to each other and flanged by 8 screws each.



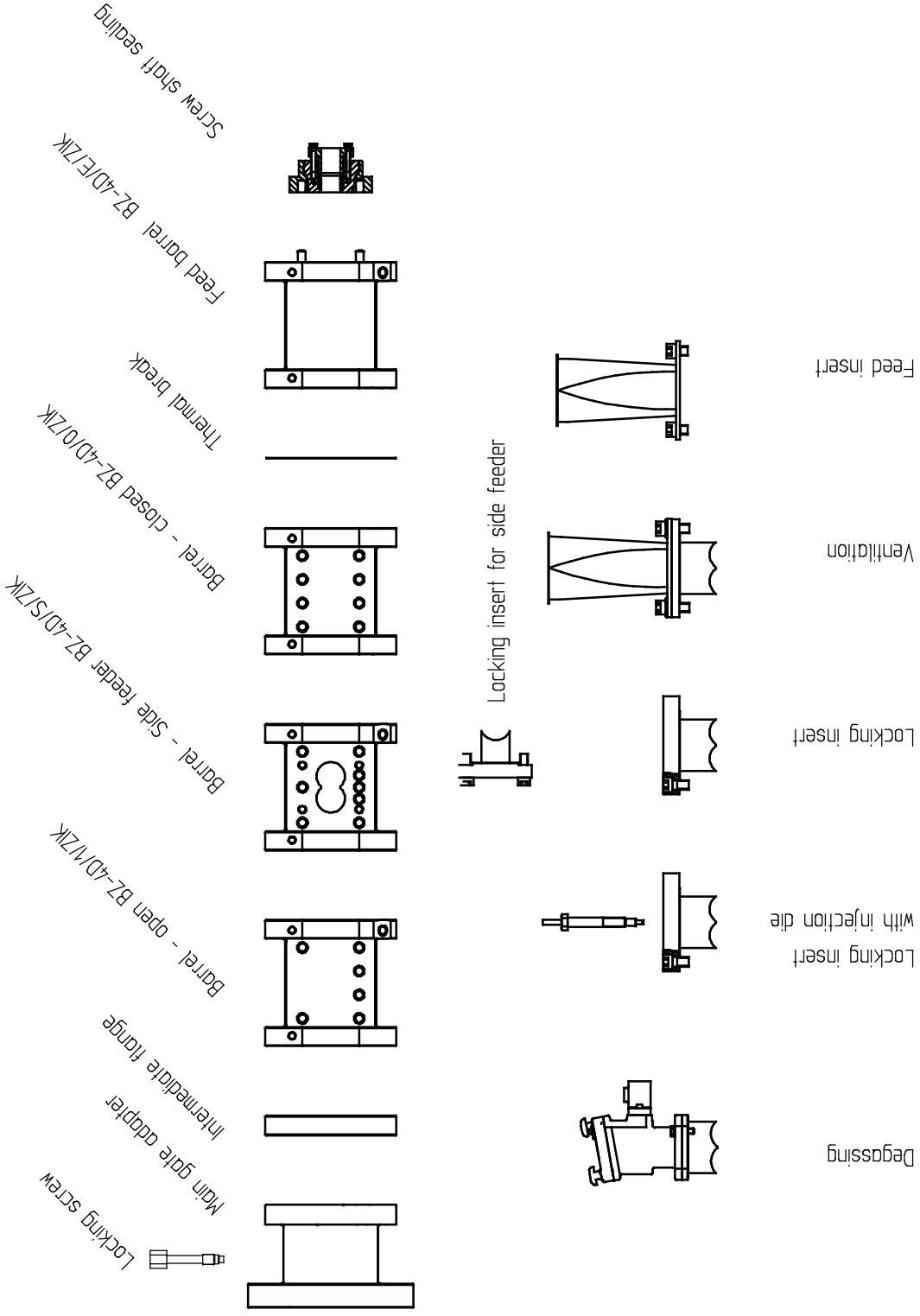
☞ **Fastening torque see chapter 4.2. Page 14. The shown sequence must be kept when tightening the screws.**

In the barrel heater cartridges are screwed in *(see chapter 7.8.1. Page 60)*.The barrel is covered by a water cooled heat-isolating hood.

1. 4D *is the length of a barrel segment and equals the quadruple diameter of the extruder-screw.*

7.3.1. Barrel parts description

☞ **The following drawing shows you a rough overview of available components. Screw shaft sealing, feed top and main gate adapter are special design and described in detail in chapter 2 spare part list.**



7.3.2. Disassembling of the top at the main gate adapter

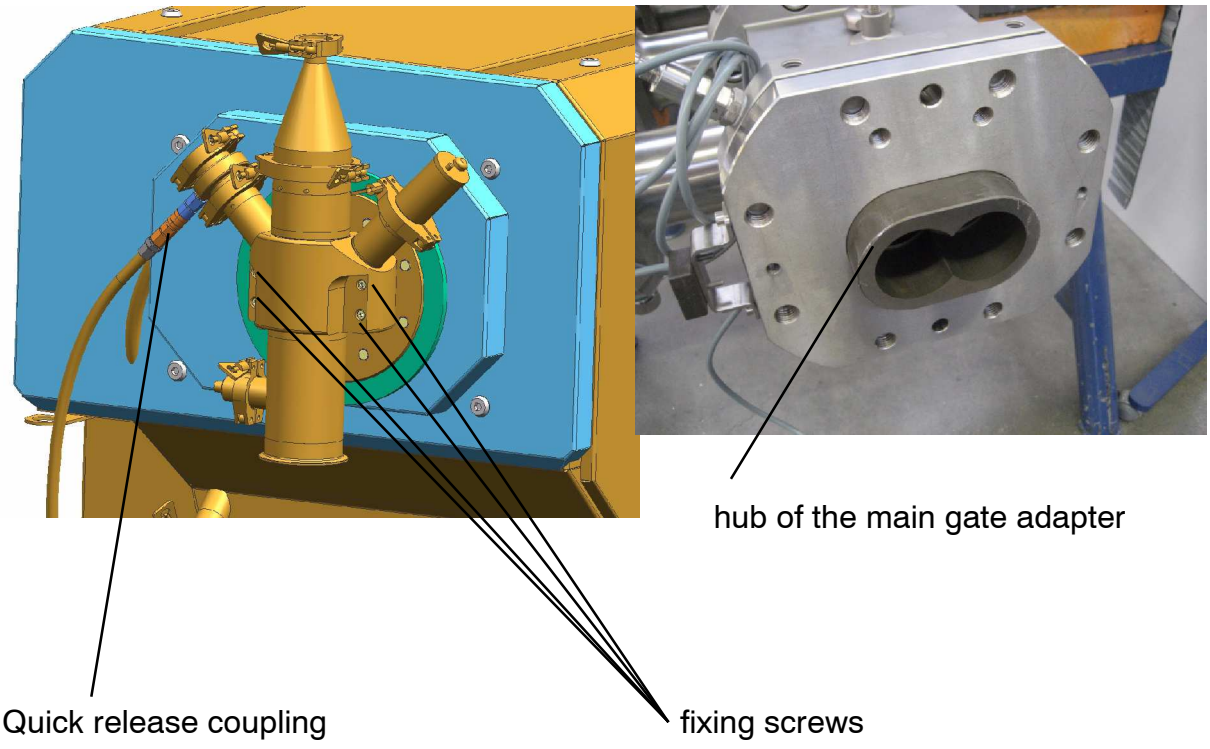
- Screw of the top in the described way
- Run extruder until it is empty

Attention: Switch off the line, lock the main switch

- disconnect al elecrical wiring to the sensor and the inspection light
- disconnect the quick release coupling to the inspection glass venting
- loose the four fixing screws

☞ **Caution: now the top is only fixed by the hub of the main gate adapter**

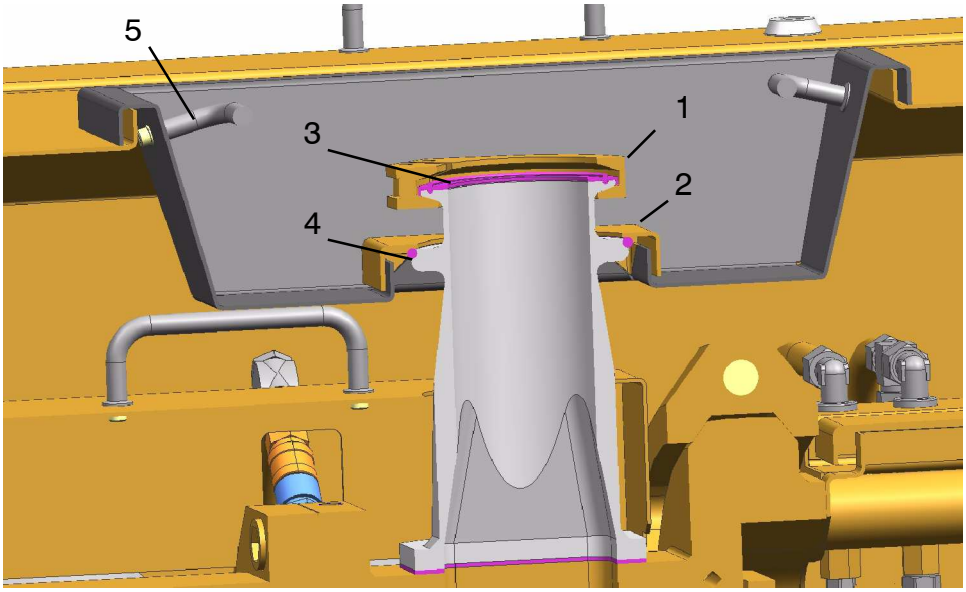
- take of the top (weight approx. 10kg)



- clean sealing faces
- extruder screws are now accessible
- assembly in reverse order

7.3.3. Lifting of the feed port

- Switch off extrusion line
- open the connection between dosing tube and feed port by means of the clamp (1)
- Pull away the dosing unit



- lift off inlaid cover (2)
- Take off clamp sealing (3) and o-ring (4)
- lift off feed opening insert (5)

7.3.4. Removal of the cover hoods

- Turn off extruder
- Cut off connection from dosing tube to feed port (see chapture 7.3.3. Page 30)
- Remove feeder from extruder

- Open closures of the hoods and lift off hoods.

- Open closures of the front cover and lift it off.

- Lift off cover plate from the feed openings

- Lift off carry bow

- Cut off water inlet of the cooled cover hood

- Lift off hood

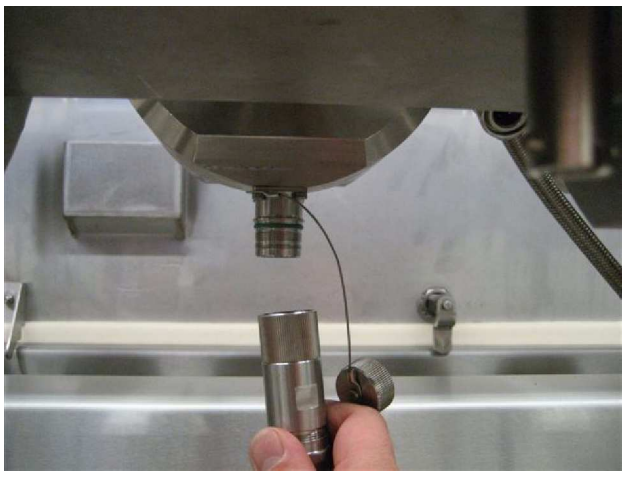
- The whole barrel is now freely accessible

7.3.5. Dismantling of the barrel

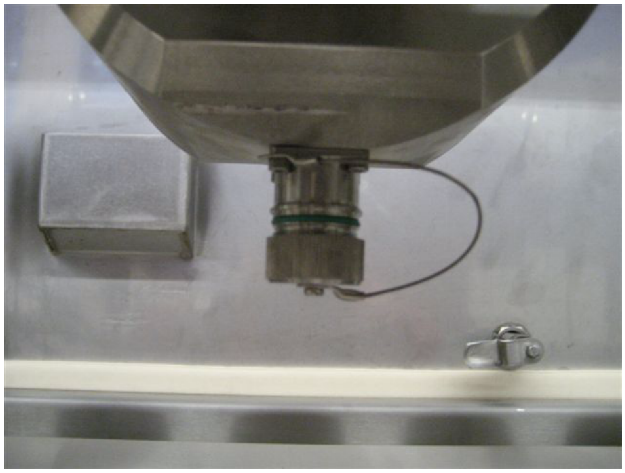
Caution! The barrel lifting truck shall be used exclusively for transportation of the barrel uncoupled from the extruder. Always take care of a safe connection between barrel and barrel lifting truck.

- Switch off extrusion line
- Lift off hoods as described in chapter 7.3.4. Page 31
- Dismantle discharge part together with pressure- and temperature transducer, thermocouple and heater band see chapter 7.2.6. Page 34 (the barrel must have working temperature)
- Pull extruder screws (barrel must have working temperature) see chapter 7.6. Page 51
- Loosen quick disconnect

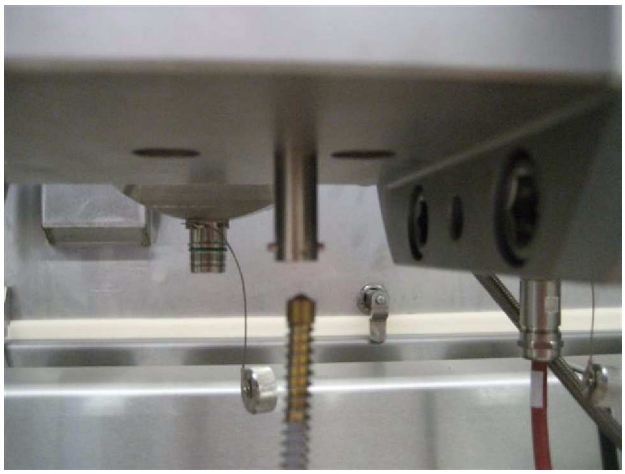
- Cut off electrical connections



- close bushings



- Unscrew thermocouple



- Loosen clamp connection between Barrel and lantern

- Take off half-shell from flange connection

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

- Drive the barrel transport car to the extruder. The forks grab with the grooves under the third barrel from the front and from the back.

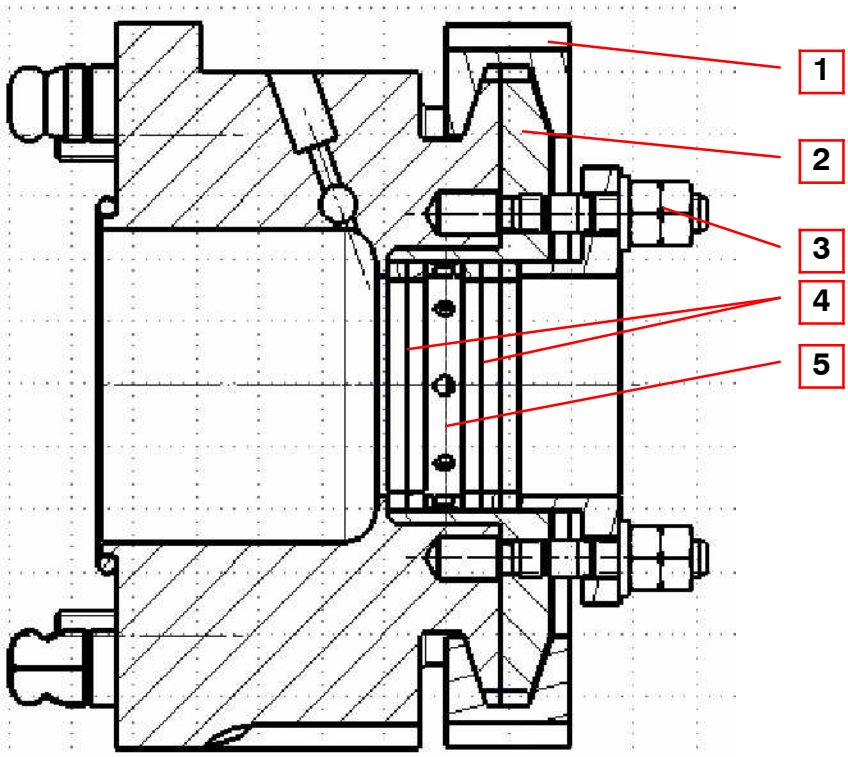
- The forks must click into place under the barrel. No objects may be between fork and barrel.

- After checking again if all connections to the barrel are detached the barel can now be lifted by means of the lifting device, in order to see if the four journals are free.

- When the barrel is lifted it can be removed from the extruder.

7.3.6. Exchange of screw shaft sealing

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



- Loosen Clamp-flange (Pos. 1)
- Take of the gland seal support (Pos.2)
- Loosen the screw nuts (Pos.6) and screw it back for a few millimeter
- take out the worn out sealings (Pos.4) and the adjusting ring (Pos.5)
- Clean all parts and check it of abrasion
- Exchange worn out sealings against new ones together wit the adjusting ring
  T**ake care of the shown order for proper function.**
- The last sealing ring should come to lie 1-2 millimeters behinde the edge of the seal support (Pos.2)
- Connect the whole unit with the Clamp-flange (Pos.1)
- Fasten the nuts (Pos.3) by hand until the gland seal packing slightly lie on the case
- Carefully assemble the set of screws
- Cautiously tighten the muts (Pos.3) so that the sealing evenly lies at the circumference of the screw shafts

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

- When decreasing sealing effect is ascertained, please equally tighten nuts (Pos.3)

7.4. Set of screws

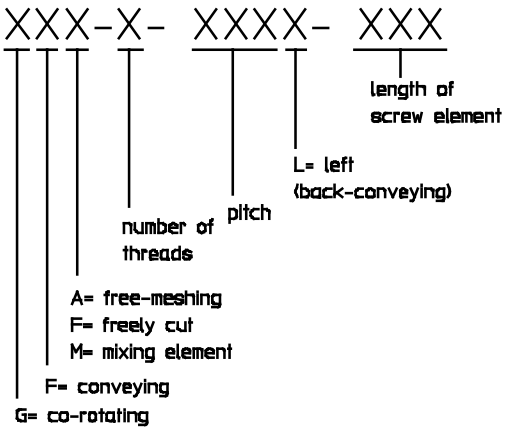
The screws are segmented and can be adapted according to the processing length, the barrel configuration and the specific characters of the product. The elements are ground and polished. The screw shaft and the screw elements have a spline profile.

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

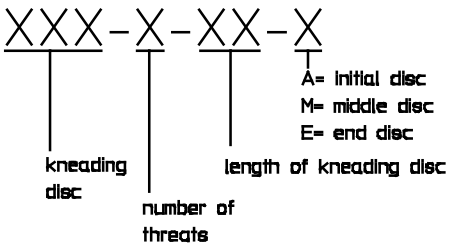
7.4.1. Description of screws

Diametre 50 / double-thread

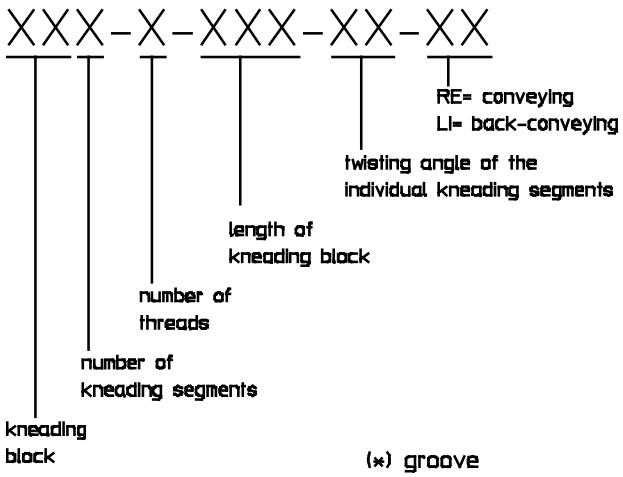
GFA-2- 30 -180
GFA-2- 30 -120
GFA-2- 30 - 60
GFA-2- 30 - 30
GFA-2- 30L- 30
GFA-2- 45 -180
GFA-2- 45 -120
GFA-2- 45 - 60
GFA-2- 45 - 30
GFA-2- 45L- 30
GFA-2- 45L- 30-Nut(*)
GFA-2- 60 -180
GFA-2- 60 -120
GFA-2- 60 - 60
GFA-2- 60 - 30
GFA-2- 72 -180
GFA-2- 72 -120
GFA-2- 72 - 60
GFF-2- 72 -360
GFM-2- 30 - 90
GFM-2- 30 - 60
GFM-2- 30 - 30



KS1-2-10-A
KS1-2-10-M
KS1-2-10-E
KS1-2-20

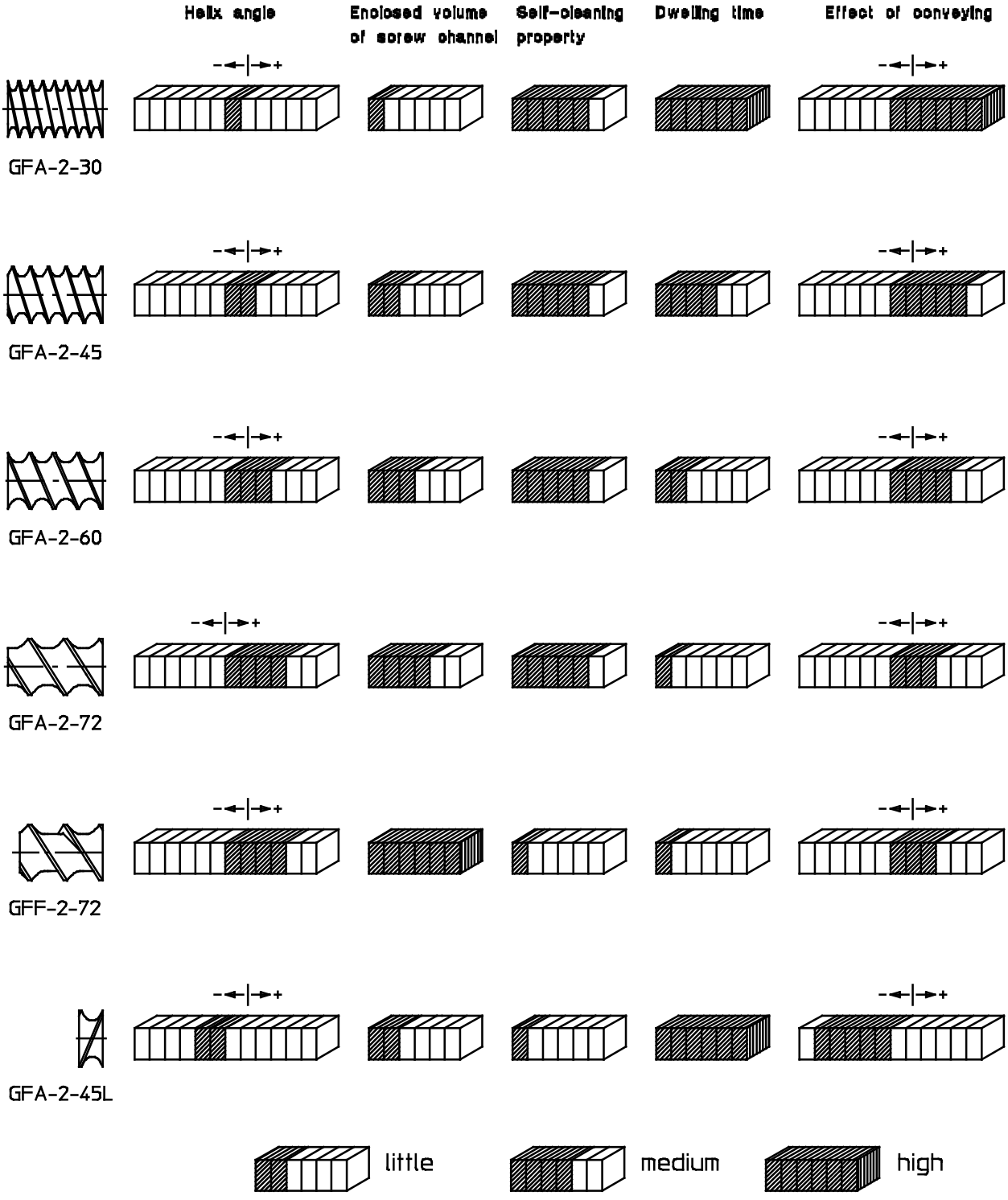


KB6-2- 60-60°-RE
KB6-2- 60-30°-RE
KB6-2- 90-30°-RE

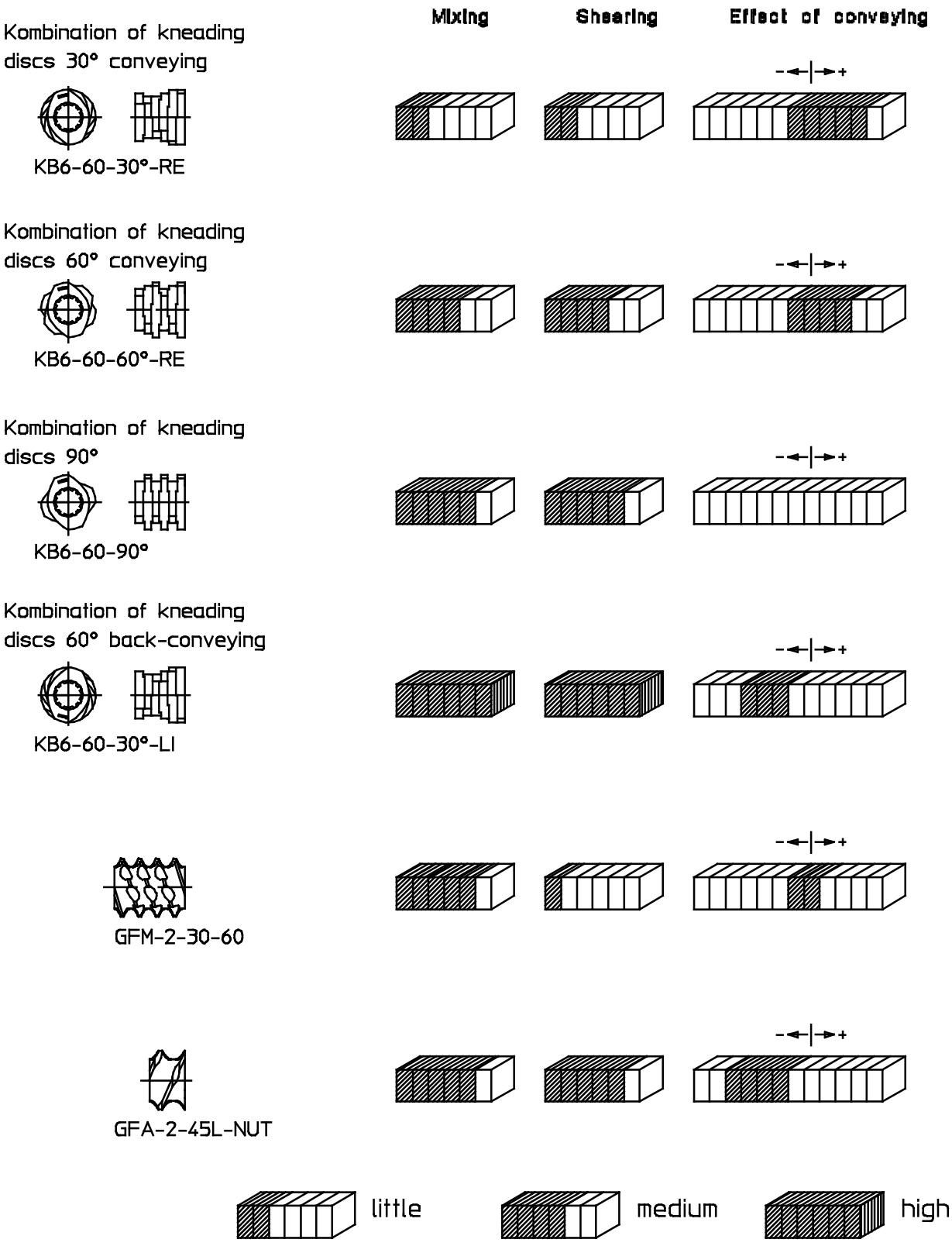


(*) groove

7.4.2. Function of screw elements with different helix angles



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

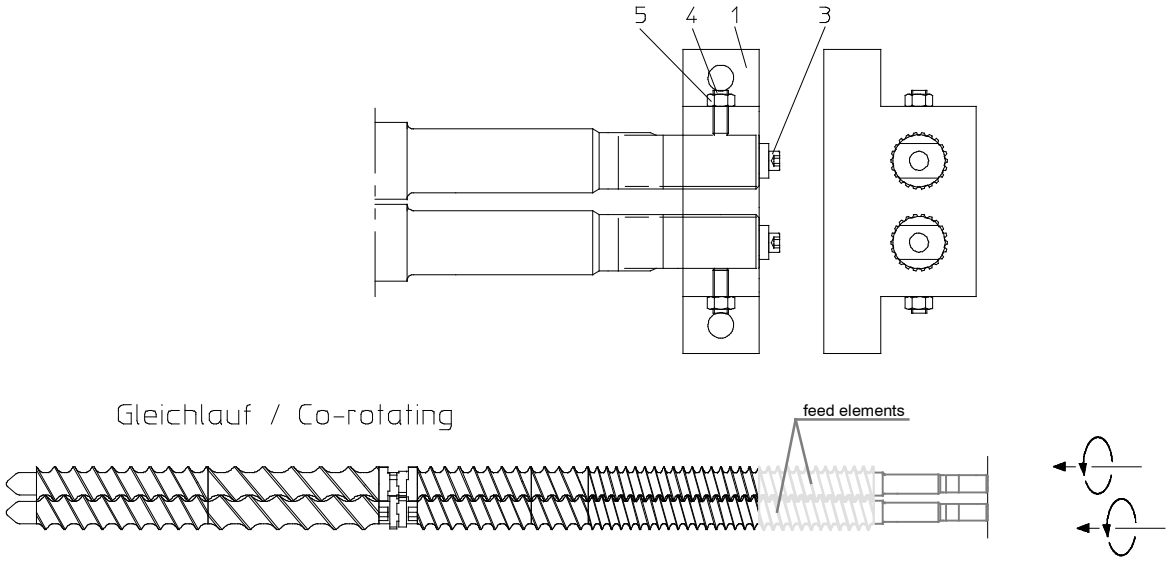


7.5. Assembly of set of screws

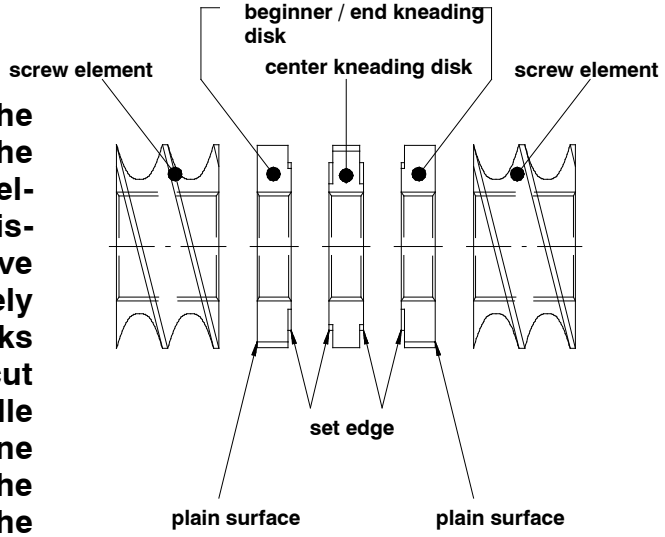
☞ **When assembling the screw sets on the screw shaft take care of rotation sense of screws (co-rotating)**

- 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.

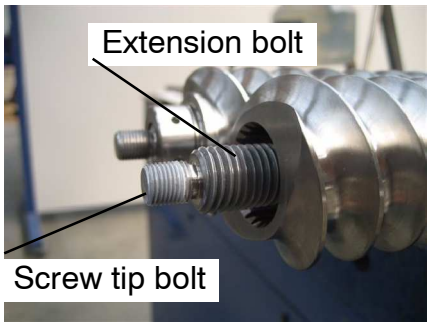
Both shaft-ends are pushed into the assembling device (1) with the grooved toothprofile diameter, the bolts (3) are to be tightened. The setscrew (4) and the locknut (5) serve as torsional stress. Pull the screw onto the shafts in pairs. *(the elements should slide easily enough so that they can be pushed on and pulled from the shaft manually.)*

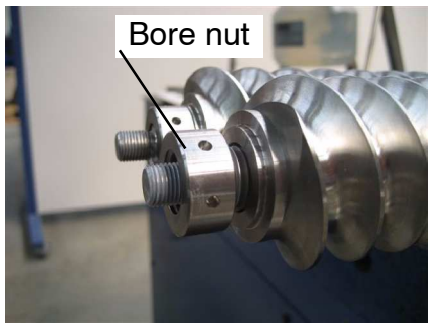


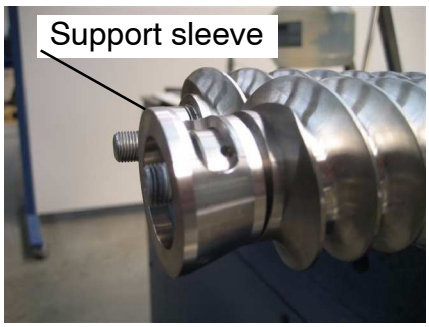
☞ **On their front and rear end the screw elements are symmetrical, i.e. it is not important to pay attention to the direction of installation. The front sides of the joining elements may not show any displacement. All transitions have to be absolutely flush. Merely front- and end kneading disks have to be installed that the cut stage points to the middle kneading disk resp. the plane surface is flush fitting with the following screw element. The screw shaft has a division of 24 teeth, i.e. kneading disks can be put on the shaft staggered by 15°. Usefully only displacements of 30°, 60° and 90° are realized. Looking on the screw shaft in opposite extrusion direction shows that a displacement anticlockwise causes positive conveying, clockwise displacement causes reversal conveying.**

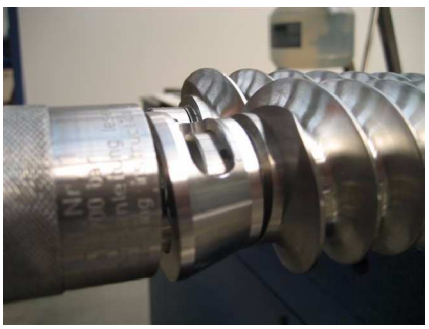


- After having mounted the last screw element's pair, the screw set must be stressed in the following way



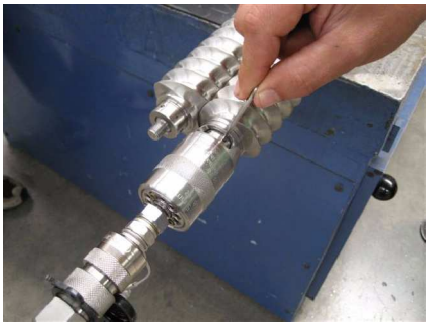






Slot for iserting the stressing bolt

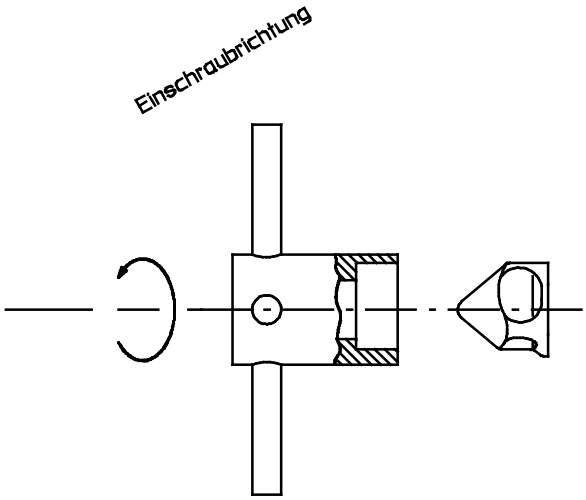
- Screw in the extension bolt in the screw shaft
- Mount the stressing disc
- Screw on the bolt nut
- Mount the support sleeve
- Screw on the top of the hydraulic assembling device



- Connect the hydraulic assembling device
- Charge the device with a pressure of 600 bar
- Fix the bolt nut
- Relieve pressure and disconnect the hydraulic device
- Disassemble the stressing device

- Assemble screw tip by means of the screw tip wrench

☞ **both screw tips - left-handed- thread**



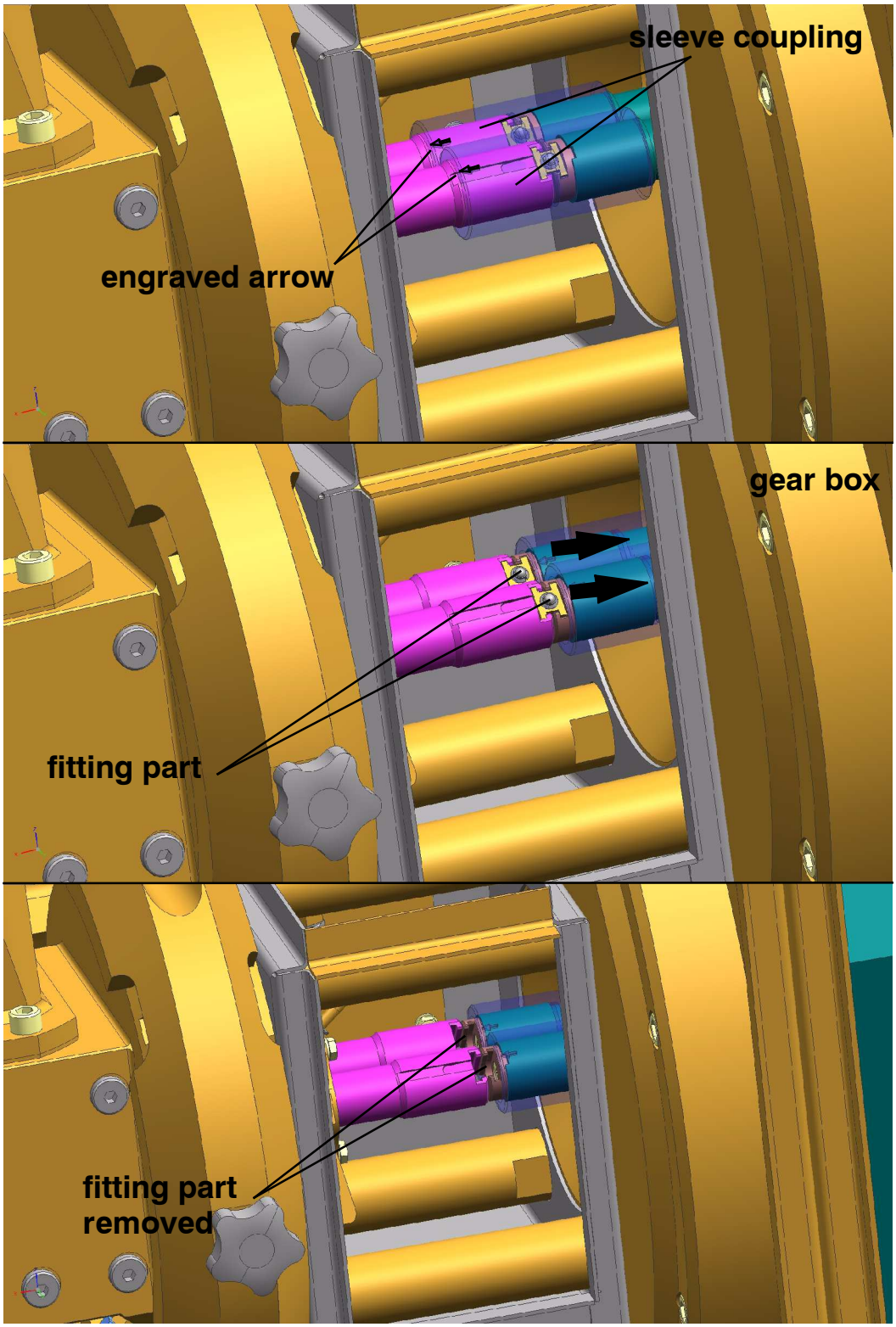
☞ **Do not fix additional levers or prolongations on the wrench**

- 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.**

- Assemble the screws in the extruder barrel (see chapter 7.6.3. Page 54)
- Then heat screw set up to operation temperature and heat up completely. Now tighten the screw tips again (hand tight).

7.5.1. Removing the axial screw safety device



Before each screw-assembly or disassembly remove the fitting part which is located in the ends of the screw shafts to provides the axial screw safety.

- Stop extruder
- Take care that the sleeve couplings with the engraved arrows are in the position the picture shows. (position approx. 30°- 60° from vertical). Maybe you have to start the drive for a very short time again to reach the position.
- Open the lantern cover by means of the coded release key
- Push both sleeve couplings in direction of the gear box as far as the fitting parts are free
- Push out the fitting parts
- Now the screws can be pulled out of the barrel
- When assembling, take care that the engraved arrows show to the balls of the fitting parts. Only in this way it is assure, that the fitting part is in the right position for disassembling.

7.6. Screw disassembly and assembly

7.6.1. 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.
- Clean the screw tips

☞ **Attention: Before pulling the screws it is absolute necessary to remove the fitting part which is located in the ends of the screw shafts (see also chapter 7.5.1. Page 49).**

☞ **Attention: use the screw extraction device (see chapter 7.6.5. *Page 56*)!**

- Start with cleaning the screws, as soon as the first elements rise from the barrel.

7.6.2. Detach screw elements from the shafts

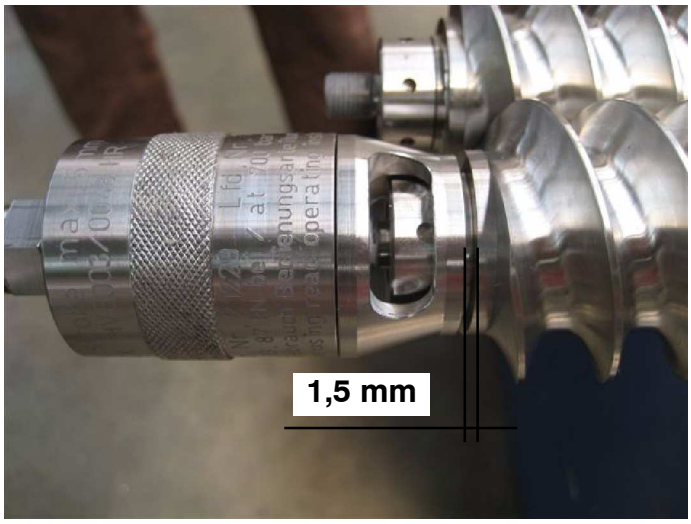
To detach the screw elements from the shafts is the most difficult mounting work and demands corresponding sense for the used materials.
The reason is, that melt can penetrate between the elements which leads to bonding between screw shaft and screw element.
However that happens in different degrees 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!**

☞ **Take care that the head of the hydraulic assembling device ins not totaly screwed on the expanding bolt. There must be a gap of 1,5 mm. If the gap is less than 1.5 mm it is not possible to disassemble the top of the hydraulich assembling device after pressure drop.**



- 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**

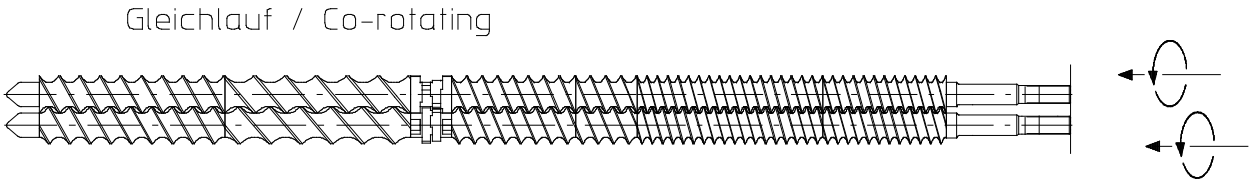
- Always try to detach only one element.
- Clean the screw shaft, which makes detaching of the next element easier.
- Take care, that the screw shaft does not cool down too much.

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.

7.6.3. 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.**

- 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 fitting part which provides the axial screw safety must be insert by any means (see also chapter 7.5.1. Page 49).**

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

7.6.4. 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.

7.6.5. Screw extraction device

see sketch 7.6.5.

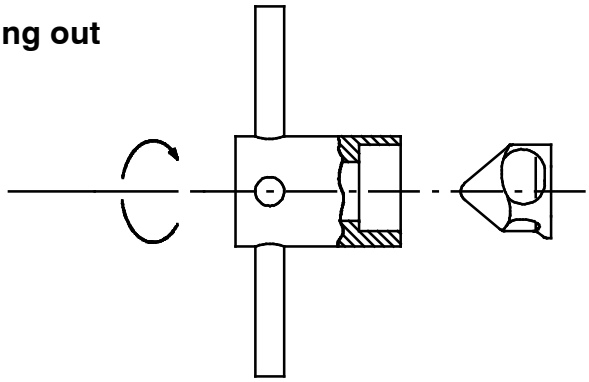
Pre-condition: barrel and screws must be heated up, maingate adapter dismounted (see chapter 7.3.2. Page 29) extruder has to be run empty of melt

☞ **Attention: Before pulling the screws it is absolute necessary to remove the fitting part which is located in the ends of the screw shafts (see also chapter 7.5.1. Page 49).**

- Clean the screw tips and screw them out

☞ **Both tips have left-hand thread!**

screwing out

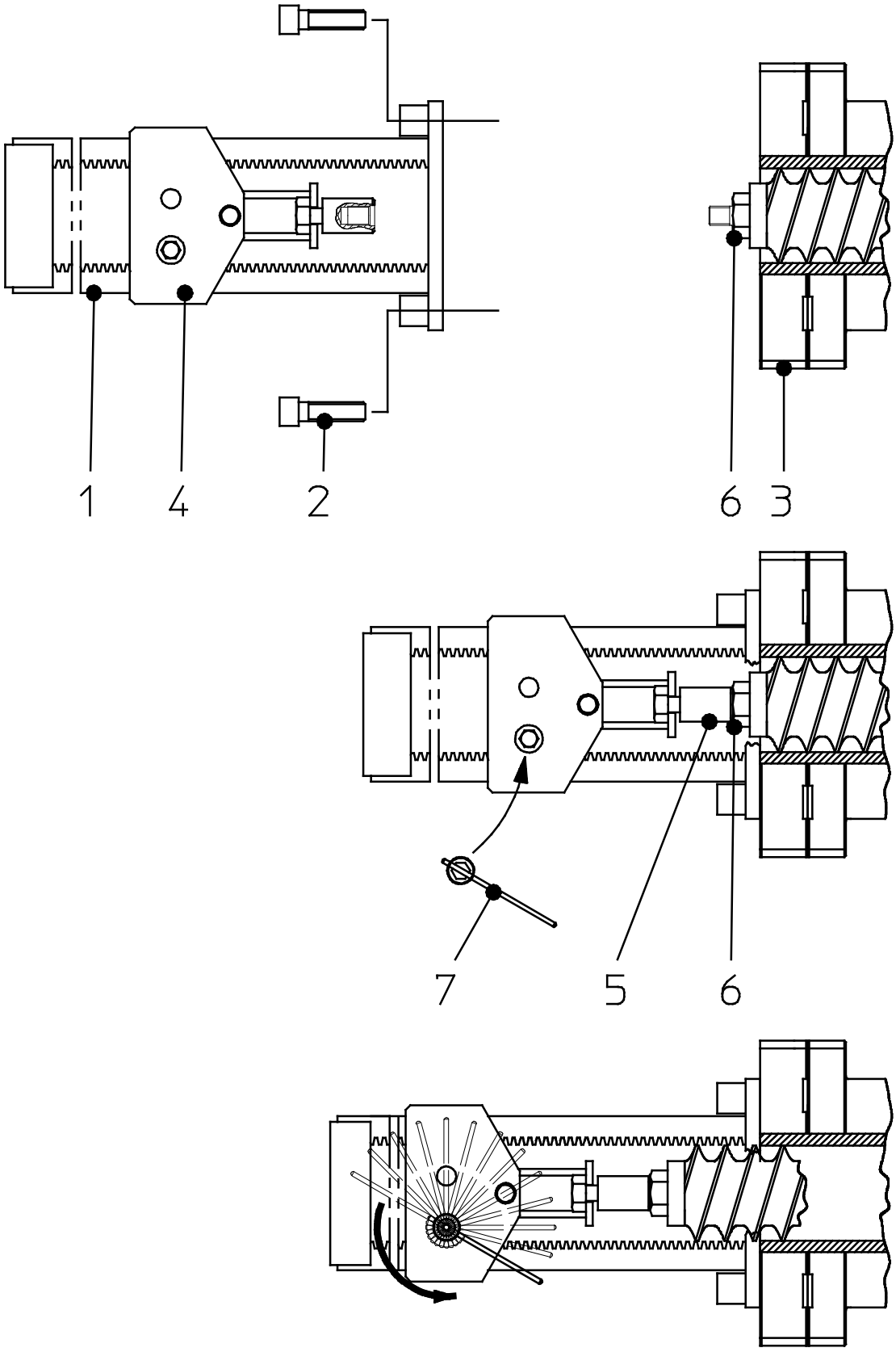


- Screw on screw extraction device (1) with allan screws (2) in the intermediate flange (3)
- Move the slide (4) as far to the front, so that the coupling nut (5) can be screwed to the screw spanner (6).
- Put on the wrench (7) and turn it while pulling out the screws
- Clean the screws continously

After slide block is at the end

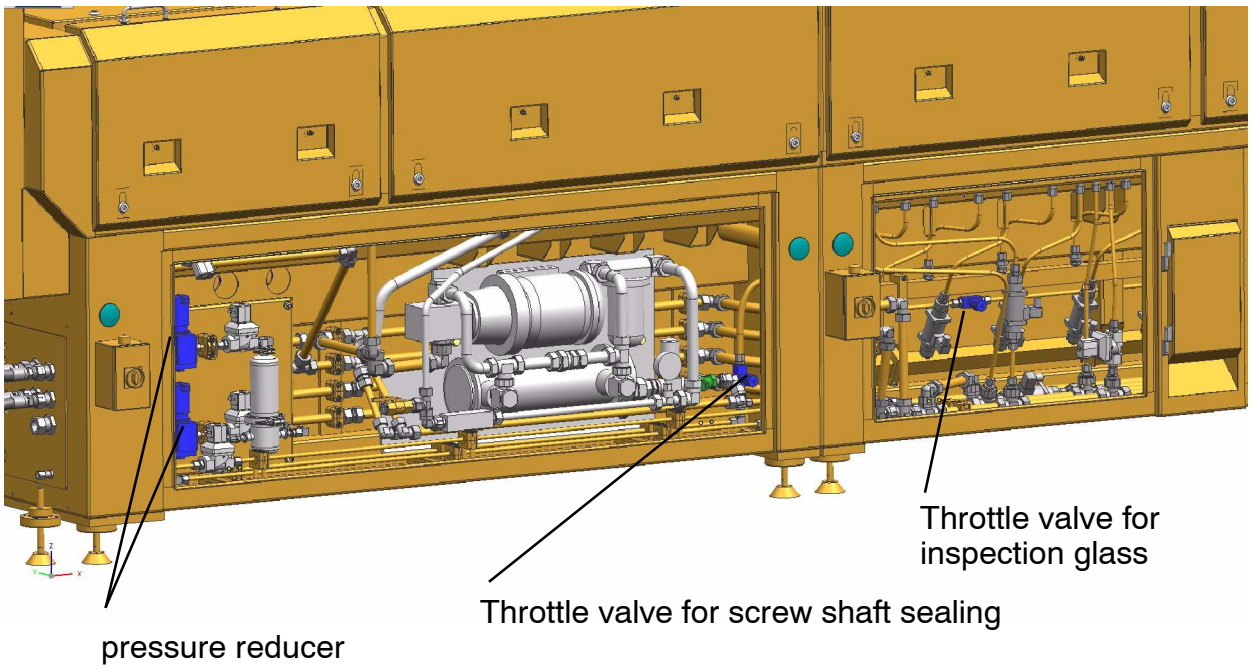
- Loosen the coupling nut (5)
- Take off the extraction device (Pos.1) after having loosened the allan screws (Pos.2)
- Completely pull out the screws, support the screws with a prism

Sketch 7.6.5.



7.7. Compressed air system

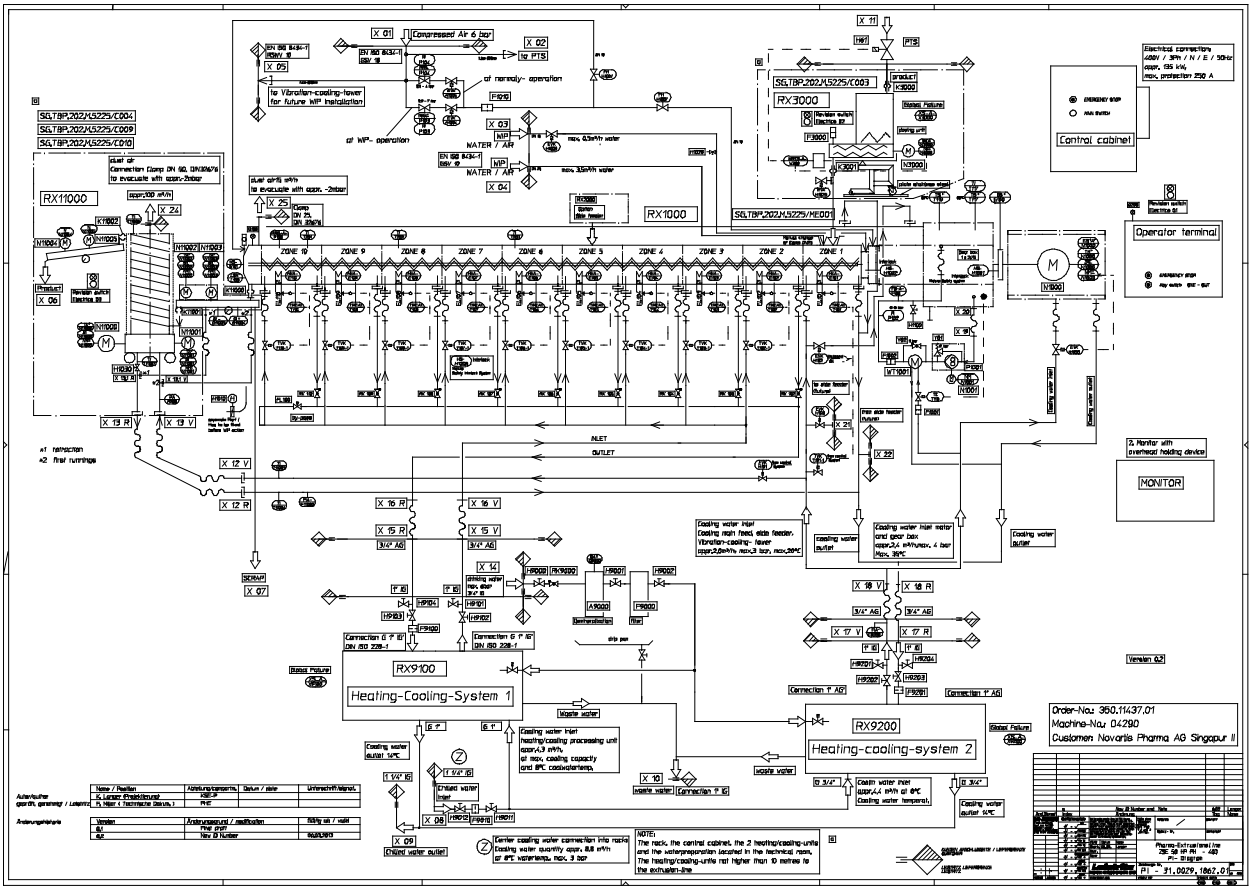
For the compressed air overlay of the screw shaft sealing and the inspection glass at the discharge unit there are installed two throttle valves and pressure reducer in the base frame of the extruder.



☞ **Switch on air supply for the screw shaft sealing only when the screws are assembled. Otherwise it will be possible that the sealings are blowed out.**

7.8. Heating/cooling

All barrels are designed as ZIK barrels (barrel-intensive-cooling) and equipped with supply fittings for cooling water. Each barrel is equipped with 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

☞ **Use demineralized cooling water. You will find details on the hydrological data in the operation manual of the heating/cooling-unit manufacturer.**

7.8.1. Exchange of heating cartridges

Attention: Each and every electrical works may only done by qualified staff!

☞ **Terminal box and heating cartridges must be dismantles only if the heating cartridges are damaged. For cleaning purposes the terminal box can remain on the barrel.**

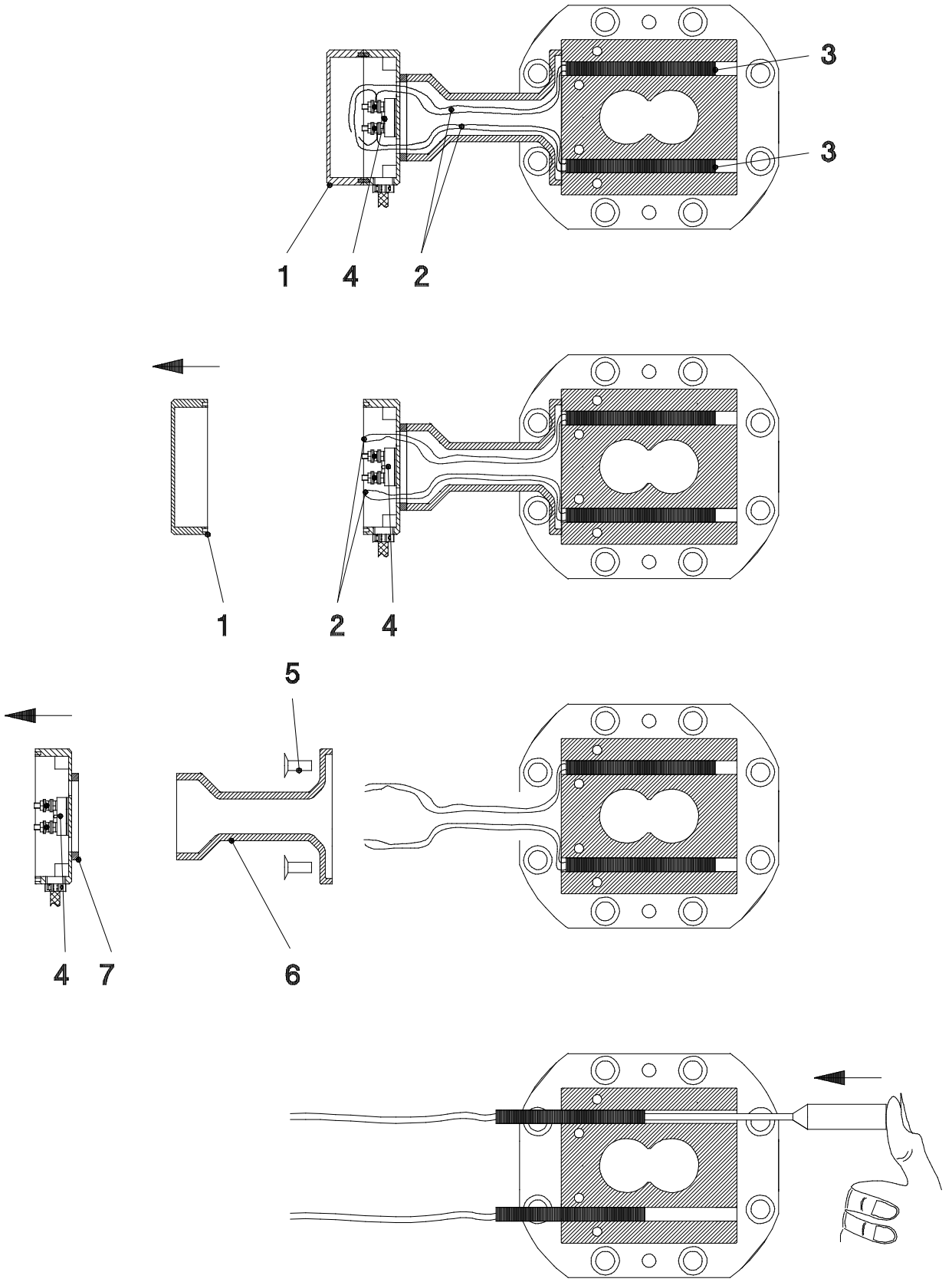
see sketch 7.8.1.

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

- Open the lid (1) of the terminal box
- Loosen all connection cables (2) of the heating cartridges (3) from the terminal screws (4)
- Screw off the terminal box and the insulator plate (7) from the cable housing (6) (this need not be done in any case, however it facilitates the re-inserting of the cables)
- Loosen the screw (5) and take of the cable house (6) from the barrel
- Now all heating cartridges are freely accessible
- Now the defective heating cartridges can be pushed out of the barrel with a bolt (do not use sharp or pointed tools as this might lead to damage of the precisely manufactured inside of the bore hole)
- Before inserting a new heating cartridge check if the bore hole is damaged or dirty (if so clean it with emery cloth)
- Spread heat resistant silicon grease to the new heating cartridges and insert it right down into the bore hole. (inserting of the cartridge must be possible manually, not with force!)
- Now the cable housing can be put on again and the cables can be connected

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

sketch 7.8.1.



8. Pre-Commissioning Checks

- All lubricant levels have been checked
- All water inlets and outlets connected and leak free
- All air lines connected and at the correct pressure if required
- All electrical connections installed
- All Thermocouples assigned to the correct heating zones
- Feed unit supplied with material
- Product collection container made ready
- **Check function of all emergency stops**

8.1. Switch-on of the extrusion line

☞ **The following operating steps describe only a short way of commissioning. Information in detail you will find in the operating manual of the control unit Chapter 3, the manual of the dosing unit file 2 and the manual of the conveying system file 6.**

- The line has to been mechanically assembled in its full start condition (e.g. locating and calibrating of dosing units, complete assembly of the processing unit, connection of cooling tubes, pressure probes and other instruments)
- All electrical connections made to the system
- All cooling water connections secure at the heating/cooling unit(s)
- Switch on main switch of the extruder
- Switch on main switch of the heating/cooling units
- Switch on control system
- Wait until the computer is completely started.
- login user 

8.2. Start-up of the extrusion process

☞ **The extruder will shut down the main drive if a high torque of 100% is reached, perhaps due to mechanical blockage of the screws. Before restarting, the reason for the blockage has to be remedied or else the gearbox, main drive and screws could be damaged.**

Possible solutions to clear an overtorque blockage:
Choose longer warm-up time
Choose higher barrel temperatures
Empty the extruder
Disassembly of inserts
Disassembly of die

☞ **Is a side feeder added, it always has to be switched on before starting the extruder and run at low speed. (The running side feeder avoids infiltration of melt into the side feeder barrel)**

☞ **Also read the control system operating instructions for more detail.**

8.2.1. Operation modes

Interlocking mode “Production” with manual operation

Interlocking mode “Cleaning” with manual operation

“Automatic” operation according to recipe values

8.2.2. Production mode

Start extrusion process

- Control of machine configuration on R_7910

All set values of the system have to be entered into the configuration pages.

- Input of all set values for the system components in the upper permanent range or the faceplates of the components on R_1000
  Extruder speed
  Side Feeder speed (optional)
  Dosing unit setpoint
- Input of temperature set values and alarm limit values of all heating zones on R_2000
- Input of limit values of the analogue values on R_7210
- Input of dosing unit parameters on R_9200 and R_3000

☞ **Installation of feeders:**

- "Taring" of empty dosing unit via R_9300
- Filling of the hopper with required quantity
- Control refill settings on R_9200 and adjust if necessary
- Initial Feed Factor: calibrate the dosing unit via R_9300 to determine the Initial Feed Factor
- Alternatively, if Feed Factor is known directly enter it via R_9300

All flagged messages have to be acknowledged on page R_5100

The system components must be connected according to the interlocking matrix:

- Start heating and wait for heating up time – Heating/Cooling devices are also automatically started
- Start main drive
- Start side feeders (optional)
- Start dosing unit(s)

In order to stop the extrusion process, the components are turned off individually.

8.2.3. Manual operation in cleaning mode

- Key F12 switches the system to interlocking mode “Cleaning”

Start extrusion process

- Set all parameters as in chapter 8.2.2. page 57.

All flagged messages have to be acknowledged on page R_5100

CAUTION! Not all interlocks are active in Cleaning Mode. The individual system components can be started freely. No heating up time is required before system start-up.

8.2.4. Automatic operation

Start extrusion process

In the Automatic operation mode the process parameters are entered as a recipe formulation and stored.

- The system parameters have to be first configured on page R_7910 (side feeder optional)
- A new recipe can be prepared on page R_8100
- Push “New”, enter recipe name and parameters and store.
- Select the required “Recipe Name” and “Version” and “Read”
- Check the parameters in the fields “Recipe”, “Version” and “Transfer” to the control system when satisfied
- The transferred formulation will now also be visible in the permanent range under
- “Recipe: and “Version”
- All flagged messages have to be acknowledged on page R_5100
- F13 starts the Automatic Operation using the Recipe parameters

The sequence is now automatically and brings up the plant in 4 steps.

However, the sequence can be paused via (F15) and then continued via (F16).

The system components will continue in their current state during the sequence pause.

After reaching Step 4, the starting step, a charge operation can be made.

- An input mask appears for the charge data
- After input of charge parameters the change can be started
- The charge data is stored in the protocol
- The charge can be stopped immediately with “Auto Off” (F14) or via “Auto Empty” (F17) with the emptying step.

In order to stop the extrusion process, the components are turned off individually.

8.3. Stop extrusion process

During Automatic operation with Auto emptying enabled, the extruder will operate until it reaches the set torque minimum and will then switch off automatically.

The barrel will remain at its operating temperature with the temperature control circuit active.

Disconnection of extrusion system

- Switch off all ancillary products
- Disconnect main switch and visualisation system.
- Now the control unit shuts down independently
- Turn off the heating/cooling units
- Disconnect cooling water and turn off
- Clean melt residues from the system
- Pull the screws (at operation temperature) for cleaning
- Remove the extruder barrel for cleaning

8.4. 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.

8.5. Procedure during line shutdown periods

All energy sources should be 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

9.1.1. First oilfilling 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 comissioning the extruder check oil level.

☞ **The oil level must reach mid-oil-eye level as long as *oil-pump is running* and the *gearbox is standing* still.**

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. 50 l . The used oils have to be secified according to the manual of the gear box manufacturer (point 10.2.1 oil specification). (do not use Polyglykol-oils)

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.

At the first operation the oil content will decrease due to the fact that the oil is distributed throughout the piping of the line. Therefore gear oil has to be added immediately.

After the first operation the oil pressure in the piping has to be checked and compared with the obligatory value.

After operating the oil supply unit for approx. 20 minutes, the main drive of the extruder can be turned on. After 10 additional minutes the extruder is ready to operate.

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

☞ **First filling with:** **Geralyn SF 320**

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 frost and longer standstill periods of the gearbox the cooling water has to be drained off and the water residues have to be blown off with pressured air.
- 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 100 operating hrs.	clean oil filter
after 300 operation hrs.	1st oil change, clean oil filter
every 2000 hrs.	clean oil filter grease bearings of maindrive
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. 20.000 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 on wooden plate
- store screw elements on wooden prism
- 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, Dosing 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.
- When hand washing: 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

☞ Before hand cleaning of the extruder barrel please take care that the closure screws of the heating cartridges are screwed in.

- 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 pressure too high/low	See disturbance oil-pressure
	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 air, clean the motor (only when it stands still) clean or replace filter tissues, 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, check if the heaters fit properly, 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 pressure is to high	Oil-filter is jammed	Wash out the filter and clean it with compressed air

Disturbance	Cause	Remedying
	Oil-pipe is jammed	Clean the flow pipe
	Oil-temperature is too low	The surrounding temperature shall not be less than 15°C , check the solenoid valve of the heat-exchanger, check the gear-cooling
Oil-pressure is too low	Too little oil in the gear	Add oil
	Leakage in the oil system	Check for leakages and obdurate them
	Pump is defect	Replace it if necessary
	Failure of pump-motor	Clean the motor and replace it if necessary, check the el. contacts
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
	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

Disturbance	Cause	Remedying
	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